The task composition and work-related mental health – a descriptive study

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Abstract

This paper analyzes the relationship between work-related mental health problems and multitasking (the number of different tasks at work) in two cross sections from the German working population in 2006 and 2012. The analysis is exploratory and hence, descriptive. For an additional task, medium severe and severe work-related mental health problems increase by 0.02 standard deviations. Absenteeism and presenteeism due to work-related mental health problems rise by one percentage point. This is driven by tasks that require interaction with other human beings but not by the simultaneity of tasks. The estimates appear small at first sight but multitasking increased by nearly one task from 2006 to 2012. The loss in gross value added due to the rise in absenteeism and presenteeism amounts to roughly €1 billion.

Keywords: work-related mental health, multitasking, job satisfaction

JEL Classification: I10, J28

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1 Introduction

Technology changes the way work is done (e.g. Spitz-Oener, 2008, Autor and Dorn, 2009). By substituting some parts of the work process and complementing others technological change affects job design. According to the task literature, a certain task is substituted when it is sufficiently well understood to be written in computer language (Autor et al., 2003). Tasks which are too complex or too unforeseeable cannot (yet) be programed and are complemented by technology. Jobs consist of a bundle of tasks, usually both substitutable and non-substitutable tasks. The substitution process demands a re-bundling of tasks to new jobs (Autor et al., 2002). New jobs can focus on few tasks (specialization) or demand a high number of different tasks (multitasking). In the organization of the firm literature, a firm decides between specialization and multitasking depending on whether there are gains from specialization or gains from task complementarities. While specialization was the job design of the twentieth century, multitasking becomes increasingly important (Oldham and Hackman, 2010). This organizational change reflects a move from exploiting gains from specialization to exploiting gains from task complementarities. Task complementarities arise from advances in production and information technology as well as from rising levels of education (Lindbeck and Snower, 2000, Boucekkine and Crifo, 2008). In Germany, empirical evidence shows that there is more multitasking today than in the past (Spitz-Oener, 2006, Antonczyk et al., 2009, Pikos and Thomsen, 2016).

Evidence on what this increase in multitasking does to human beings is still sparse. According to Herzberg (1966 and 1976), enriched jobs that demand skill variety lead to higher intrinsic motivation. The common language "multitasking" (carrying out tasks simultaneously) is much better analyzed. Simultaneity is associated with higher levels of stress (e.g. Freude and Weißbecker-Klaus, 2012). Similarly, multitasking could result in stress, especially in a rapidly changing environment that demands continuous updating of skills. In the framework of the Job Demands and Resources model, burnout arises from an imbalance between job demands and job resources (Demerouti et al., 2001). Job demands are factors which stress the employee, while job resources are factors which can buffer the detrimental influence of job demands. High job demands do not lead to burnout if the individual has many job resources. Work-related mental health suffers when demands weigh heavier than resources. In this model, multitasking could act as a job demand.

To the best of my knowledge, there is no research on a possible link between organizational change and work-related mental health outcomes yet. This paper aims at filling this gap by using two cross sections on the German working population to analyze the relationship between work-related mental health and multitasking. Work-related mental health problems are

(ranked by severity): emotional strain, emotional exhaustion, and burnout. I find that rising multitasking is associated with increased emotional strain, emotional exhaustion, and burnout. Absenteeism and presenteeism due to work-related mental health problems also increase at both the extensive and the intensive margin. This suggests that multitasking acts as a job demand. The relationship is driven by tasks that require interactions with other human beings and is strongest where work depends on the often missing cooperation of clients (nursing, protecting, training). Physical tasks such as "manufacturing" and "repairing" are associated with lower work-related mental health problems. Whether tasks are carried out simultaneously is not relevant. The association between work-related mental health and multitasking is significant but point estimates are small (0.02 standard deviations). Nevertheless, a back of the envelope calculation shows that for an increase in multitasking as it occurred from 2006 to 2012, an additional 108,000 individuals suffer from burnout and €1.1 billion gross value added are lost.

The remainder of this paper is structured as follows: section 2 gives an overview over the relevant literature. Section 3 is dedicated to data, descriptive statistics, and methodology. Results are presented in section 4. Section 5 analyzes compensation for multitasking and section 6 discusses the main results. The last section concludes.

2 Related literature

2.1 Multitasking as a job design

One of the core decisions in job design is the job's task composition, i.e. which tasks have to be performed by the job holder. There are two extremes, specialization and multitasking, which aim at maximizing productivity with different strategies. Specialization dates back to Adam Smith's description of pin production and became known in the early twentieth century as Taylorism. Work processes are broken down into very small and simple units, e.g. for the pin production example: drawing out the wire, straightening it, cutting it. Each worker performs a limited amount of these small units, at the extreme only one. By repeating the same task over and over again, the worker becomes an expert in his task which he carries out in the most efficient manner ("intratask" learning). This is the gain from specialization. In multitasking, a worker performs more than one task. He does not acquire expert knowledge in all his tasks but he makes use of task complementarities: he carries over knowledge gained in performing one task to another task which he can then perform more efficiently. The gain from multitasking arises from these task complementarities ("intertask" learning). See Oldham and Hackman (2010) for a more detailed overview.

With the turn of the century, the literature put a greater emphasis on modeling the transition from specialization to multitasking which was observed in many industries. In their static framework, Lindbeck and Snower (2000) identify four driving forces for this transition. First, technological task complementarities arise from advances in production technology. Machines are more versatile and re-programmable which allows adaptation to changing production processes. Workers need to know not only how to operate a machine but also how to adapt it. Second, informational task complementarities arise from advances in information technologies which permit easier access to information. This shortens for example feedback cycles between employees and customers which favors faster adaption to customer needs. A higher exchange of information also increases employee contact with different tasks within a firm. Informational task complementarities enhance decentralization of decision making, team work, and job rotation which in turn imply a broader scope of tasks for the employee. Third, increases in human capital make workers more versatile. Levels of education are rising in all OECD countries. Lindbeck and Snower (2000) argue that this has led to improvements not only of particular skills ("capital deepening") but also of the ability to acquire a variety of different skills ("capital widening"). More versatile workers can perform more tasks, e.g operating and programming a machine or selling and redesigning products. Fourth, workers developed a preference for more versatile work. Specialized jobs are very narrow and often highly standardized. Variety and challenges are missing which might result in reduced engagement and job satisfaction. Herzberg (1966, 1976) analyzes the dangers of simplified jobs and suggests enriched jobs to increase intrinsic motivation. As workers have the ability to do multitasking, they also developed a taste for it.

Boucekkine and Crifo (2008) model the transition from specialization to multitasking in a dynamic framework and condense the four driving forces to two: technological change results in both technological and informational task complementarities, and rising human capital increases both the ability to multitask and the taste for multitasking. This transition is also framed as part of skill-biased organizational change (SBOC). Caroli and Van Reenen (2001) define organizational change as decentralization of authority, fewer management layers, and increased multitasking. With French and British establishment data, they show the link between SBOC and education in a declining demand for less skilled labor and in a larger impact of SBOC in higher skilled workplaces.

SBOC is closely linked to skill-biased technological change (SBTC). According to the SBTC literature, technological change does not affect heterogeneous population groups homogeneously. Highly educated workers often find their skills and tasks complemented by technological change,

while low educated workers are increasingly substituted by technology. Recently, the focus has shifted from the level of education to tasks. The task literature argues that not sociodemographic characteristics but job content should be the dimension for analyzing the consequences of technological change for different groups. This literature commonly classifies tasks into three to five categories according to their degree of routine work and cognitive ability requirements. The main argument is that it is easier to substitute both routine manual and routine cognitive tasks by technology. Non-routine manual and non-routine cognitive tasks, on the other hand, are complemented by technology. The understanding of the consequences of SBTC concentrates on labor market measures such as employment and wages (e.g. Autor et al., 2003, Spitz-Oener, 2006, Goos and Manning, 2007, Autor et al., 2008, Dustmann et al., 2009, Autor and Handel, 2013). Technological change brought routinization and digitization to the workplace. This in turn affected job design but the link between both literatures is rather weak. Spitz-Oener (2008) and Autor and Dorn (2013) document that work contents and work environment changed substantially due to technological change. Spitz-Oener (2006), Antonczyk et al. (2009) and Pikos and Thomsen (2016) show that work became more "complex", i.e. that individuals perform more tasks. All three studies are based on cross-sectional surveys from the German working population (Qualification and Career surveys) but concentrate on the time before 2000 (except Pikos and Thomsen, 2016). The link between SBTC and SBOC is illustrated in the case study in Autor et al. (2002) where technological change automated programmable routine tasks. The remaining tasks were bundled into both specialized and enriched jobs depending on management goals to exploit gains from specialization or task interdependencies. For Gibbs et al. (2010), the decision for specialization or multitasking depends on whether ex ante optimization is feasible and close to perfect (specialization) or not (multitasking). This relates back to the task complementarities in Lindbeck and Snower (2000) which allows for feedback cycles between tasks.

2.2 Analyzing work-related health outcomes

In the scientific literature, burnout is the most extensively investigated work-related mental health problem. There are many studies, predominantly in work psychology, that analyze the determinants of burnout in small samples focusing on one specific occupation in one location. Since burnout was first documented in nurses and physicians, hospitals are a common unit of analysis. Only few studies consider larger populations, e.g. Zimmermann et al. (2012) study teachers in and around the German city of Freiburg. Research on teachers' burnout dates back to the end of the 1980s (Schwab et al., 1986). Studies generally measure bad mental health

with validated scales such as the Maslach Burnout Inventory (MBI, Maslach and Jackson, 1981 and 1984), or the General Health Questionniare (GHQ). Very few studies use secondary data across different occupations. Hasselhorn and Nübling (2004) for example consider the the whole German working population (Qualification and Career Survey 1999). They rank occupations according to their mental health risk and identify a common factor for bad mental health: professions in which the outcome of work depends on the cooperation of others who often lack cooperation, for example doctors/nurses and patients, teachers and students.

Burnout consists of three components: emotional exhaustion, cynicism, and personal inefficacy (e.g. (Maslach and Jackson, 1981 and 1984, Jackson and Schuler, 1982). Exhaustion arises when an employee cannot cope with demands and stress at her job anymore. Employees often perceive a high workload, lack of support, or time pressure as transitory in the beginning. In trying to keep up with their work, they become more and more exhausted. They react to the overwhelmingly impossible situation by adopting withdrawal behavior, both physically by staying away from work and mentally by showing a cynical attitude towards the organization, themselves, and/or their clients. Exhaustion and this self-protection behavior lower productivity, efficacy, and quality of work.[1] Being less and less able to live up to their personal standards and work goals can result in an even higher effort to keep up and more withdrawal behavior when failing to do so. Burnout is often a vicious cycle from which exit is hard (Schaufeli and Enzmann, 1998).

