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ABSTRACT

Firms' Wage Structures, Workers' Fairness Perceptions, Job Satisfaction and Turnover Intentions: Evidence from Linked Employer-Employee Data*

The paper uses novel data for Germany linking worker and establishment surveys with administrative social security data for all workers in the surveyed establishments. From these data, four variables are generated that describe a firm's wage structure and the positions of workers within it: (a) workers' own absolute wages, (b) workers' conditional internal reference wages within firms, (c) the conditional wage dispersion in firms, and (d) workers' conditional external reference wages across firms. Three empirical contributions are made: (1) the impact of firms' wage structures on workers' perceived wage fairness as an important organizational justice variable, (2) the impact of firms' wage structures on workers' job satisfaction and turnover intentions, and (3) the contribution of the fairness considerations on the overall effects of the wage structure variables on workers' job satisfaction and turnover intentions. The findings suggest that equity and social status considerations as well as altruistic preferences towards co-workers and inequality aversion are important, whereas the evidence for signal considerations is limited.

JEL Classification: D63, I31, J28, J31, J63, M52

Keywords: income comparison, inequality, fairness, job satisfaction, turnover

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1. Introduction

Research and public discussion about income structures traditionally account for means or percentiles as well as for variances of the distribution, which is plausible from a macro perspective (Lazear and Shaw, 2009). But from a micro perspective relative income is also important because individuals are placed in the income distribution and are not impartial spectators, which stresses the importance of interpersonal comparisons (Clark et al., 2008). Higher income of others can, for example, reduce own utility due to a loss in relative standing (social status). In such a case, an income increase for one person can yield negative externalities for another person (Luttmer, 2005). These consequences are not only important from a welfare perspective, but also lead to questions about the effects of firms' wage structures on workers' attitudes and behavioral consequences. However, relatively few studies analyze the effects of wage structures of firms, because administrative linked employer-employee data are necessary that include wage information about all workers and their characteristics to compute conditional wage structure variables. Even fewer studies look at the nexus between wage structures, worker attitudes (e.g., fairness perceptions), job satisfaction, and behavioral intentions (e.g., turnover intentions), because linked employer-employee data need to be supplemented with worker surveys.

In this paper, we use novel data for Germany that allow us to link worker and establishment surveys with administrative social security data for all workers in the surveyed establishments. From these data, we can generate four wage structure variables which also account for interpersonal comparisons: workers' own absolute wages, workers' conditional internal reference wages within firms, the conditional wage dispersion within each firm, and workers' conditional external reference wages across firms. We make three empirical contributions, which we combine in a mediation-style regression analysis. First, we are interested in the impact of firms' wage structures on workers' perceived wage fairness as an important organizational justice variable. Second, we are interested in the impact of firms' wage structures on workers' job satisfaction and turnover intentions, which are costly for firms because turnover intentions are positively correlated with actual quit behavior (turnover costs) and negatively correlated with work effort (productivity). Third, we are interested in the contribution of the fairness considerations on the overall effect of firms' wage structures on workers' job satisfaction and turnover intentions.

The remainder of the paper is organized as follows. In the next section, we discuss related literature and our theoretical considerations based on a utility framework. Section 3 informs

about the data, variables, and estimation approach. Section 4 reports the estimation results. The paper concludes with a short summary and discussion of the main findings in section 5.

2. Theoretical background and related literature

Firms' wage structures (e.g., Lazear and Shaw, 2009) and organizational justice (e.g., Colquitt et al., 2001; Colquitt, 2012) are likely to affect workers' well-being, attitudes and behavior, which have consequences for firms' performance. The standard economic framework traditionally only accounted for a person's own income and not for her relative income within a group (e.g., Clark and Oswald, 1996; Luttmer, 2005; Clark et al., 2008), i.e., in our context, only for the worker's own absolute wage and not for co-workers' wages. The development of principal-agency theory and personnel economics has then emphasized that it is also important how hierarchy and pay are structured within firms in order to set incentives (e.g., performance pay, deferred compensation, tournament theory, efficiency wages). Inspired by research from psychology and sociology, economics has further included relative wages and wage compression in a modern (behavioral) economic framework (e.g., Clark et al., 2009; Clark and D'Ambrosio, 2015). This modern framework accounts, for example, for considerations about equity, relative deprivation, aspiration levels, status, signals, altruism, inequality aversion, and monopsony power. In order to illustrate the underlying and often counteracting mechanisms of these theoretical considerations, we use a simple utility framework. Afterwards we discuss the effects of wage structures on workers' fairness perceptions, job satisfaction, and behavioral intentions such as turnover. We consider four variables that describe the wage structure and affect a worker's utility level: the worker's own absolute wage, the worker's internal reference wage within the firm, the wage dispersion in the worker's firm, and the worker's external reference wage across firms.

As the worker generates consumption from her own absolute wage, it is positively related to utility. In terms of equity theory (Adams, 1965), which is concerned with a fair relation between outcome and input compared to some reference level, a higher own absolute wage can be interpreted as a higher outcome. Equity theory leads us directly to the importance of relative wages within the firm, as a worker compares her wages (and inputs) with co-workers' wages (and inputs), which serve as reference levels. Such reference levels can also be interpreted as aspiration levels, which a worker wants to achieve and compares herself with (Stutzer, 2004). Relative deprivation theory predicts that a negative deviation of the current own wage from the

current aspiration level reduces utility, even if the own wage does not change. Higher wages of others might further indicate lower own social status within the firm (Frank, 1984a, 1984b; Clark et al., 2009), as the own relative standing is lower if others earn more. Thus, in a ceteris paribus perspective, i.e., holding the own absolute wage constant, a higher reference wage should decrease utility, because it indicates higher relative outcomes for others, higher relative deprecation from aspiration levels, and lower status. However, a counteracting "tunnel" effect exists, because a higher reference wage might signal higher own future income (Hirschman and Rothschild, 1973; Clark et al., 2009), i.e., the reference wage serves as a future and not as the current aspiration level and provides information about future prospects in the firm. In such a long-term career perspective, a higher reference wage might be positively valued and increase utility. Another counteracting effect might be that a worker has altruistic preferences and, therefore, higher wages and utility levels of co-workers also increase the own utility level.

A firm's wage structure can be more or less compressed. On the one hand, a higher wage dispersion indicates a higher degree of wage inequality in a firm, which might reduce a worker's utility if she has preferences for equality (inequality aversion) (Clark and D'Ambrosio, 2015). On the other hand, a lower wage dispersion, i.e., a more compressed wage structure, might be the result of the firm's monopsony power, which could be used to exploit workers. To the best of our knowledge, monopsony power has not been considered previously in our context. But the ideas are not new, if we think about monopsonistic labor market models and more specifically about the "new" training literature (e.g., Pfeifer, 2016) as well as about discrimination and wage differentials (Hirsch et al., 2010; Hirsch and Jahn, 2015). In case of exploitations due to monopsony power, we would expect that a higher wage dispersion as proxy for lower wage compression and less monopsony power might increase worker's utility.

Last, we leave the within firm perspective and consider workers' external reference wages across firms, which can also be interpreted as workers' potential outside options. In our utility context, higher external reference wages are likely to decrease utility. From an equity perspective, better outcomes for comparable workers in other firms might be interpreted as an unfair wage setting by the own firm and such a fairness violation might decrease utility. Moreover, a worker's social status in the society – and not just in the own firm – is lower, if comparable workers in other firms earn more. Unlike the internal reference wage within the own firm, the external reference wage does not signal better future prospects in the same firm, because the worker would need to switch to a higher paying firm. Thus, we should not expect a counteracting signal effect. Altruistic preferences are also more likely to be prevalent for the

internal reference wage, i.e., for known co-workers, than for the external reference wage, i.e., for unknown workers in other firms.

