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ABSTRACT

An Empirical Assessment of Workload and Migrants' Health in Germany

Workload and its physical and mental burden can have detrimental effects on individual health. As different jobs are associated with specific patterns of health development, occupational selection of socioeconomic groups can be attributed to health differences in society. Despite a long economic literature that has established native-migrant differences in occupational choice and health behaviour, surprisingly little research so far has been devoted to workload differences and the influence on individual health in this context. We consider differences in workload and related health status for migrants and native Germans through a detailed characterisation of occupational conditions. Based on labour force survey data for the years 2006, 2012 and 2018, our analysis takes a comprehensive set of work-related aspects into account, e.g., work tasks, job requirements, and working conditions. The empirical results show an enhanced perception of workload and related health problems among migrants. Working at the capacity limit has a particularly strong effect on emotional exhaustion, which is countered by a good working atmosphere being beneficial to health. Native Germans are more heavily burdened by high job requirements than migrants, both physically and mentally. However, as job-related factors show similar effects on the health status of males, the poorer health status of migrants could therefore be attributed to a lower utilization of health services.

JEL Classification: I14, J15, J81

Keywords: workload, working conditions, migrants, self-reported health, BIBB/BAuA

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1 Introduction

The population's state of health is important from an economic and political perspective. Good health contributes directly to reducing social inequalities and thus creating equal opportunities (Brzoska et al., 2015). However, poor health and associated sickness cause different types of costs. First, there are direct costs of sickness, including all expenses for healthcare and medical services. The total health care expenditures in Germany amounted to 390.6 billion Euros in 2018, i.e., 11.7 % of annual GDP or approximately 4,700 Euros per citizen (Statistisches Bundesamt, 2020). Second, the overall economic loss of productivity due to absenteeism or reduction of work performance are indirect costs (Cottini, 2012b). The Federal Institute for Occupational Safety and Health (BAuA) estimates the total economic loss of production at 85 billion euros and the loss of gross value added at 145 billion euros for Germany in 2018 (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA), 2020). Third, so-called intangible costs describe non-monetary costs such as complaints and a general loss of quality of life. People in precarious jobs are particularly affected by stressful working conditions that are detrimental to their health because these jobs are often characterised by comparatively low pay. The risk of health and the risk of financial impairment therefore coincide, which often leads to social decline. As Burgard & Lin (2013, p. 1105) say, "*work and working conditions are essential contributors to social inequality in health within and across generations*". Thus, it is in the interest of society and government to systematically improve the health status of the population to strengthen both economic performance and social life.

Over a period of more than six decades, immigrants and their children have become an important part of the German society which is also reflected by a large and growing share of the labour force. However, differences remain: People with a migration background, i.e., immigrants and their descendants, still pursue, on average, occupations that demand lower qualifications, require higher physical strain, and are less well paid (Aldashev et al., 2012; Becker & Faller, 2019; Ingwersen & Thomsen, 2019; Rellstab et al., 2016). The overall poorer health of this group may therefore relate to labour market segmentation (Becker & Faller, 2019; Brand et al., 2017; Brzoska et al., 2015). Migrants overproportionally are found in precarious jobs (Statistisches Bundesamt, 2019) and therefore possess a higher risk of health, economic and social decline. Moreover, given the overall poorer health of the migrant population, they may further face systematic work differences in the labour market in general.

In this study, we empirically analyse the work-related health consumption of migrants and native Germans in the labour market. We try to answer the question of whether migrants perceive higher workloads than native Germans even if they work in the same occupation and in the same job position, and thus have a worse health status. For this purpose, we use a detailed characterisation of workload having access to information on work tasks, job requirements, and working conditions. Information for the empirical analysis is based on the BIBB/BAuA Labour Force Survey of 2006, 2012 and 2018 (Bundesinstitut für Berufsbildung (BIBB), 2006, 2012, 2018). To justify our choice of variables in the empirical model, we embed the selection into theoretical considerations. These findings imply the need to distinguish not only between groups of different origins but also between genders. Occupational choices and workload (perception), as well as the state of health, require these differentiations. We estimate the

effects of a wide set of occupational and socioeconomic factors on individual health at work considering physical and mental health problems in addition to general health. To check the robustness of the main empirical findings and to explore potential underlying mechanisms, we provide several models distinguishing groups further by age, economic sector and task accomplished.

Our empirical results show that the age of migrants has no influence on their health – in contrast to native Germans. This suggests a greater impact of work and living conditions on migrants' health. Increased job requirements, such as working at the limits of capacity and working under stressful working conditions, are the strongest constraints on individuals' health. Work tasks, however, show a hardly noticeable influence. On the other hand, independent of the group in consideration, a good workplace atmosphere has the most beneficial effect on the health of all work-related factors. However, we can identify only minor differences in the influence of these work-related factors on the health status between migrants and native Germans. There is some heterogeneity between groups with regard to certain subdomains of health. For example, the frequent performance of routine manual tasks promotes musculoskeletal disorders even more strongly for migrants than for native Germans. Additionally, emotional exhaustion occurs comparatively more often in migrants than in native Germans and is negatively promoted by burdensome job requirements.

The remainder of this paper is structured as follows: First, we take a brief look at the relevant theoretical and empirical literature to review consumption and investment in the health and work-related health status of migrants (section 2). In section 3, a presentation of the data source and our general setup for assessing work-related influences on individual health is given. In section 4, descriptive statistics on both different health characteristics and on the tasks, demands and working conditions of native Germans and migrants follow. Subsequent to the empirical strategy (section 5.1), the results of our multivariate analyses are presented according to gender and migration background (section 5.2). The final section provides conclusions.

2 Literature Review

Individual health has played a focal role in economics for many decades. As part of human capital, health is fundamental to being able to exert acquired qualifications optimally and to exploit potential productivity. As a pioneer, Grossman (1972) proposed a model in which health is a durable good that can be consumed and invested in. In addition to ageing, health consumption takes place through work, leisure activities or an exhausting lifestyle. The health capital stock can be enhanced through investments in preventive health care, convalescence or the use of medical services (Breyer et al., 2013; Muurinen, 1982). Consumption and investment in health are mutually dependent: While health is consumed by work, work is also required to generate income, which in turn is necessary to invest in health and to maintain an adequate level of health.

Physically demanding work requires a higher consumption of health. To maintain employability and productivity, health investments are therefore necessary. However, different jobs are performed by different socioeconomic groups. For example, migrants often work in occupations with predominantly high physical demands and low income. This implies a stronger depreciation of their health capital (Cottini, 2012b; Giannoni et al., 2016; Pérez et al., 2012), and therefore needs a greater investment in their health. Since

poor health and a small income reduce the quality of life and limit social participation, migrants are particularly threatened by social decline and work-related health differences. These factors may contribute to persistent social and ethnic segregation.

However, Grossman's approach has raised questions due to the latent form of health capital. The Grossman model has thus motivated numerous researchers to provide elaborations emphasizing or weighing certain aspects differently. A recent extension is suggested by Schünemann et al. (2017), who designed a model of health deficit accumulation. The foundations of this approach were laid out by Dalgaard & Strulik (2014), explicating the process of increasing frailty with increasing age. With the help of the so-called frailty index, the model by Schünemann et al. (2017) employs health depreciation over the course of a lifetime. The approach explicitly captures gender-specific preferences and health behaviour. According to the model, it can be assumed that stressful work and working conditions lead to a greater accumulation of health impairments.

While the ageing process inevitably leads to a loss of initial health, socioeconomic and workplace-related factors can accelerate or delay this process. On the one hand, there are health-promoting but also health-endangering factors in the private environment, e.g., through partnership and children. Studies by Cottini (2012a) and Giannoni et al. (2016) show that living with a partner is positively related to health, whereas the presence of children worsens the condition due to increased load and brought-in diseases. In addition, the level of education attained not only influences the job and the tasks to be performed but also has an indirect effect on health and risk behaviours and how to deal with stress (Bellmann & Hübler, 2019). The relationship between education and health is well depicted by Burgard & Lin (2013): low-skilled workers are comparatively more often confronted with physically demanding jobs, which can cause both physical and psychological complaints. For well-educated people, physical demands are usually lower, and at the same time, independent work is predominant, which tends to be positively associated with good health. However, it is also the case that higher educated workers are more exposed to the risk of psychosocial stress due to their job requirements, which – due to a high degree of permeability – also increases the risk of a negative spill-over into private life (Burgard & Lin, 2013).

Empirical studies also provide a large number of influencing factors that directly result from work: job tasks, special work requirements that include the working conditions, and the working climate have been shown to be relevant. According to Bellmann and Hübler (2019), however, detailed job characteristics are all too often disregarded in the empirical literature, although they are important for the state of health. Thus, occupational characteristics, decision-making competence, physical effort, environmental conditions, time pressure and multitasking influence individuals' health. In contrast, a higher wage allows individuals to take advantage of health services and preventive health care (Bender & Habermalz, 2008; Cottini, 2012a; Giannoni et al., 2016; Rellstab et al., 2016). Although the health system in Germany ensures general medical care for everyone, access to medical care is not equal for all. In particular, for migrants, utilisation can be more difficult due to cultural and language differences (Brand et al., 2017). Being able to speak German, therefore, has a positive effect on health via two channels: first, access to certain occupations and, second, access to medical care (Wengler, 2011). Other reasons for divergent health investments of migrants are fundamental differences in behaviour, which are reflected in preventive health care or the frequency of

visiting a doctor. There could also be relatively stronger fears on the part of migrant employees towards their employer regarding negative consequences if they report sick leave.

Analyses of Oldenburg et al. (2010)¹ and Becker & Faller (2019)² state that employees with a migration background in Germany are more frequently exposed to physical stress. In this respect, migrants of Turkish origin consistently experience higher levels of physical stress because of physically demanding work. With regard to the working environment, employees with a migration background report strains much more often. Using data from the German Generations and Gender Survey (GGG) of 2005/06, Wengler (2011) confirms the worse health status for Turkish immigrants in Germany. However, if socioeconomic and individual characteristics are taken into account, the differences in health between immigrants and native Germans disappear. While the available literature focuses on certain aspects, we bring together the different strands of health-influencing factors in this paper in an integrated analysis. We examine the extent to which workplace-related stress affects individuals' health, taking relevant sociodemographic characteristics into account.

3 Data Source and Variable Definitions

3.1 Data Source

For the empirical analysis, we use the BIBB/BAuA Labour Force Survey provided by the Federal Institute for Vocational Education and Training (Bundesinstitut für Berufsbildung, BIBB) and the Federal Institute for Occupational Safety and Health (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, BAuA). The survey gathers data on working conditions and requirements as well as the acquisition and exploitation of occupational knowledge at the German labour market every 6 to 7 years since 1979. The core labour force is defined as employed persons from the age of 15 years without apprentices and without marginally employed persons (paid work for at least 10 hours a week) (Bundesinstitut für Berufsbildung (BIBB), 2006, 2012, 2018). However, we have to restrict our analysis to the recent three waves of 2006, 2012 and 2018 since only these waves provide sufficient information on both working conditions and health status. Each wave contains approximately 20,000 individuals; all data are merged into a single database for the empirical analysis.

3.2 Variable Definitions

To capture a connection between individuals' occupation and state of health, it is necessary to narrow down both concepts. Generally, "*health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" (World Health Organization, 2020). Nevertheless, apart from a subjective assessment by the persons themselves, the individual state of health is usually only indirectly describable by the existence of ailments or complaints. Since this kind of health data provides a limited picture of true health, self-reporting on health is a common and validated procedure in a large

¹ Oldenburg et al. (2010) use the BIBB/BAuA of 2005/2006 for a descriptive evaluation of the extent to which labour market segregation is reflected in unequal stress profiles of migrants and non-migrants.

² Becker & Faller (2019) use the Socio-Economic Panel (SOEP) of 2006 for a descriptive evaluation of the health of workers with a migration background and their burdens and stresses.

number of scientific papers, see for example Cottini (2012a, 2012b), Dunn & Dyck (2000); Giannoni et al. (2016) and Schmitz (2011). In the further course, we will use both self-reported health status and an approach with the level of work-related complaints to allow for a comprehensive depiction of health.