Theoretical frameworks for the determinants of burnout are built on an imbalance between demands/effort and resources/reward (Lohmann-Haislah, 2012). In the Job Demands and Resources model (JD-R), burnout arises from an imbalance between job demands and job resources (Demerouti et al., 2001, Peterson et al., 2008). Job demands and resources are found on different levels: situational (working conditions), organizational (hierarchy), and individual (personality). Situational and organizational job demands are for example workload, work pressure, conflicts at work, and interruptions, role ambiguity, role conflict, and obstacles at work (Hasselhorn and Nübling, 2004, Leiter and Maslach, 2009, Gusy et al., 2010, McHuge et al. 2011, Basińska and Wilczek-Rużyczka, 2013, Bakker and Costa, 2014, Llorens-Gumbau and Salanova-Soria, 2014, Lundqvist et al., 2014). Job resources are controlling and influencing own working process, autonomy, and freedom regarding work tasks (Jackson and Schuler, 1982, Basińska and Wilczek-Rużyczka, 2013, Lundqvist et al., 2014). Help and support from colleagues and supervisors also buffers against adverse mental health (Hombrados-Mendieta and Cosano-Rivas, 2013). Individual factors are for example gender, age, and personality (Langelaan et al., 2006,

[1]Initially and especially among young professionals, professional efficacy can increase with exhaustion and cynicism (Singh et al., 2012).

Bakker and Costa, 2014, Innanen et al., 2014) but also leisure activities (e.g. meeting friends) and work-life conflicts (Schaufeli et al., 2009, Nübling and Hasselhorn, 2010, Bakker and Costa, 2014, Lin et al., 2014).

The literature has long focused on ill-health such as burnout. A stream of positive psychology emerged when researchers began to look at desirable health outcomes. The positive counterpart of burnout is engagement (Schaufeli et al., 2002, Zhang et al., 2007, Maslach et al., 2001 and 2012). Engagement is a recent construct and not yet part of large scale surveys. These often include job satisfaction as a measure of well-being at work. While psychology and sociology use job and life satisfaction for a long time, it has a harder stand in economics due to its subjectivity. Clark and Oswald (1996) and Lévy-Garboua and Montmarquette (2004) show that subjective assessment is consistent over time and correlated with observable events and actions (e.g. poor mental health, length of life, coronary heart disease, labor turnover, absenteeism, counter- and non-productive work). Clark et al. (1998) use job satisfaction to analyze quit behavior, Winkelmann and Winkelmann (1998) measure losses in life satisfaction due to unemployment.

2.3 Multitasking and work-related mental health outcomes

The relationship between multitasking and work-related mental health is not a priori clear. In the Job Characteristics Model (JCM) of work motivation, Hackman and Oldham (1976) consider skill variety as one of five job dimensions that foster high intrinsic motivation, performance, satisfaction, and low absenteeism. They understand skill variety as the variety of different activities on the job, which corresponds to the denomination multitasking. Similarly, multitasking could be associated with lower work-related mental health problems and higher engagement.

On the other hand, the individual experiences pressure to do more tasks in less time in an environment where time and resources are scarce. The term "multitasking" means something different in common language and work psychology: simultaneously performing more than one task or constantly switching between two or more tasks. This "simultaneity" is an extreme example of multitasking. On a neurophysiological level, the human brain is not made for simultaneously processing activities that require attention (Freude and Weißbecker-Klaus, 2012). When two of these activities are performed simultaneously, the brain processes their information sequentially and both activities affect each other. It is not surprising that multitasking is detrimental to both efficiency and quality, especially when the same quality and efficiency exigencies exist for both activities (e.g. Hembrooke and Gay, 2003, Adler and Benbunan-Fich, 2012, Jeong and Hwang, 2012). Even though this is inefficient, people still perform tasks simultaneously

because they perceive ignoring or postponing new incoming information as more stressful (Lehle et al., 2009). There is also evidence that an increase in work tasks (which corresponds to multitasking) is associated with bad health. Härenstam et al. (2003) identify eight clusters according to individual conditions in paid work and in the private sphere. [2] Members of one group experienced increases in work tasks, responsibilities and demands in the previous year. Their physical and psychological workload was high. This group showed high psychological distress (measured by the 12-item General Health Questionnaire), musculoskeletal symptoms, and a bad general health status. This suggests that multitasking could act as a job demand in the JD-R framework.

The composition of the multitasking measure could matter for the direction and strenght of the relationship, e.g. manual vs. cognitive or routine vs. non-routine tasks. Multitasking in interactive tasks could be associated with worse work-related mental health. Hasselhorn and Nübling (2004) identify occupations in which the risk of poor mental health is higher. These are teaching and social professions where the employee has to cooperate with people whose cooperation is necessary for reaching the work target but who often do not cooperate (e.g. students, patients, children). Multitasking in routine tasks could generate variety in otherwise repetitive jobs. This might reduce work-related mental health problems.

3 Data and methods

3.1 Data

The data come from the 2006 and 2012 working population surveys operated by the Research Data Centre of the German Federal Institute for Vocational Training (*Bundesinstitut für Berufsbildung*, BIBB) and the Federal Institute for Occupational Safety and Health (*Bundesanstalt für Arbeitsschutz und Arbeitsmedizin*, BAuA). The first working population survey was conducted in 1979 by the Institute for Employment Research (*Institut für Arbeitsmarkt- und Berufsforschung*, IAB) to close gaps in the topics covered in official statistics. The focus is on qualification and working conditions. Cross-sectional surveys have since been conducted roughly every sixth year. A health section on frequent complaints during and after work was first included in 1999. In that year, however, the type of mental health problems was rather general (e.g. depression). The determinants of general mental health problems are even more complex than the determinants of work-related mental health problems including e.g. genetic predisposition, death of a relative, breakups and family conflicts. Since there is no information on any of these factors, the

[2] The conditions comprise supporting and straining psychosocial factors, ergonomic-physical factors, occupational hygiene factors, employment conditions, balance work/private sphere, work location in time and place, and changed conditions.

analysis is limited to clearly work-related mental health problems. The 2006 and 2012 surveys on the Working Population on Qualification and Working Conditions (QaC) sample the working population older than 15 years working at least ten hours a week. Individuals interrupting their activity for a maximum of three months (e.g. parental leave) are included, while people in voluntary work and initial training are excluded. 20,000 individuals were interviewed in each year in computer-assisted telephone interviews (Rohrbach-Schmidt, 2009, Rohrbach-Schmidt and Hall, 2013).

In the health section, participants are asked to say which health complaints they had during work or on working days in the last 12 months. This is followed by a list of around 20 complaints. One of them is burnout in 2006 and emotional exhaustion in 2012. The health section also contains information on whether individuals consulted a physician due to their health problems and on sickness behavior. Assuming that consultation is a signal for severity, both variables equal 0 if there is no exhaustion/burnout, 1 if there is exhaustion/burnout but no consultation took place, and 2 if consultation took place. Among the detailed questions on working conditions, individuals are asked how often they felt emotional strain in their job. Since wording and meaning are very similar to emotional exhaustion, this variable is considered as an outcome, too. Answer categories are "often", "sometimes", "rarely", and "never" (coded from 3 to 0). The three outcomes differ in terms of severity. Burnout is without doubt the most severe work-related mental health problem. Its component emotional exhaustion is mild but could be the beginning of a burnout. Emotional strain is not part of burnout conceptually but might be the pre-stage to emotional exhaustion. To get an overall work-related mental health measure, I construct a combined measure indicating the presence of burnout/exhaustion and/or emotional strain ranging from 0 to 5. All four variables are standardized.

When being sick, two reactions are possible: taking sick leave (absenteeism) or coming to work despite being sick and better having stayed home (presenteeism). Combining this information with the prevalence of exhaustion/burnout allows to assess absenteeism and presenteeism due to work-related mental health problems. Absenteeism and presenteeism are behaviors or reactions to mental health problems and thus occur later in the process. Arguably, presenteeism indicates lower severity because the individual is still able to be present at the workplace. Absenteeism would indicate a more severe problem but could also be a form of shirking.[3] Both

[3]On the one hand, work-related mental health problems are stigmatized which results in under-reporting. On the other hand, German employees need physician certificates for absenteeism and shirking is easier the harder it is to be detected as such. While it is easy to diagnose a broken leg, mental illnesses are more difficult to assess. Usually, the physician asks a set of questions which are then answered subjectively by the employee. In this sense, "objective" health data from insurance companies is not much more objective than self-reported survey data. Nevertheless, due to the stigma which was still considerably larger in 2006 and 2012, such over-reporting should be the exception rather than the rule. Many mental health problems are diagnosed as physical illnesses due to stigma or because they are discovered only when they affected physical health, too (e.g. neck pain or

variables are binaries.

The positive counterpart of work-related mental health problems is job satisfaction. There is information on general job satisfaction, satisfaction with income, career opportunities, working hours, working climate, supervisor, tasks, application of skills, further training, equipment, and physical working conditions. Satisfaction ranges from "very satisfied" (3) to "not satisfied" (0) and is standardized.

Detailed information on tasks carried out during work and their intensity is also available. "I will now give you a number of specific activities. Please tell me how often these activities occur in your work, whether they occur often, sometimes or never." Multitasking is measured as the number of the following tasks an individual often performs on her job.[4]

1. manufacturing, producing goods and commodities
2. measuring, testing, quality control
3. monitoring, control of machines, plans, technical processes
4. repairing, refurbishing
5. purchasing, producing, selling
6. transporting, storing, shipping
7. advertising, marketing, public relations
8. organizing, planning and preparing work processes (not own)
9. developing, researching, constructing
10. training, instructing, teaching, educating
11. gathering information, investigating, documenting
12. providing advice and information
13. entertaining, accommodating, preparing food
14. nursing, caring, healing
15. protecting, guarding, patrolling, directing traffic
16. cleaning, removing waste, recycling

Tasks are grouped to the five categories from the literature (Autor et al., 2003 for the U.S., Spitz-Oener 2006 and 2008 for Germany): non-routine manual, routine manual, routine cognitive, non-routine interactive and non-routine analytic. Each of the task categories consists of a number of "single tasks" (five non-routine manual, three routine manual, three routine

lumbago).

[4]There are two more tasks in the list, "working with computers" and "using the Internet or editing e-mails (2012 only)", which are excluded from the multitasking measure. Both tasks are likely performed jointly with another task (e.g. online marketing, customer service mails).

cognitive, three non-routine interactive and two non-routine analytic). These are not single activities but rather a grouping of similar activities under one task according to the survey questionnaires (e.g. repairing and refurbishing as one task).

Table 1: Task categories

category	tasks
non-routine manual	repairing, refurbishing entertaining, accommodating, preparing food nursing, caring, healing protecting, guarding, patrolling, directing traffic cleaning, removing waste, recycling
routine manual	manufacturing, producing goods and commodities monitoring, control of machines, plans, technical processes transporting, storing, shipping
routine cognitive	measuring, testing, quality control purchasing, producing, selling gathering information, investigating, documenting
non-routine interactive	advertising, marketing, public relations training, instructing, teaching, educating providing advice and information
non-routine analytic	organizing, planning and preparing work processes (not own) developing, researching, constructing

Task categories according to Spitz-Oener (2006) and Pikos and Thomsen (2016). Data sources: BIBB/BAuA. Own table.

