Working Paper – Deliverable 6.1

Impact of health and skills on the risk of weak labour market attachment

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December 2024

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No Project 101094626. *Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. The European Union cannot be held responsible for them. The deliverable is under review by the European Commission.*

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European Labour Markets Under Pressure – New knowledge on pathways to include persons in vulnerable situations

Title: Impact of health and skills on the risk of weak labour market attachment

Date: December 2024

Responsible organisation: Institute for Structural Research

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DOI: 10.5281/zenodo.15076603

Acknowledgements:

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No Project 101094626.

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1. Introduction

The importance of health for labour market outcomes is well recognised in economic, sociological, and psychological literature, with empirical evidence showing the negative effects of bad health and health deterioration on labour force participation and income (Cai, 2010; Cai & Kalb, 2006; Charles, 2003; Dano, 2005; García-Gómez et al., 2013; Zhang et al., 2009).

Boosting the labour market participation of less active groups, such as older individuals or people with health problems, is crucial for alleviating the economic pressure caused by ageing populations and addressing the skills and labour shortages many economies face. In 2022, the employment rate in the European Union (EU) reached a record high of 74.5%, but the job vacancy rate also climbed to the highest level ever recorded (2.9%) (European Commission, 2023). Increased employment rates also have positive individual effects. Besides remuneration, employment has other functions that are beneficial for individual well-being, such as social contact, activity, or time structure (Jahoda, 1981). Research also indicates the negative effects of unemployment on health, which are not buffered by generous unemployment benefits (Voßemer et al., 2018).

Previous literature shows that the relationship between health and labour market outcomes depends on a number of factors. Type of occupation (Simonetti et al., 2022), earnings (Vaalavuo, 2021), and education moderate the relationship between health and labour force participation, with education being the most important. Sudden health deterioration has a greater relative negative impact on individuals with a low level of education (Lundborg et al., 2015; Vaalavuo, 2021), and educational attainment is a major factor determining the probability of employment among persons with disabilities. The educational gradient in the effect of health on activity/employment can be explained, on the one hand, by the fact that the educational level could be associated with social capital and timely access to health care (Vaalavuo, 2021). On the other hand, the job's skill requirements partially explain the educational gradient (Heinesen et al., 2018). Heinesen et al. (2018) showed that the negative effect of cancer on employment is stronger for individuals with high levels of manual skills or low levels of cognitive skills.

Leaving the labour force because of low levels of health is the adjustment along the extensive margin - it is a binary decision: work or not work. Still, employees might also respond by adjustments along the intensive margin: adjustments in the amount of labour supplied, without exiting the labour force. The empirical evidence on the effects of health status on hours worked is mixed. Cai et al. (2014) showed that lower health status results in fewer hours worked, and health shocks lead to further reductions. On the contrary, other studies find no effect of health problems on hours worked among those who remain employed (Mani et al., 2018; Simonetti et al., 2022).

Contrary to standard labour supply models, where individuals maximise utility by choosing the desired number of hours, individuals often face restrictions in their choice of working hours. Working hours are influenced by employer preferences, technological advancements, industrial

relations, and the business cycle (Böheim & Taylor, 2004). This results in a mismatch between the worker's actual and preferred number of hours worked. Experiencing working hours constraints (both underemployment and overemployment) might increase the probability of withdrawing from the labour market, especially among workers with health limitations. Workers with health limitations often require flexible work schedules to manage health issues or therapy, thus suffering from overemployment if employed in traditional full-time jobs without flexible hours. At the same time, they often work in elementary and part-time jobs, and as a result, they are more prone to underemployment (Pagan, 2018).

People with health limitations experience underemployment and overemployment more often than individuals without health limitations (Antal et al., 2024; Pagan, 2018; Tam, 2010). Some evidence suggests that the seriousness of health conditions determines the direction of the effect: disabled workers are often underemployed, while workers with milder conditions suffer from overemployment (Antal et al., 2024).

This paper aims to quantify the role of skills used at work in fostering labour market attachment of individuals with health limitations. We use data from the European Union Labour Force Survey (EU-LFS) Job skills ad hoc module conducted in 2022 to investigate if specific skills are related to a lower probability of weak labour market attachment among people with health limitations in Europe. The data has the advantage of having skills and health indicators accompanied by detailed questions about the labour market situation of respondents. Our main contribution is to investigate the role of skills in the labour market attachment of people with health limitations within occupations. To the best of our knowledge, this research gap has not been addressed earlier. In a related research, Heinesen et al. (2018) showed the importance of skills used at work in moderating the effect of a sudden illness on employment. They used skill-use measures at the occupational level while we concentrate on worker-level skill use within occupations.