Population groups may perceive workload differently, resulting in group-specific health patterns, and the practised occupation contributes substantially to individuals' health consumption. Occupations differ considerably in their activities and requirements, so a detailed consideration is necessary. We subdivide the job characteristics into three central groups of factors (see Table 1 for an overview): (1) *work tasks* are the activities performed within the job, (2) *job requirements* depict specifications and work performance, and (3) *working conditions* describe the work environment and the working atmosphere. With regard to the "job demands-resources model" (JD-R model) by Demerouti et al. (2001) and a special focus on psychological health problems, it makes sense to divide working conditions into factors that put a strain on work demands (e.g., job pressure) and work resources that cushion negative influences (e.g., support and autonomy, career prospects) (Bellmann & Hübler, 2019; Perez et al., 2012).

In the first group, we distinguish five categories of performed *work tasks* according to Spitz-Oener (2006, 2008): non-routine manual, routine manual, routine cognitive, non-routine interactive and non-routine analytic (Table 1). The individual task composition of these five categories reflects the work activities. It therefore points to different potential health complaints; e.g., a high share of manual tasks may imply physical complaints, while being requested to perform non-routine interactive tasks may be psychologically stressful. In the second group of factors (job requirements), we separate performance from demand: Performance comprises prescribed work implementation and the minimum performance requirements. In addition, we consider whether there are increased performance requirements, such as making improvements or being confronted with new tasks. Subsequently, requirements that demand parallel management of different processes with a high degree of distraction (multitasking) as well as working towards strict deadlines and performance pressure are also considered. We regard further how often individuals have to reach their performance limit at work. We assume that a high content of challenging job requirements has a negative effect on both physical and mental health.

< Include Table 1 about here >

The last group comprises the *working conditions*. These cover to what extent the work performed can be classified as physically or mentally demanding. Available information includes posture at work and physical exertion. These aspects are complemented by environmental influences under which work is carried out and is physically stressful (e.g., smoke and dust, cold, heat, wetness, dirt, bright light or darkness, noise). Physically stressful work and the work environment can impact an individual physically but also psychologically. The working atmosphere constitutes an important part of the working conditions. We capture it by focusing on teamwork in the workplace, mutual support and a permanent exchange of information. The degree of self-determination in the workplace is measured by the possibility of determining the workload individually (Table 1).

We will examine whether there are differences in work tasks, job requirements and working conditions between migrants and native Germans within an occupation. To distinguish between migrants and native

Germans, we define individuals' migration background according to Oldenburg et al. (2010): (1) *Foreigners* are individuals without German citizenship, whereas (2) *Germans with migration background* have a second foreign citizenship in addition to German citizenship, or they are in possession of German citizenship but learned a foreign mother tongue during childhood. (3) *Native Germans* are persons with German citizenship, and no further foreign mother tongue was learned during childhood or no second citizenship was in place (see Table A.1 in the appendix for a summary of the applied concepts). In further analysis, we unify *foreigners* and *Germans with migration background* to depict *persons with migration background* (in short: *migrants*) in an adequate form.

In the following analyses, only persons of labour force age (15 to 64 years) who are not employed by the military are considered. We conduct wage trimming at both ends of the hourly wage distribution by 1 % each to exclude incomprehensible combinations of wage and working time. Based on this, our estimation sample contains 57,488 individuals, of which 53,315 are native Germans, 2,448 are *Germans with migration background* and 1,725 are *foreigners*. In total, we have 4,173 *persons with migration background* (7.3 %). Relative to the official numbers, migrants are underrepresented in the data.³ The main reason is that interviews were conducted by telephone in German. Due to the choice of survey instrument, German-speaking migrants tend to be better integrated and thus have easier access to a broader range of occupations and medical care than non-German-speaking migrants. In this respect, the migrants interviewed can be assumed to be a positive selection of the migrant population in Germany. Our results in the following may therefore show correspondingly smaller differences to native Germans than when considering the entire migrant population. In a narrow sense, they may reflect lower bounds of the true differences. At the same time, the unemployment rate of foreigners is three times higher than that of Germans, which may reduce the potential bias, as we focus on employees in the empirical analysis. Survey weights correct for deviations from characteristic distributions in the micro-census of the previous year each, thus obtaining a representative sample of the economically active population aged 15 and over in Germany.⁴

4 Descriptive Statistics

4.1 Health

In the BIBB/BAuA Labour Force Survey, the general health condition is reported on a 5-point Likert scale from poor to excellent. For the study at hand, we have recoded the scale from poor (0), not so well (0.25), good (0.5), very good (0.75), to excellent (1) to obtain a range of values between 0 and 1 while maintaining the spacing. Furthermore, specific questions are asked about workplace-related physical and mental complaints. A classification of the individuals' symptoms is made on the basis of two statements. First, information is considered on whether health complaints have occurred during work or on

³ In the years 2006, 2012 and 2018, the share of employed persons with a migration background was 20.1 %, on average (Statistisches Bundesamt, 2008, 2013, 2019).

⁴ See Gensicke et al. (2012) for BIBB/BAuA sample weighting. Structural weighting uses the characteristics distribution in the micro-census regarding place of residence, gender, marital status, age, education, German/non-German and employed/non-employed (Bundesinstitut für Berufsbildung (BIBB), 2012).

working days in the last 12 months. Second, information is considered on whether the persons were treated for these complaints by a physician or therapist in the last 12 months.

The **general health status** indicates a good state of health overall (see Figure 1). It is rated almost equally well between native Germans and migrants. However, women in both groups report a slightly worse state of health. Although the most frequent symptoms are comparable, women consistently report symptoms more often than men, and migrants consistently report symptoms more frequently than native Germans do. Compared to native men, migrant men are more likely to report complaints at the lower back (0.47 to 0.42) and in the neck and shoulder (0.43 to 0.38). Additionally, they mentioned greater general fatigue (0.50 to 0.42) and headaches (0.33 to 0.26) more often. Similar to men, but more frequently, migrant women state relatively more complaints at the lower back (0.62 to 0.59) and in the neck and shoulder (0.52 to 0.48), again followed by general fatigue (0.54 to 0.48) and headaches (0.45 to 0.39).

The strongest differences between migrants and native Germans can be found in the naming of problems with hands, arms, feet and legs, which occur significantly more frequently among migrants. **Physical complaints** during work as an aggregate of afflictions of the lower back, neck and shoulder, hip, arms, hands, knees, legs or feet occur significantly more frequently among migrants, both for women (0.38 to 0.34) and men (0.32 to 0.29).⁵ In addition, the share of people with musculoskeletal disorders rises with increasing age from a quarter to a third. The relative differences between migrants and native Germans are even greater for **mental health problems** in the form of emotional exhaustion, both for women (0.27 to 0.21) and men (0.20 to 0.15). Emotional exhaustion increases with age but is already prevalent in the middle age groups. In addition, there are clear gender differences: older women report symptoms twice as often as men (Figure 1).

< Include Figure 1 about here >

4.2 Occupation

Occupations are primarily characterised by performed work tasks and required qualification. The survey participants were asked about a number of different tasks and how often they perform these activities at work in three categories: frequently, sometimes or never. A task is included in the participants' job description if it is performed "frequently". Standardized work tasks by category differ between migrants and native Germans: Independent of gender, migrants carry out significantly more routine and non-routine manual tasks as well as non-routine analytic tasks than native Germans do. In contrast, native Germans perform significantly more non-routine interactive tasks, while there were no significant differences in routine cognitive tasks (Table 2). These differences may point to a relatively low degree of substitutability in interactive tasks for migrants and native Germans, on average, due to different labour market-relevant skills. Potential reasons may be differences in language skills (Aldashev et al., 2009) and/or qualifications obtained abroad (Haas et al., 2013).

We further use standardized values for *job requirements* and *working conditions* originally surveyed by 4-point Likert scales, with respondents reporting whether certain conditions occur "frequently" (4),

⁵ The aggregation of eight afflictions results in a discrete distribution in nine values.

“sometimes” (3), “rarely” (2) or “never” (1). Regarding job requirements, migrants are significantly more often confronted with quantity specifications, monotonous tasks and/or repetitive operations. In contrast, migrants are less often entrusted with tasks that have demanding performance requirements or a high degree of coordination and responsibility. These are even rarer for migrant women (Table 2). The working conditions of migrants and native Germans do not differ in terms of physically stressful environmental influences and only slightly differ in physical activities. This is not surprising given the high level of work safety regulations in Germany. However, migrants perform their work significantly more often in shift work. Despite the comparability in working conditions, there are clear differences in the way migrants and native Germans evaluate the workplace atmosphere. Migrants rate the working climate significantly worse in the sense that they feel less involved in the working community, and migrants are also less likely to state that they are allowed to determine their own workflow (Table 2).⁶

< Include Table 2 about here >

5 Multivariate Analysis

5.1 Empirical Strategy

To empirically analyse how much the state of health can be attributed to the individual labour market situation, we regress work-related health on a set of variables characterising work tasks, work requirements, working conditions and the socioeconomic situation of the individual. The theoretical considerations in section 2 imply estimation of separate models by gender and migration background for each of our self-reported health indicators: general health (SRH), physical health (MSD), and mental health (EMX). The econometric notation used for all three indicators and model variations is the following (exemplary for SRH):

$$SRH = \alpha + SOCIO\beta_1 + WORK\beta_2 + TASK\beta_3 + REQ\beta_4 + COND\beta_5 + FSY\beta_6 + \mu_i, \quad (1)$$

where *SRH* represents a vector of the standardized self-reported general health status. *SOCIO* is a matrix of socio-demographic characteristics (e.g., age, age squared, vocational education level, marital status and the presence of children in the household). The variables contained in *WORK* capture the individual scope of work and occupational status: real working hours, real working hours squared, job position, hourly wage, firm size dummies (5 size categories), and occupational dummies using the German Classification of Occupations 2010⁷ (KldB) at the 2-digit level (see Table A.2 in the appendix for further information). Based on our characterisation of job contents, we consider the three groups of factors: The matrix *TASK* contains the five task categories according to Spitz-Oener (2006, 2008). *REQ* represents a set of job requirements regarding different work performance specifications, while *COND* includes a set of the working conditions to which the employees are exposed (see section 3). The matrices *REQ* and *COND* comprise a set of

⁶ Further descriptive statistics on individual and work-related characteristics can be found in Appendix Table A.3.

⁷ For detailed information, see Statistik der Bundesagentur für Arbeit (2015).

standardized survey questions further compiled to standardized summary indicators. The compositions of the indicators for job requirements and working conditions are given in Table A.2 in the appendix. To take differences in the share of migrants across regions and over time into consideration, we control for federal states and survey years (*FSY*). β_1 to β_6 denote the corresponding coefficient vectors, μ_i is the i.i.d. error term. We specify the estimation models on work-related physical and mental complaints analogously. Physical complaints represent a set of musculoskeletal disorders (MSD). Mental health describes emotional exhaustion (EMX).

The models presented so far for analysing the effects on the three health outcomes for the four groups are apt to capture a comprehensive interplay of work-related and socioeconomic aspects. However, these models aim at illustrating effects at the mean and may therefore mask some important underlying heterogeneity. To emphasise this heterogeneity and to investigate potential patterns in work-related health influences, we augment the empirical analysis and distinguish the following three channels that may exert a specific contribution to the effects obtained by the main models:

- As a *first* model variant, we distinguish the potentially differing influences of work-related factors on general health by **age group**. Age patterns may be expected, as working activities change with age and self-assessed health is also time-variant. Especially in the middle age groups (i.e., at the family foundation), the effects could tend to be enhanced by private circumstances. At the same time, more stressful tasks may be assigned, particularly to younger (and presumably more resistant) workers, while at an older age, the strain of a long working life may have accumulated already, and working at the limit may have an even greater negative effect on health. To allow for a detailed picture of potential age patterns, we divide the sample into five age groups of decade intervals (15-24, 25-34, 35-44, 45-54, 55-64 years) and estimate separate models.
- As a *second* model variant, we consider the influence of work-related factors on general health in different **economic sectors**. This allows us to examine how the burden of work demands and work conditions on individuals' health varies across branches.
- As a *third* model variant, we split the sample into **manual** and **non-manual occupations**. We assume that health burden – at least physical burden – tends to be greater in manual occupations, as these require increased physical activity (Pérez et al., 2012).