The expected effects of our four wage structure variables on workers' utility and the underlying theories are a starting point for a further discussion of the effects of firms' wage structures on workers' fairness perceptions, job satisfaction, and turnover intentions. First, we are interested in the nexus between the wage structure variables and perceived fairness of own rewards in the firm, which we label, for simplicity, perceived wage fairness. Although we do not assume a direct link from utility to perceived wage fairness and it is more reasonable to assume a positive causal link from perceived wage fairness to utility, the theoretical considerations about wage structures and perceived wage fairness should be quite similar to the ones about utility. But if we take perceived wage fairness literally, status and signal considerations should be less important than explicit justice considerations such as equity theory, altruistic preferences, and inequality aversion. However, in the context of equity theory, status might be considered as a current outcome and signals as potential future outcomes, which might be taken into account by workers in addition to their current own wage.

Second, we are interested in the impact of the wage structure variables and the perceived wage fairness on workers' job satisfaction. As job satisfaction is a proxy for utility from work, the above theoretical considerations for utility are the same for job satisfaction. If we additionally condition job satisfaction on perceived wage fairness, we would expect that part of the wage structure effects is absorbed (mediated) by perceived wage fairness, which should be positively correlated with job satisfaction. Note again that if we take perceived wage fairness literally, controlling for wage fairness should primarily absorb explicit justice considerations such as equity theory, altruistic preferences, and inequality aversion, but not status and signal considerations.

Third, worker behavior and behavioral intentions are often directly related to utility and job satisfaction. This is especially true for workers' turnover intentions, as an unsatisfied worker is more likely to quit the current job or at least to search for a new job, in which she could obtain a higher utility level than in the current firm (Clark, 2001). Consequently, utility is negatively correlated with turnover intentions and the expected effects of the wage structure variables on utility simply reverse their signs (Pfeifer and Schneck, 2012). However, this might not be the case for our monopsony power argument for wage compression, because a source of monopsony power can be workers low mobility (e.g., due to fewer outside options in a monopsonistic labor market). If we additionally condition turnover intentions on perceived

wage fairness and on job satisfaction, we would expect that part of the wage structure effects is again absorbed, because their effects are partly mediated by perceived wage fairness and job satisfaction.

Previous studies using survey data (without information about workers within the same firm and consequently without internal wage structure variables) have reported evidence that unfair perceived wages, the gap between fair and actual wages, and external reference wages are negatively correlated with job satisfaction and turnover intentions and positively with actual quits (e.g., Clark and Oswald, 1996; Kersting and Pfeifer, 2013; D'Ambrosio et al., 2018). But in order to study properly the consequences of firms' wage structures, linked employer-employee data are necessary. Clark et al. (2009) match the Danish sample of the European Community Household Panel (ECHP) with administrative data and find that, holding the own wage constant, the average wage in an establishment is positively correlated with job satisfaction. Brown et al. (2008) report for the UK positive correlations of the mean wage and the wage rank within the firm with pay satisfaction. Godechot and Senik (2015) match a worker survey with administrative data for France and use different reference wage variables. Even though all internal reference wage variables are positively correlated with wage satisfaction, only the median wage and the 75th percentile wage in the entire firm (or establishment) are statistically significant. The ordinal wage rank, median and average internal reference wages for comparable co-workers in the same occupation and age group are not statistically significant, if analyzed separately. But if jointly analyzed in one regression, wage satisfaction is significantly larger for higher wage ranks, higher median wages, lower regional reference wages, and lower top earnings. Godechot and Senik (2015) find, however, no significant correlations between quit intentions and internal reference wage variables, whereas quit intentions are positively correlated with the regional reference wage. Pfeifer and Schneck (2012) find for German linked employer-employee data (LIAB) that the average wage in an establishment as well as a conditional internal reference wage measure are on average negatively correlated with the probability to quit. They additionally include the ordinal wage rank, which is on average positively correlated with the probability to quit. Galizzi and Lang (1998) report for Italy that the average wage in an establishment is negatively correlated with workers' probability to quit the job. Card et al. (2012) find in a field experiment with an information treatment among employees of the University of California that workers, who know they earn lower relative wages, have significantly lower job and pay satisfaction and, in turn, a higher probability to search for a new job. Dube et al. (2019) use personnel data of a large US retailer and a regression-discontinuity design. They find strong causal effects of own

wages and peer wages on quits, which are largely driven by peer comparisons and fairness concerns; but no evidence for signal considerations.

The main results of these previous studies using linked employer-employee data can be summed up as follows: Internal reference wages are on average positively correlated with pay and job satisfaction and negatively with turnover intentions or actual quits, from which one might conclude that the signal effect (higher reference wage indicates better future career prospects) dominates the status effect (higher reference wage indicates lower own status). But none of these studies has taken into account workers' perceived wage fairness, which we analyze explicitly as mediator variable. Moreover, the studies have in common that they accounted for more or less unconditional reference wages (e.g., average, median, 75th percentile) in the entire firm, whereas we use more narrowly defined conditional reference wages. The importance of conditional reference wages of comparable co-workers within the same firm is illustrated by Clark et al. (2009), who report for job satisfaction a positive correlation with the average wage in the entire firm and a negative correlation with the average wage of workers in the same occupation in the same firm. Thus, for more comparable workers the status effect seems to dominate the signal effect, and not vice versa as it is the case for the average wage in the entire firm.

3. Data, variables, and estimation approach

Dataset and data preparations

We use the Linked Personnel Panel (LPP) merged with the social security records of all employees working in the LPP firms in Germany (Kampkoetter et al., 2016). The LPP consists of questionnaires for the employer and a questionnaire for the employees. The employee questionnaire asks about job characteristics, attitudes, personality, and socio-demographic background. The employer questionnaire, answered by the owner or top managers of the establishment, entail questions about HRM practices and general firm policies. Note that the LPP asks additional questions to a subsample of the IAB Establishment Panel firms, a representative annual survey of German establishments (Fischer et al., 2009). The LPP establishment survey focuses more on HR policies, while the IAB Establishment Panel focuses more on general management and employment structure issues. Hence, the data entail the IAB Establishment Panel survey and the LPP survey for employers.

The LPP is a representative sample of private sector establishments with 50 or more employees in manufacturing and service industries. The sample is stratified according to four establishment size classes (50-99, 100-249, 250-499, and 500 and more employees), five industries (metalworking and electronic industries, further manufacturing industries, retail and transport, services for firms, and information and communication services) and four regions (North, East, South, and West). We use the waves 2012 and 2014 consisting of 10,175 individuals nested in 869 establishment, who gave consent to merge the required data. The analysis is based on the individual level (LPP employee survey) pooled cross-section data augmented with establishment level characteristics (LPP establishment survey/ IAB Establishment Panel survey) and wage structure variables (social security records). We dropped individuals from our estimation sample with reported earnings below (<€400 per month in 2012) and above (>€5600 per month in 2012) the social security thresholds, with no comparable co-workers in the same occupation and establishment cell, and with item non-responses in variables used, which leaves us with 8,483 worker-year observations nested in 867 establishments for the analysis.

