



The effects of effort-reward imbalance on the job, overcommitment, and income on life satisfaction in Germany from a longitudinal perspective

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ABSTRACT

Background: The effort-reward imbalance at work model offers a theoretical and analytical framework to estimate the subjective perception of work-related stress. High demands and low rewards in return can harm mental and physical health, well-being, and life satisfaction. According to the theory, overcommitment partially explains why employees endure such straining jobs. In Germany, cultural and economic aspects of labor differ between East and West. Incomes are lower in the East, while work centrality there is higher. In this article, the effects of effort-reward imbalance, overcommitment, and income on life satisfaction as well as their interactions with region were analyzed to gain a clearer picture of regional disparities regarding life satisfaction and the generality of this work stress model in Germany.

Methods: Data from 3848 participants from 2006 to 2011 of the German Socio-Economic Panel were analyzed. Within-between models were estimated, including fixed and random effects of the continuous form of effort-reward imbalance to predict subjective life satisfaction. Time-variant covariates – e.g., overcommitment or income – as well as time-constant variables – e.g., region, sex, education – were integrated. Differences in regional labor markets between East and West Germany were considered.

Results: Easterners exhibited higher imbalances and overcommitment than Westerners, indicating worse working conditions. Higher imbalances and overcommitment were associated with lower life satisfaction within and between participants, whereas for income only random effects were supported. While region did not moderate the effect of work stress, East Germans' life satisfaction benefitted more from a higher income.

Conclusion: The importance of internal work structures in terms of recognition, adequate pay, advancement opportunities, or time pressure were underlined. As compared to the West, Easterners' life satisfaction benefitted more from higher income but not more from a lower imbalance or lower overcommitment. The interplay between materialistic and nonmaterialistic rewards at work should be focused on in the future.

1. Introduction

As an indicator of subjective well-being (Diener et al., 1999; Fergusson et al., 2015), life satisfaction is associated with a broad range of aspects in life. For instance, mental health and life satisfaction are related reciprocally: Not only do common mental health problems, such as depression or anxiety, decrease life satisfaction, the increase of the latter also attenuates mental health problems (Fergusson et al., 2015). Further, life satisfaction is related to physical health and longevity (Diener and Chan, 2011), as well as career satisfaction (Hagmaier et al., 2018) and distress (Hamarat et al., 2001). The relation between distress

and life satisfaction will be further assessed in this article.

The focal indicator of distress and adverse health in this article is displayed by deleterious working conditions. Individual distress can be caused by them (Karasek and Theorell, 1990; Siegrist, 1996). In general, life satisfaction is oftentimes associated with job-related aspects as job-related tension (Erdogan et al., 2012), perceived meaningfulness of work (Allan et al., 2019), or work engagement (De Simone et al., 2014). A model that is often used to illuminate job-related health problems and which will be focused in this article is Siegrist's (1996) effort-reward imbalance (ERI) at work model. It hypothesizes that distress is triggered by a mismatch of efforts made by the employees and the perceived

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rewards they receive in return. Income is a form of reward employees receive for their efforts. The ERI questionnaire contains the subjective adequacy of one's pay. This might be similar to financial satisfaction, which is positively related to a higher level of life satisfaction (Pawsey et al., 2023). However, since increasing incomes are also positively related to a rising life satisfaction (Salinas-Jimenez et al., 2011; Schöllgen et al., 2019), low incomes might cause low life satisfaction despite the subjective adequacy of one's pay. Thus, including the absolute income level in our analyses is crucial to account for instances of simultaneous financial dissatisfaction and adequacy.

This article aims at contributing to research in occupational health in a multifaceted way. In contrast to the many previous researchers who mostly used cross-sectional data on ERI, by using longitudinal data, the link between ERI and life satisfaction can be examined. Moreover, to the authors' knowledge, associations between overcommitment and life satisfaction have rarely been studied.

Another contribution to previous research stems from its regional focus. The relationships between ERI, overcommitment, personal income, and life satisfaction were tested under two different regional sets of working conditions, which have evolved due to the separation and more recent unification of the former West Germany, the Federal Republic of Germany (FRG) including West Berlin, and the former East Germany, the German Democratic Republic (GDR) including East Berlin. The different regional sets of working conditions will later be discussed more thoroughly; for example, perceived quality of employment relationships (i.e., psychological contracts as mutual obligations between employer and employee; Rigotti et al., 2007) as well as the overall income level (Kasinger et al., 2023) are lower in East Germany compared to the West. Moreover, work centrality is higher in the East (Jaufmann, 1995, 2000). Thus, economic as well as cultural aspects, and quality of work differ between East and West Germany. An association between socialization in East or West Germany and the influences of working conditions on well-being can thus be assumed. Therefore, this article portrays the results separately for respondents from East and West Germany. To the authors' knowledge, no previous research has tested work stress consisting of ERI and overcommitment for East and West Germany.

Overall, the analyses aim at answering the question how imbalances between subjective job-related efforts and rewards, overcommitment at the job, as well as personal income impact life satisfaction of employees in Germany. To address the research question, effort-reward imbalance and overcommitment as the concepts depicting work stress will first be introduced. Differences in meaning and gratifications of work between East and West Germany will further be described afterwards. Results of the within-between model which includes fixed and random effects separately will be presented thereafter. At last, the results will be discussed.

1.1. Work stress: effort-reward imbalance at work and overcommitment

ERI explains the disparate exchange of the employee's job-related efforts and rewards (Siegrist, 1996). While efforts are represented by time pressure, frequent interruptions, or extra hours worked, rewards include esteem and recognition, career promotion and job security, as well as a subjectively adequate pay. A ratio portraying the (im-)balance between efforts and rewards is computed using the indicators (Siegrist et al., 2004). Moreover, to further indicate work stress, Siegrist et al. (2004) integrated the concept of overcommitment to the work stress model, which contains time pressure at the job, ruminating, or career sacrifices. Overcommitted employees exhibit certain attitudes, behaviors, and emotions promoting excessive attempts and desires to be approved and esteemed (Siegrist, 2001). These attempts lead to taking up too many demanding tasks with exaggerated efforts to solve them (Siegrist et al., 2004). Moreover, they might perceive demands and resources in an inappropriate way (Siegrist, 2000). This can result in frustrations because overcommitted employees are more likely to be

affected by subjectively low rewards, as their efforts are disproportionately high (Siegrist et al., 2004). Nevertheless, Siegrist et al. (2004) deem overcommitment an independent predictor of adverse health, as it goes beyond mere efforts. While ERI is considered an extrinsic component, overcommitment is viewed as intrinsic (Steptoe et al., 2004).