We look at three weak labour market attachment indicators: economic inactivity, unemployment, and mismatch between worker's actual and preferred number of work hours. We include the working hours mismatch as a labour market attachment indicator as it might increase the probability of withdrawing from the labour market as described earlier. The measure of health we use is self-reported long-lasting limitations in daily activities for health reasons: the Global Activity Limitation Indicator – GALI, which is widely used in Eurostat surveys. We focus on the 25–54 age group, excluding older workers who are more likely to suffer from health limitations related to ageing.

The responses to health deterioration regarding labour market participation differ between the countries. Social security arrangements partially explain cross-country differences (García-Gómez, 2011; Trevisan & Zantomio, 2016). There is also evidence that employment protection legislation (EPL) impacts the responses to health deterioration (Simonetti et al., 2022). In this paper, we follow earlier literature and group countries to reflect differences in cultural attitudes, social environment and labour and welfare institutions (e.g. Magda & Lipowska, 2022; Trevisan & Zantomio, 2016). We classify the European countries into four groups: the Continental, the Southern, the Nordic, and the Central and Eastern European (CEE) models. The Anglo-Saxon model is not represented due to data limitations.

Our results indicate that the effect of health limitations on inactivity differs by the individual skill level for digital, cognitive, and social skills but not in the case of manual skills. The probability of inactivity among individuals with health limitations decreases as their social and digital skills improve, while it increases with higher cognitive skills. In contrast to inactivity, health limitations' impact on unemployment is unrelated to an individual's skill level.

Health limitations are related to a higher probability of mismatch between the number of preferred and worked hours, especially overemployment. Cognitive skills moderate the effect of health limitations on the mismatch between the number of preferred and worked hours. The probability of overemployment is stable across levels of cognitive skills for workers with no health limitations. Conversely, the probability of overemployment increases with the use of cognitive skills among people with health limitations. This pattern repeats for cognitive skills and underemployment. In the case of manual skills, however, the more manual skills are used by workers with health limitations, the lower their probability of underemployment.

In the next section, we introduce our data and present descriptive evidence on the labour market attachment of persons with and without health limitations. In Section 3, we outline our methodology. In Section 4, we report our econometric results. In Section 5, we conclude.

2. Data and descriptive statistics

2.1 Data

We use microdata from the European Union Labour Force Survey (EU-LFS) Job skills ad hoc module conducted in 2022. This dataset allows us to identify respondents' health status and analyse the skills they use at current work or in their last job if respondents left their last employment within the last 24 months. We include 23[1] European Union member states, Switzerland, and Norway.

We focus on the 25–54 age group. When investigating labour market activity and unemployment, the population of interest consists of employees and former employees who left their last employment within the last 24 months[2]. By definition, this population has some work experience and is more employable than the total population aged 25-54. When investigating the mismatch between workers' actual and preferred number of work hours, the population consists of current employees. The sample sizes vary between the countries, from about 1 100 for the population of employees and former employees (1 000 for employees) in Croatia to about 39 000 for the population of employees and former employees (38 000 for employees) in Germany. We assign equal weights to each country. Self-employed individuals are excluded from both samples.

The EU-LFS respondents can report being (i) severely limited, (ii) limited but not severely, or (iii) not limited in daily activities because of health problems[3]. We construct the measure of health limitations by merging the categories of severely limited and limited in daily activities because of a low incidence of severe limitations. The shares of individuals reporting health limitations among employees and employees and former employees are lower than in the general