Dependent variables

The three dependent variables stem from the LPP employee survey. Workers' perceived wage fairness (*WFAIR*) relates to the question: "I believe that I am being rewarded fairly at work", answered on a five-point ordinal scale ranging from 1 to 5 (1: "does not apply at all", 2: "does rather not apply", 3: "neutral", 4: "largely applies", 5: "fully applies"). Higher values indicate that the individual regards the rewards at work as fairer. The variable focusses on the individual perception of fair rewards at work and originates from distributional fairness scale developed by Kim and Leung (2007). Table 1 shows that the mean perceived wage fairness is 3.5 measured on a five-point scale from 1 to 5. In more detail, about 7 percent of the surveyed workers give the lowest fairness rating ("does not apply at all"), 14 percent give a low fairness rating ("does rather not apply"), 19 percent give a neutral rating, 41 percent give a high fairness rating ("largely applies"), and 19 percent give the highest fairness rating ("totally applies"). Even though our five-point scale fairness rating is not directly comparable to binary fairness judgements in other data sets, workers seem on average to perceive their rewards as rather fair. For example, D'Ambrosio et al. (2018) report for the German Socio-Economic Panel that more than one-third of the workers in their sample perceive their wages as unfair, whereas in our sample only 21 percent give low fairness ratings and additional 19 percent give a neutral rating.

Workers' job satisfaction (*JSAT*) relates to the question: "How satisfied are you today with your job? Please answer on a scale from 0 to 10, where 0 means "totally unhappy" and 10 means "totally happy"." Thus, a higher value represents a higher job satisfaction level. Table 1 shows that mean job satisfaction is relatively high with 7.6 measured on an eleven-point Likert scale from 0 to 10. Mean job satisfaction and the distribution of job satisfaction is comparable between the LPP and the German Socio-Economic Panel (Kampkoetter et al., 2016).

Workers' turnover intention (*TI*) is based on the response to the question: "In the past twelve months, how many times have you thought about changing your job?" Respondents answered on a five-point ordinal scale ranging from 1 to 5 (1: "never", 2: "a few times a year", 3: "a few times a month", 4: "a few times a week", 5: "every day"). Hence, a higher value represents an increasing intention-to-leave the current employer. Table 1 indicates that the mean turnover intention is relatively low with 1.6 measured on a five-point scale from 1 to 5. The majority of 62 percent of the surveyed workers has never thought about changing the job in the past twelve months and about 24 percent have thought about it only a few times per year. About 9 percent have thought about changing the job a few times per month and 4 percent have thought about it a few times per week. Less than 2 percent of the workers have thought about changing the job every day.

Table 1 further indicates that our three dependent variables of interest are significantly correlated with each other. Whereas perceived wage fairness and job satisfaction are positively correlated, both are negatively correlated with turnover intentions. A more elaborated analysis on these interrelations and the impact of wage structure variables will be based on ordered probit regression results and a mediation analysis.

[insert Table 1 about here]

Wage structure variables

We estimate and calculate four wage structure variables based on the social security records of all full-time employees working in a LPP establishment on June 30th in 2012 and 2014: the worker's own absolute wage (*WABS*), the worker's conditional internal reference wage within the firm (*WREF*), the conditional wage dispersion in the worker's firm (*WSER*), and the worker's conditional external reference wage across firms (*WEXT*). The worker's own absolute wage (*WABS*) is simply the log of individual nominal earnings per day. As the average wage in

a complete establishment is a very broad comparison income for workers with different characteristics and productivity levels, we predict a worker's reference wage within the firm (*WREF*) based on the results of Mincer type earnings regressions estimated separately for each establishment and year. The regressions explain log daily earnings of full-time employees with individual schooling level (three categories), quadratic age function and dummies for one-digit occupation codes. The predicted internal reference wage within the firm is consequently the average wage in each cell of the considered explanatory variables. We use the same approach to generate the worker's conditional external reference wage across firms (*WEXT*) by predictions from a Mincer type earnings regression for all workers across all firms in the sample instead of separate regressions for each establishment. Our approach to estimate reference wages closely follows Clark and Oswald (1996), who included predicted wages conditional on schooling, occupation, sector, region, and other variables from their entire sample in satisfaction equations. Note that we use Tobit models for all earnings regressions, because the earnings in the social security data are bottom and top coded at the social security thresholds. In total, we use approximately half a million worker-year observations from administrative social security data for the regressions to predict internal and external reference wages.

The wage dispersion in a firm (*WSER*) can also be generated from the social security records. The simplest approach would be to use the standard deviation of workers' daily wages in a given establishment, which would measure the unconditional wage dispersion. This unconditional wage dispersion has however the disadvantage that it does not account for differences in worker characteristics such as qualifications, which affect productivity and wage classifications. Therefore, we generate a conditional wage dispersion measure following the approach of Winter-Ebmer and Zweimüller (1999), who analyzed the effect of intra-firm wage dispersion on establishment performance. This approach has been widely used with linked employer-employee data in order to study the effects of wage inequality on firm performance measures such as productivity and profits (Mahy et al., 2011) as well as the effects of wage compression on cost coverage of training (Pfeifer, 2016). Based on the results from the above Mincer type earnings regressions for each establishment and year, the standard error of the Tobit regression is generated. The standard error of the regression in an establishment can be interpreted as the standard deviation of workers' individual error terms in an estimated earnings function for this establishment in a given year. A larger standard error of the regression indicates a larger conditional intra-firm wage dispersion and consequently lower intra-firm wage compression.

Table 1 presents means, standard deviations, and correlations for our four wage structure variables. The own absolute daily wage (*WABS*) is on average 4.709 log points and the predicted reference daily wage within the firm (*WREF*) is on average 4.695 log points. Not surprisingly, *WABS* and *WREF* are strongly correlated (r=0.904), as the latter is a prediction from regressions for the former at the firm level. The wage dispersion in firms (*WSER*) is on average 0.192 with a standard deviation of 0.056, which are comparable in size with other studies using this approach. *WSER* is negatively correlated with *WABS* (r=-0.140) and *WREF* (r=-0.167). The predicted external reference daily wage across firms (*WEXT*) is on average 4.775 log points and positively correlated with *WABS* (r=0.635), *WREF* (r=0.702), and *WSER* (r=0.087). It can also be seen that *WABS*, *WREF*, and *WEXT* are positively correlated with perceived wage fairness as well as job satisfaction and negatively correlated with turnover intentions. *WSER* is negatively correlated with perceived wage fairness as well as job satisfaction and positively correlated with turnover intentions. These are, however, only raw correlations and a more elaborated analysis follows using ordered probit regressions and a mediation analysis.

Control variables

We control for a wide range of socio-demographic variables (age, education, gender, having a partner, having kids, German citizenship), personality (Big Five, trust), employment characteristics (permanent contract, working hours, shift work, flexible working time, managerial responsibilities), job characteristics (out-of-hours demand, decision autonomy, task autonomy, interdependence with co-workers, physical loading), and establishment characteristics (works council, collective agreement, workforce composition, limited company, foreign-owned company, state-of-the-art technology, firm-size categories, sector and regional dummies) to capture confounding factors that are correlated with the wage structure variables, fairness perceptions, job satisfaction, and turnover intentions. Thereby, we also extend previous studies by including the job level in the analysis, which is particularly relevant in analyzing fairness perceptions. The complete list of control variables and their descriptive statistics are displayed in the Appendix Table A.1.