ERI was theorized to interact with overcommitment (Siegrist et al., 2004). This was supported by the finding that ERI's negative association with mental health is intensified by higher levels of overcommitment (Kunz, 2019). Siegrist (2001) further deems overcommitment one of the reasons why employees remain in jobs that are associated with ERI. Therefore, many researchers included overcommitment in analyses related to ERI and confirmed their important interplay (e.g., Hinsch et al., 2019; Kudielka et al., 2004; Siegrist et al., 2004). Since these studies found that higher overcommitment is related to adverse health, we hypothesize:

H1. Increasing levels of overcommitment reduce life satisfaction.

Several researchers have confirmed significant associations between the occurrence of ERI and health problems. For example, ERI is associated with biological pathways as well as biomarkers able to explain pathogenesis due to chronic work stress (Siegrist and Li, 2017). From a longitudinal perspective, ERI is associated with psychological distress and physical complaints after a 1-year time-lag (Shimazu and de Jonge, 2009). These findings highlight that ERI causes distress, which in turn can decrease life satisfaction.

Meta-analyses showed that ERI as well as job strain are strong predictors of common mental health problems, like depressive disorders (Rugulies et al., 2017; Stansfeld and Candy, 2006) and suicide (Stansfeld and Candy, 2006). Job strain comprises psychological strain leading to fatigue, anxiety, depression, and physical illness, induced by high job demands and low control over decisions within this job (Karasek and Theorell, 1990). The frequency of suffering from migraine increases with a rising imbalance between efforts and rewards (Leineweber et al., 2020). In one longitudinal study, exhaustion cannot be predicted by ERI in its combined form, but the separate versions of efforts and rewards are associated with it (Gorgievski et al., 2019). Finally, outcomes regarding physical health are also associated with ERI: cardiovascular problems (Siegrist, 1996; van Vegchel et al., 2005), coronary heart disease (Dragano et al., 2017), and musculoskeletal problems (Dragano et al., 2003).

Longitudinal analyses including ERI and overcommitment in their influence on life satisfaction are rather scarce. One exception found that employees with a higher imbalance leaning towards higher efforts exhibit poorer life satisfaction, lower anxiety, depression, physical and mental well-being as well as higher levels of overcommitment over several time points (Buddeberg-Fischer et al., 2008). Considering all these findings, we hypothesize that:

H2. Rising levels of ERI decrease life satisfaction.

Total personal income serves as an additional criterion for reward in addition to subjective adequacy. Previous research showed that an increasing personal income ameliorates life satisfaction (Salinas-Jimenez et al., 2011; Schöllgen et al., 2019). To test if this finding can be replicated, we hypothesize:

H3. An increasing personal income improves life satisfaction.

1.2. The meaning and gratifications of work in former eastern and Western German states

German data provide the unique opportunity to compare two different regions with different conditions and meanings of employment. Deduced from political and economic disparities between the East and West of Germany during division, unification, and subsequent political and economic transformation of the former GDR, it can be stated that employment and its meaning differ between the two regions.

First, in the GDR, work was seen as both right and a duty (Schmidt,

2003). This was upheld by the socialist GDR's constant unemployment rate of 0% (Diewald et al., 1999), whereas proportions ranged between 0.7 and 9.5% in the FRG over time (destatis, 2022). While the GDR reinforced female full-time employment, the FRG relied on the male breadwinner-model (Nickel, 2011). Therefore, unlike the East, many Western women were not part of the workforce. Shortly after unification, the unemployment rate in the East reached an unprecedented high (Ketzmerick, 2016), with 10.2% already being unemployed in 1991 (destatis, 2022). Mass sectoral layoffs were the consequence of a failed economic integration of East German structures into West German standards (Ketzmerick, 2016). Further, work experiences of former GDR citizens were perceived as degraded (Peters, 2021).

Labor market structures have been differing between East and West until today. Despite higher mean educational and occupational qualifications, East Germans acquired jobs with lower ISCO (International Standard Classification of Occupations) skill levels and prestige (Granato, 2011). This is partially explained by the lower share of East Germans in the more prestigious service sector and the surplus of workforce in the formerly Eastern states (Granato, 2011). These findings go along with the persistent higher unemployment share (destatis, 2022) as well as the lower financial gratification (Kasinger et al., 2023) in the East. As one of the reasons for maintaining a straining job is the lack of alternative jobs (Siegrist, 2001), it can be assumed that East Germans are more likely to experience ERI at work as they are less likely to change jobs:

H4. Compared to West Germans, East Germans exhibit higher levels of ERI.

To test this assumption, the prevalence of exhibiting an imbalance was observed in this article for East and West Germans. Moreover, if East Germans abided situations of ERI longer than West Germans who might more easily change jobs, region could moderate the association between ERI and life satisfaction:

H5. Higher levels of ERI diminish life satisfaction more strongly in the East than in the West.

Socialization and region-specific experiences have led to ongoing differences in the meaning of work between East and West Germany. Empirically, East Germans are more committed to their work (Otto and Dalbert, 2012; Rigotti et al., 2007) which is not correlated to the unemployment rate, but can rather be ascribed to cultural differences between East and West (Rigotti et al., 2007). Work commitment was, for example, indicated by loyalty to one's job (Otto and Dalbert, 2012) or pride in working for one's company (Rigotti et al., 2007). Due to these findings, we hypothesize that:

H6. Compared to West Germans, East Germans exhibit higher levels of overcommitment.