Covariates comprise job demands and resources, sociodemographic and job characteristics. A high workload is measured by the variables reaching the limits of one's capacity and feeling overstrained. Psychological demands are interruptions during work, deadline pressure, and when even small mistakes can entail huge financial losses. Repetition, minimum performance, having to work fast, and following very detailed predetermined steps can also exert pressure. Lacking resources are measured by missing or untimely information. Job resources comprise four variables for scope of decision making: plan/schedule own work, influence own workload, decide when to break, and perform tasks independently. Good collaboration measures interpersonal resources. There are four variables which, depending on individual factors, can act either as a job demand or as a job resource: being a supervisor (more responsibility versus more scope for decision making), getting familiar with tasks, improving methods, and being demanded unknown things (positive challenge or excessive demand). Sociodemographic characteristics are age, gender, having a partner, having children, and level of education. Job variables comprise company size and sector, experience, tenure, atypical work (temporary or limited contract), working overtime, and working at atypical hours (night, shift, standby duty) but also attitudes:

successful work-life balance, feeling that own work is important, and working in one's dream job (motivation vs. overcommitment).[5]

The analysis is limited to German nationals aged 18 to 65 years who provided information on their tasks and occupation code (around 26,000 individuals). The data is weighted according to census data. Summary statistics are displayed in table A.1 in the appendix.

Table 2: Covariates

job demands and resources	sociodemographics	job characteristics
job demands	gender	hours, squared hours
reach limits of own capacity	having a partner	tenure
interrupted during work	having children	atypical work (short or temporary)
deadline/performance pressure	education	night work
work fast	(base: medium)	shift work
minimum performance	age, age square	work on weekends
overstrained		standby duty
risk of financial loss		feel work is important
no timely information about future		successful work life balance
do not receive all necessary information		
details predetermined		
repetition		
job resources		
plan/schedule own work		
influence own workload		
decide when to break		
perform tasks independently		
good collaboration		
ambiguous factors		
supervisor for somebody		
get familiar with tasks		
improve methods		
demanded unknown things		

3.2 Descriptives

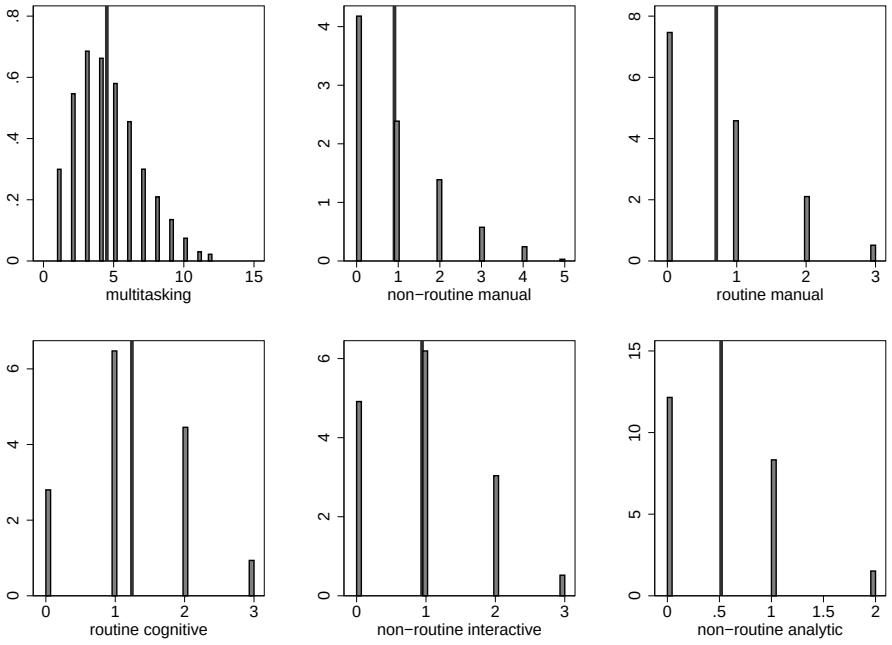
German employees perform 4.4 tasks on average.[6] Multitasking is censored at 12 tasks since numbers of observations in the highest categories are very low. The lowest quartile of the multitasking distribution frequently performs two different activities at work, the highest quartile six. Figure 1 depicts a histogram for general multitasking and multitasking within task categories. 45% of the employees perform neither non-routine manual nor routine manual tasks.

[5] Age, hours, and tenure have variance inflation factors (VIF) larger than 10 which hints at multicollinearity. Excluding them from the econometric analysis does not substantially change the coefficient of interest (multitasking). Results reported include these variables.

[6] 4.0 in 2006 and 4.8 in 2012. The difference is significant.

Around 30% perform one manual task. 21% do not carry out any routine cognitive and 39% no non-routine interactive task. 44% perform one routine cognitive and 40% one routine interactive task. Non-routine analytic tasks are less frequent as 58% does not do any of them. The average employee performs 0.9 non-routine manual, 0.8 routine manual, 1.2 routine cognitive, 0.9 non-routine interactive and 0.5 non-routine analytic tasks.

Figure 1: Histograms of multitasking measures



Vertical black lines: mean. Task categories according to table 1. Data sources: BIBB/BAuA. Own figure.

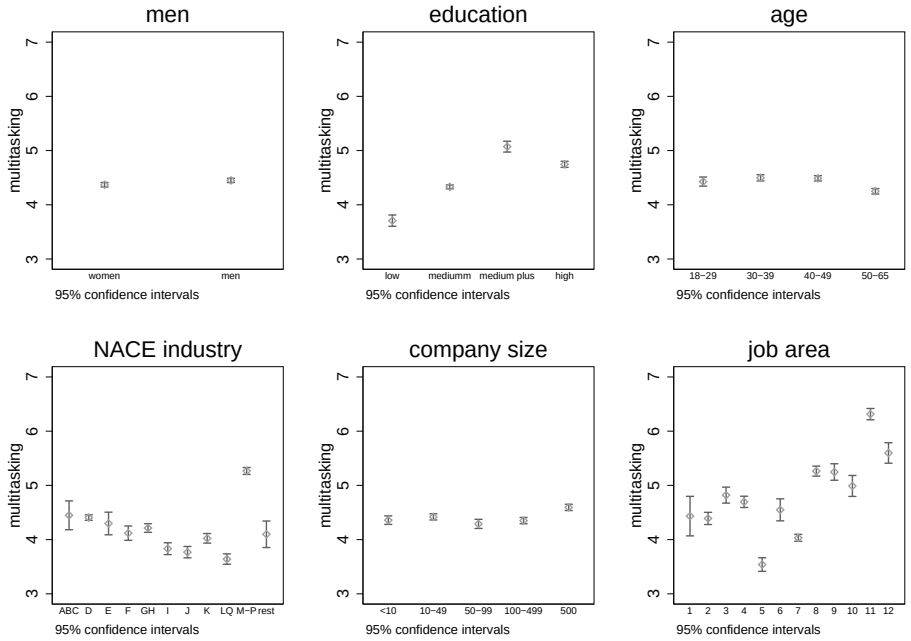
To get a better understanding of general multitasking, figure 2 illustrates differences for some sociodemographic and job characteristics. Men perform 4.3 tasks on average, women 4.1.[7] Low educated employees carry out 3.6 tasks on the job, people with medium plus education 4.7 tasks on average. Medium and high educated employees do 4.2 and 4.3 tasks.[8] People aged 50 to 65 perform 4 tasks on average, 18 to 29-year-olds 4.2, and 30 to 49-year olds 4.3. Multitasking

[7]Since multitasking is a self-reported measure, overconfidence is a concern. Men could be more likely than women to state that they perform an activity "often". To address this concern, t-tests compare the mean multitasking for men and women in each two digit occupation. Men report significantly higher multitasking than women in 27 occupations. These differences could still reflect different jobs within two digit occupations. Limiting the analysis to men and women who have the most common level of education in their two digit occupation and who work more than 34 hours a week, 8 differences remain significant. In one case, medium educated "goods merchants", women perform more tasks than men.

[8]It makes sense that medium plus educated employees perform more tasks than higher educated employees. Medium plus educated individuals start their working career with an apprenticeship (medium education) and work some years. To climb up the hierarchical ladder, they go through additional training (master craftsmen, technician). Afterwards they continue to work in their job but are now in a higher position. In addition to their regular tasks they need to organize, coordinate, and interact with superiors, clients and subordinates. Higher educated employees in high positions focus more on these leadership tasks and carry out fewer other tasks.

is highest in public and private services (5) and lowest in finance and public administration (3.2). Company size matters to some extent for multitasking which is highest (4.3 tasks) in smaller companies with fewer than 50 and in huge companies with more than 500 employees. In companies with between 50 and 500 employees, 4.1 tasks are the average. The bottom right panel displays multitasking by job area in 2012 (not available in 2006). "Health and social work" demand more than six different tasks. "Traffic, transport, security" and "office, services" need less than four different tasks.

Figure 2: Multitasking by individual and company characteristics

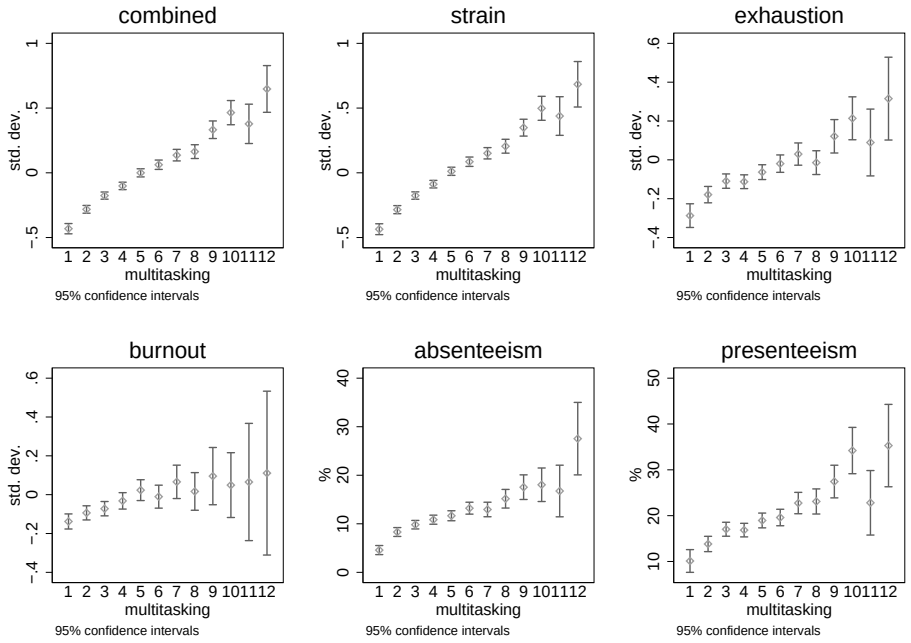


NACE industries: A&B: Agriculture & fishery, C&D: Mining & manufacturing, E: Energy & water supply, F: Construction, G&H: Commerce and hotels, I: Transport, J: Finance, K: Real estate etc., L&Q: Public administration, M-P: Public & private services, rest not elsewhere allocated. Legend of job areas: 1. production of raw materials, 2. processing, repairing, 3.operating, maintaining machines, 4. commodity trade, sales, 5. traffic, transport, security, 6. gastronomy, cleaning, 7. office, services, 8. technical, natural sciences, 9. law, management, economics, 10. artists, media, social sciences, 11. health, social, 12. teachers. Data sources: BIBB/BAuA. Own calculations.