Estimation approach

We have three research questions, which we combine in a mediation-style regression analysis.[1] First, we are interested in the impact of firms' wage structures on workers' perceived wage fairness (*WFAIR*). Second, we are interested in the impact of firms' wage structures on workers' job satisfaction (*JSAT*) and turnover intentions (*TI*). Third, we are interested in the contribution of the fairness considerations on the overall effect of the wage structures on workers' job satisfaction and turnover intentions. For this purpose, we estimate several equations. In the first equation, we investigate if the wage structure variables have an effect on individual fairness perceptions. If the regression confirms such relationships, we estimate in the next step the effects of the wage structure variables on job satisfaction and turnover intentions without accounting for individual fairness perceptions. The estimated parameters are the total effects of the wage structure variables on job satisfaction and turnover intentions incorporating several mechanisms such as fairness, signal, and status. In further equations, we then estimate the effects of the wage structure variables on job satisfaction accounting for individual fairness perceptions and on turnover intentions accounting for individual fairness perceptions as well as for job satisfaction. These estimations give us the direct effects of the wage structure variables on job satisfaction and turnover intentions controlling for the mechanism of fairness perceptions. Finally, the contribution of fairness perceptions on the relation of the wage structure on job satisfaction and turnover intention (indirect effects) can be assessed by comparing the coefficients of the wage structure coefficients between the regressions with and without fairness perceptions.

More formally expressed, our estimation approach is a regression-based mediation analysis (for a detailed discussion see, for example, Hayes, 2015, 2017). The effects of the wage structure variables on perceived wage fairness, which is our mediator variable that explains part of the effects of wage structures on job satisfaction and turnover intentions, are measured by $\beta^{(1)}$ in equation (1). The two job satisfaction equations are helpful in illustrating the differences between direct and indirect effects of the wage structure variables. Whereas equation (2) estimates the "total effects" $\beta^{(2)}$, equation (3) additionally controls for perceived wage fairness so that $\beta^{(3)}$ is the remaining effect, i.e., part of the total effect is absorbed (mediated) by the impact of wage structures on perceived wage fairness. In terms of mediation analysis, we can simply call $\beta^{(3)}$ the "direct effects" of wage structures on job satisfaction and $\beta^{(2)}$-$\beta^{(3)} \approx \beta^{(1)} \times \delta^{(3)}$

[1] Note that the used term "effects" refers to the terminology in mediation analysis and not to causality.

the "indirect effects" of wage structures on job satisfaction. Hence, the total effects are $\beta^{(3)}+\beta^{(1)}\times\delta^{(3)}\approx\beta^{(2)}$.

(1) $$WFAIR = \alpha + \beta_1^{(1)}WABS + \beta_2^{(1)}WREF + \beta_3^{(1)}WSER + \beta_4^{(1)}WEXT + \gamma^{(1)}X + \varepsilon$$

(2) $$JSAT = \alpha + \beta_1^{(2)}WABS + \beta_2^{(2)}WREF + \beta_3^{(2)}WSER + \beta_4^{(2)}WEXT + \gamma^{(2)}X + \varepsilon$$

(3) $$JSAT = \alpha + \beta_1^{(3)}WABS + \beta_2^{(3)}WREF + \beta_3^{(3)}WSER + \beta_4^{(3)}WEXT + \delta^{(3)}WFAIR + \gamma^{(3)}X + \varepsilon$$

Total effects of wage structures on *JSAT*: $\beta^{(2)} \approx \beta^{(3)}+\beta^{(1)}\times\delta^{(3)}$

Direct effects of wage structures on *JSAT*: $\beta^{(3)}$

Indirect effects of wage structures on *JSAT*: $\beta^{(1)}\times\delta^{(3)} \approx \beta^{(2)}\text{-}\beta^{(3)}$

We repeat this procedure for turnover intentions as dependent variable and job satisfaction as an additional mediator variable.

(4) $$TI = \alpha + \beta_1^{(4)}WABS + \beta_2^{(4)}WREF + \beta_3^{(4)}WSER + \beta_4^{(4)}WEXT + \gamma^{(4)}X + \varepsilon$$

(5) $$TI = \alpha + \beta_1^{(5)}WABS + \beta_2^{(5)}WREF + \beta_3^{(5)}WSER + \beta_4^{(5)}WEXT + \delta_1^{(5)}JSAT + \delta_2^{(5)}WFAIR + \gamma^{(5)}X + \varepsilon$$

All three dependent variables are ordinally measured. Workers' perceived wage fairness (*WFAIR*) and workers' turnover intentions (*TI*) are measured on five-point ordinal scales and job satisfaction (*JSAT*) is measured on an eleven-point ordinal scale. Hence, we estimate pooled cross section ordered probit regressions and calculate average marginal effects for a quantitative interpretation. Although we use data for the years 2012 and 2014, worker random or fixed effects models are not a feasible estimation strategy in our application. First, our data consist of only two waves. Second, even though the establishment panel survey includes most firms for both waves, the worker survey with our outcome variables does not. Consequently, many workers are only observed once and the overall within variance is low. Because we use aggregated and predicted wage variables at the establishment level as regressors, we report robust standard errors clustered at the establishment level. Note, however, that such clustered standard errors are rather conservative, i.e., we might produce too low statistical significance levels.

4. Regression results

Workers' perceived wage fairness

The ordered probit regression results for workers' perceived wage fairness (*WFAIR*) (equation (1)) in Table 2 indicate that all estimated coefficients for the wage structure variables are statistically significant.[2] On the one hand, workers with higher own absolute wages (*WABS*) and with higher internal reference wages within the firm (*WREF*), that is with higher paid peers, are on average significantly more likely to perceive their wages as fairer. On the other hand, workers in firms with higher wage dispersion (*WSER*) and workers with higher external reference wages across firms (*WEXT*) are on average significantly less likely to perceive their wages as fairer. For a quantitative assessment, we have computed average marginal effects on the probability of each of the five ordinal outcomes. In addition to absolute marginal effects, we also present relative marginal effects, which are in principle semi-elasticities. For brevity reasons, we only give an example for the interpretation and refer to the result tables for all marginal effects. A 0.1 log point (approximately 10 percent) higher own absolute wage is associated with a 0.95 percentage point or 19.5 percent lower probability to give the lowest fairness rating and with a 2.18 percentage point or 13.8 percent higher probability to give the highest fairness rating. Without going into detail, the marginal effects suggest that our four wage structure variables have a sizeable impact on perceived wage fairness.

[insert Table 2 about here]

Our results indicate that not only the own absolute wage matters for the fairness perception. Relative wages also matter. In our ceteris paribus interpretation, holding the own wage constant, the coefficients and marginal effects of the reference wage inside the firm have about half the size of the own absolute wage. If we assume that explicit justice considerations such as equity, altruistic preferences, and inequality aversion are more important than status and signal considerations when making fairness judgements, we can draw the following conclusions from our results. Because the internal reference wage is positively correlated with the perceived wage fairness, equity considerations (higher reference wages indicate higher relative outcome for comparable co-workers) seem to be less important than altruistic preferences (workers care for co-workers). Moreover, the results support the notion of inequality aversion of workers,

[2] Note that we only present and discuss the results for our variables of interest in the main text. The complete ordered probit regression results are displayed in the Appendix Table A.2. Also note that we estimate correlations and not necessarily causal effects. The used term "effects" in our text and tables mainly refers to marginal effects as well as the terminology in mediation analysis (total, direct and indirect effects).

because wages are perceived as less fair if the firm's wage dispersion is higher. In addition to the internal wage structure, outside comparisons in form of equity and status considerations also matter, because the external reference wage is negatively correlated with the perceived wage fairness. The opposing signs for external and internal reference wages might indicate that altruistic preferences are more important in closer interpersonal relations, i.e., they are more directed to known co-workers than to unknown workers in other firms.