5.2 Estimation Results: Health Status

a) General Health Status

Table 3 shows the estimation results with regard to individuals' general health status. When considering socioeconomic characteristics only (specifications 1 to 4), the relationships between individual characteristics and the self-reported general health status (SRH) are comparable independent of gender and migration background. In line with theory, age has the expected significant negative impact on health, whereas a higher level of vocational education shows a strong positive correlation with health status. However, a first notable difference between migrants and native Germans becomes observable in the household variables: the positive influence of a partnership is significant only for native Germans, while children in the household mean a heavy health burden solely for migrants.

The addition of work attributes and controls for regional and time trends (specifications 5 to 8) changes the relationship between individual characteristics and health status. Individuals' age remains significant only for native Germans, which indicates that working and living conditions may have stronger effects on migrants' than on native Germans' health. Furthermore, the effect size of the level of vocational education becomes relatively smaller but remains significantly positive for native women only. Depending on the qualification degree, their health improves by 0.11 to 0.19 standard deviations (SD) compared to no professional qualification. A change by 0.1 SD corresponds approximately to an improvement or deterioration by approximately 2 percentage points (ppts) in general health. As expected, occupational status indicates a substantial explanation for general health status. A higher job position and higher wage come with better health, whereas longer working hours are detrimental to the health of migrants. Contrasting this evidence with the theoretical models discussed above shows that our empirical findings confirm the implications of the theory for native Germans only but not for migrants.

< Include Table 3 about here >

Standardized work-related factors allow a direct comparison between the influence of work tasks, work requirements and working conditions on the general state of health. Working at the capacity limit and working conditions in general have the largest effect on health overall, but these effects are much weaker for migrant women. However, there are notable differences in the effects of the three regarded groups of work-related factors. First, *work tasks* have at best a small impact on health only, as indicated by very few significant coefficient estimates (e.g., routine manual and non-routine interactions for migrants). The coefficients relating to the work tasks performed are consistently higher for migrants, indicating a higher relevance for this group (Table 3).⁸

With regard to *job requirements*, we observe that working frequently at the capacity limit has the strongest significant negative effect on individuals' health status of all regarded work-related factors: an increase of one standard deviation decreases the general health status by 0.10 (migrant women) to 0.14 SD (native women), on average (or about -3 ppts). The strength of this effect is highly plausible, as it can negatively influence all other job requirements. Moreover, performing repeated operations is significantly stressful only for native Germans. Performance requirements tend to show a positive (but not significant) relationship with health, whereas coordination efforts and quantity performance negatively correlate with individuals' general health condition (Table 3).⁹

⁸ When *work tasks* are considered separately, i.e., without job requirements and working conditions (see Table A.4 in the appendix), "routine manual" tasks have a negative effect on health for all groups but is much stronger for migrants. In contrast, "non-routine manual" tasks are significantly negative for men's but not for women's health. There are still no significant effects for the other three task categories, but there are clear patterns: "routine cognitive" tasks correlate positively with health for men but not for women. Conversely, "non-routine analytic" tasks have a positive relationship to women's health but not to men's health. Last, there is a negative correlation between "non-routine interactive" tasks and health among migrants, while it seems to be positive among native Germans.

⁹ The same clear patterns – but with a higher significance – can be seen if *job requirements* are considered separately (Table A.4 in the appendix): Higher performance requirements have a significantly positive effect on health of men. An increased load due to quantity specifications, repeating operations and coordination efforts, however, tends to be negative for all groups, but it is significant only for native Germans. A strong negative and significant influence on health is still caused by an increased work at the performance limit. Overall, higher work demands seem to affect the health of native Germans more than those of migrants.

According to the estimation results, *workplace conditions* are the group of work-related factors with the strongest influence on health. While we observe only slight differences between migrants and native Germans among men, the gap is more pronounced for women. Working in a stressful environment significantly leads to poorer health of up to 0.11 SD. In the same way, information asymmetries approximated by insufficient information transfer are detrimental to employee health (-0.07, migrant men, to -0.09 SD, native men). Additionally, a high level of physical stress is negatively associated with women's health status. In contrast, positive interpersonal interactions in the workplace increase the likelihood of good health. A good workplace atmosphere has the strongest positive and group-independent effect on the health of all work-related factors: an increase of one SD improves the general health status by between 0.07 (migrant women) and 0.13 SD (migrant men) (i.e., approximately 3 pts on average). This is supported by a significant positive effect of self-determination at work (from 0.05 SD for native women, to 0.11 SD for migrant men) (Table 3).¹⁰

Turning back to the theoretical model from section 2, there was a distinction between “consumption of health” and “investment in health”. Our detailed empirical model of socioeconomic and workplace-related factors is able to describe the different health consumption of individuals. We contrast comparable groups within particular working circumstances, where the consumption of health should be approximately the same. For men, the results of the basic model show very small differences in the coefficients only and nearly the same adjusted coefficient of determination (adj. R^2), implying a similar work-related influence on health for migrants and native Germans of this gender. The differences in general health status between males may therefore be attributed to differences in health investment. Among women, considerable differences can be observed in the influence of working conditions and the degree of vocational training on health. An almost equal adj. R^2 indicates, however, that the differences among women's health are due to factors not taken into account.¹¹

b) Physical Complaints

A constituent part of general health in the labour market is physical health. To allow a better understanding of whether the factors have different effects on certain subdomains of health, we present the results of separate models using the same specification as in the basic model. Table 4 provides the corresponding results. Physical complaints comprise musculoskeletal disorders in particular (here, physical complaints are an aggregate of afflictions of the lower back, neck and shoulder, hip, arms, hands, knees, legs or feet).¹² As became obvious from the descriptive statistics (see section 4), physical complaints during work occur more frequently among migrants.

¹⁰ The consideration of *working conditions* as an independent set confirms the negative effects on health by stressful physical and environmental working conditions (Table A.4 in the appendix). The strongest positive impact still comes from a good working atmosphere. The effect of shift work is ambiguous and only significant for men. However, there are still no noteworthy differences in the effects of working conditions on general health between migrants and native Germans.

¹¹ To test the validity of the OLS results on individuals' general health status, we present a second approach in which the dependent variable is replaced by a dummy variable. We differentiate between self-reported good health (“good”, “very good”, or “excellent”) and self-reported bad health (“poor”, or “not so well”) and estimate a probit model. The results of the probit model confirm the results of the OLS regression. The magnitudes, significance levels of the coefficients and coefficients of determination are in the same ratio as in the OLS regression and show a slightly stronger variation among migrants (Table A.5).

¹² Available in this constellation only for the waves 2012 and 2018.

Initially, it is noticeable that a higher working position comes – at least in tendency – with a lower occurrence of physical health problems. This is even more pronounced for migrants than for native Germans. No less surprisingly, physical health problems are strongly accreted by physical activities (0.04 to 0.05 SD) and physically stressful environmental conditions (0.03 to 0.07 SD, up to 1.5 ppts) at work. In particular, the frequent performance of routine manual tasks promotes musculoskeletal disorders. Moreover, working at the capacity limit is significantly negatively associated with physical complaints in all groups alike but much less strong than in the basic model (0.02 to 0.03 SD). While job requirements such as repeated operations place a heavier health burden on native Germans, quantity performance consistently impairs physical health to a greater extent among migrants. On the other hand, an overall good working atmosphere (indirectly) diminishes physical health problems.

< Include Table 4 about here >

c) Emotional Exhaustion

Emotional exhaustion occurs comparatively more often for migrants than for native Germans, and women report a higher exposure than men. With regard to the triggering factors, Table 4 shows the results of our preferred estimation linear probit model. The results suggest that mental disorders of migrant women are less age-dependent, as age is not relevant for explaining mental problems for them. A partnership, however, reduces the presence of emotional exhaustion but differs between genders. The effect of a partnership is extremely strong for male migrants but does not exist for female migrants.

Compared to physical complaints, work-related factors showed significantly stronger effects on mental health (Table 4). The most important factor that promotes emotional exhaustion in all groups is when people frequently have to work at their capacity limits: an increase of one SD raises the occurrence of emotional exhaustion by up to 6 ppts. Working at the capacity limit is therefore less physically stressful but more mentally stressful. Coordination efforts are also psychologically highly stressful for men but not for women. Furthermore, quantitative performances are more likely to lead to emotional exhaustion for native Germans (1 ppts). On the other hand, a good working atmosphere significantly reduces emotional exhaustion. This positive impact is more pronounced for native Germans than for migrants (up to -6 ppts) and thus has an equally large but opposite effect as working at the capacity limit. Furthermore, adverse working conditions, such as a physically stressful work environment, have a significant negative impact on mental health for all individuals (2 ppts), especially for migrant women (6 ppts). Overall, native Germans seem to be more mentally burdened by high work demands than migrants, while working conditions have little impact on migrant women's mental health.

5.3 Estimation Results: Investigation of Heterogeneous Patterns

a) Age groups

The individual perception of stress due to work demands and conditions and its effects on the state of health vary with age. When divided into five age groups of ten years each (15-24, 25-34, 35-44, 45-54, 55-64 years), various shifts in the effect sizes of certain coefficients on health become clear (see Table A.6 and Table A.7 in the appendix). Regarding the main question of interest, the results imply differences

between migrants and native Germans with regard to the influence of working conditions: for individuals with a migration background, both the working atmosphere and physical strain are much more meaningful for health in all age groups than for native Germans. For males (Table A.6), working at the capacity limit again has the strongest negative effect on health – mainly in the middle age groups – but it particularly strong among migrants aged 25-34 years (-0.19 SD, or approximately -4 ppts). There is an increasing burden due to physical stressful environmental conditions for male native Germans at higher ages (-0.18 SD). For women (Table A.7), working at the performance limit is also negatively linked to health status across all age groups, whereby this is very constant among native women and only becomes apparent among women with a migration background (up to -0.16 SD). Similarly, physically stressful environmental conditions have a very strong negative impact on women’s health, regardless of origin (up to -0.14 SD).

b) Economic sectors

Similar occupations differ between the economic sectors, and employees face different work requirements. The BIBB/BAuA data allow differentiation by economic branches. Based on the German “Classification of Economic Activities” of 2003 (WZ 2003, corresponding to the international ISIC and NACE classifications) of the Federal Statistical Office (Statistisches Bundesamt, 2003), we use an aggregation of economic branches in the following three sectors: (1) agriculture, manufacturing, and construction; (2) private and business-related services; and (3) public and health services. This high level of aggregation is necessary to achieve reliable results due to the small numbers of observations per occupation and sector.¹³ In addition to the ongoing strong negative impact on the health of working at the performance limit, we expect a comparatively stronger influence of physically stressful working conditions in the first sector, whereas work demands and work atmosphere may be emphasised in the service sectors.

The corresponding results reveal, however, only minor differences in effect sizes between the aggregated economic sectors (see Table A.9 and Table A.10 in the appendix). Coefficients for the migrant groups should be interpreted with caution due to the small number of observations. For migrant men (Table A.9), we observe a significant positive impact of job position on health for public and health services but a negative relationship with private and business-related services. This indicates that in the latter, moving up the career ladder does not come with lower health burden but rather shows an increase. Furthermore, working conditions (significant) and job requirements (not significant) have a stronger impact on health in public and health services but a smaller impact in the first sector. This could be a cautious indication that high work demands are associated with different effects, i.e., a weaker negative impact on health in craft-based industries than in service branches. On the other hand, we do not recognise any differences between the economic sectors for native men. Regardless of the economic sector, working hours have a significant negative effect on the health of migrant women (Table A.10). Further, high work demands in public and health services show a greater health burden than in private and business-related services. From these results, we can conclude that migrant men are more susceptible to job-related influences than migrant women. Nevertheless, the differences in the influencing factors are again small within the group of men and considerably larger within the group of women.

¹³ The assignment of the sectors at the 1-digit level can be found in Table A.8 in the appendix.

c) Manual and non-manual occupations

We further investigated the potential differing effects of manual work and physically demanding work factors to examine the role of work design on health.¹⁴ In summary, there are some differences in the influence of individual workplace-related factors on health between manual and non-manual jobs (see Table A.12 in the appendix). First, repeating activities and coordination efforts are significantly detrimental to the health of native men in manual jobs (approximately -0.06 SD). Second, we recognize a multilevel gap with respect to vocational training: the correlation between education and general health is positive for men in manual occupations but negative for men in non-manual occupations. For women, the level of vocational training has an overall positive impact on native Germans' health but an overall negative impact on migrants' health, confirming the results from the basic model. Working at the limits of capacity still shows the most negative impact on individual health. The effect is balanced among native Germans, whereas it is more pronounced among migrant men in non-manual occupations (-0.15 SD) and among migrant women in manual occupations (-0.19 SD). Furthermore, environmental conditions show a greater negative effect on native Germans' health.