Work-related mental health problems increase with multitasking (figure 3). People performing less than five tasks have below mean work-related mental health problems. Absenteeism does not exceed 10%. 15% go to work despite being sick. Among people with ten or more different tasks, exhaustion is 0.2 and strain 0.5 standard deviations above the mean. Except for an outlier at 11 different tasks, absenteeism and presenteeism are at 20% and 30%. The increase is rather slow for burnout and overlapping confidence intervals do not suggest that high

multitaskers experience more burnout than medium multitaskers. The increase is steepest for emotional strain which ranges from -0.5 to 0.8 standard deviations. Multitasking seems to be associated more strongly with the two mild mental health problems, strain and exhaustion.

Figure 3: Work-related mental health outcomes by multitasking



Multitasking measured as the number of tasks at work (1 to 12). Data sources: BIBB/BAuA. Own calculations.

3.3 Estimation procedure

The relationship between multitasking and work-related mental health outcomes is estimated with OLS according to equation 1.[9] Y_i is a standardized variable (combined measure, emotional strain, emotional exhaustion, and burnout) or a dummy variable (absenteeism and presenteeism) for individual i's health. $multitasking_i$ measures the number of activities with values between 1 and 12, $\mathbf{X}_i$ is a vector of control variables, α is a constant, and u_i the error term. For binary outcomes, equation 1 is a linear probability model. As a point of reference, Y_i is regressed on multitasking only. Then, variables capturing job demands, job resources, sociodemographic and job characteristics are added (table 2). A survey dummy accounts for macroeconomic differences (e.g. changed public perception of mental health problems). $\hat{\beta}$ gives the association between multitasking and work-related mental health but is not a causal effect. Multitasking can be endogenous for two reasons. First, individuals with bad work-related mental health

[9]The results are similar for binary dependent variables with marginal effects after logit estimation – 0 if no exhaustion/burnout/no frequent strain, 1 if exhaustion/burnout/frequent strain.

could select systematically into multitasking (reversed causality). Second, there could be an underlying factor inducing individuals to choose multitasking and making their work-related mental health more vulnerable (selection). Individuals select into multitasking for example through job crafting by switching tasks with a colleague or taking over newly created tasks. To identify a causal effect of multitasking on work-related mental health requires an exogenous variation in multitasking. Such an increase could in principle come from any of the four driving forces identified by Lindbeck and Snower (2000) but is not the focus of this paper which remains exploratory.

$$Y_i^* = \alpha + \beta multitasking_i + \mathbf{X}_i'\delta + u_i \tag{1}$$

4 Estimation results

4.1 Main results

Higher multitasking is significantly associated with worse work-related mental health. Table 3 displays the multitasking coefficients, their standard errors, the constant, number of observations, and adjusted R^2. The upper panel contains the estimates of the base model with multitasking as the only explanatory variable, the lower panel the estimates of the full model with all covariates according to table 2. Dependent variables are given in the column headers. Absenteeism and presenteeism are binary, all other outcomes standardized. Base model coefficients roughly decrease by half in the full model with all controls.[10] Multitasking explains between 0.5% and 4.3% of the variation in the outcome. Full models explain 7.5% (burnout) to 28.6% (combined).

An increase in multitasking by one, i.e. performing one additional task at work, is associated with an increase in any work-related mental health problem of 0.041 standard deviations in the full model. The coefficient is the same for strain. Multitasking is associated with an increase in exhaustion and burnout of 0.02 standard deviations. Absenteeism and presenteeism increase by 0.6 and 0.8 percentage points. 11% do not come to work with work-related mental health problems, while 16% go to work despite mental health problems. An additional task translates to increases in both probabilities of 5%. There is thus a significant positive relationship between work-related mental health problems and multitasking. In terms of magnitude, the effects are rather small, especially for more severe conditions.

[10] Model selection criteria such as the AIB and BIC favor the full model with all controls (not reported). Including hourly wage as another proxy for job type does not change the coefficients of interest.

Table 3: OLS estimates for work-related mental health outcomes

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
base model						
multitasking	0.085***	0.089***	0.041***	0.033***	0.013***	0.018***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.001)	(0.002)
constant	-0.421***	-0.425***	-0.268***	-0.142***	0.065***	0.100***
	(0.018)	(0.019)	(0.021)	(0.025)	(0.006)	(0.009)
full model						
multitasking	0.041***	0.041***	0.020***	0.021***	0.006***	0.008***
	(0.004)	(0.004)	(0.004)	(0.007)	(0.001)	(0.002)
constant	-0.720***	-0.582***	-0.748***	-0.513**	-0.080*	0.019
	(0.122)	(0.131)	(0.140)	(0.204)	(0.044)	(0.061)
N	20089	20120	13521	6576	20102	13548
R^2 adj. base	0.041	0.043	0.010	0.005	0.008	0.011
R^2 adj. full	0.286	0.252	0.153	0.075	0.120	0.147

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Full model contains job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

The relationship between multitasking and work-related mental health could be driven by certain task categories, e.g. routine versus non-routine or cognitive versus manual. Table 4 displays the results for multitasking within task categories in the full model. Of the 16 tasks, five are non-routine manual, three routine manual, three routine cognitive, three non-routine interactive, and two non-routine analytic (see table 1). Multitasking measures within task categories range from 0 to the maximum number of tasks within that category and are standardized for comparability.

Non-routine manual multitasking is significantly associated with all work-related mental health problems. An increase in one standard deviation of non-routine manual multitasking is associated with an increase in any work-related mental health problem of 0.102 standard deviations. Strain increases by 0.114 standard deviations and exhaustion by 0.026 standard deviations. The estimate for burnout is 0.039 and significant at the 5% level. Absenteeism increases by 1.1 percentage points and presenteeism by 1.6 percentage points. Routine manual multitasking is associated with lower emotional strain, emotional exhaustion, absenteeism, and presenteeism (the latter significant at the 5% level). The point estimate for burnout is insignificant. A one standard deviation increase in routine manual multitasking is associated with a decrease in any work-related mental health of 0.06 standard deviations. Routine cognitive multitasking is associated with risk increases for burnout (0.05 standard deviations), emotional strain (0.023 standard deviations), and absenteeism (0.6 percentage points, significant at the 5% level). The estimates for exhaustion and presenteeism are insignificant. Non-routine interactive

multitasking is highly significant and positive for all outcomes. The point estimates are larger than for non-routine manual multitasking. A one standard deviation increase is associated with an increase in strain of 0.13 standard deviations, exhaustion of 0.06 standard deviations, and burnout of 0.05 standard deviations. The probabilities for absenteeism and presenteeism increase by 1.8 and 2.4 percentage points. Non-routine analytic multitasking is related to higher exhaustion (0.025 standard deviations) and strain (0.016 standard deviations) at the 5% level but not to burnout. Absenteeism increases by 0.5 and presenteeism by 0.8 percentage points (10% level).

Table 4: OLS estimates for work-related mental health outcomes, task categories

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
non-routine manual multitasking	0.102***	0.114***	0.026***	0.039**	0.011***	0.016***
	(0.008)	(0.008)	(0.010)	(0.015)	(0.003)	(0.004)
constant	-0.629***	-0.493***	-0.681***	-0.477**	-0.065	0.046
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.061)
routine manual multitasking	-0.062***	-0.059***	-0.039***	-0.022	-0.011***	-0.010**
	(0.008)	(0.009)	(0.010)	(0.015)	(0.003)	(0.004)
constant	-0.643***	-0.503***	-0.689***	-0.476**	-0.069	0.046
	(0.121)	(0.132)	(0.138)	(0.202)	(0.044)	(0.060)
routine cognitive multitasking	0.028***	0.023***	0.012	0.051***	0.006**	0.005
	(0.008)	(0.009)	(0.009)	(0.014)	(0.003)	(0.004)
constant	-0.595***	-0.459***	-0.670***	-0.410**	-0.060	0.052
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.061)
non-routine interactive multitasking	0.126***	0.130***	0.061***	0.050***	0.018***	0.024***
	(0.008)	(0.009)	(0.011)	(0.015)	(0.003)	(0.005)
constant	-0.627***	-0.489***	-0.677***	-0.461**	-0.065	0.049
	(0.120)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
non-routine analytic multitasking	0.020**	0.016**	0.025**	0.001	0.005*	0.008*
	(0.008)	(0.008)	(0.010)	(0.013)	(0.003)	(0.004)
constant	-0.595***	-0.459***	-0.659***	-0.465**	-0.060	0.055
	(0.122)	(0.132)	(0.139)	(0.202)	(0.044)	(0.060)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

The positive relationship between multitasking and work-related mental health is thus driven by non-routine manual and non-routine interactive tasks, while routine manual multitasking is associated with better health. As outlined in subsection 2.3, it makes sense that interactive

tasks are associated with worse work-related mental health. To analyze whether the grouping into the categories masks any individual task effects, tables 5 to 9 show the coefficients for single task dummies.

The positive relationship of non-routine manual tasks and mental health is driven by "nursing" and "protecting", two tasks that require interaction with potentially not cooperating customers (patients and criminals), and by "accommodating" which requires interaction with potentially unsatisfied customers (hotel guests, table 5). Point estimates are largest for "nursing". The increase in any work-related mental health problem is 0.478 standard deviations. The largest coefficient is the one for strain (0.536). Exhaustion and burnout increase about 0.1 standard deviations. "Accommodating" coefficients are second largest except for burnout (insignificant). Strain increases by 0.247 standard deviations, exhaustion by 0.1 standard deviation. Point estimates for "protecting" are 0.164 for strain and below 0.1 for exhaustion and burnout. Absenteeism increases by 4 percentage points for "accommodating" and "nursing". The "protecting" estimate is half that size. Presenteeism increases about 4 percentage points. The estimates for "repairing" are negative which fits to the finding that (routine) manual tasks are associated with better mental health. The "cleaning" coefficient is positive for burnout and strain but negative, small, and insignificant for exhaustion. "Cleaning" is also insignificant for health behaviors. This is probably because "cleaning" generally requires less interaction.