Workers' job satisfaction

We have estimated two specifications for workers' perceived job satisfaction (*JSAT*) in Table 3, one without (equation (2), upper part of the table) and one with perceived wage fairness (equation (3), lower part of the table) to assess the proportion of fairness perceptions that are carried by the wage structure variables. The first specification reveals that only the own absolute wage and the external reference wage are statistically significantly correlated with job satisfaction. A higher own absolute wage is associated with higher job satisfaction and a higher external reference wage is associated with lower job satisfaction, which supports again the view that outside comparisons in form of equity and status considerations matter. These counteracting effects have about the same size, which is in line with the Easterlin Paradox and strong relative income concerns in a society (Clark and Oswald, 1996; Clark et al., 2008). But internal reference wages and wage dispersion do not seem to be very relevant in determining job satisfaction. The picture changes, however, once we include the perceived wage fairness in the second specification. Not surprisingly, the perceived wage fairness is highly correlated with job satisfaction. More interestingly is the mediation role it plays, i.e., how strongly perceived wage fairness affects the correlations of the wage structure variables. First, the own absolute wage is not significant anymore, as most of its effect is driven by the wage fairness perceptions. Second, the internal reference wage becomes significantly and negatively correlated with job satisfaction. Thus, after taking the fairness effect (e.g., altruistic preferences) out in a ceteris paribus perspective, the status effect seems to dominate. This means that status and fairness balanced each other in the first specification. The firm's wage dispersion is still not significant, whereby the external reference wage is still negatively correlated with job satisfaction.

[insert Table 3 about here]

In order to assess the mediation role of the perceived wage fairness more closely, we use the ordered probit regression results for a mediation analysis in Table 4. The total effects of our wage structure variables on job satisfaction are their coefficients in equation (2) without controlling for perceived wage fairness. These total effects can be separated in direct effects, which are the coefficients after controlling for perceived wage fairness in equation (3), and indirect effects, which are the absorbed part of the total effects driven by the effects of the wage structure variables on fairness perceptions. The total effect of own absolute wages on job satisfaction is 0.262, of which 0.236 (90 percent) can be attributed to perceived wage fairness as indirect effect and only 0.026 remain as direct effect. Whereas the total effect of the internal reference wage is virtually zero due to balancing of counteracting effects, the direct effect is -0.175 and the indirect effect is 0.144. The positive indirect effect via perceived wage fairness might be reasoned by altruistic preferences, i.e., own job satisfaction is larger if co-workers earn more, because workers in a firm care for each other. The negative direct effect might be reasoned by status considerations, i.e., own job satisfaction is lower if co-workers earn more because this leads to lower own social status. Furthermore, about half of the total effect of the firm's wage dispersion, which is however not significant, is driven by the indirect effect via perceived wage fairness (e.g., inequality aversion). For the external reference wage only a third of the total effect is driven by the indirect effect via perceived wage fairness. If we assume that the indirect effect via perceived wage fairness includes equity considerations, the direct effect is likely to include social status considerations when comparing with workers in other firms. Our overall findings suggest that the effects of the internal wage structure on job satisfaction via perceived wage fairness are significant and that status considerations are also relevant.

[insert Table 4 about here]

Workers' turnover intentions

We proceed by estimating two specifications for workers' turnover intentions (*TI*), one without (equation (4), upper part of Table 5) and one with controlling for workers' perceived wage fairness and job satisfaction (equation (5), lower part of Table 5). The results in Table 5 show for the first specification that higher own absolute wages and higher internal reference wages within the firm are significantly correlated with lower turnover intentions, whereby higher wage dispersion in firms and higher external reference wages are significantly correlated with higher turnover intentions. If we control for perceived wage fairness and job satisfaction in the second

specification, which are both significantly negatively correlated with turnover intentions, the own absolute wage is not statistically significant anymore, which supports the mediating role of perceived wage fairness and job satisfaction. The wage dispersion in firms is only significant at p=0.17. But the internal reference wage remains significantly negatively correlated with turnover intentions, even after taking the fairness effect (e.g., altruistic preferences) and job satisfaction effect (e.g., status consideration) out in a ceteris paribus perspective. One explanation might be that, although workers dislike that peers earn more due to status considerations, higher wages of comparable co-workers signal potential own wage growth in the future. Moreover, the external reference wage is still significantly positively correlated in the second specification, which stresses the important role of outside options when thinking about voluntary turnover. This finding is in line with Godechot and Senik (2015), who also find that quit intentions are significantly positively correlated with the external regional reference wage. Godechot and Senik (2015) find, however, no significant correlation with internal reference wage variables.

[insert Table 5 about here]

We use again the ordered probit regression results for a mediation analysis in Table 6. The total effects of our wage structure variables on turnover intentions are their coefficients in equation (4) without controlling for perceived wage fairness and job satisfaction. These total effects can be separated in direct effects, which are the coefficients after controlling for perceived wage fairness and job satisfaction in equation (5), and indirect effects, which are the absorbed part of the total effect driven by the effects of wage structures on fairness perceptions and job satisfaction. The total effect of own absolute wages on turnover intentions is -0.337, of which -0.313 (more than 90 percent) can be attributed to perceived wage fairness and job satisfaction as indirect effect and only -0.023 remain as direct effect. For the internal reference wage, the indirect effect makes up only about ten percent of the total effect. The large remaining direct effect might be explained by the signal character of peer wages. For firms' wage dispersion, a quarter of the total effect can be attributed to perceived wage fairness and job satisfaction as indirect effect. The large remaining direct effect might be explained by wage dispersion as a proxy for firms' monopsony power. One reason for a firm's monopsony power can be that workers have few outside options so that they have limited chances to find a new job and, consequently, have lower turnover intentions. For the external reference wage, one-third can be attributed to the indirect effect via perceived wage fairness and job satisfaction, whereas the

remaining direct effect might be explained by the interpretation of the external reference wage as a proxy for outside options.

[insert Table 6 about here]

Robustness checks

We have checked the sensitivity of our results by several robustness checks.[3] First, we have estimated additional specifications, in which we have excluded the internal reference wage, the firm's wage dispersion, or the external reference wage, because of potential multicollinearity problems. The results are quite robust to these changes. Second, we have estimated specifications without controlling for differences in personality traits and trust, as they might be affected by wage comparisons. The results are again quite robust to these changes. Third, we have included firm fixed effects, which have however the disadvantage that the firm's wage dispersion drops out and that within firm variance is lower than the overall variance. But the results do not change qualitatively. Fourth, we have repeated the regressions for subsamples (small vs. large firms, East vs. West, Men vs. Women). Noteworthy differences are that the external reference wage as a proxy for potential outside options in turnover decisions is not significant in East German firms and for women. An explanation might be that job opportunities in East Germany and for women are still worse so that the choice set of outside options and the reaction to potential external reference wages is smaller. Overall, our results seem to be quite robust in our sensitivity analyses. Unfortunately, we cannot estimate worker fixed effects models to deal with individual unobserved heterogeneity, because too few workers have panel observations and the within variance is very low. But at least the survey data allow us to include many control variables such as personality traits, job and firm characteristics. Moreover, reverse causality seems rather unlikely in our application with a clear logical link from wage structures to perceived wage fairness to job satisfaction to turnover intentions. Nevertheless, the interpretation of our estimated correlations – including total, direct and indirect effects in the mediation analyses – as causal effects should be made with caution.