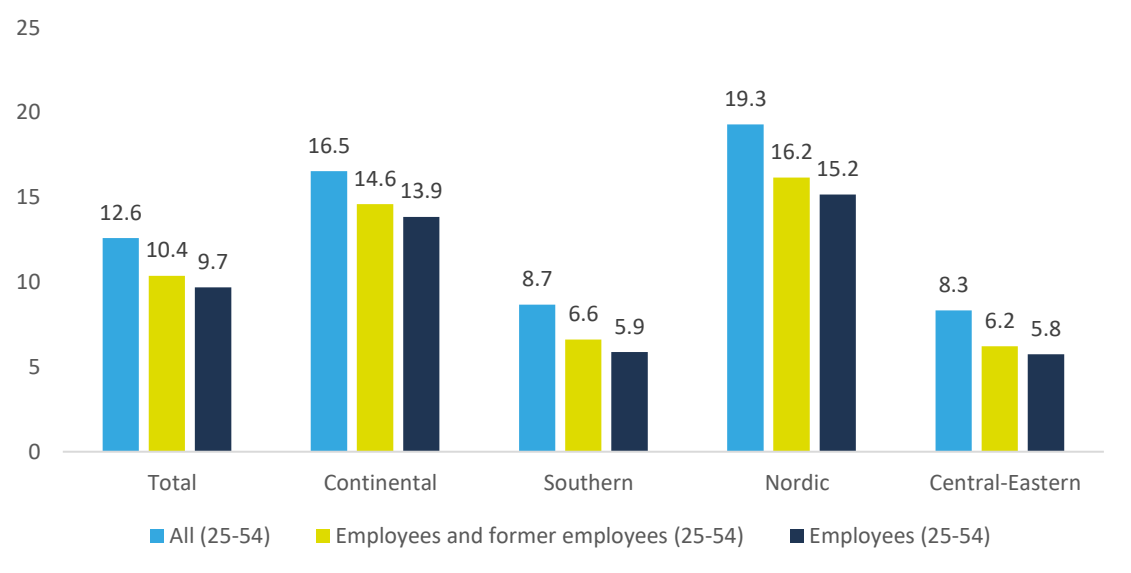
[1] Ireland, Malta, Hungary, and Greece are not included because of data limitations: no data for Hungary; no GALI indicator for Ireland; only ISCO 1D for Malta and Greece.

[2] The choice of such a time horizon is dictated by the assumption that it is difficult for employees to recall detailed information about the skills they used more than 2 years ago. This is the time horizon used in the EU-LFS for questions about skill use at work.

[3] "The variable reports on participation restriction through long-standing limitation (6 months or more) in activities that people usually do because of health problems, and its severity. It measures the respondent's self-assessment of whether he/she is limited (in “activities people usually do”) by any on-going physical, mental or emotional health problem, including disease or impairment, and old age. Consequences of injuries/accidents, congenital conditions, etc., are all included. Only the limitations directly caused by or related to one or more health problems are considered. In this context, disabilities are considered as being the consequence of health problems, and limitations due to disabilities are taken into account as being caused by health problems. Limitations due to financial, cultural or other none health-related causes should not be taken into account.” (Eurostat, 2021, p. 239).

population[4] (9.7% and 10.4% compared to 12.6%) (Figure 1). Groups of countries differ concerning the share of individuals with health limitations, ranging from 19.3% in the Nordic countries to 8.7% in the Southern and 8.3% in the CEE countries (Figure 1). These differences highlight the potential limitations of using self-reported health indicators in international comparisons, as also noted in the literature (Berger et al., 2015). The high values observed in the Nordic countries may reflect better diagnostic quality, greater health awareness, or differing expectations of what constitutes a healthy life. However, since our analysis focuses on the relationship between health, skills, and labour market attachment within country groups, this represents only a minor limitation.

Figure 1 The share of people with health limitations in the general population, the population of current and former employees, and among current employees (25-54 years old)



Source: Own calculations based on 2022 EU-LFS ad hoc module data. The general population is defined here as all individuals aged 25-54 regardless of labour market status. The population of current and former employees consists of employees and former employees who left their last employment within the last 24 months. Sample sizes: all individuals (N=239 419), employees and former employees (N=187 806), and employees (N=176 239).

The advantage of using the EU-LFS Job Skills ad hoc module is that the detailed questions on skill use at work were asked not only to current employees but also to former employees who stopped working in the last two years, allowing us to investigate the role of skills in weak labour market attachment of individuals with health limitations. We use measures of (i) cognitive skills (reading and calculating), (ii) social skills (internal communication and external communication), (iii) digital skills (work on digital devices), and (iv) manual skills (physical strength and dexterity) used in the workplace[5]. We first standardise each item within the current and former employee

[4] The general population is defined throughout the article as all individuals aged 25-54 regardless of their labour market status.