Furthermore, Andolšek and Štebe (2004) already showed that East and West Germans' levels of commitment differ in their associations with occupational aspects: West Germans' commitment levels are associated with a broader set of job aspects (e.g., job quality, organizational efficiency) compared to East Germans. Therefore, West Germans might be more likely to link their commitment at the job to a positive workspace, whereas East Germans tend to be committed independently from job quality. Higher job quality is related to increased life satisfaction (Grün et al., 2010) and it is also assumed that subjective well-being is related to organizational efficiency (Taheri et al., 2019). As the probability of a deleterious job is higher for overcommitted East Germans compared to West Germans who rather reduce their commitment upon bad working conditions, we hypothesize:

H7. Compared to West Germans, East Germans' life satisfaction diminishes more with increasing levels of overcommitment.

Besides commitment, work centrality and work values differ between East and West, as well. As mentioned above, work centrality is

higher among East Germans (Jaufmann, 1995, 2000). This is again corroborated by the finding that more East Germans than West Germans would still pursue their jobs despite having enough money to quit (Arnhold, 2009). Looking at work values, East Germans deem a high pay as well as healthy working conditions more important compared to West Germans (Borg and Braun, 1996; Braun and Borg, 2004), whereas intrinsic values to work do not differ between regions (Braun and Borg, 2004).

Personal income might moderate the association between region and life satisfaction as it can be assumed that getting closer to or even achieving one's goal of having a large income increases one's satisfaction with life. As economic deprivation in the East is higher than in the West, Eastern employees might be more dependent on financial rewards of their jobs than the immaterial aspects which again highlights the need of integrating the current place of residence as a moderator of the association between income and life satisfaction. Therefore, including personal income is important for the analyses. In conclusion, we deduce:

H8. East Germans' life satisfaction benefits more from rising incomes compared to West Germans.

2. Methods

2.1. Sample

Data of the German Socio-Economic Panel (GSOEP) were used for this study. Since 1984, the GSOEP has been conducting annual panel surveys in households in Germany. All respondents gave their informed consent before participation. Two waves – 2006 and 2011 – contained data on ERI and were used in the following analyses. Unfortunately, the 2016 wave could not be compared as another version of the questionnaire was used. Only participants who attended both waves were integrated which excluded 7649 cases. To obtain a more homogeneous sample, additional inclusion criteria were set. Due to job changes between 2006 and 2011, 2156 cases were excluded. Job changes needed to be excluded as otherwise, inherently differing working conditions would have biased the results. Additionally, 24,882 cases with participants who did not work in full-time or part-time and 1162 more cases with participants who worked less than 15 h per week at either time point were excluded in order to make sure that their job experiences affected their everyday lives. Moreover, 2467 self-employed were excluded as for them the interpretation of ERI would be inherently different. Top and bottom coding was used in the case of personal net income in order to exclude outliers (Gottschalk and Smeeding, 1997; Smeeding, 1997): This is why 102 cases with respondents who stated that their income was more than ten times the median of personal income or gained less than 1% of its mean were excluded. Further, 30 cases with participants who moved their location between East and West Germany during the observation period were excluded. Finally, 4852 cases with missing data on used variables were omitted. One exception was income, as the dataset offered an imputed version of it which will be explained further below. Thus, the final sample contained $N = 3848$ participants of both waves, leading to 7696 observations.

2.2. Variables

Effort-reward imbalance at work. To estimate the time-variant ERI, its validated short form containing 10 items (Siegrist et al., 2009) was used. For items on efforts (e.g., "Because of the high volume of work, there is often high time pressure.") and rewards (e.g., "I receive the recognition I deserve from my superiors."), respondents first agreed or disagreed whether the statement applied to them. As a second step, after an affirmative answer, they rated their perceived burden between 1 'Not at all' and 4 'Very heavily'. Afterwards, the answers of the two steps were transformed to 1 indicating the statement did not apply, 2 it applied 'without a burden', 3 it applied with 'not much of a burden', 4 it

applied with 'a bit of a burden', and 5 it applied with 'a heavy burden'. Negatively phrased items regarding rewards were reversed; thus, a high reward or a low perceived burden of a missing reward were ranked higher. Internal consistency of both efforts (2006: Cronbach's $\alpha = 0.69$, McDonald's $\Omega = 0.70$, 2011: Cronbach's $\alpha = 0.70$, McDonald's $\Omega = 0.70$) and rewards was acceptable (2006: Cronbach's $\alpha = 0.71$, McDonald's $\Omega = 0.71$, 2011: Cronbach's $\alpha = 0.73$, McDonald's $\Omega = 0.72$).

As a next step, ERI was measured with the formula (Richter et al., 2017; Siegrist et al., 2004):

$$ERR = e / (r * c).$$

e described the sum of the answers regarding effort, while r was indicated by the sum of the answers regarding reward. c corrected the ratio between the two constructs as the number of respective items differed. In this case, effort consisted of three items, whereas reward was answered using seven statements. Thus, c was $3/7$. An ERI level close to 0 indicated low perceived effort accompanied by high rewards. Mathematically, a value of 1 indicated a perfect balance, while an imbalance was found at results above one. Furthermore, values between 0.2 and 5 (range) could theoretically be reached.

Some researchers use the dichotomous version of ERI, with the ratio's value > 1 indicating an imbalance and ≤ 1 no imbalance that is possibly detrimental for the employee (Siegrist, 2011; Siegrist et al., 2004). However, it was shown that the type of transformation of the measurement scale (dichotomous ERI, continuous effort-reward ratio, or efforts and rewards as separate constructs) has an impact on the strength of the association between ERI and the respective health outcome (Gorgievski et al., 2019; Kunz, 2019; Niedhammer et al., 2004). Moreover, regarding the binary approach, it was criticized that information is lost and a cut-off at 1 leads to overestimating work stress within a population with means above 1 (Montano et al., 2016). In this article, the continuous form of ERI was used as it can be assumed that health suffers more from a higher imbalance (Niedhammer et al., 2004).