[3] The complete results can be requested from one of the authors.

5. Conclusion

The main findings of our empirical analysis are that firms' wage structures are major determinants of workers' perceived wage fairness, even when controlling for workers' own absolute wages in a ceteris paribus perspective, and that workers' perceived wage fairness is a major determinant of workers' job satisfaction and turnover intentions. The total effects of the own absolute wage on job satisfaction and turnover intentions are largely driven by the positive indirect effects via perceived wage fairness. Moreover, we have found evidence for equity and social status considerations, if workers compare wages with comparable workers inside and outside the own firm, which is consistent with recent findings for France by Godechot and Senik (2015) who also compute wage measures from social security records and use survey information as outcome variables. Note, however, that Godechot and Senik (2015) analyze wage satisfaction, whereas we analyze job satisfaction, and that we use different measures of the internal wage structures. Co-workers wages as signals seem to matter in the context of turnover intentions, but seem not to be very important in determining job satisfaction, which contradicts in part previous findings in the literature that the signal effect (ambition) dominates on average the status effect (jealousy). But if compared to our empirical analysis, most previous studies have not used conditional reference wages, have not included further wage structure variables, and have not taken into account workers' perceived wage fairness as mediator. For example, Clark et al. (2009) find that job satisfaction is positively correlated with the average wage in the entire firm (signal dominates status) and negatively correlated with the average wage of workers in the same occupation in the same firm (status dominates signal). Furthermore, our findings suggest that altruistic preferences towards co-workers and inequality aversion towards the own firm's wage distribution are prevalent among workers.

Our findings have implications for firms' wage policies and labor market policies. Even if unequal pay structures and comparisons at the workplace might be beneficial from an incentive point of view (e.g., performance pay, rank-order tournaments), they might have negative effects on worker attitudes (e.g., fairness perceptions), job satisfaction, and behavioral outcomes (e.g., quits). For example, on the one hand, higher internal reference wages of co-workers can yield positive incentive effects and are seen as fair due to altruistic preferences. On the other hand, higher internal reference wages reduce job satisfaction due to status considerations and reduce turnover intentions due to signal considerations, if fairness considerations are put aside. Moreover, external reference wages have neither the signaling character nor a strong altruistic component so that status should be the main force in social comparisons with workers in other

firms. If in total the status effect dominates the signal effect as suggested by the findings of our analysis, this might explain why many workers insist on pay secrecy rules and one might question policies of pay transparency within and across firms.

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Tables and figures to be included in text

Table 1: Definitions, descriptive statistics, and correlations for variables of interest

Variable	Definition	Mean	Std. dev.	*TI*	*JSAT*	*WFAIR*	*WABS*	*WREF*	*WSER*
TI	Turnover intentions in past 12 months (1: low; 5: high)	1.595	0.922	1					
JSAT	Job Satisfaction (0: low; 10: high)	7.555	1.706	-0.531	1				
WFAIR	Perceived fairness of rewards (1: low; 5: high)	3.525	1.143	-0.338	0.323	1			
WABS	Log own daily wage	4.709	0.410	-0.178	0.135	0.412	1		
WREF	Predicted log daily reference wage in firm	4.695	0.370	-0.176	0.114	0.400	0.904	1	
WSER	Wage dispersion in firm (standard error of regression)	0.192	0.056	0.078	-0.018	-0.088	-0.140	-0.167	1
WEXT	Predicted log daily reference wage outside firm	4.775	0.279	-0.070	0.048	0.243	0.635	0.702	0.087

Notes: 8483 worker-year observations in 867 establishments. All correlation coefficients are statistically significant different from zero at $p<0.01$.

Table 2: Ordered probit regression results for perceived wage fairness (*WFAIR*)

	Coefficients	Average marginal effects on ordinal outcomes from 1 ("does not apply at all") to 5 ("totally applies") [frequency] …				
	(p-values)	1 [6.6%]	2 [14.0%]	3 [18.9%]	4 [41.4%]	5 [19.1%]
WABS	0.895***	-0.095	-0.121	-0.082	0.081	0.218
	(<0.01)	[-194.7%]	[-114.6%]	[-53.1%]	[28.0%]	[138.4%]
WREF	0.485***	-0.051	-0.066	-0.045	0.044	0.118
	(<0.01)	[-105.6%]	[-62.1%]	[-28.8%]	[15.2%]	[75.0%]
WSER	-0.520*	0.055	0.071	0.048	-0.047	-0.126
	(0.08)	[113.1%]	[66.6%]	[30.9%]	[-16.3%]	[-80.4%]
WEXT	-0.464***	0.049	0.063	0.043	-0.042	-0.113
	(<0.01)	[101.0%]	[59.5%]	[27.6%]	[-14.5%]	[-71.8%]

Notes: 8483 worker-year observations in 867 establishments. Dependent variable is perceived wage fairness (*WFAIR*) rated on a five-point ordinal scale. Ordered probit regression includes all control variables. Descriptive statistics for all variables are displayed in Appendix Table A.1 and the complete regression results in Appendix Table A.2. We have computed robust standard errors clustered at the establishment level. Coefficients are statistically significant different from zero at * p<0.10, ** p<0.05, and *** p<0.01. Relative marginal effects (semi-elasticities) below the absolute marginal effects and frequency of each output variable category in brackets.

Table 3: Ordered probit regression results for job satisfaction (*JSAT*)

	Coefficients	Average marginal effects on ordinal outcomes from 0 ("totally unhappy") to 10 ("totally happy") [frequency] …				
	(p-values)	0 [0.6%]	2 [0.7%]	5 [6.4%]	8 [38.2%]	10 [16.6%]
WABS	0.262***	-0.004	-0.004	-0.020	0.013	0.038
	(<0.01)	[-81.4%]	[-65.0%]	[-39.6%]	[4.1%]	[51.0%]
WREF	-0.030	0.000	0.000	0.002	-0.001	-0.004
	(0.76)	[9.4%]	[7.5%]	[4.6%]	[-0.5%]	[-5.9%]
WSER	-0.225	0.003	0.003	0.017	-0.011	-0.033
	(0.44)	[69.9%]	[55.8%]	[34.0%]	[-3.6%]	[-43.9%]
WEXT	-0.353***	0.005	0.005	0.027	-0.017	-0.051
	(<0.01)	[109.5%]	[87.5%]	[53.3%]	[-5.6%]	[-68.7%]
WFAIR	0.281***	-0.004	-0.004	-0.021	0.013	0.039
	(0.00)	[-89.9%]	[-72.3%]	[-44.1%]	[4.6%]	[56.3%]
WABS	0.026	0.000	0.000	-0.002	0.001	0.004
	(0.73)	[-8.5%]	[-6.8%]	[-4.2%]	[0.4%]	[5.3%]
WREF	-0.175*	0.003	0.002	0.013	-0.008	-0.025
	(0.07)	[55.9%]	[44.9%]	[27.4%]	[-2.8%]	[-34.9%]
WSER	-0.117	0.002	0.002	0.009	-0.005	-0.016
	(0.67)	[37.5%]	[30.2%]	[18.4%]	[-1.9%]	[-23.5%]
WEXT	-0.238**	0.004	0.003	0.018	-0.011	-0.033
	(0.01)	[76.1%]	[61.2%]	[37.3%]	[-3.9%]	[-47.6%]

Notes: 8483 worker-year observations in 867 establishments. Dependent variable is perceived job satisfaction (*JSAT*) rated on an eleven-point ordinal scale. The first specification in the upper part of the table does not include perceived wage fairness (*WFAIR*), whereby the second specification in the lower part does. Ordered probit regressions include all control variables. Descriptive statistics for all variables are displayed in Appendix Table A.1 and the complete regression results in Appendix Table A.2. We have computed robust standard errors clustered at the establishment level. Coefficients are statistically significant different from zero at * p<0.10, ** p<0.05, and *** p<0.01. Relative marginal effects (semi-elasticities) below the absolute marginal effects and frequency of each output variable category in brackets.