[5] For example, the question regarding the use of reading skills for current employees is phrased as follows: „How much time do you spend reading work-related manuals and technical documents in your main

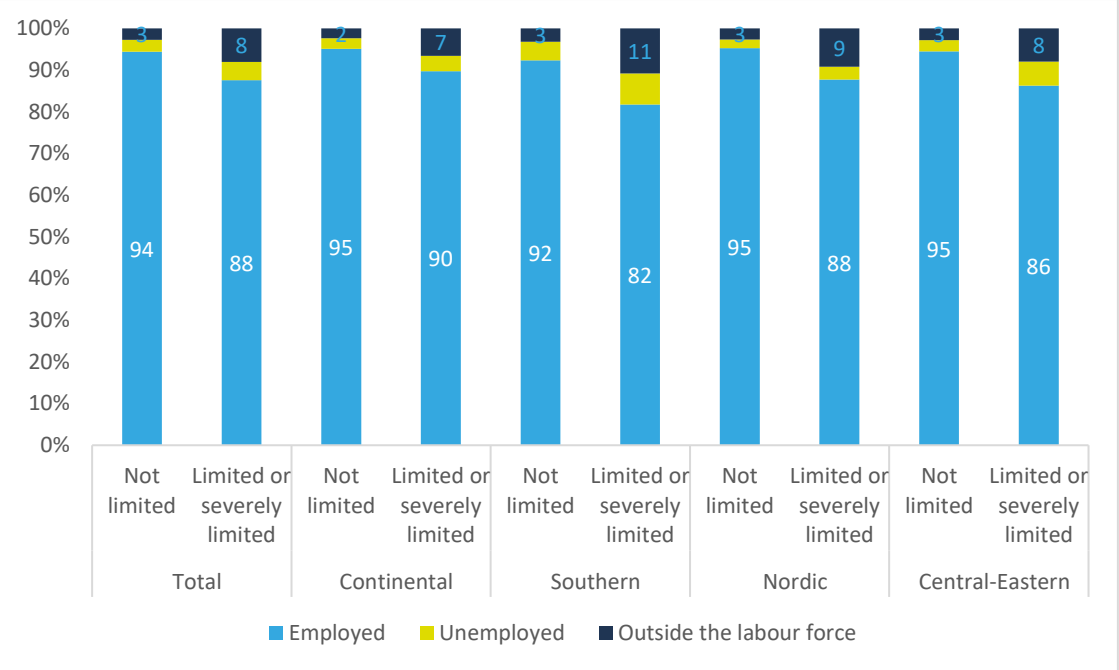
population and then construct the skill measures by averaging the corresponding items. Finally, we standardise each skill measure.

We use the International Labour Organisation (ILO) definitions of labour market status and time-related underemployment implemented in the EU-LFS. Underemployment is defined as the willingness to work additional hours and being available to do so within two weeks. There is no official definition of overemployment. We define overemployment as the willingness to work fewer hours than one's usual working hours in the main job and the secondary job (if applicable).

2.2 Descriptive statistics

This section provides descriptive statistics of labour market attachment indicators of interest. People with health limitations have lower employment rates than those without (88% vs 94%) and higher inactivity rates (8% vs 3%) (Figure 2). This is the case in all the regions, with the highest differences between the groups in the Southern countries (10 percentage points (pp.) in case of employment and 8 pp. in case of inactivity). As expected, the employment rates in the subpopulation of current and former employees shown in Figure 2 are higher than in the general population (Figure A1 in the Appendix), as the former consists of people with work experience.

Figure 2 Labour market status by health status and region in the population of current and former employees (25-54 years old)