Table 5: OLS estimates for work-related mental health outcomes, non-routine manual tasks

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
repairing						
dummy	-0.118***	-0.118***	-0.054**	-0.029	-0.014*	-0.014
	(0.022)	(0.023)	(0.024)	(0.046)	(0.008)	(0.011)
constant	-0.617***	-0.479***	-0.677***	-0.466**	-0.064	0.049
	(0.121)	(0.131)	(0.139)	(0.203)	(0.044)	(0.060)
accommodating						
dummy	0.232***	0.247***	0.100***	0.036	0.040***	0.037**
	(0.026)	(0.028)	(0.033)	(0.052)	(0.011)	(0.015)
constant	-0.668***	-0.534***	-0.703***	-0.472**	-0.073*	0.040
	(0.121)	(0.131)	(0.138)	(0.203)	(0.044)	(0.060)
nursing						
dummy	0.478***	0.536***	0.130***	0.113***	0.037***	0.047***
	(0.021)	(0.022)	(0.027)	(0.039)	(0.008)	(0.012)
constant	-0.782***	-0.665***	-0.717***	-0.509**	-0.076*	0.035
	(0.121)	(0.130)	(0.139)	(0.204)	(0.044)	(0.060)
protecting						
dummy	0.160***	0.164***	0.075***	0.067*	0.022***	0.041***
	(0.018)	(0.019)	(0.023)	(0.036)	(0.007)	(0.010)
constant	-0.638***	-0.500***	-0.686***	-0.482**	-0.067	0.043
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
cleaning						
dummy	0.044**	0.056***	-0.014	0.063*	0.002	0.008
	(0.019)	(0.020)	(0.022)	(0.038)	(0.007)	(0.009)
constant	-0.623***	-0.490***	-0.666***	-0.491**	-0.063	0.047
	(0.122)	(0.132)	(0.140)	(0.204)	(0.044)	(0.061)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

"Manufacturing" is clearly driving the negative association between routine manual tasks and work-related mental health problems (table 6). Performing manufacturing tasks is associated with a decrease in mental health problem of 0.188 standard deviations. The point estimate is largest for emotional strain. Exhaustion and burnout are 0.087 and 0.109 standard deviations lower. The probabilities to stay home sick or to go to work sick are 2.9 and 3.1 percentage points smaller. "Monitoring" is negative and significant for all outcomes except presenteeism. The point estimates are smaller than for "manufacturing". "Transporting" is significantly associated with exhaustion only, the coefficient is similar in size to the "monitoring" estimate.

Table 6: OLS estimates for work-related mental health outcomes, routine manual tasks

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
manufacturing						
dummy	-0.188***	-0.188***	-0.087***	-0.109***	-0.029***	-0.031***
	(0.021)	(0.023)	(0.024)	(0.036)	(0.008)	(0.010)
constant	-0.619***	-0.482***	-0.675***	-0.458**	-0.064	0.050
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
monitoring						
dummy	-0.083***	-0.077***	-0.044**	-0.072**	-0.012*	-0.006
	(0.018)	(0.019)	(0.021)	(0.034)	(0.007)	(0.009)
constant	-0.606***	-0.468***	-0.670***	-0.463**	-0.062	0.051
	(0.122)	(0.132)	(0.139)	(0.202)	(0.044)	(0.060)
transporting						
dummy	-0.016	-0.008	-0.037*	0.047	-0.009	-0.009
	(0.018)	(0.019)	(0.021)	(0.035)	(0.006)	(0.009)
constant	-0.602***	-0.466***	-0.662***	-0.476**	-0.060	0.053
	(0.122)	(0.131)	(0.140)	(0.202)	(0.044)	(0.061)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

The positive relationship between routine cognitive tasks and work-related mental health problems comes from the task "documenting" (table 7). The size of the estimates is similar to the ones for the non-routine manual task "protecting". The two other routine cognitive tasks, "measuring" and "purchasing", have an ambiguous association with mental health. "Measuring" is negatively significant for exhaustion and strain but insignificant for burnout and presenteeism. "Purchasing" is positively associated with exhaustion and negatively with strain. This is probably because the task is composed of somewhat heterogeneous single activities which have different associations with mental health.[11]

[11] "Purchasing" includes purchasing, producing, and selling. Purchasing and selling involve some degree of customer and supplier interaction (which should be related positively to mental health problems), while producing refers more to "manufacturing" (negative association). The largely insignificant estimates for "purchasing" suggest that these two single associations cancel out.

Table 7: OLS estimates for work-related mental health outcomes, routine cognitive tasks

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
measuring						
dummy	-0.059***	-0.053***	-0.071***	0.043	-0.009	-0.024***
	(0.015)	(0.016)	(0.019)	(0.027)	(0.006)	(0.008)
constant	-0.599***	-0.463***	-0.657***	-0.467**	-0.061	0.056
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
purchasing						
dummy	-0.020	-0.041**	0.041*	-0.003	-0.000	0.022**
	(0.017)	(0.018)	(0.023)	(0.031)	(0.006)	(0.010)
constant	-0.596***	-0.449***	-0.693***	-0.465**	-0.062	0.040
	(0.122)	(0.132)	(0.138)	(0.204)	(0.044)	(0.061)
documenting						
dummy	0.180***	0.173***	0.089***	0.139***	0.032***	0.027***
	(0.016)	(0.017)	(0.019)	(0.028)	(0.006)	(0.008)
constant	-0.648***	-0.509***	-0.697***	-0.459**	-0.070	0.043
	(0.121)	(0.131)	(0.139)	(0.203)	(0.044)	(0.060)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

All three non-routine interactive tasks are significantly associated with worse work-related mental health (table 8). "Training" point estimates are largest except for presenteeism and burnout. Performing the task "training" is associated with an increase in any work-related mental health problem of 0.222 standard deviations. "Informing" and "advertising" are associated with increases of 0.181 and 0.113 standard deviations. "Training" coefficients are similar to "accommodating" estimates. "Informing" and "advertising" are similar to "protecting".

Table 8: OLS estimates for work-related mental health outcomes, non-routine interactive tasks

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
advertising						
dummy	0.113***	0.102***	0.096***	0.080**	0.019**	0.041***
	(0.022)	(0.023)	(0.031)	(0.040)	(0.008)	(0.014)
constant	-0.626***	-0.486***	-0.692***	-0.466**	-0.066	0.042
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
training						
dummy	0.222***	0.225***	0.117***	0.068**	0.036***	0.035***
	(0.019)	(0.020)	(0.025)	(0.033)	(0.007)	(0.011)
constant	-0.636***	-0.498***	-0.685***	-0.480**	-0.067	0.047
	(0.121)	(0.131)	(0.139)	(0.203)	(0.044)	(0.060)
informing						
dummy	0.181***	0.194***	0.065***	0.062**	0.020***	0.033***
	(0.016)	(0.017)	(0.020)	(0.029)	(0.006)	(0.008)
constant	-0.738***	-0.610***	-0.716***	-0.503**	-0.077*	0.029
	(0.121)	(0.132)	(0.139)	(0.203)	(0.044)	(0.060)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

The association between non-routine analytic tasks and mental health is rather weak in comparison (table 9). "Organizing" is significant for all outcomes but burnout. Emotional strain increases by 0.073 standard deviations, exhaustion by 0.065 standard deviations. "Researching" is insignificant for all outcomes but the combined measure and emotional strain. The point estimates are negative (-0.054 and -0.065). All other coefficients are very small and negative. The different associations reflect that "organizing" (organizing, planning and preparing work processes of others) involves interaction with coworkers or subordinates, while "researching" (developing, researching, constructing) requires less interaction. All in all, there are differences even within task categories regarding the relationship with work-related mental health. These differences seem to arise from different degrees of interaction that the single task requires. The analysis confirms a significant positive association between interactive tasks and work-related mental health problems. The association is stronger where cooperation from clients is necessary but potentially missing (nursing, protecting, training).

Table 9: OLS estimates for work-related mental health outcomes, non-routine analytic tasks

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
organizing						
dummy	0.076***	0.073***	0.065***	0.003	0.013**	0.025***
	(0.016)	(0.017)	(0.020)	(0.028)	(0.006)	(0.009)
constant	-0.616***	-0.477***	-0.682***	-0.466**	-0.064	0.047
	(0.121)	(0.132)	(0.139)	(0.202)	(0.044)	(0.060)
researching						
dummy	-0.054**	-0.065***	-0.009	-0.002	-0.001	-0.011
	(0.022)	(0.023)	(0.027)	(0.039)	(0.008)	(0.012)
constant	-0.606***	-0.469***	-0.673***	-0.466**	-0.062	0.051
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

4.2 Gender difference and intensive margins

A common prejudice is that men are worse multitaskers than women. Even though this relates to the common language multitasking, i.e. simultaneously performing tasks, there might also be a gender difference in the association between work-related mental health and the number of tasks. Table 10 displays the results for women and men separately. Point estimates are about three times larger for women than for men. Multitasking is associated with an increase in any work-related mental health problem of 0.062 standard deviations for women and 0.017 standard deviations for men. The difference is the same for strain. Exhaustion increases by 0.029 standard deviations for women and by 0.1 standard deviations for men. The female multitasking coefficient is 0.037 for burnout, the male one is insignificant (0.005). Female absenteeism and presenteeism increase 0.9 percentage points with multitasking (around 5%). Male absenteeism is not affected by rising multitasking but presenteeism increases by 0.7 percentage points (4%). Female work-related mental health is more strongly affected than male health. This makes sense taking into account that women tend to select into tasks that require human interaction, while men are more apt to carry out physical tasks in manufacturing.[12]

[12]Male overconfidence in task reporting could be an issue, see footnote 7. The weaker overall association for men could be partially explained by this if misreporting was higher for higher levels of multitasking only. This seems rather unlikely.

Table 10: OLS estimates for work-related mental health outcomes by gender

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
women						
multitasking	0.062***	0.062***	0.029***	0.037***	0.009***	0.009***
	(0.005)	(0.005)	(0.006)	(0.010)	(0.002)	(0.003)
constant	-0.603***	-0.341*	-0.869***	-0.688***	-0.110*	0.052
	(0.169)	(0.181)	(0.222)	(0.266)	(0.067)	(0.092)
men						
multitasking	0.017***	0.017***	0.010*	0.005	0.003	0.007***
	(0.005)	(0.006)	(0.006)	(0.009)	(0.002)	(0.003)
constant	-0.967***	-0.982***	-0.634***	-0.367	-0.037	0.009
	(0.182)	(0.197)	(0.194)	(0.305)	(0.064)	(0.087)
N women	10654	10668	7094	3563	10661	7106
N men	9435	9452	6427	3013	9441	6442

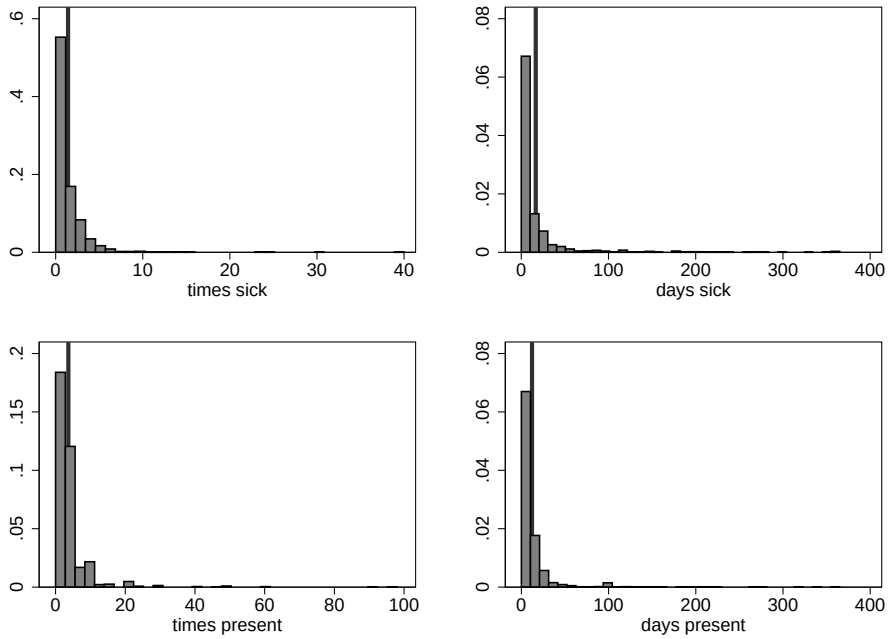
Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Full model contains job demands and resources, sociodemographic, and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Multitasking is associated with increased absenteeism and presenteeism at the extensive margin, i.e. whether or not employees are on sick leave or come to work sick. The intensive margin is recorded as the number of times (2012 only) and the number of days this occurred. Figure 4 shows the histograms for the intensive margins of absenteeism (upper panel) and presenteeism (lower panel). In 2012, employees were on sick leave with emotional exhaustion 1.4 times on average. They were on sick leave with burnout in 2006 on 20 days and with emotional exhaustion on 15 days in 2012. Employees went to work despite being exhausted 3.6 times and on 12 days in 2012.