Table 4: Mediation analysis and summary of ordered probit regression results for wage structures, perceived wage fairness, and job satisfaction

	(1) *WFAIR*	(2) *JSAT without WFAIR* (total effect)	(3) *JSAT with WFAIR* (direct effect)	indirect effect ≈ total effect (2) – direct effect (3)
WABS	0.895***	0.262***	0.026	0.236***
WREF	0.485***	-0.030	-0.175*	0.144***
WSER	-0.520*	-0.225	-0.117	-0.108**
WEXT	-0.464***	-0.353***	-0.238**	-0.115***
WFAIR			0.281***	

Notes: Results for (1) from Table 2 and for (2) and (3) from Table 3. Coefficients are statistically significant different from zero at * p<0.10, ** p<0.05, and *** p<0.01. In order to assess the statistical significance of the indirect effect, we have used a bootstrap procedure to obtain standard errors.

Table 5: Ordered probit regression results for turnover intentions (*TI*)

	Coefficients	Average marginal effects on ordinal outcomes from 1 ("never") to 5 ("every day") [frequency] …				
	(p-values)	1 [62.0%]	2 [23.6%]	3 [8.8%]	4 [3.9%]	5 [1.7%]
WABS	-0.337***	0.111	-0.046	-0.033	-0.020	-0.013
	(<0.01)	[21.1%]	[-25.1%]	[-50.2%]	[-69.8%]	[-93.0%]
WREF	-0.226*	0.074	-0.031	-0.022	-0.013	-0.009
	(0.06)	[14.2%]	[-16.9%]	[-33.7%]	[-46.9%]	[-62.5%]
WSER	0.561*	-0.184	0.076	0.054	0.033	0.021
	(0.09)	[-35.1%]	[41.9%]	[83.6%]	[116.2%]	[154.9%]
WEXT	0.610***	-0.201	0.083	0.059	0.036	0.023
	(<0.01)	[-38.2%]	[45.6%]	[91.0%]	[126.5%]	[168.7%]
JSAT	-0.344***	0.097	-0.044	-0.028	-0.015	-0.010
	(<0.01)	[23.1%]	[-28.6%]	[-60.1%]	[-85.7%]	[-113.4%]
WFAIR	-0.216***	0.061	-0.028	-0.018	-0.009	-0.006
	(<0.01)	[14.5%]	[-17.9%]	[-37.7%]	[-53.7%]	[-71.1%]
WABS	-0.023	0.007	-0.003	-0.002	-0.001	-0.001
	(0.81)	[1.6%]	[-1.9%]	[-4.1%]	[-5.8%]	[-7.7%]
WREF	-0.205*	0.058	-0.026	-0.017	-0.009	-0.006
	(0.09)	[13.8%]	[-17.1%]	[-35.9%]	[-51.2%]	[-67.7%]
WSER	0.424	-0.119	0.054	0.034	0.019	0.012
	(0.17)	[-28.4%]	[35.2%]	[74.1%]	[105.7%]	[139.9%]
WEXT	0.408***	-0.115	0.052	0.033	0.018	0.011
	(<0.01)	[-27.3%]	[33.8%]	[71.2%]	[101.5%]	[134.4%]

Notes: 8483 worker-year observations in 867 establishments. Dependent variable is turnover intentions (*TI*) rated on a five-point ordinal scale. The first specification in the upper part of the table does not include perceived job satisfaction (*JSAT*) and wage fairness (*WFAIR*), whereby the second specification in the lower part does. Ordered probit regressions include all control variables. Descriptive statistics for all variables are displayed in Appendix Table A.1 and the complete regression results in Appendix Table A.2. We have computed robust standard errors clustered at the establishment level. Coefficients are statistically significant different from zero at * p<0.10, ** p<0.05, and *** p<0.01. Relative marginal effects (semi-elasticities) below the absolute marginal effects and frequency of each output variable category in brackets.

Table 6: Mediation analysis and summary of ordered probit regression results for wage structures, perceived wage fairness, job satisfaction, and turnover intentions

	(1) *WFAIR*	(3) *JSAT with WFAIR*	(4) *TI without WFAIR and JSAT* (total effect)	(5) *TI with WFAIR and JSAT* (direct effect)	indirect effect ≈ total effect (4) – direct effect (5)
WABS	0.895***	0.026	-0.337***	-0.023	-0.313***
WREF	0.485***	-0.175*	-0.226*	-0.205*	-0.021***
WSER	-0.520*	-0.117	0.561*	0.424	0.136*
WEXT	-0.464***	-0.238**	0.610***	0.408***	0.203***
WFAIR		0.281**		-0.216***	
JSAT				-0.344***	

Notes: Results for (1) from Table 2, for (3) from Table 3, and for (4) and (5) from Table 5. Coefficients are statistically significant different from zero at * p<0.10, ** p<0.05, and *** p<0.01. In order to assess the statistical significance of the indirect effect, we have used a bootstrap procedure to obtain standard errors.

Appendix

Table A.1: Descriptive statistics for all variables

	Mean	Std. dev.
TI	1.595	0.922
JSAT	7.555	1.706
WFAIR	3.525	1.143
WABS	4.709	0.410
WREF	4.695	0.370
WSER	0.192	0.056
WEXT	4.775	0.279
Age	45.136	10.522
Male	0.816	0.388
Partner	0.841	0.366
Kids	0.370	0.737
Uni	0.319	0.466
Citizen	0.979	0.145
Permanent contract	0.955	0.208
Working hours	42.378	7.076
Shiftwork	0.323	0.468
Flexible working hours	0.149	0.356
Manager	0.339	0.474
Available outside working time	2.059	1.143
Decision autonomy	4.019	0.993
Task variety	4.256	0.919
Dependence on co-worker	3.870	1.195
Co-worker depend on me	3.374	1.301
Physical work environment	2.370	1.456
Works council	0.808	0.394
Collective agreement	0.706	0.456
Share females	0.254	0.198
Share university graduates	0.129	0.146
Share apprenticeship degree	0.645	0.221
Firm managed by owner	0.192	0.394
Limited company	0.908	0.289
Foreign majority ownership	0.201	0.401
Modern technique	0.772	0.420
Agreeableness	4.047	0.577
Consciousness	4.368	0.476
Neuroticism	2.689	0.755
Openness	3.660	0.627
Extraversion	3.704	0.726
Trust	3.472	0.781
Firm size categories		
100 - 249 employees	0.258	0.437
250 - 499 employees	0.254	0.436
500 und more employees	0.349	0.477
Industry		
Metal, electro, vehicles	0.413	0.492
Retail, logistics, communication	0.098	0.297
Service for firms	0.111	0.314
IT and other services	0.050	0.217
Region		
North	0.158	0.365
East	0.270	0.444
South	0.260	0.439
West	0.311	0.463
Year 2014	0.453	0.498

Notes: N=8483 worker-year observations in 867 establishments.