6 Conclusion

This paper explores the consequences of a high workload and health status of migrants in the German labour market. The aim of this paper is to analyse whether a poorer state of health of migrants can be explained by labour market selection or whether the demands and stresses for migrants within jobs are higher than those for native Germans. Descriptive statistics from the pooled 2006, 2012 and 2018 BIBB/BAuA labour force survey show that self-reported general health (SRH) by gender differs slightly between migrants and native Germans. By using a unique model of work tasks, job requirements and working conditions, we incorporate a detailed characterisation of work-related factors and their influence on the health of employees.

When evaluating health complaints at work, the findings clearly indicate that migrants have a worse health status than native Germans, both for men and women. The regression results show that working at the performance limit and under adverse working conditions strongly deteriorate the general state of health. An increase in the frequency of working at the stress limit by one standard deviation (SD) causes a deterioration of the health status by approximately 0.1 SD or two percentage points, on average. Working at the performance limit implies a strong health burden especially in middle-aged groups of migrant men. For women, this negative impact is even larger and particularly evident in the higher age groups. On the other hand, a good working atmosphere positively promotes health to the same magnitude. Consideration of certain subdomains of health shows that the frequent performance of routine manual tasks promotes more musculoskeletal disorders in migrants than in native Germans. Moreover, age is a relevant attribute for explaining emotional exhaustion for native Germans but not for migrants. This finding suggests that emotional exhaustion in migrants are less age-dependent, as these also occur more frequently in earlier

¹⁴ The classification of manual and non-manual occupations on the basis of the KIdB (2-digit level) can be found in Table A.11 in the appendix.

years. In addition to working at the capacity limit, coordination efforts are psychologically highly stressful for men but not for women.

Overall, efforts should continue to reduce the burden of working at capacity limits and improve the conditions of the working environment. Furthermore, minor differences in the coefficients of work-related factors on health and nearly the same proportion of explained variance between migrant men and native Germans within the same delimitation indicate a comparable consumption of health. The differences in general health status between males may therefore be due to differences in health investment. The lower utilization of health care among migrants is recognized in a number of studies (Klein & von dem Knesebeck, 2018). To enable migrants to make greater use of health services and therefore to reduce the risk of social decline, barriers to access to health care must be lowered.

The related literature shows that migrants' access to health care differs from that of non-migrants for different reasons: they may possess limited information about the health care system and how to obtain medical assistance (Nørredam & Krasnik, 2018). Language barriers may be a further major problem (Klein & von dem Knesebeck, 2018, p. 7) as communication problems between patients and medical or health staff can lead to a poorer identification of health problems (Ansar et al., 2017). Furthermore, there is a strong correlation between ethnic inequalities in health care utilization and inequalities according to socioeconomic status. The fear of a loss of wages or negative consequences by the employer because of sick leave is particularly prevalent among migrants (Klein & von dem Knesebeck, 2018; Ansar et al., 2017). In addition to the reduction of language barriers, the discussion focuses on the development of the awareness of cultural variations by medical professionals. However, the challenge of migrant-sensitive health care lies in the heterogeneity of this group (Nørredam & Krasnik, 2018; Klein & von dem Knesebeck, 2018). Therefore, barriers to accessing health services can only be lowered by providing more extensive information on health services or through a promotion of awareness campaigns for doctors and medical staff targeting different ethnic and linguistic groups (Nørredam & Krasnik, 2018). However, the impact of work-related factors on health among women differs greatly. There is already initial evidence that migrant women take workloads for granted and have lower overall expectations for their working conditions (Pérez et al., 2012). For this reason, further efforts should be made to follow up on the work-related health of migrants.

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Tables and Figures

Table 1: A comprehensive characterisation of health-related job aspects

<i>Job requirements</i>	<i>Work tasks</i>	<i>Working conditions</i>
<p>Performance specifications</p> <ul style="list-style-type: none"> - Prescribed work implementation - Prescribed minimum performance - work fast <p>Performance requirements</p> <ul style="list-style-type: none"> - familiarize with new tasks - improve existing procedures - things you have not learned or you do not master <p>Repeating operations</p> <ul style="list-style-type: none"> - same operations are repeated in every detail <p>Coordination effort</p> <ul style="list-style-type: none"> - strong deadline or performance pressure - disturbed or interrupted at work - keep an eye on different processes simultaneously <p>Performance limit</p> <ul style="list-style-type: none"> - push themselves to the performance limit 	<p>Non-routine manual</p> <ul style="list-style-type: none"> - repairing, refurbishing - entertaining, accommodating, preparing food - nursing, caring, healing - protecting, guarding, patrolling, directing traffic <p>Routine manual</p> <ul style="list-style-type: none"> - manufacturing, producing goods and commodities - monitoring, control of machines, plans, technical processes - transporting, storing, shipping - cleaning, removing waste, recycling <p>Routine cognitive</p> <ul style="list-style-type: none"> - measuring, testing, quality control - purchasing, producing, selling - gathering information, investigating, documenting <p>Non-routine interactive</p> <ul style="list-style-type: none"> - advertising, marketing, public relations - training, instructing, teaching, educating - providing advice and information <p>Non-routine analytic</p> <ul style="list-style-type: none"> - organizing, planning and preparing work processes (not own) - developing, researching, constructing 	<p>Physical activities</p> <ul style="list-style-type: none"> - Working standing up - Lifting heavy loads - Working in a stooped or kneeling position <p>Environmental conditions</p> <ul style="list-style-type: none"> - Smoke and dust, cold, heat, wetness, dirt, bright light or darkness, noise <p>Working hours</p> <ul style="list-style-type: none"> - Shift work <p>Workplace atmosphere</p> <ul style="list-style-type: none"> - Part of the working community - Help and support from colleagues/direct superiors <p>Poor information flow</p> <ul style="list-style-type: none"> - You do not receive all the information you need to carry out your job properly - Not being informed in time about far-reaching decisions, changes or plans for the future <p>Self determination</p> <ul style="list-style-type: none"> - Plan and schedule work yourself - Influence on the assigned workload - Decide when to take a break

Notes: Allocation of tasks according to Spitz-Oener (2006, 2008), translation according to Pikos (2017a, 2017b) with little deviation.
Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own allocation.

Table 2: Work-related descriptive statistics by gender and migration background

Variable		Native men	Migrant ^a men	Diff. M-N men	Native women	Migrant ^a women	Diff. M-N women
<i>Tasks (Spitz-Oener, 2006)</i>							
Non-routine manual	z	0.00	0.16	0.16 ***	0.04	0.11	0.07 ***
Routine manual	z	0.27	0.38	0.11 ***	-0.03	0.01	0.04 **
Routine cognitive	z	0.01	-0.03	0.04	-0.08	-0.11	-0.03
Non-routine interactive	z	-0.20	-0.29	-0.09 ***	0.03	-0.11	-0.14 ***
Non-routine analytic	z	-0.02	0.11	0.13 ***	-0.11	-0.04	0.07 ***
<i>Job requirements</i>							
Quantity performance	z	0.05	0.26	0.21 ***	-0.00	0.11	0.11 ***
Performance requirements	z	0.02	-0.07	-0.09 ***	-0.16	-0.29	-0.13 ***
Coordination efforts	z	-0.05	-0.25	-0.20 ***	-0.09	-0.39	-0.30 ***
Working at capacity limit	z	0.01	0.02	0.01	-0.07	-0.24	-0.17 ***
Repeating operations	z	-0.03	0.08	0.11 ***	0.16	0.20	0.04 *
<i>Working conditions</i>							
Physical activities	z	0.24	0.31	0.07 ***	0.01	0.03	0.02
Environmental conditions	z	0.44	0.46	0.02	-0.20	-0.19	0.01
Shift work	z	0.09	0.26	0.17 ***	-0.04	0.09	0.13 ***
<i>Working atmosphere</i>							
Working climate	z	-0.01	-0.23	-0.22 ***	0.01	-0.10	-0.11 ***
Insuf. information transfer	z	0.05	0.06	0.01	-0.10	-0.16	-0.06 **
Self determination	z	-0.01	-0.15	-0.14 ***	-0.14	-0.19	-0.05 **
Obs.		26,235	2,136		27,045	2,031	

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table 3: Regression results on general health conditions

Depended variable: Self-reported health (z-values)	Men		Women		Men		Women	
	Migrant ^a	Native						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Individual characteristics</i>								
Age	-0.036*	-0.053***	-0.050**	-0.037***	-0.022	-0.053***	-0.021	-0.035***
Age squared	0.000	0.000***	0.000*	0.000***	0.000	0.000***	0.000	0.000**
Education: Vocational training	0.105	0.007	-0.025	0.167***	0.076	-0.024	-0.086	0.114***
Education: Advanced training	0.175	0.130***	0.056	0.253***	-0.003	0.000	-0.114	0.139**
Education: University degree	0.341***	0.325***	0.294***	0.385***	0.014	0.014	-0.082	0.189**
Partnership-Dummy	0.060	0.078***	0.044	0.102***	0.043	0.004	-0.044	0.053***
Children in the household	-0.155**	-0.020	-0.168**	-0.003	-0.153**	-0.015	-0.214***	-0.007
<i>Work characteristics</i>								
Real working hours					-0.020*	0.006	-0.041***	-0.005
Real working hours, squared					0.000*	-0.000	0.001***	0.000*
Job pos.: skilled worker					-0.012	0.067**	0.013	0.031
Job pos.: highly qualified employee					0.015	0.114***	0.139	0.098***
Job pos.: specialist					0.060	0.102**	0.712*	0.082
Hourly wage					0.002	0.010***	0.010*	0.008***
Firm size, 5 categories					X	X	X	X
KldB, 2-digit level					X	X	X	X
<i>Work tasks (z-values)</i>								
Non-routine manual					-0.015	0.002	0.045	0.011
Routine manual					-0.019	0.002	-0.069	0.007
Routine cognitive					0.045	0.010	0.020	-0.014
Non-routine interactive					-0.073*	0.016	-0.037	0.027**
Non-routine analytic					-0.011	-0.009	0.064*	0.007
<i>Job requirements (z-values)</i>								
Performance requirements					0.018	0.011	0.023	0.007
Repeating operations					-0.032	-0.034***	-0.016	-0.018*
Coordination efforts					-0.002	-0.040***	-0.098**	-0.015
Quantity performance					0.020	-0.005	-0.039	-0.016
Working at capacity limit					-0.111***	-0.103***	-0.099**	-0.137***
<i>Working conditions (z-values)</i>								
Physical activities					-0.015	-0.011	-0.062	-0.061***
Environmental conditions					-0.094**	-0.081***	-0.024	-0.107***
Shift work					-0.058**	0.018**	0.010	-0.010
Working climate					0.129***	0.111***	0.072**	0.116***
Insuf. information transfer					-0.065***	-0.094***	-0.026	-0.082***
Self determination					0.111***	0.078***	0.035	0.049***
<i>Control</i>								
Federal states					X	X	X	X
Survey years					X	X	X	X
constant	1.023***	1.465***	1.136***	0.839***	0.808	1.332***	0.162	1.086***
Obs.	2,122	26,145	2,027	26,959	1,701	21,478	1,574	22,608
adj. R ²	0.052	0.072	0.059	0.055	0.178	0.161	0.177	0.172

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table 4: Regression results on physical complaints and emotional exhaustion