The distribution of the count data suggests a Poisson distribution but as it is often the case with sick day data, the variation is large. This is why sick days models are often negative binomial regression models: the count variable follows a Poisson distribution but variation can be larger (called "overdispersion"). Indeed, conditional variances exceed conditional means (i.e. in each multitasking category, see table 11).[13] Table 12 displays the multitasking coefficients of negative binomial regressions for the four count variables. A one task increase in multitasking is associated with a decrease in the difference in the logs of the expected number of sick leaves (0.023, significant at the 5% level). Similarly, multitasking is associated with increases in the difference in the logs of expected number of presenteeism times and days (0.045 and 0.030,

[13]This is confirmed when running Poisson and binomial negative regressions in Stata. After *poisson*, the goodness-of-fit chi-squared test is highly statistically significant, suggesting that a Poisson model is not the best choice. The likelihood-ratio chi-square test in the *nbreg* command (binomial negative regression) tests that the dispersion parameter is zero. In this case, a Poisson would be sufficient. The test is rejected at the 1% level for all models and outcomes.

Figure 4: Histogram of times and days of absenteeism and presenteeism



Vertical lines: mean. Times sick: times on sick leave (2012), days sick: days on sick leave (2006 and 2012), times present: times sick but went to work (2012), days present: days sick but went to work (2012). Data sources: BIBB/BAuA. Own figure.

significant at the 5% level). The estimate for the number of sick days is not significant. In the full model with all covariates, the estimate for times sick is not significant any more. Multitasking is associated with an increase in sickness days and times and days of presenteeism. Interpreting the exponentiated point estimates, an increase in multitasking of one task is associated with an increase in sickness days of a factor of 1.026 (2.6%). Times present increase by 2% and presenteeism days by 4.2%.

Table 11: Overdispersion

	times sick			days sick			times present			days present		
multitasking	mean	var	n	mean	var	n	mean	var	n	mean	var	n
1	1.6	3.4	89	25.3	2529.5	150	4.5	54.4	83	15.3	619.6	84
2	1.8	6.2	321	22.1	2560.7	429	2.9	12.2	301	10.9	365.1	292
3	1.4	2.4	567	16.0	1232.1	713	3.1	23.9	534	10.7	385.5	538
4	1.4	4.7	615	14.4	924.8	782	3.5	39.1	588	11.8	453.6	591
5	1.4	3.8	654	13.9	1113.6	790	3.1	17.0	618	10.7	427.6	610
6	1.3	2.0	541	17.0	1649.5	627	3.8	48.2	509	11.9	611.7	502
7	1.3	4.0	369	15.5	1663.3	442	4.5	86.4	339	15.4	905.3	345
8	1.3	2.2	266	14.0	844.4	309	4.1	37.1	241	12.3	313.4	249
9	1.4	2.4	218	16.8	1945.3	250	4.8	52.6	199	12.4	298.3	195
10	1.2	1.5	143	22.2	2450.9	159	4.7	39.6	132	17.1	1246.2	127
11	1.3	1.9	48	16.3	1595.1	53	3.9	24.8	46	17.7	1054.8	46
12	1.5	2.8	50	32.8	4137.8	53	4.8	49.8	45	15.6	1039.9	40
Total	1.4	3.4	3881	16.6	1514.5	4757	3.7	37.8	3635	12.2	526.2	3619

Var: variance, n: number of observations. Sick: sick leave, present: went to work despite being sick. Sickness: burnout (2006), emotional exhaustion (2012). Data sources: BIBB/BAuA. Own calculations.

Table 12: Negative binomial regression estimates for absenteeism and presenteeism frequency and amount

	times sick	days sick	times present	days present
base model				
multitasking	-0.023***	-0.004	0.045***	0.030***
	(0.008)	(0.013)	(0.009)	(0.011)
full model				
multitasking	-0.005	0.026*	0.020*	0.041***
	(0.010)	(0.015)	(0.010)	(0.013)
N	3614	4171	3402	3392

Sick: sick leave, present: went to work despite being sick. Sickness: burnout (2006), emotional exhaustion (2012). Full model contains job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

4.3 Robustness

This subsection analyzes the robustness of the above findings to alternative measurements of the outcomes and alternative multitasking measures. Table 13 considers alternative measures of work-related mental health. The outcomes emotional strain, emotional exhaustion, burnout, absenteeism, and presenteeism were chosen based on availability in the data. To check whether they represent a common underlying factor "work-related mental health problems", factor analyses determined a common factor for all outcomes measured in 2012 (exhaustion, strain, absenteeism, presenteeism) and 2006 (burnout, strain, absenteeism) with an iterated principal

factor. One factor had an eigenvalue larger than 1. The common factors were predicted after rotation. The regression results for these common factors are displayed in columns one and two. Multitasking is highly significant for both common factors in the full model.

The third and fourth column display the results for binary measures of emotional exhaustion and burnout indicating the presence of either health problem but not distinguishing by physician consultation. An additional task is associated with an increase in burnout of 0.6 percentage points. Since 7% of the weighted sample suffer from burnout, the relative increase is 8%. The associated increase for emotional exhaustion is 1 percentage point. At a mean prevalence of 24%, this corresponds to 4%. With the binary definition, the relative increase is larger for burnout.

Hackman and Oldham (1976) suggest that skill variety is related to lower absenteeism. This was not confirmed for absenteeism due to work-related mental health problems. Columns five and six regress overall absenteeism and presenteeism on multitasking and covariates to check whether their prediction holds for general measures. The point estimate for absenteeism is negative but small and insignificant (-0.003). The multitasking coefficient for presenteeism is positive (0.002) but insignificant, too. While there is no association as suggested by Hackman and Oldham (1976), this robustness check confirms that the previous finding of increased absenteeism and presenteeism is determined by the cause (work-related mental health problems) and is not a general finding.

Table 13: OLS estimates for alternative work-related mental health outcomes

	common 2012	common 2006	burnout	exhaustion	absenteeism	presenteeism
multitasking	0.022***	0.021***	0.006***	0.010***	-0.003	0.002
	(0.004)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)
constant	-0.636***	-0.506**	-0.058	-0.032	0.368***	0.622***
	(0.145)	(0.202)	(0.056)	(0.066)	(0.077)	(0.088)
N	13521	6573	6577	13525	20094	13518

Dependent variable given in column header. Common 2012: common factor from factor analysis with emotional exhaustion, emotional strain, absenteeism and presenteeism. Common 2006: burnout, emotional strain, absenteeism. Burnout/exhaustion: binary. Absenteeism/presenteeism: general, not only due to work-related mental health problems. Models include job demands and resources, sociodemographic, and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

The role multitasking plays for work-related mental health could depend on the context, e.g. on the general multitasking distribution or on the occupation-specific multitasking distribution.[14] Adding one more task might be less relevant in practice as people compare their

[14]The concept of comparisons to the context dates back to Festinger (1954)'s theory of social comparison processes. His second hypothesis states that people evaluate opinions and abilities in comparing themselves to

own situation to that of others. Individual multitasking might have a different effect if it is high (above the average) or extremely high (larger than the mean plus one standard deviation) compared to the general level of multitasking or compared to the occupation-specific level. 39% of the individuals have above mean multitasking and 43% perform more tasks than the average in their occupation in 2006 or 2012. 16% are extreme multitaskers both in general and within their occupation. Another way to account for the context is to consider occupational instead of individual multitasking. In the task literature, it is common practice to work with occupational tasks because individual task information is seldom available. The QaC is one of the few exceptions. While it makes sense to let tasks vary within a job, measurement error on the individual level might be larger. Occupation-specific multitasking averages 4.2 tasks with a standard deviation of 0.86. The level of aggregation is two-digit occupation codes according to the 1992 version of the German classification of occupations ("Klassifikation der Berufe"). The sample contains 89 different occupations.

Table 14 shows the estimates for alternative multitasking measures. The first two panels consider above average and extreme multitasking in general. The average of multitasking is 4.2, the standard deviation is 2.3. Performing 5 tasks or more compared to less than 5 is associated with an increase in the risk for any work-related mental health problem of 0.138 standard deviations. The increase in strain is 0.135 standard deviations and larger than for burnout (0.095 standard deviations) and exhaustion (0.069 standard deviations). The probability to miss work due to sickness is 1.8 percentage points higher and the probability to go to work sick 2.5 percentage points. Extreme multitasking of 7 or more tasks is associated with higher exhaustion, strain, absenteeism, and presenteeism. Point estimates are similar to the ones obtained with the above average measure for complaints and larger for health behaviors (27. and 4.0 percentage points).

Mean occupation multitasking ranges from 2 (stoneware and brick makers) to 7.7 tasks (beverage and tobacco makers). Performing more tasks than one's occupation average is significantly associated with all outcomes but health behaviors. The increase is largest for burnout (0.1 standard deviations). Strain and exhaustion increase by 0.051 and 0.032 standard deviations (the latter at the 10% level). Extreme occupation multitasking is significantly related to the combined measure, absenteeism, and presenteeism at the 5% level. The coefficients for health behaviors are larger than for the above mean measure. The remaining point estimates are positive but insignificant. All in all, above mean multitasking is associated with worse work-related mental health. Extreme multitasking is more detrimental to health behaviors.

others if no objective standard is available.

The last two panels in table 14 compare individual to occupational multitasking. Both measures are standardized. Occupational multitasking is significantly related to all outcomes but burnout. The point estimates are comparable to the ones with individual multitasking for exhaustion and absenteeism. The estimate for strain is larger with the occupational measure, the one for presenteeism with the individual measure. Overall, individual multitasking seems to be more relevant for more severe work-related mental health.