Table A.2: Complete ordered probit regression results

	(1) *WFAIR*		(2) *JSAT*		(3) *JSAT*		(4) *TI*		(5) *TI*	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
JSAT									-0.344	<0.01
WFAIR					0.281	<0.01			-0.216	<0.01
WABS	0.895	<0.01	0.262	<0.01	0.026	0.73	-0.34	<0.01	-0.023	0.81
WREF	0.485	<0.01	-0.030	0.76	-0.175	0.07	-0.23	0.06	-0.205	0.09
WSER	-0.520	0.08	-0.225	0.44	-0.117	0.67	0.56	0.09	0.424	0.17
WEXT	-0.464	<0.01	-0.353	<0.01	-0.238	0.01	0.61	<0.01	0.408	<0.01
Individual level variables										
Age	0.001	0.42	0.006	<0.01	0.006	<0.01	-0.03	<0.01	-0.036	<0.01
Male	-0.104	0.01	-0.037	0.33	-0.013	0.72	0.13	<0.01	0.128	<0.01
Partner	-0.099	0.01	0.017	0.64	0.042	0.26	0.06	0.13	0.069	0.07
Kids	-0.002	0.92	-0.003	0.86	-0.003	0.87	-0.01	0.73	-0.012	0.56
Uni	-0.131	<0.01	-0.120	<0.01	-0.087	<0.01	0.19	<0.01	0.130	<0.01
Citizen	0.057	0.52	-0.069	0.45	-0.084	0.36	-0.04	0.68	-0.050	0.62
Job level variables										
Permanent contract	-0.210	<0.01	-0.123	0.04	-0.073	0.23	0.03	0.68	-0.062	0.41
Working hours	-0.008	<0.01	-0.007	<0.01	-0.005	0.01	0.01	<0.01	0.007	0.01
Shiftwork	0.125	<0.01	0.050	0.12	0.022	0.50	-0.17	<0.01	-0.143	<0.01
Flexible working hours	0.090	0.01	-0.009	0.80	-0.030	0.39	0.05	0.26	0.068	0.15
Manager	-0.042	0.16	0.039	0.17	0.050	0.08	-0.03	0.32	-0.033	0.35
Available outside work	-0.044	<0.01	-0.049	<0.01	-0.040	<0.01	0.10	<0.01	0.084	<0.01
Decision autonomy	0.096	<0.01	0.220	<0.01	0.203	<0.01	-0.18	<0.01	-0.063	<0.01
Task variety	0.011	0.45	0.086	<0.01	0.087	<0.01	-0.02	0.22	0.026	0.14
Dependent on co-worker	-0.001	0.90	0.016	0.16	0.017	0.13	0.00	0.96	0.012	0.40
Co-worker depend on me	0.015	0.16	-0.024	0.02	-0.028	0.01	0.02	0.09	0.009	0.47
Physical work environment.	-0.030	0.01	-0.050	<0.01	-0.044	<0.01	0.03	0.01	0.005	0.71
Firm level variables										
Works council	-0.088	0.09	-0.033	0.45	-0.012	0.77	0.00	0.94	-0.015	0.75
Collective agreement	0.176	<0.01	0.023	0.52	-0.024	0.49	-0.11	0.01	-0.060	0.15
Share females	0.087	0.41	-0.060	0.55	-0.086	0.38	0.09	0.46	0.127	0.28
Share university graduates	0.093	0.43	0.012	0.93	-0.008	0.95	-0.02	0.91	0.074	0.67
Share apprenticeship degree	0.051	0.51	0.037	0.61	0.024	0.72	-0.27	<0.01	-0.241	<0.01
Firm managed by owner	0.018	0.69	-0.001	0.98	-0.005	0.91	-0.04	0.38	-0.041	0.37
Limited company	-0.110	0.07	-0.128	0.02	-0.101	0.05	0.20	<0.01	0.166	<0.01
Foreign majority owner	-0.051	0.24	-0.054	0.15	-0.041	0.27	0.01	0.88	-0.039	0.41
Modern technique	-0.003	0.94	0.064	0.08	0.066	0.06	-0.06	0.18	-0.037	0.32

Agreeableness	0.059	0.02	0.095	<0.01	0.086	<0.01	-0.12	<0.01	-0.097	<0.01
Consciousness	0.089	0.01	0.217	<0.01	0.207	<0.01	-0.09	0.01	-0.024	0.51
Neuroticism	-0.070	<0.01	-0.203	<0.01	-0.194	<0.01	0.17	<0.01	0.100	<0.01
Openness	-0.015	0.54	0.057	0.01	0.064	<0.01	0.11	<0.01	0.147	<0.01
Extraversion	0.030	0.16	0.076	<0.01	0.073	<0.01	-0.04	0.06	-0.016	0.49
Trust	0.184	<0.01	0.186	<0.01	0.144	<0.01	-0.17	<0.01	-0.062	0.01
Firm size (ref. 50-99)										
100 - 249 employees	0.001	0.98	0.047	0.32	0.049	0.28	-0.13	0.03	-0.107	0.05
250 - 499 employees	0.112	0.04	0.061	0.22	0.032	0.50	-0.27	<0.01	-0.219	<0.01
500 und more employees	-0.021	0.73	0.045	0.41	0.054	0.30	-0.36	<0.01	-0.369	<0.01
Industry (ref. other manufacturing)										
Metal, electro, vehicles	0.015	0.71	-0.011	0.76	-0.014	0.69	-0.05	0.30	-0.064	0.18
Retail, logistics, communication	0.081	0.18	0.062	0.29	0.045	0.44	-0.09	0.18	-0.073	0.27
Service for firms	-0.059	0.34	0.010	0.86	0.032	0.55	0.07	0.31	0.064	0.34
IT and other services	-0.290	<0.01	-0.219	0.01	-0.150	0.06	0.13	0.20	-0.020	0.81
Region (ref. west)										
North	0.061	0.23	0.005	0.92	-0.011	0.82	-0.01	0.87	0.015	0.78
East	-0.156	0.01	-0.095	0.07	-0.058	0.25	0.01	0.90	-0.058	0.33
South	0.006	0.88	0.073	0.06	0.075	0.04	-0.04	0.42	-0.013	0.80
Year 2014	-0.017	0.53	-0.047	0.05	-0.041	0.08	-0.02	0.385	-0.058	0.05
Cut point 1	3.234		-0.844		-1.228		-1.69		-3.50	
Cut point 2	4.052		-0.652		-1.031		-0.82		-2.43	
Cut point 3	4.708		-0.413		-0.787		-0.21		-1.65	
Cut point 4	6.000		-0.090		-0.454		0.38		-0.88	
Cut point 5			0.193		-0.161					
Cut point 6			0.648		0.312					
Cut point 7			0.950		0.626					
Cut point 8			1.568		1.269					
Cut point 9			2.693		2.440					
Cut point 10			3.452		3.228					
Pseudo R squared	0.085		0.055		0.075		0.096		0.213	

Notes: 8483 worker-year observations in 867 establishments. Ordered probit regressions. Robust standard errors clustered at establishment level.