	Physical Complaints ^b				Emotional exhaustion			
	Men		Women		Men		Women	
	Migrant ^a	Native	Migrant ^a	Native	Migrant ^a	Native	Migrant ^a	Native
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>z-values</i>	-0.091	0.100	0.145	0.314				
<i>Dummy</i>					0.149	0.207	0.216	0.274
<i>Individual characteristics</i>								
Age	-0.003	0.003**	0.011	-0.001	0.013*	0.009***	0.000	0.006**
Age squared	0.000	0.000	0.000	0.000***	0.000	-0.000***	0.000	-0.000*
Education: Vocational training	-0.032	-0.002	-0.021	-0.017	-0.041	0.014	-0.005	-0.024*
Education: Advanced training	0.026	-0.023	0.010	-0.041***	0.024	0.029*	0.100	-0.013
Education: University degree	0.035	-0.017	-0.026	-0.035***	-0.017	0.022	0.075	-0.014
Partnership-Dummy	0.007	0.014**	-0.010	-0.005	-0.081***	-0.021***	0.001	-0.028***
Children in the household	0.023	0.005	0.012	-0.003	0.027	-0.005	0.003	-0.009
<i>Work characteristics</i>								
Real working hours	0.006	-0.001	0.009**	0.003***	-0.001	-0.002	-0.001	0.002
Real working hours, squared	0.000	0.000	-0.000*	-0.000**	0.000	0.000	0.000	0.000
Job pos.: skilled worker	-0.049**	-0.016**	-0.050*	-0.023***	-0.035	-0.002	-0.062	-0.004
Job pos.: highly qualified employee	-0.044	-0.010	-0.049	-0.028***	-0.095**	-0.013	-0.072	0.001
Job pos.: specialist	0.037	-0.001	-0.045	-0.014	-0.078	0.006	-0.176	-0.006
Hourly wage	-0.004***	-0.002***	-0.001	-0.002***	0.004*	-0.001	0.000	-0.002***
Firm size, 5 categories	x	x	x	x	x	x	x	x
KldB, 2-digit level	x	x	x	x	x	x	x	x
<i>Work tasks (z-values)</i>								
Non-routine manual	0.000	-0.005	0.012	-0.003	-0.017	0.004	0.031*	0.012**
Routine manual	0.019*	0.002	0.039***	0.009**	0.010	-0.015***	-0.023	-0.004
Routine cognitive	-0.011	-0.005*	-0.017	-0.002	0.009	-0.003	-0.004	0.005
Non-routine interactive	0.008	0.003	0.010	-0.001	0.023	0.013***	0.020	0.005
Non-routine analytic	0.014	0.000	-0.021**	-0.001	0.014	0.006*	-0.002	0.005
<i>Job requirements (z-values)</i>								
Performance requirements	-0.001	0.000	0.003	0.001	0.018	0.007*	0.012	0.001
Repeating operations	0.015	0.013***	0.004	0.010***	0.019	0.005*	-0.005	-0.013***
Coordination efforts	-0.004	0.007**	0.023*	0.002	0.060***	0.024***	-0.001	0.005
Quantity performance	0.024**	0.011***	0.020*	0.013***	0.001	0.011***	0.030	0.012***
Working at capacity limit	0.031***	0.025***	0.021*	0.034***	0.057***	0.045***	0.047***	0.064***
<i>Working conditions (z-values)</i>								
Physical activities	0.047***	0.045***	0.043***	0.043***	0.010	-0.009*	0.001	-0.005
Environmental conditions	0.069***	0.033***	0.027*	0.047***	0.019	0.020***	0.063***	0.025***
Shift work	-0.003	0.003	-0.016	0.007**	-0.018*	0.003	0.001	0.001
Working climate	-0.006	-0.017***	-0.009	-0.018***	-0.037***	-0.048***	-0.020	-0.056***
Insuf. information transfer	0.018**	0.020***	0.011	0.017***	0.017	0.026***	0.036**	0.038***
Self determination	-0.009	-0.004	-0.017	-0.009***	-0.050***	-0.016***	0.004	-0.015***
<i>Control</i>								
Federal states	x	x	x	x	x	x	x	x
Survey years	x	x	x	x	x	x	x	x
constant	0.106	0.048	-0.138	0.146**	0.097	-0.157***	0.429	-0.149**
Obs.	1,117	13,898	1,079	15,219	1,696	21,465	1,574	22,602
adj. R ²	0.328	0.260	0.271	0.288	0.184	0.154	0.179	0.197

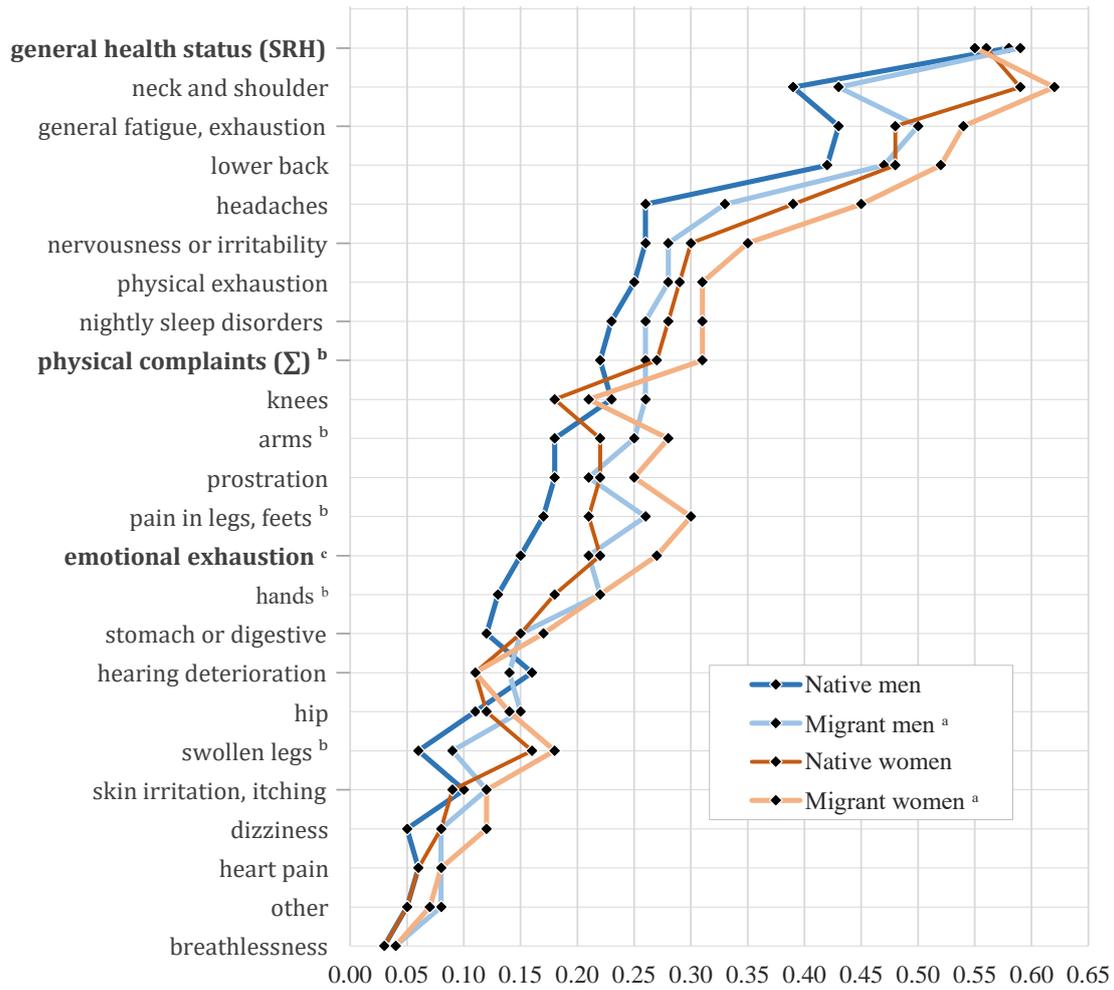
Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

b) Available only for the waves 2012 and 2018.

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Figure 1: Physical and mental complaints by gender and migration background



Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

b) Data availability only for 2012 and 2018.

c) In 2006: Depressiveness

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Appendix

Table A.1: Population by migration background

Migration background	Group	Definition
Yes	Foreigners	Individuals without a German citizenship
Yes	Germans with migration background	a) German citizens with a second foreign citizenship; or b) German citizens but learned a language other than German as a mother tongue during childhood.
No	Native Germans	Individuals with German citizenship and no further foreign mother tongue than German was learned during childhood and no second citizenship is in place.

Notes: Definition of individuals' migration background according to Oldenburg et al. (2010, p. 142).

Table A.2: Variable definitions

Variable	Definition
Dependent variables	
General health status	- self-reported health: poor (0), not so well (0.25), good (0.5), very good (0.75), excellent (1)
Physical complaints	- Mean of the frequent occurrence (yes=1, no=0) of the following “musculoskeletal disorders” in the last 12 months during work or on workdays: (1) lower back, (2) neck and shoulder, (3) arms, (4) hands, (5) hip, (6) knee, (7) swollen legs, (8) pain in legs or feet
Mental health	- Frequent occurrence (yes=1, no=0) of “emotional exhaustion” (2012, 2018) respectively “depressions” (2006) in the last 12 months during work or on workdays.
Independent variables	
<i>Individual characteristics</i>	
Age	- Age at time of survey (starting from 15 years of age)
Prime age	- Yes=1 (age from 25 to 54 years) - No=0 (age below 25 or 55 years and older)
Labour force age	- Yes=1 (age from 15 to 64 years) - No=0 (age below 15 or 65 years and older)
Partnership	- Yes=1 (married, civil partnership) - No=0 (single, divorced, widow)
Children	- Yes=1 (children in the household) - No=0 (no children in the household)
<i>Origin</i>	
Foreigners	- Individuals without a German citizenship
Germans with migration background	- German citizens with a second foreign citizenship; or - German citizens but learned a language other than German as a mother tongue during childhood.
Native Germans	- Individuals with German citizenship and no further foreign mother tongue than German was learned during childhood and no second citizenship is in place.
<i>Education</i>	
Educational level (Dummy)	(1) Without professional qualification (2) Vocational training (3) Advanced training (4) University degree
<i>Occupational status</i>	
Job Position (Dummy)	(1) Labourer, freelancer, lower level civil servants (2) Skilled worker, journeyman, middle level civil servants (3) Highly qualified employee, upper-level civil servants (4) Foreman, self-employed, senior-level civil servants
Real working hours	- Average actual weekly working hours, including regular overtime, additional work, standby duty
Hourly wage	- $\text{hourly wage} = \frac{\text{Gross monthly earnings from work}}{\text{Actual weekly working hours} * 4.35}$ Weeks per month = $\frac{365.25/12}{7} = 4.35$
<i>Work place</i>	
Firm size (Dummy)	(1) Micro: 0-9 employees (2) Small: 10-49 employees (3) Medium: 50-249 employees (4) Large: 250-999 employees (5) Huge: 1000+ employees
KldB	- German classification of occupations (Klassifikation der Berufe 1992, KldB), 2-digits

Continuation of Table A.2

<i>Job requirements</i>	
Quantity specification	In your work, how often does it happen that you are required to carry out your work in every detail? ^a ... you are prescribed a certain minimum performance or time to do a certain job? ^a ... you have to work very quickly? ^a
Performance requirement	In your work, how often does it happen that you are confronted with new tasks, which you first have to think about and get used to? ^a ... you improve existing procedures or try something new? ^a ... things are demanded of you which you have not learned or which you have not mastered? ^a
Repeating operations	In your work, how often does it happen that that one and the same operation is repeated in every detail? ^a
Coordination effort	In your work, how often does it happen that you have to work under strong deadline or performance pressure? ^a ... you are disturbed or interrupted at work? ^a ... you have to keep an eye on different types of work or processes at the same time? ^a
Performance limit	In your work, how often does it happen that you have to go to the limits of your ability to perform? ^a
<i>Work tasks</i>	
According to Spitz-Oener (2006, 2008)	Only if the activity is performed "frequently", then the mean value of the assigned tasks is calculated taking into account the number of assigned tasks (Range: 0-1). <u>non-routine manual</u> - repairing, refurbishing entertaining, accommodating, preparing food nursing, caring, healing protecting, guarding, patrolling, directing traffic ^b <u>routine manual</u> - manufacturing, producing goods and commodities monitoring, control of machines, plans, technical processes transporting, storing, shipping cleaning, removing waste, recycling ^b <u>routine cognitive</u> - measuring, testing, quality control purchasing, producing, selling gathering information, investigating, documenting ^b <u>non-routine interactive</u> - advertising, marketing, public relations training, instructing, teaching, educating providing advice and information ^b <u>non-routine analytic</u> - organizing, planning and preparing work processes (not own) developing, researching, constructing ^b
<i>Working conditions</i>	
Physically stressful working conditions	- Working while standing ^a - Lifting and carrying loads ^a - Working in a stooped, squatting, kneeling position or working overhead ^a
Shift work	- Yes=1 (working in shifts) - No=0 (no shift work)
Physically stressful environmental conditions	- Work in smoke, dust or under gases, vapours ^a - Work in cold, heat, wet, damp or draughty conditions ^a - Working with oil, grease, dirt, grime ^a - Work in bright light or in poor or weak lighting ^a - Working under noise ^a
Working atmosphere	How often does it happen that you feel part of a community at your workplace? ^a ... do you find the cooperation between you and your work colleagues to be good? ^a ... do you get help and support for your work from colleagues when you need it? ^a ... do you get help and support for your work from your direct supervisor when you need it? ^a
Poor information flow	How often does it happen that you are not informed in time about drastic decisions, changes or plans for the future? ^a ... you do not receive all the information you need to carry out your work properly? ^a
Self determination	How often does it happen that you can plan and schedule your own work yourself? ^a ... you have influence on the amount of work assigned to you? ^a ... you can decide for yourself when to take a break? ^a

a) frequently (1), sometimes (0.25), rarely (0.1), never (0).

b) frequently (1), sometimes (0), never (0) – Use only if the value is "frequently".