Overcommitment. As part of Siegrist's et al. (2004) model on work stress, the time-variant overcommitment was integrated into the analyses. The validated questionnaire contained six items (e.g., "Work seldom lets go of me, it stays in my head all evening."); respondents could choose between 1 'strongly disagree', 2 'disagree', 3 'agree', and 4 'strongly agree' (Siegrist et al., 2004). A sum scale was built, ranging between 6 and 24 which was transformed to vary between 0 and 18; high values indicated a stronger overcommitment. This is why one item needed to be reversed. Internal consistency was acceptable in both years (2006: Cronbach's $\alpha = 0.79$, McDonald's $\Omega = 0.78$, 2011: Cronbach's $\alpha = 0.80$, McDonald's $\Omega = 0.80$).

Life satisfaction. Life satisfaction as the dependent variable was assessed by the following question: 'In conclusion, we would like to ask you about your satisfaction with your life in general. How satisfied are you with your life, all things considered?' ranging between 1 'completely dissatisfied' and 11 'completely satisfied'. To achieve an easier interpretation, the range was changed so that life satisfaction varied between 0 and 10.

Income. Even while controlling for education, unemployment, health, and other variables, larger personal income is related to higher levels of life satisfaction (Salinas-Jimenez et al., 2011; Schöllgen et al., 2019). Income was included in the analyses as the time-variant personal net income of the previous month and was later transformed into its logarithmized form because of its broad range. The dataset offered an imputed net labor income (Frick and Grabka, 2014), summing possibly multiple streams of income. Further, the imputation of item nonresponse followed the Row- and Column method (Little and Su, 1989) relying both on individual longitudinal and cross-sectional trend data. In the case of missing longitudinal data, gross labor income was imputed.

Region. Region was a time-constant variable as those who moved between East and West Germany during the time of observation were excluded. It differed between the current residence in the former Western (0) or Eastern (1) states of Germany. Previous research

consistently concludes that life satisfaction is lower in East Germany compared to West Germany (Easterlin and Plagnol, 2008; Kasinger et al., 2022; Petrunyk and Pfeifer, 2016).

Covariates. Sex, age, education, and work hours were included as covariates. While work hours were considered time-variant, the other variables were considered time-constant (e.g., marginal change of education, homogeneous change of age). Previous research showed that the regionally aggregated composition regarding sex is influential in workplace settings: If employment grade, job control, job demands, and work hours differ between men and women, health differs between them, as well (Sekine et al., 2011). Therefore, sex needed to be taken into account in our analyses. As in West Germany, work hours of women are lower compared to men (Nickel, 2011), health might differ between sexes, too. Age was centered for the analyses. Life satisfaction varies over the life course with decreasing levels over the working age (de Ree and Alessie, 2011; Salinas-Jimenez et al., 2011). As in this study only employed respondents who were predominantly of regular working ages were included, a negative linear association between age and life satisfaction could be assumed. Education was implemented using the generated version of CASMIN (Comparative Analysis of Social Mobility in Industrial Nations; Brauns and Steinmann, 1999). It asked for the highest degree or diploma and exhibited a fitting scale for potential international comparisons. The item varied between 1 'inadequately completed' and 9 'higher tertiary education'. Apart from their direct association, higher levels of education are indirectly positively associated with life satisfaction via accompanied higher monetary returns and a lower probability of becoming unemployed (Salinas-Jimenez et al., 2011). Satisfaction with specific life domains as well as both levels of eudaimonic (fulfillment of psychological needs) and hedonic (balance between positive and negative emotions) subjective well-being are higher when people have higher education levels (Nikolaev, 2018). Finally, work hours portrayed the actual work time per week as they accounted for overtime which was an additional job-related effort. Longer work hours indirectly diminish life satisfaction via end-of-work strain (Matthews et al., 2012). The occupational status was implemented to integrate another workplace factor which could be related to ERI, overcommitment, income, and life satisfaction. Therefore, the metric International Socio-Economic Index (ISCO-88) was used. In general, these covariates might explain how respondents exhibited individual resources in their distinct reaction to the stressors (Lazarus and Folkman, 1984) given by ERI and overcommitment.

2.3. Analyses

All analyses were estimated with *Rstudio* (Version, 2022.07.1) and its package *panelr* to estimate within-between models with the command *wbm*. To display distinct coefficients of both time-constant and time-varying variables, a within-between model was used. It combined random as well as fixed effects and therefore included changes within a person as well as differences between the means of participants (Brüderl, 2010). Further, the Hausman test (Hausman, 1978) showed that the within and between effects of ERI on life satisfaction ($p < .01$) and overcommitment and life satisfaction ($p < .001$) differed significantly (Bell et al., 2019) which rendered it preferable to observe both fixed and random effects. One advantage of using fixed effects is that the problem of unobserved heterogeneity is reduced, since all time-constant variables are accounted for in the analysis (Brüderl, 2010). As in this case, the association between time-constant variables and life satisfaction was of interest, random effects were estimated in addition. Compared to pooled ordinary least squares regression, random effects account for variation on the individual and time levels (Bell et al., 2019) which was preferable in the case of panel data. Furthermore, interactions between region and personal net income, region and ERI, as well as region and overcommitment were estimated to account for random slopes. For these analyses, income, ERI, and overcommitment were z-standardized. Fig. 1 portrays the estimated model.

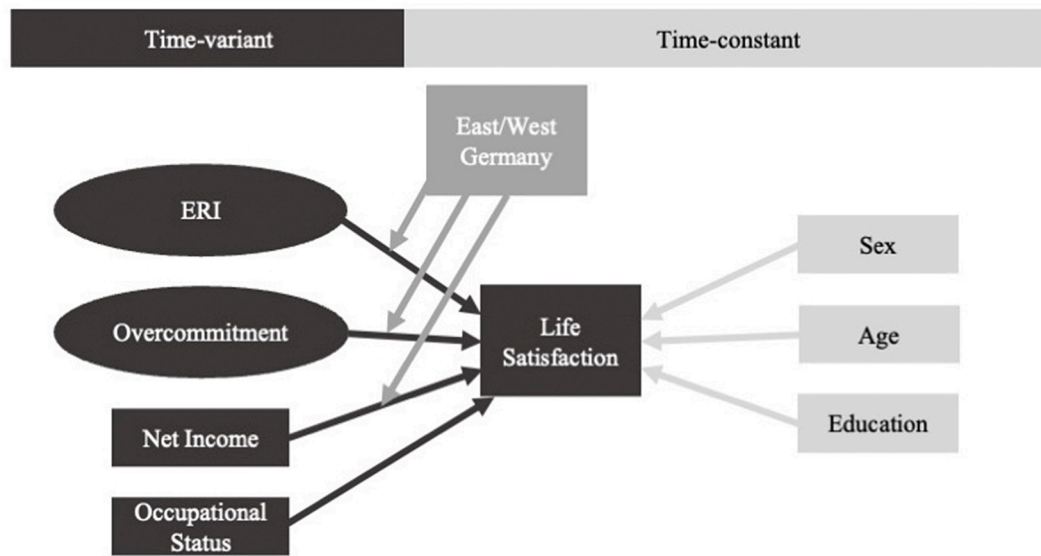


Fig. 1. Model specification of the used variables.