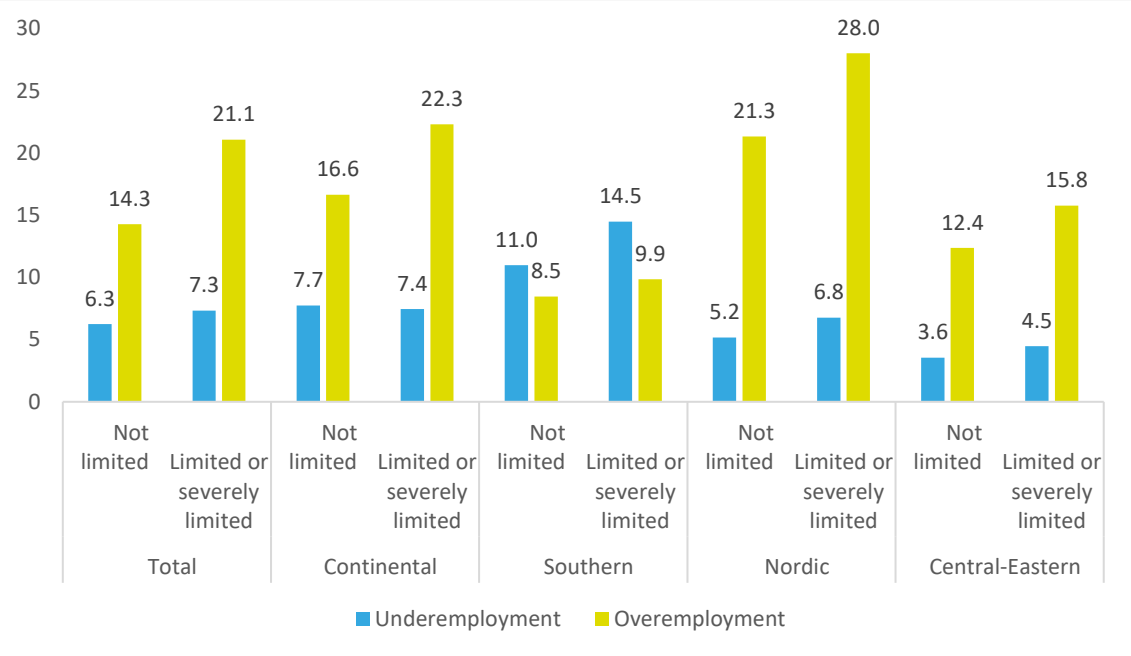


Source: Own calculations based on 2022 EU-LFS ad hoc module data. The population of current and former employees consists of employees and former employees who left their last employment within the last 24 months. Sample size: N= 87 806.

job?" with the answers: All or most of the working time / Half of the working time or slightly more / Some of the working time / Little of the working time / None of the working time.

As in earlier research, people with health limitations are more likely to be overemployed or underemployed, except in Continental countries where the underemployment rate does not vary by health status (Figure 3). This confirms more individualized requirements regarding working hours for people with health limitations. The overemployment rates are higher than underemployment rates for both groups, with and without health limitations. The underemployment rates exceed the overemployment rates only in the Southern countries. Considerable differences exist between the regions concerning the share of overemployed and underemployed. The highest overemployment rate is in the Nordic countries, while the lowest is in the Southern countries (28.0% compared to 9.9% among people with health limitations). This potentially reflects differences in levels of earnings between the groups of countries. The highest underemployment rate is in the Southern countries, while the lowest is in the CEE countries (14.5% compared to 4.5% among people with health limitations). In CEE countries, part-time work is uncommon (OECD, 2024), which reduces the potential for underemployment.

Figure 3 The share of underemployed and overemployed individuals by the health status and region among current employees (25-54 years old)



Source: Own calculations based on 2022 EU-LFS ad hoc module data. Sample size: N=176 239.

3. Methodology

The labour attachment differs between people with and without health limitations, as shown in the previous section. To quantify the role of skill use in the labour attachment of those with health limitations, we estimate separate models for each weak labour market attachment indicator. First, to study the probability of economic inactivity, we estimate logistic regression with the outcome variable equal to "1" if an individual is economically inactive and "0" otherwise. Second, to study the probability of unemployment among economically active individuals, we estimate logistic regression with the outcome variable equal to "1" if an individual is unemployed and "0" otherwise. Finally, to study the mismatch between worker's actual and preferred number of work hours, we estimate multinomial logistic regressions among employees where the outcome has values: overemployed, matched, and underemployed. The sample consists of individuals aged 25-54 who are employed either currently or have been employed within the last 24 months in the case of economic inactivity and unemployment and those aged 25-54 who are employed in the case of working hours mismatch.