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018).

Table A.3: Descriptive statistics on individual and work-related characteristics

	min	max	Native men	Migrant ^a men	Diff. M-N men	Native women	Migrant ^a women	Diff. M-N women
<i>Individual characteristics</i>								
Age	15	64	43.1	39.8	-3.3 ***	43.0	38.9	-4.1 ***
Partnership	0	1	0.58	0.63	0.05 ***	0.56	0.57	0.01
Children in the household	0	1	0.56	0.62	0.08 ***	0.63	0.64	0.01
Children in the household (<18)	0	1	0.33	0.46	0.13 ***	0.35	0.46	0.11 ***
<i>Education</i>								
Education: No occupational training	0	1	0.07	0.20	0.13 ***	0.08	0.20	0.12 ***
Education: Vocational training	0	1	0.59	0.48	-0.11 ***	0.63	0.48	-0.15 ***
Education: Advanced training	0	1	0.10	0.05	-0.05 ***	0.05	0.02	-0.03 ***
Education: University degree	0	1	0.24	0.27	0.03 ***	0.24	0.30	0.06 ***
German language proficiency	0	1	(1.0)	0.23	0.77 ***	(1.0)	0.22	0.78 ***
<i>Work-related characteristics</i>								
Real working hours	10	120	43.5	42.2	-1.3 ***	33.6	32.1	-1.5 ***
Job position	1	4	2.32	2.12	-0.20 ***	2.02	1.85	-0.17 ***
Job tenure	0	51	13.4	10.0	-3.4 ***	11.7	7.6	-4.1 ***
Hourly wage	3.1	57.5	17.35	17.32	-0.03	14.60	13.62	0.98 ***
<i>Firm size</i>								
Firm size: micro	0	1	0.18	0.18	0.00	0.22	0.24	0.02
Firm size: small	0	1	0.23	0.22	-0.01	0.30	0.31	0.01
Firm size: medium	0	1	0.25	0.24	-0.01	0.24	0.23	-0.01
Firm size: large	0	1	0.17	0.15	-0.02 **	0.14	0.12	-0.02 **
Firm size: huge	0	1	0.17	0.21	0.04 ***	0.10	0.11	0.01
Obs.			26,235	2,136		27,045	2,031	

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.4: Regression results on general health status by work tasks, job requirements and working conditions

Depended variable: Self-reported health (z-values)	Men		Women		Men		Women		Men		Women	
	Migrant ^a	Native										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Individual characteristics</i>												
Age	-0.030	-0.064***	-0.030	-0.046***	-0.027	-0.060***	-0.030	-0.041***	-0.028	-0.053***	-0.021	-0.037***
Age squared	0.000	0.000***	0.000	0.000***	0.000	0.000***	0.000	0.000***	0.000	0.000***	0.000	0.000***
Education: Vocational training	0.108	-0.040	-0.075	0.143***	0.135	-0.053	-0.065	0.144***	0.084	-0.011	-0.057	0.110***
Education: Advanced training	0.146	-0.006	-0.080	0.177***	0.127	-0.009	-0.071	0.193***	0.031	0.007	-0.114	0.136***
Education: University degree	0.183*	0.062	0.016	0.236***	0.182	0.037	0.062	0.243***	0.033	0.032	-0.021	0.187***
Partnership-Dummy	0.048	0.028	0.033	0.070***	0.048	0.026	0.023	0.067***	0.023	0.004	0.002	0.051***
Children in the household	-0.200**	-0.006	-0.160**	0.016	-0.184**	0.002	-0.180***	0.032*	-0.131*	-0.020	-0.193***	-0.002
<i>Work characteristics</i>												
Real working hours	-0.008	0.003	-0.031***	-0.011***	-0.006	0.009*	-0.027***	-0.004*	-0.023*	0.003	-0.042***	-0.008***
Real working hours, squared	0.000	-0.000	0.000***	0.000***	0.000	-0.000	0.000***	0.000***	0.000*	-0.000	0.001***	0.000**
Job pos.: skilled worker	-0.022	0.069**	-0.032	0.058**	-0.022	0.093**	0.015	0.089**	-0.006	0.054**	-0.013	0.014
Job pos.: highly qual. employee	0.065	0.151***	0.095	0.163***	0.069	0.189***	0.138	0.205***	0.003	0.093***	0.154	0.070**
Job pos.: specialist	0.028	0.142***	0.438***	0.207***	0.046	0.180***	0.399***	0.205***	0.083	0.078	0.684**	0.055
Hourly wage	0.007	0.012***	0.012***	0.009***	0.008*	0.013***	0.014***	0.010***	0.003	0.009***	0.008	0.007***
Firm size, 5 categories	x	x	x	x	x	x	x	x	x	x	x	x
KldB, 2-digit level	x	x	x	x	x	x	x	x	x	x	x	x
<i>Work tasks (z-values)</i>												
Non-routine manual	-0.040	-0.026**	0.005	-0.027***								
Routine manual	-0.060*	-0.031***	-0.113***	-0.048***								
Routine cognitive	0.065	0.010	-0.000	-0.021**								
Non-routine interactive	-0.031	0.016	-0.045	0.016								
Non-routine analytic	-0.002	-0.008	0.064*	0.006								
<i>Job requirements (z-values)</i>												
Performance requirements					0.069**	0.019*	0.009	0.015				
Repeating operations					-0.055*	-0.038***	-0.034	-0.021**				
Coordination efforts					-0.035	-0.060***	-0.064*	-0.041***				
Quantity performance					-0.028	-0.036***	-0.060	-0.050***				
Working at capacity limit					-0.126***	-0.133***	-0.119***	-0.172***				
<i>Working conditions (z-values)</i>												
Physical activities									-0.029	-0.023*	-0.095**	-0.081***
Environmental conditions									-0.117***	-0.096***	-0.091*	-0.129***
Shift work									-0.058**	0.016*	0.010	-0.013
Working climate									0.133***	0.118***	0.077**	0.125***
Insuf. information transfer									-0.084***	-0.116***	-0.071**	-0.108***
Self determination									0.100***	0.083***	0.030	0.059***
<i>Control</i>												
Federal states	x	x	x	x	x	x	x	x	x	x	x	x
Survey years	x	x	x	x	x	x	x	x	x	x	x	x
constant	1.123***	1.665***	1.020	1.329***	0.997	1.288***	0.673	0.831***	1.125*	1.525***	0.355	1.360***
Obs.	2,000	25,155	1,823	25,337	1,990	25,078	1,826	25,248	1,723	21,692	1,612	22,907
adj. R ²	0.095	0.091	0.132	0.085	0.109	0.119	0.157	0.125	0.169	0.147	0.147	0.153

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.5: Results of probit-model on general health condition

Depended variable: Good health (Dummy)	Men		Women		Men		Women	
	Migrant ^a	Native	Migrant ^a	Native	Migrant ^a	Native	Migrant ^a	Native
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Individual characteristics</i>								
Age	-0.042	-0.025**	-0.057*	-0.042***	-0.014	-0.031**	-0.062	-0.039***
Age squared	0.000	0.000	0.000	0.000**	0.000	0.000	0.001	0.000
Education: Vocational training	0.270**	0.187***	0.266**	0.281***	0.247*	0.072	0.212	0.207***
Education: Advanced training	0.214	0.350***	0.662***	0.493***	-0.009	0.096	0.501	0.325***
Education: University degree	0.461***	0.631***	0.533***	0.583***	-0.009	0.102	0.124	0.337***
Partnership-Dummy	-0.016	0.145***	0.202**	0.196***	0.001	0.023	0.158	0.132***
Children in the household	-0.096	-0.031	-0.241**	-0.011	-0.214	-0.011	-0.232*	0.007
<i>Work characteristics</i>								
Real working hours					-0.027	0.027***	-0.052***	0.004
Real working hours, squared					0.000	-0.000***	0.001**	0.000
Job pos.: skilled worker					0.078	0.159***	0.016	0.053
Job pos.: highly qualified employee					-0.036	0.194***	0.138	0.059
Job pos.: specialist					0.238	0.214**	0.536	0.199*
Hourly wage					0.006	0.019***	0.021**	0.010***
Firm size, 5 categories					X	X	X	X
KldB, 2-digit level					X	X	X	X
<i>Work tasks (z-values)</i>								
Non-routine manual					0.015	-0.001	0.075	0.010
Routine manual					-0.068	-0.002	-0.199***	-0.030
Routine cognitive					0.097	-0.010	0.050	-0.031*
Non-routine interactive					-0.110	0.022	-0.073	0.011
Non-routine analytic					-0.024	-0.038**	0.152**	-0.030*
<i>Job requirements (z-values)</i>								
Performance requirements					0.036	0.037*	0.055	0.026
Repeating operations					0.004	-0.045**	0.000	-0.031*
Coordination efforts					-0.099	-0.054**	-0.080	0.000
Quantity performance					-0.033	-0.010	0.042	-0.007
Working at capacity limit					-0.164***	-0.183***	-0.197***	-0.234***
<i>Working conditions (z-values)</i>								
Physical activities					-0.021	-0.002	-0.112	-0.076***
Environmental conditions					-0.172**	-0.108***	-0.092	-0.112***
Shift work					-0.046	0.011	0.070	0.011
Working climate					0.211***	0.173***	0.075	0.186***
Insuf. information transfer					0.070	-0.120***	0.028	-0.087***
Self determination					0.095	0.093***	0.046	0.081***
<i>Control</i>								
Federal states					X	X	X	X
Survey years					X	X	X	X
constant	2.067***	2.042***	2.225***	2.039***	1.600	1.641***	1.877	2.591***
Obs.	2,122	26,145	2,027	26,959	1,695	21,478	1,524	22,608
adj. R ²	0.025	0.056	0.053	0.046	0.210	0.158	0.208	0.155

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.6: Regression results for self-reported health by age groups: Males