Note. The Pearson correlation coefficients indicated weak linear associations between the metric variables and life satisfaction.

3. Results

3.1. Descriptive results

Table 1 shows the descriptive results of the final sample for both survey waves. The distribution of all variables was comparable in 2006 and 2011. The proportion of women was significantly higher in the East, which was to be expected due to a higher female labor market participation rate in East Germany. All covariates differed significantly between East and West at both time points. While in the East, the level of education and the amount of actual work hours were higher, West Germans exhibited higher levels of life satisfaction, personal income, and occupational status.

Fig. 2 portrays the mean values of ERI, overcommitment, and the single components efforts and rewards. Mean values of all indicators of the ERI and overcommitment constructs can be taken from Supplement A. The higher mean values of ERI and overcommitment among East Germans hint at the assumed associations hypothesized in H4 and H6. Moreover, the levels of imbalance between efforts and rewards

diminished in both regions significantly over time, because rewards increased, in general. While there were no regional differences in the prevalence and burden severity of efforts, disparities could be found in the cases of rewards and overcommitment, disadvantaging East Germans (see Supplement A).

3.2. Fixed effects regression results

Table 2 first portrays the results of the central predictors in their distinct effects on life satisfaction, only containing fixed and random effects without integrating covariates. Results for all covariates can be taken from the note or Supplement B. In a second step, all covariates were added. Increasing overcommitment led to lower life satisfaction, thereby confirming H1. While the result of the model without the integration of control variables shows that rising ERI levels diminished life satisfaction, this relation became stronger upon integrating all covariates. Since rising levels of ERI diminish life satisfaction, H2 was confirmed, as well. The tested work stress indicators consequently decrease life satisfaction, confirming previous assumptions and findings.

Table 1
Descriptive results of the used variables.

Variable	Total (N = 3848)		West (N = 2912)		East (N = 936)	
	Mean (SD)/N (%)	Range	Mean (SD)/N (%)	Range	Mean (SD)/N (%)	Range
2006						
Female	1671 (43%)	0–1	1208 (42% ^{***})	0–1	463 (50% ^{***})	0–1
Age	42.62 (8.92)	19–68	42.62 (8.89)	19–68	42.64 (9.01)	20–63
Education	5.75 (2.23)	1–9	5.56 ^{***} (2.3)	1–9	6.32 ^{***} (1.86)	1–9
LS	7.10 (1.55)	0–10	7.21 ^{***} (1.54)	0–10	6.76 ^{***} (1.52)	0–10
Net income (Euro)	1829.20 ^{***} (1027.99)	200 - 15,000	1940.95 ^{***} (1082.85)	200 - 15,000	1481.52 ^{***} (733.14)	00 - 6000
Work hours	40.94 (9.43)	15–80	40.47 ^{***} (9.73)	15–80	42.40 ^{***} (8.27)	18–80
Occupational Status	48.35 (15.81)	16–90	48.79 ^{**} (15.66)	16–90	46.97 ^{**} (16.20)	1–90
2011						
Age	47.62 (8.92)	24–73	47.62 (8.89)	24–73	47.64 (9.01)	25–68
Education	5.77 (2.23)	1–9	5.58 ^{***} (2.31)	1–9	6.33 ^{***} (1.87)	1–9
LS	7.08 (1.52)	0–10	7.14 ^{***} (1.53)	0–10	6.89 ^{***} (1.47)	1–10
Net income (Euro)	2108.02 ^{***} (1152.25)	240–12,000	2234.59 ^{***} (1192.35)	240–12,000	1714.24 ^{***} (911.76)	300–9030
Work hours	41.25 (8.98)	15–80	40.95 ^{***} (9.18)	15–80	42.21 ^{***} (8.23)	15–80
Occupational Status	48.95 (15.98)	16–90	49.39 ^{**} (15.84)	16–90	47.59 ^{**} (16.24)	16–90

Note. Sex is not portrayed in 2011 as the same participants were included in both surveys. Stars in the Total column indicate a significant difference between 2006 and 2011, whereas stars in the East and West columns indicate significant differences between regions in the respective year according to the TukeyHSD post-hoc test (*p < .05, **p < .01, ***p < .001). LS = life satisfaction.