All three models have the form:

$$\boldsymbol{Y_i = \beta_0 + \beta_1 H_i + \beta_2 S_i + \beta_3 H_i * S_i + \beta_4 ISCO_i + \beta_5 X_i + \alpha_c + A_i * \alpha_c + \varepsilon_i} \qquad (1)$$

where, $\boldsymbol{Y_i}$ is the outcome variable described above for each model; H_i is the health limitations indicator equal to "1" if an individual has health limitations and equal to "0" otherwise; S_i is a vector of individual skills used at work: cognitive, social, digital, and manual (in the current or last job if an individual is not in employment); $ISCO_i$ is the occupation of an individual *i* (in the current or last job if an individual is not in employment) measured by ISCO 2-digit classification; X_i is a vector of demographic characteristics of individual *i*; α_c are country fixed effects, and A_i denotes age group of individual *i*. The standard errors are robust. Interactions between health status and skill use are included to determine whether skills moderate the effect of health status on labour market attachment. Interactions between country fixed effects and individual's age group are included to account for possible differences in age structure between countries, which may influence the frequency of declared health limitations.

Different sets of independent variables are included. The baseline specification controls for demographic characteristics (gender, three age groups, marital status, parental status (children under 15 living in the same household), a dummy for tertiary education, migrant, migrant 2nd generation), country dummies, interactions between age groups and country dummies, and health limitations. We use extended migration proxies as there is evidence of lower educational attainment and worse labour market outcomes of second-generation migrants in comparison to their native-born peers (OECD 2010, 2017).

The second specification adds 38 occupation dummies (International Standard Classification of Occupations 2008; ISCO-08). This allows us to analyse the effects of skills within occupations with potentially more actionable implications.

The third specification adds measures of skill use. The full specification includes interactions between health limitations and skill-use indicators. The change in health limitations marginal effect between specifications (1) and (2) reflects the extent to which an individual's health status affects his or her selection into occupations. The change in health limitations marginal effect between specifications (2) and (3) indicates a possible mediation effect.

We include 25 European countries in the analysis, assigning equal weights to each. The full models are estimated for a pooled sample (all European countries in our sample) and four country groups separately, which is in line with previous research that found substantial differences in the effects of health on labour market outcomes by country groups. We classify the European countries into four groups: the Continental (Austria, Belgium, Switzerland, Germany, France, Luxembourg, the Netherlands), the Southern (Cyprus, Italy, Portugal, Spain), the Nordic (Denmark, Finland, Norway, Sweden), and the Central and Eastern European (Bulgaria, Czechia, Estonia, Croatia, Lithuania, Latvia, Poland, Romania, Slovenia, Slovakia). The Anglo-Saxon model is not represented due to lack of data.

In the main specification, we use the health limitations indicator, which includes merged categories of severely limited and limited individuals because of a low incidence of severe limitations. As a sensitivity check, we also estimate the full model with an alternative indicator of health limitations: we exclude persons with severe health limitations and concentrate on moderate health limitations.

In our analyses, the information about skill use and occupations of individuals concerns the current job if they are employed and the last job if they are unemployed or inactive and left their last employment within 24 months. This setup requires two assumptions: (i) that individuals not employed still have the skills they used in their last job and (ii) that people with health limitations currently employed have not switched to less demanding jobs because of health limitations. While the former assumption cannot be checked, there is some evidence for the latter assumption in the literature: Heinesen et al. (2018) find no effects of cancer on the probability of moving to different occupations, plants, or industries or on the job characteristics of those who remain employed.

4. Results

4.1 Economic inactivity and unemployment

Health limitations are related to a higher probability of economic inactivity in the total sample of countries and the country groups (Table 1). On average, persons with health limitations have a 4.8 p.p. higher probability of inactivity (Table 1, column (4)). This result differs between the country groups, with the biggest effect of health limitations in the Southern countries (7.5 p.p.) and the smallest in the Nordic (3.8 p.p.). The former are the countries with one of the lowest share of people declaring health limitations, while the latter has the highest share of people with health limitations (Figure 1). Predicted probabilities of inactivity from the full specification in our sample of current employees and former employees who left their last employment within 24 months are shown in Table 2.

Next, we compare the effects of health limitations on economic activity in four specifications, adding controls for occupations, skills indicators, and skills interacted with health limitations stepwise to our baseline specification (Table 1). Adding controls for occupations to the baseline specification reduces the effect of health limitations by around 10%, with a reduction of 30% in Nordic, 10% in CEE, and no reduction in Continental and Southern countries. The latter result suggests no selection into occupations based on health status in Continental and Southern countries. Adding skills and their interactions with health status does not change the marginal effects of health status on inactivity.