Table 14: OLS estimates for work-related mental health outcomes, alternative multitasking

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
above average						
multitasking	0.138***	0.135***	0.069***	0.095***	0.018***	0.025***
	(0.016)	(0.017)	(0.019)	(0.030)	(0.006)	(0.008)
constant	-0.618***	-0.479***	-0.692***	-0.459**	-0.064	0.044
	(0.121)	(0.131)	(0.139)	(0.203)	(0.044)	(0.060)
extreme						
multitasking	0.129***	0.134***	0.069**	0.026	0.027***	0.040***
	(0.022)	(0.023)	(0.028)	(0.042)	(0.008)	(0.012)
constant	-0.609***	-0.470***	-0.676***	-0.463**	-0.063	0.049
	(0.122)	(0.132)	(0.139)	(0.202)	(0.044)	(0.061)
above average occupation						
multitasking	0.062***	0.051***	0.032*	0.100***	0.008	0.012
	(0.016)	(0.016)	(0.019)	(0.029)	(0.006)	(0.008)
constant	-0.610***	-0.471***	-0.677***	-0.466**	-0.063	0.049
	(0.121)	(0.131)	(0.139)	(0.203)	(0.044)	(0.060)
extreme occupation						
multitasking	0.043**	0.031	0.041	0.047	0.019**	0.024**
	(0.021)	(0.022)	(0.027)	(0.040)	(0.008)	(0.012)
constant	-0.605***	-0.467***	-0.673***	-0.459**	-0.062	0.051
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.060)
individual						
multitasking, std.	0.095***	0.095***	0.046***	0.048***	0.015***	0.020***
	(0.008)	(0.009)	(0.010)	(0.015)	(0.003)	(0.004)
constant	-0.555***	-0.416***	-0.651***	-0.427**	-0.054	0.060
	(0.121)	(0.131)	(0.139)	(0.202)	(0.044)	(0.061)
occupational						
multitasking	0.117***	0.131***	0.048***	0.000	0.014***	0.016***
	(0.008)	(0.008)	(0.011)	(0.013)	(0.003)	(0.004)
constant	-0.671***	-0.540***	-0.708***	-0.466**	-0.070	0.038
	(0.121)	(0.131)	(0.138)	(0.202)	(0.044)	(0.060)
N	20089	20120	13521	6576	20102	13548

Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Above average (occupation) multitasking: binary for multitasking that is larger than average (occupation) multitasking, extreme multitsaking (occupation): binary for multitasking that is larger than average (occupation) multitasking plus one standard deviation, individual/occupational multitasking: standardized. Models include job demands and resources, sociodemographic and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Multitasking is defined differently in organizational job design than in the public usage of the term where multitasking means performing different tasks at the same time or switching between short sequences of different tasks. A measure for this simultaneity is how often people need to keep an eye on different work processes or sequences at the same time. 60% report doing so often, a quarter sometimes. 10% rarely do different things at the same time and 6% never do. Estimation results for the standardized measure of simultaneity in the base and the full model are reported in table 15. The simultaneity measure explains a similar percentage of

variation in the outcomes as the multitasking measure. Simultaneity is significantly associated with all outcomes in a model without any covariates (upper panel). Coefficients decrease to half or one eighth in the full model with all controls and turn insignificant except for the combined measure and strain. A one standard deviation increase in simultaneity is associated with an increase in strain of 0.03 standard deviations. This is three times smaller than with the standardized multitasking measure from table 14. The simultaneity of tasks appears to be much less important than the number of tasks.

Table 15: OLS estimates for work-related mental health outcomes, simultaneity

	combined	strain	exhaustion	burnout	absenteeism	presenteeism
base model						
simultaneity	0.198***	0.204***	0.097***	0.047***	0.020***	0.041***
	(0.008)	(0.009)	(0.009)	(0.016)	(0.003)	(0.004)
constant	-0.029***	-0.015*	-0.066***	-0.013	0.126***	0.189***
	(0.008)	(0.009)	(0.010)	(0.013)	(0.003)	(0.004)
full model						
simultaneity	0.026***	0.030***	0.013	-0.024	0.003	0.006
	(0.009)	(0.009)	(0.010)	(0.017)	(0.003)	(0.004)
constant	-0.597***	-0.459***	-0.668***	-0.479**	-0.061	0.052
	(0.121)	(0.131)	(0.139)	(0.201)	(0.044)	(0.060)
N	20087	20118	13520	6575	20100	13547
R^2 adj. base	0.040	0.042	0.012	0.002	0.004	0.012
R^2 adj. full	0.279	0.246	0.151	0.073	0.119	0.146

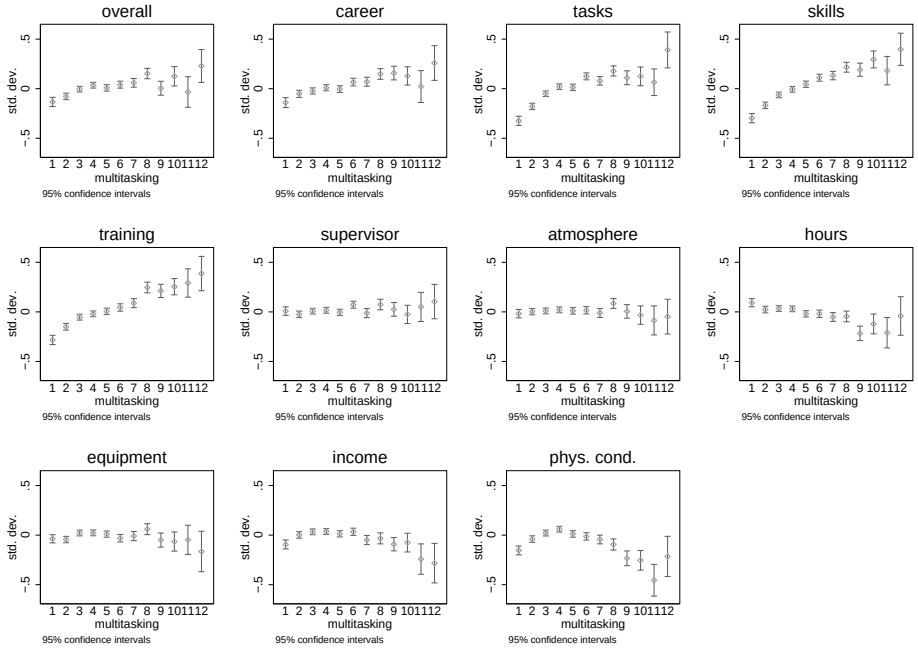
Standardized dependent variable given in column header (absenteeism, presenteeism: binary). Combined: emotional exhaustion, burnout and/or emotional strain. Models include job demands and resources, sociodemographic, and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

5 Compensation

This section analyzes whether there are positive effects of multitasking in the work context that could offer compensation for the detrimental link to work-related mental health problems. In the Job Chracteristics Model, Hackman and Oldham (1976) associate skill variety with intrinsic motivation and job satisfaction. The term "skill variety" designates the variety of different activities on the job, which corresponds to multitasking. The model suggests a positive association between multitasking and job satisfaction. The relationship between standardized job satisfaction and multitasking is depicted in figure 5. Overall job satisfaction and career satisfaction are slightly higher for higher multitasking. The pattern is steeper for satisfaction with tasks, application of skills, and further training. Multitasking does not seem to be related to satisfaction with supervisor and working atmosphere. Satisfaction with hours, working equip-

ment, and income decrease slowly over multitasking, while the decrease is more pronounced for satisfaction with physical working conditions for high multitasking.

Figure 5: Job satisfaction by multitasking



Standardized job satisfaction. Phsc. cond.: physical working conditions. Data sources: BIBB/BAuA. Own figure.

Table 16 displays the multitasking coefficients in the full model with all covariates. An additional task is associated with an increase in overall job satisfaction of 0.019 standard deviations. The point estimate is small but positive and significant for career satisfaction. Coefficients are larger for satisfaction with application of skill, further training and tasks (around 0.02 to 0.03). Contrary to the bivariate descriptive evidence, multitasking is somewhat relevant for satisfaction with supervisor and working atmosphere (0.01 at the 5% and the 10% level). The results for satisfaction with income and physical working conditions confirm the descriptive picture: multitasking is related to lower satisfaction (-0.02 standard deviations). In general, the multitasking estimates are smaller than the ones for the combined mental health measure and emotional strain suggesting that even though there might be compensatory effects, these are probably smaller.

Table 16: OLS estimates for job satisfaction

	overall	career	tasks	skills	training	supervisor	atmosphere	hours	equipment	income	phys. cond.
multitasking	0.019***	0.010**	0.023***	0.029***	0.029***	0.010**	0.006*	0.002	-0.001	-0.021***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
constant	0.517***	0.714***	-0.136	-0.317**	0.543***	0.373***	1.008***	0.288**	0.266*	0.055	0.456***
	(0.144)	(0.160)	(0.142)	(0.156)	(0.147)	(0.140)	(0.128)	(0.140)	(0.144)	(0.160)	(0.139)
N	20121	18342	20121	20105	19829	19952	20104	20103	19995	20106	20054
Adj. R^2	0.196	0.127	0.136	0.143	0.155	0.174	0.250	0.208	0.095	0.107	0.198

Standardized dependent variable given in column header. Phys. cond.: Satisfaction with physical working conditions. Full model contains job demands and resources, sociodemographic, and job covariates according to table 2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

In addition to non-monetary compensation, multitasking could be associated with higher wages. Indeed, Pikos and Thomsen (2016) find a positive association between the number of task categories (one to five) an individual carries out and the hourly wage. The relationship was strongest in the 1980s where a one standard deviation increase was associated with an increase in hourly wages by 8%. This reduced to half the size after 2000. At the same time, multitasking became much more common. The relationship between multitasking and wages is also weaker for higher educated employees. Both findings suggest that multitasking pays off less when it is more common. Hence, if there is monetary compensation, it is becoming less and less important.

6 Discussion

Rising multitasking is significantly and robustly associated with worse mental health at work, absenteeism, and presenteeism. The magnitude of these associations is small at first sight: for an additional task, burnout and exhaustion increase by about 0.02 standard deviations, absenteeism and presenteeism by 0.6 and 0.8 percentage points. A one task increase in multitasking corresponds nearly to the increase in the average number of tasks from 2006 (4) to 2012 (4.8). Assuming that the increase in multitasking is equally distributed across time and continues in the future, the estimated associated increases of one task would occur within seven to eight years.

To calculate the cost of rising multitasking regarding work-related mental health, one needs to estimate the average cost of work-related mental health problems. This is problematic because data is scarce. Among the three outcomes – emotional strain, emotional exhaustion, and burnout – there is only data on burnout and even that is rare. The main reason is that burnout is not coded in a single category in the International Statistical Classification of Diseases and Related Health Problems which is used by physicians to classify diseases. In the 10th revision, German Modification (ICD-10-GM), it is coded in category Z73 among "other problems to cope with life".[15] Burnout costs arise to individuals (reduced quality of life, loss of self esteem, reduced work capacity), companies (value added, expertise, loss of reputation), and society (health care expenditures, early retirement, work incapacity). Due to lacking data, the following will be a back of the envelope calculation of the loss in gross value added.

To put a value on absenteeism and presenteeism, it is necessary to estimate the number of cases, the average number of days, and the average value loss per day. The German Federal

[15]These comprise for example accentuation of personality traits, limited activities due to handicap, lack of relaxation or leisure, social role conflict, stress, and insufficient social competences (not classified elsewhere).