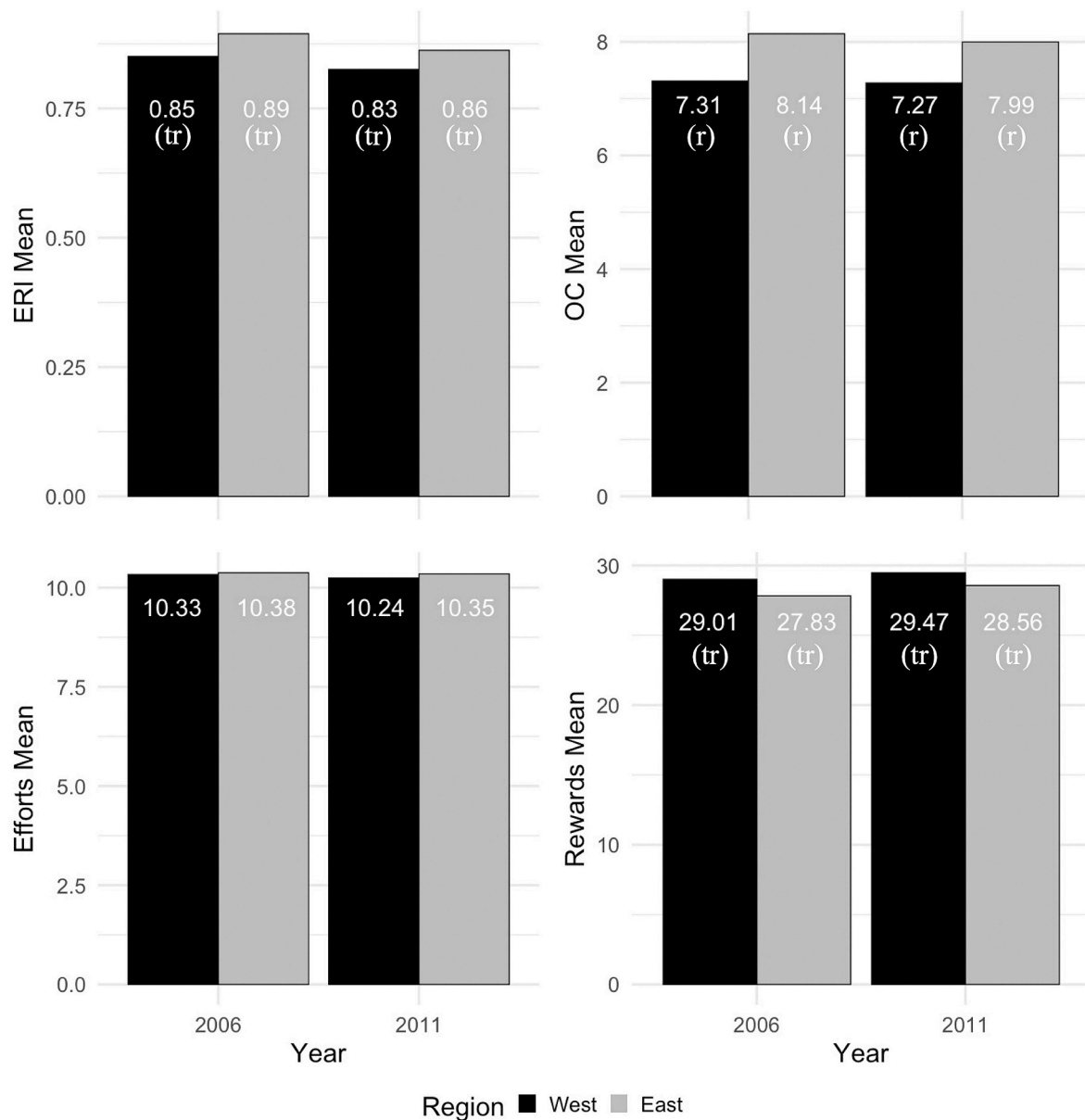


Fig. 2. Mean values of work stress indicators.

Note. Letters in brackets indicate significant group comparisons. t = significant difference ($p < .05$) between 2006 and 2011 as showed by a TukeyHSD post hoc-test. r = significant difference ($p < .05$) between East and West Germany as showed by a TukeyHSD post hoc-test.

Table 2

Full model including the results of the within-between model predicting life satisfaction.

	Without control variables			Including control variables		
	Est.	LB 95% CI	UB 95% CI	Est.	LB 95% CI	UB 95% CI
ERI fixed effects	-0.26**	-0.41	-0.10	-0.38***	-0.55	-0.22
ERI random effects	-0.53***	-0.71	-0.35	-.21***	-.25	-.17
Overcommitment fixed effects	-0.05***	-0.06	-0.04	-0.06***	-0.07	-0.04
Overcommitment random effects	-0.10***	-0.11	-0.08	-.41***	-.46	-.37
Personal Net Income (log.) fixed effects	0.35***	0.27	0.43	0.11	-0.08	0.29
Personal Net Income (log.) random effects	.18***	.14	.22	.21***	.15	.28
East Germany random effects	-.09	-.12	-.07	-.12*	-.22	-.02

Note. Number of observations = 3848; data from 2006 to 2011 were used; stars indicate significance levels (* $p < .05$, ** $p < .01$, *** $p < .001$); unstandardized results are presented for fixed effects, standardized results are presented for random effects; results of covariates: work hours (fixed: Est. = -0.00, LB = -0.02, UB = -0.00, random: Est. = -0.00, LB = -0.03, UB = 0.02), occupational status (ISEI-88) (fixed: Est. = -0.00, LB = 0.00, UB = 0.01, random: Est. = 0.06, LB = -0.03, UB = 0.02), female sex (random: Est. = 0.13, LB = 0.03, UB = 0.22), centered age (random: Est. = -0.11, LB = -0.15, UB = -0.07), education (CASMIN (random: Est. = 0.06, LB = 0.01, UB = 0.12); Pseudo-R² (fixed effects) = 0.10, Pseudo-R² (total) = 0.49; Est. = estimation, LB = lower bound, UB = upper bound, CI = confidence interval, ERI = effort-reward imbalance, log. = natural logarithm.

In contrast, rising logarithmized personal net income was not associated with a change in life satisfaction. H3 was thus rejected. As without the inclusion of control variables, income significantly ameliorated life satisfaction, this effect could better be explained by the other variables such as ERI or overcommitment. A stepwise approach showed that how ERI affected life satisfaction only increased upon the inclusion of overcommitment and decreased slightly when including the occupational status. However, the effect increased again by including age and level of education. In the case of overcommitment, the effect was only increased by the inclusion of ERI.

3.3. Random effects regression results

Table 2 also contains both the results of the random effects without covariates and including them. Additional to the within effect of ERI, its increasing value was also associated with lower life satisfaction using the between estimator. Moreover, respondents with higher levels of overcommitment exhibited a lower life satisfaction. A higher personal net income was significantly related to high levels of life satisfaction. Therefore, respondents who gained more money were more satisfied with their lives, but an increasing income did not lead to higher life satisfaction on the individual level, indicating that fixed and random effects of income on life satisfaction differed. While the standardized coefficients of personal net income and ERI exhibited similar effect sizes only with differing directions, overcommitment was a stronger predictor of life satisfaction. Supplement C includes fixed and random effects of efforts and rewards separately.