Age group	Migrant men ^a					Native men				
	15-24 y.	25-34 y.	35-44 y.	45-54 y.	55-64 y.	15-24 y.	25-34 y.	35-44 y.	45-54 y.	55-64 y.
Self-reported health (0-1)	0.65	0.63	0.58	0.55	0.52	0.68	0.65	0.60	0.55	0.52
Self-reported health (z-value)	0.36	0.28	0.03	-0.11	-0.24	0.52	0.33	0.11	-0.13	-0.22
<i>Individual characteristics</i>										
Age	-0.970	0.284	0.183	0.022	2.314	0.669	-0.276 *	-0.153	-0.049	-0.678 **
Age squared	0.021	-0.006	-0.002	0.000	-0.020	-0.017	0.004 *	0.002	0.000	0.006 **
Education: Vocational training	1.039 **	-0.152	0.075	0.069	0.730 ***	-0.050	-0.053	0.074	-0.071	-0.067
Education: Advanced training	0.000	-0.247	0.051	-0.294	-0.032	-0.015	0.021	0.039	-0.064	0.037
Education: University degree	3.094 **	-0.123	0.262	0.090	0.212	0.046	0.098	0.121	-0.118	-0.063
Partnership-Dummy	0.930 **	-0.068	0.157	-0.084	0.177	-0.021	-0.005	0.077 *	0.032	-0.092 *
Children in the household	-0.222	0.007	-0.218	-0.341 **	-0.104	-0.389 ***	-0.026	-0.053	-0.009	0.023
<i>Work characteristics</i>										
Real working hours	-0.077	-0.014	-0.062	-0.008	0.048	-0.013	0.002	0.005	0.019 ***	0.020 **
Real working hours, squared	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000 *	0.000
Job pos.: skilled worker	0.038	0.108	-0.035	0.032	-0.027	-0.002	0.062	-0.037	0.130 ***	0.076
Job pos.: highly qualified employee	1.303 *	0.235	0.024	-0.026	-0.210	0.276	0.023	0.015	0.197 ***	0.125
Job pos.: specialist	0.000	-0.241	0.455	0.213	-0.298	-0.945 ***	-0.007	0.136	0.152 *	0.114
Hourly wage	-0.025	0.016	-0.011	0.008	0.001	0.023 *	0.016 ***	0.010 ***	0.012 ***	0.006 **
Firm size, 5 categories	x	x	x	x	x	x	x	x	x	x
KldB, 2-digit level	x	x	x	x	x	x	x	x	x	x
<i>Work tasks (z-values)</i>										
Non-routine manual	-0.308 *	-0.010	-0.028	0.016	0.016	-0.057	0.000	-0.002	0.027	-0.035
Routine manual	0.060	-0.014	0.060	-0.025	-0.032	-0.040	0.001	-0.020	0.005	0.043 *
Routine cognitive	-0.598 **	0.040	0.006	0.023	-0.170	-0.048	0.017	0.009	-0.006	0.059 **
Non-routine interactive	0.337	-0.021	0.055	-0.092	-0.144	0.062	0.015	0.034 *	0.012	-0.004
Non-routine analytic	-0.081	-0.070	-0.051	0.147 *	0.079	-0.037	0.008	-0.005	-0.019	-0.004
<i>Job requirements (z-values)</i>										
Performance requirements	0.275	0.087	-0.087	0.069	-0.052	0.100 **	0.016	-0.009	0.021	0.005
Repeating operations	0.402	-0.056	-0.065	0.081	-0.078	-0.028	-0.045 **	-0.023	-0.028 *	-0.048 **
Coordination efforts	-0.081	0.016	0.067	-0.141 *	0.237	-0.108 **	-0.032	-0.031	-0.024	-0.070 ***
Quantity performance	-0.375 **	-0.045	0.059	0.034	-0.163	-0.011	0.003	-0.003	-0.005	-0.009
Working at capacity limit	-0.062	-0.187 ***	-0.111 *	-0.111 *	0.038	-0.072	-0.120 ***	-0.067 ***	-0.136 ***	-0.107 ***
<i>Working conditions (z-values)</i>										
Physical activities	-0.343	-0.076	0.121	0.004	-0.204	-0.133 **	0.011	-0.017	-0.004	0.041
Environmental conditions	0.295	-0.032	-0.261 ***	0.031	-0.063	0.077	-0.048 *	-0.061 ***	-0.097 ***	-0.176 ***
Shift work	0.216	-0.012	-0.061	-0.095	-0.194 **	0.029	0.005	0.014	0.016	0.042 *
Working climate	0.206	0.130 ***	0.138 **	0.127 *	0.237 ***	0.029	0.118 ***	0.120 ***	0.097 ***	0.102 ***
Insuf. information transfer	0.047	-0.017	-0.049	-0.095 *	0.210 **	-0.022	-0.102 ***	-0.125 ***	-0.088 ***	-0.074 ***
Self determination	0.309 *	0.033	0.198 ***	0.005	0.114	0.139 ***	0.051 **	0.082 ***	0.085 ***	0.046 *
<i>Control</i>										
Federal states	x	x	x	x	x	x	x	x	x	x
Survey years	x	x	x	x	x	x	x	x	x	x
Constant	11.164	-2.820	-3.222	-0.511	-63.010	-5.644	4.741 **	2.755	0.921	19.112 *
Obs.	96	508	521	399	177	797	3,898	6,100	6,453	4,230
adj. R ²	0.53	0.17	0.20	0.10	0.44	0.13	0.14	0.11	0.14	0.13

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.7: Regression results for self-reported health by age groups: Females

Age group	Migrant women ^a					Native women				
	15-24 y.	25-34 y.	35-44 y.	45-54 y.	55-64 y.	15-24 y.	25-34 y.	35-44 y.	45-54 y.	55-64 y.
Self-reported health (0-1)	0.61	0.61	0.53	0.52	0.49	0.65	0.61	0.58	0.53	0.51
Self-reported health (z-value)	0.15	0.16	-0.21	-0.26	-0.39	0.35	0.19	0.04	-0.18	-0.31
<i>Individual characteristics</i>										
Age	3.780	-0.207	0.626	0.633	0.363	0.406	-0.339 **	0.041	0.073	-0.266
Age squared	-0.085	0.004	-0.008	-0.006	-0.002	-0.010	0.005 *	-0.001	-0.001	0.002
Education: Vocational training	0.031	-0.150	-0.065	-0.160	0.215	-0.010	0.165	0.225 ***	0.059	0.169 ***
Education: Advanced training	0.919	-0.376	-0.398	-0.027	-0.100	-0.132	0.222	0.327 ***	0.016	0.252 ***
Education: University degree	0.489	-0.328	-0.052	-0.081	-0.018	0.271	0.296 **	0.320 ***	0.069	0.173 **
Partnership-Dummy	0.197	0.003	0.017	-0.131	-0.106	-0.122	0.074 *	0.075 **	0.057 **	0.091 ***
Children in the household	-0.053	-0.280 **	-0.297 **	0.171	-0.597 **	-0.067	-0.058	0.001	0.027	0.039
<i>Work characteristics</i>										
Real working hours	-0.035	-0.068 ***	-0.003	0.014	-0.111	-0.012	0.008	-0.003	-0.005	-0.009
Real working hours, squared	0.000	0.001 ***	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000 **
Job pos.: skilled worker	-0.916 *	0.018	-0.100	0.122	0.192	-0.091	-0.055	0.059	0.016	0.093 *
Job pos.: highly qualified employee	0.893	0.328	0.102	-0.041	0.050	0.301 **	0.095	0.138 **	0.027	0.079
Job pos.: specialist	0.000	0.793	0.971 *	1.352 ***	-0.064	-0.377	-0.062	0.174	0.040	0.136
Hourly wage	0.043	0.019 *	-0.002	0.021 **	0.017	0.006	0.017 ***	0.009 ***	0.007 **	0.004
Firm size, 5 categories	x	x	x	x	x	x	x	x	x	x
KldB, 2-digit level	x	x	x	x	x	x	x	x	x	x
<i>Work tasks (z-values)</i>										
Non-routine manual	-0.182	-0.091	0.122 *	-0.020	-0.035	0.130 **	0.024	-0.009	0.016	-0.023
Routine manual	0.362	-0.066	-0.059	-0.028	0.022	-0.060	-0.014	0.026	0.024	-0.005
Routine cognitive	0.046	0.068	-0.002	0.021	-0.138	-0.054	-0.050 **	0.010	0.002	0.002
Non-routine interactive	0.106	-0.113 *	-0.046	0.143 *	0.005	0.045	0.043	0.016	0.015	0.046 **
Non-routine analytic	-0.283	0.133 **	0.039	-0.088	0.051	-0.083	0.014	-0.017	0.031 *	-0.003
<i>Job requirements (z-values)</i>										
Performance requirements	0.058	-0.038	0.107 *	0.137 *	0.206 **	0.080	0.006	-0.012	0.009	0.025
Repeating operations	-0.188	0.000	0.031	0.100	0.077	0.095 **	-0.018	-0.028 *	-0.003	-0.048 ***
Coordination efforts	-0.369	0.002	-0.128 **	-0.372 ***	0.022	-0.153 ***	-0.022	-0.020	0.007	0.004
Quantity performance	0.347	0.003	0.022	-0.066	-0.405 ***	-0.084 *	-0.009	-0.017	-0.014	-0.024
Working at capacity limit	0.128	-0.108	-0.077	-0.250 ***	-0.241 **	-0.119 **	-0.123 ***	-0.120 ***	-0.161 ***	-0.152 ***
<i>Working conditions (z-values)</i>										
Physical activities	-0.759 **	-0.025	-0.083	-0.079	-0.006	-0.106	-0.030	-0.034	-0.079 ***	-0.075 ***
Environmental conditions	-0.421	-0.122	-0.125	0.104	-0.146	-0.131 **	-0.118 ***	-0.088 ***	-0.108 ***	-0.122 ***
Shift work	0.339 *	0.066	0.020	-0.159 **	0.049	0.028	-0.028	-0.008	-0.030 *	0.014
Working climate	0.365	0.110 **	-0.024	0.138 **	0.001	0.034	0.145 ***	0.145 ***	0.069 ***	0.138 ***
Insuf. information transfer	0.201	-0.031	-0.091	0.170 **	-0.139	-0.069	-0.052 **	-0.073 ***	-0.104 ***	-0.104 ***
Self determination	0.144	-0.025	0.072	0.007	-0.021	0.081	-0.003	0.055 ***	0.075 ***	0.033 *
<i>Control</i>										
Federal states	x	x	x	x	x	x	x	x	x	x
Survey years	x	x	x	x	x	x	x	x	x	x
Constant	-42.277	3.643	-12.368	-19.448	-10.288	-3.344	4.894 **	-0.436	-1.025	7.142
Obs.	88	428	500	372	186	707	3,652	5,851	7,619	4,779
adj. R ²	0.07	0.19	0.17	0.32	0.38	0.19	0.15	0.14	0.14	0.18

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.8: Economic sector aggregates

Economic sector aggregates	German Classification of Economic Activities, Edition 2003, 1-digit-level
[1] Agriculture, manufacturing, construction	[1] Agriculture and forestry [2] Mining/Energy/Water [3] Food and beverages [4] Textile/Leather production [5] Woodworking/Paper production [6] Printing industry [7] Chemical Industry etc. [8] Metal and electrical industry/Craft industry nes. [9] Manufacturing furniture/Jewellery etc. [10] Recycling/Disposal [11] Construction
[2] Private and business-related services	[12] Trade/Repair/Rental [13] Hotels and restaurants [14] Transport/News/Media [15] Banks/Insurance companies [16] Housing [17] Data Processing/Research/Company services [21] Other services
[3] Public and health services	[18] Public administration/Interest groups/Corporations [19] Education and teaching [20] Health and social services

Source: Statistisches Bundesamt (2003). Own categorization.