Institute for Occupational Safety and Health (*Bundesanstalt für Arbeitsschutz und Arbeitsmedizin*, BAuA) calculates an average of €59,000 of gross value added per employee in 2009. There were around 253 working days in 2009.[16] Thus, gross value added per day and employee was around €233,20. In the QaC, people reporting burnout in 2006 missed 20 working days on average.[17] This implies a total loss in gross value added per burnout of €4,664. Around 10.9% stayed home with burnout. The total German working population subject to social security contribution (not including self-employed and public sector employment) was 27 million in 2009. This gives 2.9 million absenteeism cases.[18] Hence, the total loss in gross value added would be around €13.7 billion. Holding the working population constant,[19] an increase in absenteeism by 0.6 percentage points corresponds to about 3.1 million employees on sick leave, an increase of 162,000. Sickness days increase by 2.6% to 20.5 days. This slightly increases absenteeism costs per burnout case to €4,781. The total cost of absenteeism rises by €1.1 billion to around €14.8 billion in total.

Costs from presenteeism are harder to calculate because data are even sparser. In the QaC, presenteeism is recorded in 2012 only. As emotional exhaustion is a component of burnout and thus mild, the following can be seen as a lower bound estimate for the presenteeism cost of burnout. On average, employees went to work despite feeling emotionally exhausted on 12 days. The costs from presenteeism come for example from lower work quality, higher rate of mistakes, and higher risk for accidents (Volber, 2014). Assuming that lower work quality and higher rate of mistakes entail a loss of about 20%, gross value added per day would be reduced by €46.64 to €185.56.[20] This is a loss of €559.68 for 12 days. 18.6% of the employees went to work despite being emotionally exhausted. This corresponds to 5 million employees who would lose about €2.8 billion. Holding the working population constant, an increase in presenteeism by 0.8 percentage points corresponds to 5.2 million sick employees at work, an increase of around

[16]The number of working days differs by federal state (between 252 and 254). This is mainly due to different religious holidays for catholic and protestants, the two major religions in Germany. Northern federal states are predominantly protestant, southern federal states predominantly catholic.

[17]According to the WHO, individuals with burnout miss 30.4 working days on average. In Germany, data availability depends on health insurance companies. There are private and public health insurances and their estimates differ. In the largest public health insurance (*Allgemeine Ortskrankenkassen*, AOK), there are 5.1 sickness cases due to category Z73 and 101,6 sick leave days for 1,000 insurants (Springer, 2017). This corresponds to around 20 days/case. A medium sized private health insurance (*Betriebskrankenkassen*, BKK) records 40 days of sickness leave for "mental disorders" (Henrich, 2015). The AOK-estimate includes mild conditions than burnout (e.g. deficient social skills, social role conflict) and is probably downward biased. The BKK-estimate is likely upward biased as recovery from their included mental health disorders (e.g. schizophrenia) can take more time. This suggests that the true number of sick leave days due to burnout is somewhere in the middle. I use the 20 days from the QaC.

[18]This is downward biased as individuals suffering from burnout who left the working population are not included.

[19]In fact, the German working population increased to nearly 29 million people in 2013.

[20]There is an estimate that mental health presenteeism would equal a loss of 1.5 hours on an 8 hour working day which corresponds to a similar percentage (Marquart, 2011).

200,000. Presenteeism days increase by 4.1% to 12.5 days. The total loss of presenteeism rises by €241 million to €3.1 billion in total. In sum, the additional cost from increased multitasking for seven to eight years corresponds to a loss in gross value added of about €1.3 billion. For the time period 2006 to 2012, €900 million are lost due to absenteeism and €200 million due to presenteeism (80%). The total loss hence amounts to €1,1 billion.

The above calculation does not include health care expenditures for burnout treatment because no estimates are available. All I can say here is that the number of burnouts increases by 0.02 standard deviations (or 0.5 percentage points at a standard deviation of 0.25)[21]. 6.8% report burnout in the data. This corresponds to 1.8 million people. A 0.5 percentage points increase translates into about 135,000 (from 2006 to 2012:108,000) additional employees with burnout for whom health care costs (also including co-morbidity)[22] , reduced employability costs, early retirement costs, and work incapacity costs have to be added.

7 Conclusion

Rising multitasking is significantly and robustly associated with higher emotional strain, emotional exhaustion, and burnout. Absenteeism and presenteeism increase at the extensive and the intensive margin. Multitasking thus acts as a job demand in the Job Demands and Resources model. Simultaneity (common language "multitasking") is only associated with the least severe work-related mental health outcome (strain). Neuroscience suggests that the human brain is not made for doing different things simultaneously and that stress can arise from simultaneity. The results presented here confirm that while this is true to some degree, simultaneity is not significantly associated with more medium to severe mental health conditions (emotional exhaustion, burnout) nor health behavior once controlling for job demands and resources, sociodemographic and job characteristics.

The relationship between multitasking and work-related mental health is driven by tasks that require interactions with other human beings and is strongest where work depends on the often missing cooperation of "clients" (nursing, protecting, training). This confirms the findings of Hasselhorn and Nübling (2004) who identify cooperation with people whose cooperation is often missing as the common denominator of occupations in which the risk for poor mental health is high. Physical tasks (manufacturing and repairing) are associated with lower work-related

[21]This is close to the estimate with the binary burnout variable of 0.6 percentage points

[22]Co-morbidity means that other health problems arise together with burnout, e.g. respiratory diseases because of a stressed immune system or heart problems due to stress. Early retirement costs are relevant because in Germany, 41% of early retirement is caused by mental health issues (Lohmann-Haislah, 2012). The absenteeism and presenteeism costs calculations include co-morbidity if burnout and emotional exhaustion are reported because absenteeism and presenteeism reports do not distinguish between sickness types. As long as participants stated burnout or exhaustion, their co-morbidity – if it translated into absenteeism or presenteeism – is included.

mental health problems. This can be related to Cato who praised farming over trading and money-landing in his "De agri cultura" (even though he focused on the prestige of occupations and not mental health outcomes, Froesch, 2009).

In line with the Hackman and Oldham's Job Characteristics Model (JCM) of work motivation (Hackman and Oldham, 1976), multitasking is associated with higher job satisfaction. It plays a positive albeit smaller role for overall job satisfaction, satisfaction with career, tasks, training application of skills, and supervisor. The JCM suggests that skill variety is associated with lower absenteeism and turnover but absenteeism due to work-related mental health problems increases with multitasking. Multitasking is insignificant for general absenteeism and presenteeism suggesting that the reason for this discrepancy could lie in a different understanding of "absenteeism". In the JCM, absenteeism carries the connotation of voluntary absenteeism or shirking, while the present measure relates to actual sick leaves for which physician certificates are required usually in Germany. Mental health problems were still stigmatized much more in 2006 and 2012 and the main part of shirking should be justified with other health complaints.

The results suggest a trade-off between mental health and job satisfaction as the former decreases with multitasking, while the latter increases. Overall job satisfaction, satisfaction with career opportunities, tasks, application of skills, training, supervisor, and working atmosphere rise with multitasking but point estimates are about half as large as for health problems. Satisfaction with working hours and equipment are unaffected, satisfaction with income and physical working conditions decrease with multitasking. Hence, non-monetary compensation is rather small. Similarly, monetary compensation exists but decreases over time. The trade-off between satisfaction/wage and work-related mental health requires a thorough rethinking of job design and mental health problems prevention strategies. Particular attention should be paid to employees in jobs with a high number of interactive tasks, especially when customers' cooperation is important but difficult to obtain.

This paper shows that job design is related to mental health at work. A word of caution is necessary, as the associations analyzed are not causal. This is left for future work. Nevertheless, a back of the envelope calculation suggests that an increase in multitasking as it occurred from 2006 to 2012 (roughly) is associated with 108,000 additional employees suffering from burnout. Increased absenteeism and presenteeism leads to an estimated loss in gross value added of €1.3 billion. Direct health care expenditures for burnout treatment, indirect costs for co-morbidity, early retirement, and the reduction in quality of life should be added to complete this picture but data is scarce. Further research also in other fields needs to lay the ground for assessing the

individual, economic, and societal costs of multitasking regarding work-related mental health problems.

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Tables

Table A.1: Descriptive statistics

	mean	sd	min	max
combined	-0.1	1.0	-1.3	3.2
emotional strain	-0.1	1.0	-1.3	1.7
exhaustion	-0.1	0.9	-0.6	2.8
burnout	-0.0	0.9	-0.3	5.1
absenteeism	0.1	0.3	0.0	1.0
presenteeism	0.2	0.4	0.0	1.0
common factor 2012	-0.1	0.9	-0.6	1.8
common factor 2006	-0.0	0.9	-0.3	3.5
exhaustion	-0.1	0.9	-0.6	2.8
burnout	-0.0	0.9	-0.3	5.1
multitasking	-0.0	1.0	-1.7	3.6
above average multitasking	0.4	0.5	0.0	1.0
extreme multitasking	0.1	0.3	0.0	1.0
above average occupation multitasking	0.4	0.5	0.0	1.0
extreme occupation multitasking	0.2	0.4	0.0	1.0
occupational multitasking	-0.0	1.0	-3.1	3.7
reach limits of own capacity	-0.0	1.0	-1.6	1.5
interrupted during work	-0.1	1.0	-2.6	0.9
deadline/performance pressure	-0.0	1.0	-3.0	0.8
work fast	-0.0	1.0	-2.3	1.0
minimum performance	0.0	1.0	-1.3	1.3
overstrained	0.2	0.4	0.0	1.0
risk of financial loss	0.0	1.0	-1.2	1.7
no timely information about future	-0.0	1.0	-1.5	1.6
do not receive all information necessary	-0.0	1.0	-1.4	1.9
details predetermined	0.0	1.0	-1.5	1.4
repetition	0.0	1.0	-2.0	0.9
plan, schedule own work	-0.1	1.0	-2.9	0.5
influence own workload	-0.0	1.0	-1.5	1.1
decide when to break	-0.1	1.0	-1.9	0.7
good collaboration	-0.0	1.0	-6.5	0.3
perform tasks independently	0.7	0.5	0.0	1.0
supervisor for somebody	0.3	0.5	0.0	1.0
get familiar with tasks	-0.0	1.0	-2.7	1.0
improve methods	-0.0	1.0	-2.3	1.2
demanded unknown things	-0.0	1.0	-1.3	2.0
men	0.6	0.5	0.0	1.0
married or registered partnership	0.6	0.5	0.0	1.0
having children	0.6	0.5	0.0	1.0
low education	0.1	0.3	0.0	1.0
medium+ education	0.1	0.3	0.0	1.0
higher education	0.2	0.4	0.0	1.0
age	42.1	10.7	18.0	65.0
age squared	1883.5	892.3	324.0	4225.0

Table A.1 – continued on next page

Table A.1 – continued from previous page

working hours main job	38.8	11.4	10.0	120.0
hours squared	1635.0	913.9	100.0	14400.0
tenure in years	11.9	10.1	0.0	51.0
atypical	0.1	0.3	0.0	1.0
night	0.2	0.4	0.0	1.0
shift	0.2	0.4	0.0	1.0
weekend	0.7	0.5	0.0	1.0
standby	0.2	0.4	0.0	1.0
work is important	-0.0	1.0	-4.6	0.4
successful work life balance	0.6	0.5	0.0	1.0

Weighted according to census data. Data sources: BIBB/BAuA.