The stepwise approach illustrated a decreasing association between ERI and life satisfaction upon integrating overcommitment. Income as well as occupational status diminished the effect slightly. For overcommitment, the association with life satisfaction became stronger upon including ERI, income, the occupational status, and sex. It reduced when integrating work hours, East Germany, and age. In the case of income, integrating work hours, sex, and age enhanced its association with life satisfaction. Including the occupational status, region, or education attenuated the association between income and life satisfaction.

3.4. Regression results of interaction terms

Table 3 portrays the results of four different models which distinctly included interaction terms to predict life satisfaction. Despite previous findings and the theoretical background which consider ERI and overcommitment to constitute work stress, their interaction term did not reach a sufficient significance level. Moreover, region did not moderate the effects of ERI or overcommitment which is why H5 as well as H7 were rejected.

Solely, personal net income was moderated by region in East Germany, indicating that East German's life satisfaction experienced a steeper increase upon their rising income. This finding supported H8. Fig. 3 illustrates this result graphically. The coefficients did not change

Table 3
Results of the interaction terms predicting life satisfaction.

	Est.	LB 95% CI	UB 95% CI
ERI*Overcommitment	0.00	-0.00	0.00
ERI*East Germany	-0.08	-0.17	0.02
Overcommitment*East Germany	0.06	-0.07	0.18
Personal Net Income (log.)*East Germany	0.35**	0.13	0.56

Note. Number of observations = 3848; data from 2006 to 2011 were used; stars indicate significance levels (*p < .05, **p < .01, ***p < .001); four different models are portrayed; all models: Pseudo-R² (fixed effects) = 0.10, Pseudo-R² (total) = 0.49; ERI, overcommitment, and income were z-standardized; models include ERI, overcommitment, personal net income, actual work hours, occupational status, region, sex, age, and level of education; Est. = estimation, LB = lower bound, UB = upper bound, CI = confidence interval, ERI = effort-reward imbalance, log. = natural logarithm.

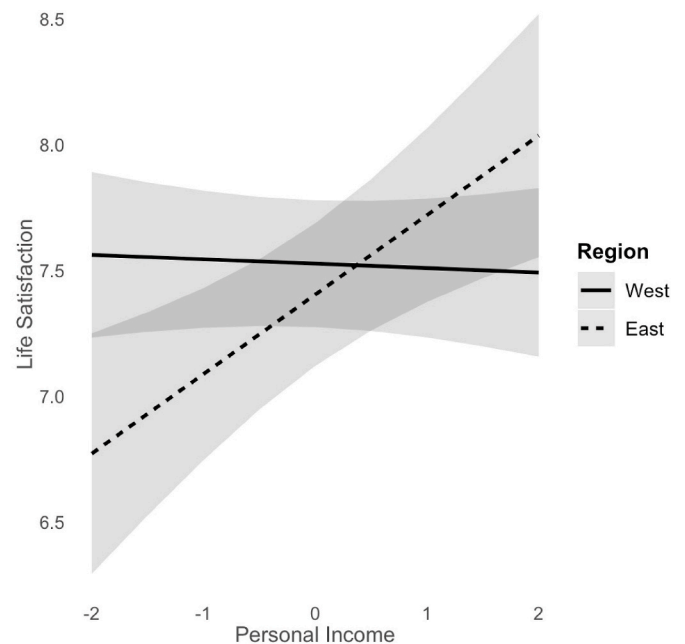


Fig. 3. Significant interaction with region.

Note. The solid line portrays the association between personal income (z-standardized) and life satisfaction among West Germans, while the dashed line accounts for East Germans.

markedly when all interaction terms were included in one model. Supplement D presents the results of interactions between region and both efforts and rewards separately.

Comparing models including interaction terms with the model without them, the likelihood ratio test showed that a model which integrates the interaction between personal income and region was more suited to predict life satisfaction. Further, the AIC was also lower than that of the model without interaction terms. Thus, the interaction between region and net income benefitted the analysis.

4. Discussion

The aims of this study were to first unfold levels of ERI and overcommitment in Germany. The effects of ERI, overcommitment, and income on life satisfaction were estimated, using location in East and West Germany as a moderator in order to account for their differing labor structures. Further, associations between life satisfaction and time-constant variables (region, sex, age, education) were tested. To estimate the effects of ERI, overcommitment, and income on life satisfaction, a within-between-model was used to include both fixed and random effects.

Descriptively, in line with our hypothesis, East Germans exhibited higher levels of ERI and overcommitment. Thus, East Germans are disadvantaged due to their working conditions regarding their well-being and health. This could be one reason why East Germans reported higher levels of depression and anxiety (Beutel et al., 2022). Moreover, East Germans were not only more committed to their work than West Germans, they tended to exhibit overcommitment. As work centrality is higher in the East, it should be tested if East Germans' overcommitment is unhealthy or if they differ from West Germans in their view of job commitment. A psychometric validation of overcommitment which accounts for the regional difference between East and West should be targeted. Rigotti et al. (2007) found cultural differences between East and West describe their disparities in job commitment. Another indication that overcommitment might inherently differ between East and West Germans is the finding that while higher levels of overcommitment were associated with a lower

probability of changing one's job, region did not predict job changes. This might either be caused by the problematic labor market in the East, confirming Siegrist's (2001) assumption that a lack of alternative jobs prevents job changes despite bad working conditions, or by their higher resilience (Beutel et al., 2022).

However, ERI values decreased between 2006 and 2011 in both parts of Germany, pointing towards improving working conditions over time. In accordance with our hypothesis, an increasing ERI significantly lowered life satisfaction. By implementing interaction terms between region and ERI or overcommitment, it could be shown that contrary to our hypotheses, life satisfaction was similarly affected by work stress in East and West Germany. Yet, the beneficial impact of income on life satisfaction was stronger in East Germany, a region that is more economically deprived and disadvantaged regarding labor opportunities than former West Germany. Comparing between participants, higher levels of ERI and overcommitment were also related to lower levels of life satisfaction. As opposed to that, an increased life satisfaction was associated with higher personal net income between respondents. Therefore, benefitting from the within-between model, it could be analyzed that 1) increasing levels of ERI and overcommitment lowered life satisfaction over time and 2) participants with higher work stress levels were less satisfied with their lives than those with lower levels. This finding highlights the importance of adequate working situations regarding well-being of employees.