Finally, we show that the effect of health limitations on inactivity differs by the individual skill use for digital, cognitive, and social skills but not manual skills (Table 3). The probability of inactivity among persons with health limitations remains mostly stable despite higher cognitive skill use, while their probability of inactivity is lower the higher their social and digital skill use (Figure 4). In the case of high digital skill use (2 SD above the mean), the probability of inactivity is almost the same for persons with and without health limitations.

Table 1 Marginal effects of health limitations on economic inactivity by country groups

	Demography	(1) + ISCO 2 digits	(2) + skills	(3) + skills # health status
	(1)	(2)	(3)	(4)
Total sample	0.056**	0.051**	0.049**	0.048**
	(0.003)	(0.003)	(0.003)	(0.003)
N	187806	186516	183922	183922
Continental	0.046**	0.044**	0.042**	0.041**
	(0.003)	(0.003)	(0.003)	(0.003)
N	80668	79912	77813	77813
Southern	0.081**	0.077**	0.075**	0.075**
	(0.010)	(0.009)	(0.009)	(0.010)
N	36550	36449	36215	36215
Nordic	0.059**	0.043**	0.039**	0.038**
	(0.006)	(0.005)	(0.005)	(0.005)
N	24999	24565	24359	24359
Central-Eastern	0.055**	0.049**	0.048**	0.048**
	(0.008)	(0.007)	(0.007)	(0.007)
N	45589	45490	45435	45435

Note: The sample comprises current and former employees who left their last employment within 24 months. Controls included in the column (1) are: gender, age groups, parental status, a dummy for tertiary education, migrant, migrant 2nd generation, country dummies, interactions between age groups and country dummies, and health limitations. Robust standard errors. ** p<.01, * p<.05
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Table 2 Predicted probabilities of inactivity depending on health limitations and country group

	Total sample	Continental	Southern	Nordic	Central-Eastern
Overall	0.031**	0.030**	0.037**	0.028**	0.031**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Not limited	0.026**	0.024**	0.032**	0.021**	0.028**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Limited	0.075**	0.065**	0.108**	0.058**	0.076**
	(0.003)	(0.003)	(0.010)	(0.005)	(0.007)
N	183922	77813	36215	24359	45435

Note: The sample comprises current and former employees who left their last employment within 24 months. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)). ** p<.01, * p<.05.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Table 3 Marginal effects of health limitations and skills on inactivity

	Total sample	Continental	Southern	Nordic	Central-Eastern
Limitations	0.048**	0.041**	0.075**	0.038**	0.048**
	(0.003)	(0.003)	(0.010)	(0.005)	(0.007)
Digital	-0.009**	-0.008**	-0.009**	-0.015**	-0.008**
	(0.001)	(0.002)	(0.003)	(0.003)	(0.002)
Digital X Limited	**	*n.s.*	*	*n.s.*	*n.s.*
Manual	0.001	0.002*	0.004**	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Manual X Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Cognitive	-0.002	0.001	-0.005	0.001	-0.007**
	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
Cognitive X Limited	*	*n.s.*	*n.s.*	*n.s.*	**
Social	-0.002*	-0.001	0.000	-0.003	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Social X Limited	**	**	*n.s.*	*n.s.*	*
N	183922	77813	36215	24359	45435

Note: The sample comprises current and former employees who left their last employment within 24 months. Results from the specification include all control variables, skills, and skills in interaction with health status (Table 1, column (4)). All predicted probabilities significantly differ from zero unless indicated otherwise. ** p<.01, * p<.05, n.s. – not significant.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

The negative relationship between digital skills use and the probability of inactivity among persons with health limitations is present in all the country groups but statistically significant in the Southern countries only (Figure 5). Among persons with health limitations in Southern countries, persons whose digital skills use is 1 SD (standard deviation) below the average have over two times the predicted probability of inactivity than persons with digital skills use 1 SD above the average (14% versus 6%).