Table A.9: Regression results for self-reported health by economic sector: Males

Depended variable: Self-reported health (z-values)	Migrant men			Native men		
	Agriculture, manufacturing, construction (1)	Private and business-related services (2)	Public and health services (3)	Agriculture, manufacturing, construction (4)	Private and business-related services (5)	Public and health services (6)
<i>Individual characteristics</i>						
Age	-0.011	-0.036	-0.102	-0.042***	-0.067***	-0.061***
Age squared	0.000	0.000	0.001	0.000**	0.001***	0.000***
Education: Vocational training	0.191	-0.181	0.947**	-0.053	-0.015	0.079
Education: Advanced training	-0.096	0.089	1.265*	-0.082	0.075	0.177
Education: University degree	-0.076	0.070	0.378	-0.037	0.078	0.116
Partnership-Dummy	-0.071	0.088	0.565**	0.004	0.027	-0.035
Children in the household	-0.201**	-0.132	-0.277	-0.029	-0.036	0.068*
<i>Work characteristics</i>						
Real working hours	-0.048*	-0.009	0.012	0.014*	0.001	0.006
Real working hours, squared	0.001**	0.000	0.000	0.000	0.000	0.000
Job pos.: skilled worker	-0.041	-0.032	0.665**	0.044	0.102**	0.122*
Job pos.: highly qualified employee	0.143	-0.141	0.722*	0.095**	0.152***	0.143*
Job pos.: specialist	-0.064	-0.295	1.130**	0.090	0.031	0.189*
Hourly wage	-0.002	-0.001	0.004	0.011***	0.009***	0.007**
Firm size, 5 categories	X	X	X	X	X	X
KldB, 2-digit level	X	X	X	X	X	X
<i>Work tasks (z-values)</i>						
Non-routine manual	-0.023	-0.026	-0.033	0.008	-0.011	-0.023
Routine manual	-0.042	0.076	0.295*	-0.004	0.023	0.035
Routine cognitive	0.061	0.061	-0.223**	0.016	-0.018	0.020
Non-routine interactive	0.017	-0.156**	-0.133	0.020	0.012	0.018
Non-routine analytic	-0.009	-0.054	0.171	-0.014	-0.015	0.004
<i>Job requirements (z-values)</i>						
Performance requirements	0.026	0.038	-0.130	0.036**	-0.011	-0.030
Repeating operations	-0.059	0.015	-0.063	-0.031**	-0.040**	-0.038**
Coordination efforts	-0.004	0.035	-0.023	-0.047***	-0.048**	-0.021
Quantity performance	0.040	0.044	-0.092	-0.008	0.009	-0.025
Working at capacity limit	-0.087**	-0.130**	0.089	-0.110***	-0.101***	-0.096***
<i>Working conditions (z-values)</i>						
Physical activities	-0.007	-0.022	-0.478**	-0.022	-0.044*	0.072**
Environmental conditions	-0.110**	-0.168*	0.307*	-0.098***	-0.039*	-0.078***
Shift work	-0.054	-0.022	-0.045	0.018	0.026	0.007
Working climate	0.123***	0.122**	0.185*	0.110***	0.099***	0.113***
Insuf. information transfer	-0.062*	-0.038	-0.133	-0.101***	-0.088***	-0.085***
Self determination	0.086*	0.178***	0.246*	0.082***	0.086***	0.070***
<i>Control</i>						
Federal states	X	X	X	X	X	X
Survey years	X	X	X	X	X	X
constant	2.407***	0.628	-0.700	1.069***	1.792***	1.299***
Obs.	953	540	195	10,270	6,402	4,702
adj. R ²	0.197	0.195	0.293	0.177	0.157	0.146

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.10: Regression results for self-reported health by economic sector: Females

Depended variable: Self-reported health (z-values)	Migrant women			Native women		
	Agriculture, manufacturing, construction (1)	Private and business-related services (2)	Public and health services (3)	Agriculture, manufacturing, construction (4)	Private and business-related services (5)	Public and health services (6)
<i>Individual characteristics</i>						
Age	-0.020	-0.049	-0.024	-0.033**	-0.041***	-0.031***
Age squared	0.000	0.001	0.000	0.000	0.000**	0.000
Education: Vocational training	0.087	-0.278*	0.239	0.186***	0.072	0.137*
Education: Advanced training	-0.308	0.116	0.044	0.125	0.145*	0.183**
Education: University degree	0.065	-0.316*	0.193	0.264***	0.170**	0.192**
Partnership-Dummy	0.174	0.030	-0.138	0.071*	0.042	0.055**
Children in the household	-0.278*	-0.265**	-0.055	-0.015	0.040	0.006
<i>Work characteristics</i>						
Real working hours	-0.044*	-0.031*	-0.039**	-0.007	-0.003	-0.003
Real working hours, squared	0.001	0.000*	0.001**	0.000	0.000	0.000
Job pos.: skilled worker	-0.123	-0.050	0.172	0.074	0.000	0.024
Job pos.: highly qualified employee	0.236	0.110	0.284	0.108	0.088	0.095**
Job pos.: specialist	0.000	-0.278	1.257***	0.035	-0.334	0.102
Hourly wage	-0.002	0.018**	-0.008	0.001	0.010***	0.008***
Firm size, 5 categories	X	X	X	X	X	X
KldB, 2-digit level	X	X	X	X	X	X
<i>Work tasks (z-values)</i>						
Non-routine manual	-0.093	0.046	0.058	0.014	0.024	-0.005
Routine manual	0.033	-0.234***	-0.014	0.004	0.004	0.006
Routine cognitive	-0.046	0.003	0.089	0.008	-0.035**	-0.008
Non-routine interactive	0.088	-0.080	-0.012	-0.008	0.051***	0.034**
Non-routine analytic	-0.006	0.106*	0.015	0.019	0.005	0.004
<i>Job requirements (z-values)</i>						
Performance requirements	0.165**	-0.049	0.057	0.042*	0.002	-0.007
Repeating operations	-0.009	0.015	-0.007	-0.028	-0.002	-0.024*
Coordination efforts	-0.162**	-0.040	-0.143**	-0.018	-0.024	-0.007
Quantity performance	0.061	0.009	-0.147**	-0.021	-0.026	-0.005
Working at capacity limit	-0.083	-0.072	-0.112*	-0.117***	-0.125***	-0.157***
<i>Working conditions (z-values)</i>						
Physical activities	-0.110	0.039	-0.119*	-0.050*	-0.078***	-0.057***
Environmental conditions	-0.113	-0.076	-0.040	-0.138***	-0.120***	-0.085***
Shift work	0.042	-0.046	-0.066	-0.011	-0.018	0.007
Working climate	0.071	0.035	0.105**	0.129***	0.085***	0.138***
Insuf. information transfer	-0.069	-0.069	0.070	-0.098***	-0.081***	-0.072***
Self determination	0.012	0.065	0.005	0.064***	0.072***	0.022
<i>Control</i>						
Federal states	X	X	X	X	X	X
Survey years	X	X	X	X	X	X
constant	1.815	1.969**	-0.190	1.140***	1.024**	0.964***
Obs.	332	624	601	4,304	7,385	10,809
adj. R ²	0.291	0.173	0.257	0.201	0.164	0.179

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.

Table A.11: Manual and non-manual occupations

German Classification of Occupations 2010 (KldB), 2-digit level	
Manual occupations	01 Armed forces personnel
	11 Occupations in agriculture, forestry, and farming
	12 Occupations in gardening and floristry
	21 Occupations in production and processing of raw materials, glass- and ceramic-making and -processing
	22 Occupations in plastic-making and -processing, and wood-working and -processing
	23 Occupations in paper-making and -processing, printing, and in technical media design
	24 Occupations in metal-making and -working, and in metal construction
	25 Technical occupations in machine-building and automotive industry
	26 Occupations in mechatronics, energy electronics and electrical engineering
	27 Occupations in technical research and development, construction, and production planning and scheduling
	28 Occupations in textile- and leather-making and -processing
	29 Occupations in food-production and -processing
	32 Occupations in building construction above and below ground
	33 Occupations in interior construction
	34 Occupations in building services engineering and technical building services
	52 Drivers and operators of vehicles and transport equipment
	53 Occupations in safety and health protection, security and surveillance
	54 Occupations in cleaning services
81 Medical and health care occupations	
82 Occupations in non-medical healthcare, body care, wellness and medical technicians	
Non-manual occupations	31 Occupations in construction scheduling, architecture and surveying
	41 Occupations in mathematics, biology, chemistry and physics
	42 Occupations in geology, geography and environmental protection
	43 Occupations in computer science, information and communication technology
	51 Occupations in traffic and logistics (without vehicle driving)
	61 Occupations in purchasing, sales and trading
	62 Sales occupations in retail trade
	63 Occupations in tourism, hotels and restaurants
	71 Occupations in business management and organisation
	72 Occupations in financial services, accounting and tax consultancy
	73 Occupations in law and public administration
	83 Occupations in education and social work, housekeeping, and theology
	84 Occupations in teaching and training
	91 Occupations in in philology, literature, humanities, social sciences, and economics
	92 Occupations in advertising and marketing, in commercial and editorial media design
	93 Occupations in product design, artisan craftwork, fine arts and the making of musical instruments
94 Occupations in the performing arts and entertainment	

Source: Statistik der Bundesagentur für Arbeit (2015). Own categorization

Table A.12: Regression results on general health condition: Manual and non-manual occupations

Depended variable: Self-reported health (z-values)	Migrant men ^a		Native men		Migrant women ^a		Native women	
	manual	non-manual	manual	non-manual	manual	non-manual	manual	non-manual
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Individual characteristics</i>								
Age	0.001	-0.050	-0.049***	-0.054***	-0.084**	0.003	-0.045***	-0.030***
Age squared	0.000	0.000	0.000***	0.000***	0.001**	0.000	0.000**	0.000*
Education: Vocational training	0.194*	-0.163	0.017	-0.102	-0.145	-0.042	0.110*	0.114**
Education: Advanced training	0.123	-0.106	0.017	-0.040	-0.345	-0.052	0.169*	0.122*
Education: University degree	0.087	-0.135	0.070	-0.054	0.027	-0.130	0.332***	0.146***
Partnership-Dummy	0.007	0.108	0.008	-0.003	-0.157	0.029	0.034	0.067***
Children in the household	-0.199**	-0.131	-0.032	0.006	-0.150	-0.227**	-0.018	0.017
<i>Work characteristics</i>								
Real working hours	-0.007	-0.027	0.005	0.007	-0.038**	-0.040**	0.003	-0.008**
Real working hours, squared	0.000	0.000*	0.000	0.000	0.001**	0.001**	0.000	0.000***
Job pos.: skilled worker	-0.021	-0.044	0.061*	0.054	0.092	-0.036	0.079*	0.004
Job pos.: highly qualified employee	0.032	-0.039	0.108**	0.109**	0.087	0.108	0.162***	0.064*
Job pos.: specialist	0.204	-0.103	0.057	0.139**	-2.265***	0.780*	-0.049	0.057
Hourly wage	0.009	-0.003	0.012***	0.008***	0.012	0.009	0.008**	0.007***
Firm size, 5 categories	x	x	x	x	x	x	x	x
KldB, 2-digit level	x	x	x	x	x	x	x	x
<i>Work tasks (z-values)</i>								
Non-routine manual	0.029	-0.055	0.004	-0.003	0.040	0.033	0.017	0.006
Routine manual	-0.017	-0.030	0.002	-0.003	-0.070	-0.064	0.020	-0.001
Routine cognitive	0.018	0.089	0.030**	-0.015	-0.017	0.029	-0.037**	-0.003
Non-routine interactive	-0.058	-0.085	0.032**	-0.011	-0.024	-0.021	0.020	0.030**
Non-routine analytic	-0.009	-0.050	-0.002	-0.018	0.137**	0.061	-0.004	0.011
<i>Job requirements (z-values)</i>								
Performance requirements	0.008	0.060	0.019	-0.003	-0.002	0.028	-0.006	0.012
Repeating operations	-0.060	0.003	-0.053***	-0.010	0.077	-0.065	-0.002	-0.021**
Coordination efforts	0.005	-0.014	-0.062***	-0.007	0.007	-0.162***	-0.022	-0.010
Quantity performance	0.015	0.048	-0.002	-0.008	-0.069	-0.031	-0.007	-0.019
Working at capacity limit	-0.098**	-0.147***	-0.107***	-0.098***	-0.194***	-0.075*	-0.141***	-0.138***
<i>Working conditions (z-values)</i>								
Physical activities	-0.048	0.024	-0.018	0.000	-0.035	-0.091	-0.038*	-0.078***
Environmental conditions	-0.081*	-0.112	-0.068***	-0.108***	0.015	-0.054	-0.105***	-0.113***
Shift work	-0.039	-0.093*	0.016	0.025	-0.016	0.011	-0.005	-0.019
Working climate	0.101**	0.188***	0.119***	0.092***	0.121***	0.049	0.138***	0.106***
Insuf. information transfer	-0.077**	-0.060	-0.096***	-0.094***	-0.050	0.000	-0.072***	-0.087***
Self determination	0.099**	0.118**	0.062***	0.105***	0.048	0.035	0.044***	0.053***
<i>Control</i>								
Federal states	x	x	x	x	x	x	x	x
Survey years	x	x	x	x	x	x	x	x
constant	-0.346	1.594**	1.217***	1.408***	0.997	0.216	1.063***	0.926***
Obs.	1,053	648	10,878	10,600	528	1,046	6,172	16,436
adj. R ²	0.140	0.255	0.169	0.148	0.230	0.161	0.201	0.159

Notes: * p<0.1, ** p<0.05, *** p<0.01 – Survey weights are integrated to counteract sample bias. Persons in labour force age only.

a) Foreigners and Germans with migration background (2nd citizenship or learned foreign mother tongue during childhood)

Source: Bundesinstitut für Berufsbildung (BIBB) (2006, 2012, 2018). Own calculations.