As ERI and overcommitment as indicators of work stress were related to life satisfaction, good working conditions need to be further promoted. Future research should focus on the distinct effects of material and nonmaterial rewards on employee well-being and health. Moreover, supervisors should concentrate on the working atmosphere and foster recognition of their employees' efforts and companies should increase job security. In the case of advancement opportunities, the possibilities are limited. However, in agreement with previous research, our findings could show that the working atmosphere is of great importance when it comes to life satisfaction.

Andolšek and Štebe (2004) found that East Germans suffered less from bad working conditions which could not be replicated in this study. Nevertheless, East Germans received fewer rewards, additional to their relatively lower pay, leading to imbalanced reciprocities with their supervisors. Thus, working conditions could be improved in East Germany by enhancing job-related rewards. Previous research has shown that interventions to improve employees' well-being by providing more work-related resources and reducing job demands increase productivity (Roczniewska et al., 2022). Moreover, transformational leadership providing inspiration and care for employees boosts the engagement of employees even while demands are high (Breevaart and Bakker, 2018). Therefore, the relationship between supervisors and employees is an important aspect of the ERI questionnaire with the potential of attenuating the employees' productivity.

Further, there was a regional difference regarding the impact of income on life satisfaction. This might be explained by the finding that East Germans have a higher mean level of education than West Germans, while pursuing jobs with lower ISCO and prestige values (Granato, 2011), and thus, gaining less money. Therefore, their level of education would actually qualify them for both a better pay and higher prestige. Thus, apart from their lower income levels compared to the West (Kasinger et al., 2023), their higher impact of increasing income on life satisfaction could be attributed to the effect of a diminishing status inconsistency. The finding that East Germans have been significantly less satisfied with their economic situation between 1991 and 2020 compared to West Germans (Kasinger et al., 2022) supports this assumption. This should be tested in future research on ERI: Though it asks for adequate pay for the participants in regards of their accomplishments and efforts, the questionnaire could gain knowledge from distinctly asking for an adequate pay in terms of education and work experience as well. However, East Germans are not the only group that receive a beneficial effect on life satisfaction by increasing incomes.

Millennials deem extrinsic material means of pay and job security the second most influential aspect of their work motivation, whereas the same means were one of the least important motivators for older generations (Mahmoud et al., 2020). Generally, Germans are extrinsically motivated to work due to financial rewards, though their intrinsic motivation to perceive their work tasks as important is stronger (Kuchinke et al., 2011). Potentially, immaterial working conditions that are integrated in the ERI questionnaire are also strong motivators.

Rather than using smaller groups of specific occupation or restricted age subgroups, this article's analyses included a sizeable sample of the German working population. Thus, the present study could show that a general population is affected by ERI.

Some limitations need to be mentioned. Levels of ERI decreased between 2006 and 2011. We cannot preclude that further shifts have occurred since the time of the survey which may have also affected differences between former East and West German states. Further problems could have occurred due to the rather wide gap between panel years of 2006 and 2011. This gap also led to a marked reduction in sample size, as a large number of respondents did not attend both waves. Due to that and the sample restriction criteria, a selectivity bias cannot be ruled out. As overcommitment is considered a dynamic, and not stable, characteristic (Siegrist, 2001), it remains uncertain how long respondents have exhibited it until the survey in 2011. The same holds true for the duration of ERI. A selection bias was possible due to excluding those who changed jobs, which is likely if ERI occurs and persists (Siegrist, 2001). Thus, in this sample, respondents might have either been experiencing ERI for a rather short time or are affected by the three reasons to maintain in jobs associated with ERI which Siegrist (2001) mentions: 1) the labor market does not offer enough alternative jobs, 2) employees endure the situation because they work towards a promotion or another benefit, and 3) they are overcommitted. Moreover, an omitted variable bias should be considered (Bell et al., 2019), as additional unobserved time-varying variables affect life satisfaction and unobserved heterogeneity regarding time-constant aspects are related to random effects. In addition, unobserved random slopes might be beneficial to further predict life satisfaction. Moreover, though the sample of the GSOEP is quite large, as with any other analysis, adding more covariates leads to the question if the power is high enough to detect smaller effects. Finally, previous research called for the revision of how ERI or overcommitment are indicated (Kunz, 2019; Sonnentag, 2012; Sonnentag and Fritz, 2007). While the variation inflation factors of the models within this article were all below 10 (not displayed), thus not detecting multicollinearity, indicators of efforts ("Because of the high volume of work, there is often high time pressure") and overcommitment ("At work, I easily get into time pressure") are somewhat similar. As Kunz (2019) points out that four out of six overcommitment indicators account for the ability of detachment from work, the conceptualization of overcommitment could be revisited to both generate a more distinct and simultaneously broader concept.

5. Conclusion

Whereas changing personal net income did not affect life satisfaction within employees, both rising ERI and overcommitment diminished it. Still, higher income was a protective factor for the life satisfaction of East Germans. As their levels of ERI and overcommitment were higher compared to West Germans, it is plausible that their well-being and health is more impaired due to their more detrimental working conditions. Since rewards were less frequent in East Germany and they profited more from increasing incomes, region-specific working conditions and job-related needs should be revisited.

Ethics approval

An ethical approval is not required as the data originate from a public use file (10.5684/soep.core.v37eu).

Submission declaration

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CRedit authorship contribution statement

Lisa Braunheim: Conceptualization, Formal analysis, Methodology, Software, Validation, Visualization, Writing - original draft, Writing - review & editing. **Nico Dragano:** Writing - review & editing. **Kristine Khachatryan:** Writing - review & editing. **Manfred E. Beutel:** Funding acquisition, Project administration, Supervision, Writing - review & editing. **Elmar Brähler:** Funding acquisition, Project administration, Supervision, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data originates from a public use file (10.5684/soep.core.v37eu)

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2023.116523>.

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