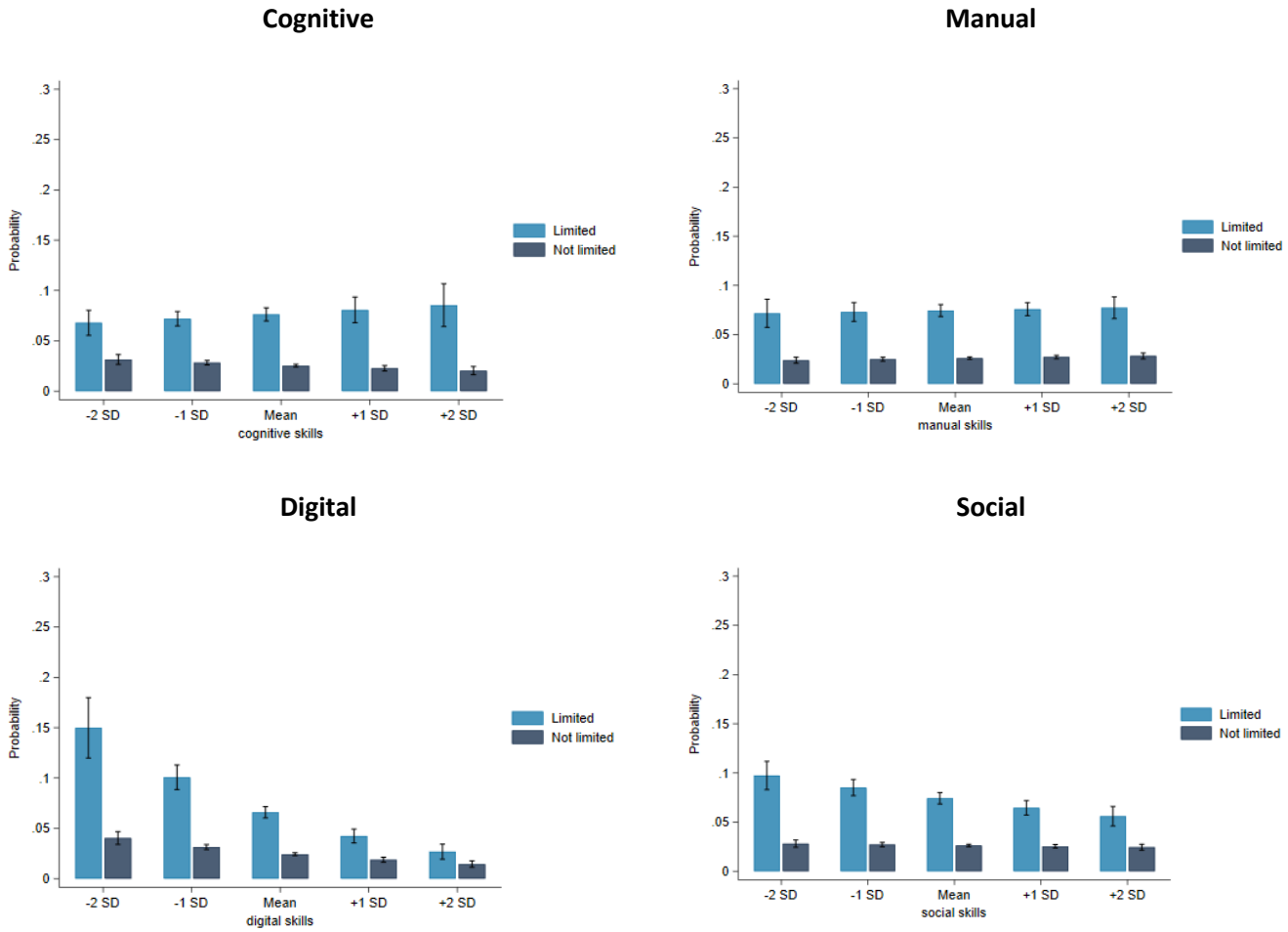
The CEE countries drive the positive relationship between cognitive skills use and the probability of inactivity among persons with health limitations. In other country groups, the probability of inactivity does not depend on cognitive skills use (Figure 6). In CEE, more intensive use of cognitive skills correlates with a lower probability of inactivity, but only in the case of persons without health limitations. Contrastingly, in other country groups, the probability of inactivity remains mostly stable for different levels of cognitive skill use.

In the case of social skills use, the negative relationship between skill use intensity and inactivity among persons with health limitations is present in the CEE and Continental countries (Figure 7). Among persons with health limitations in these groups of countries, persons with social skills

1 SD below the average have a predicted probability of inactivity of 8%, while persons with digital skills 1 SD above the average of 5%.

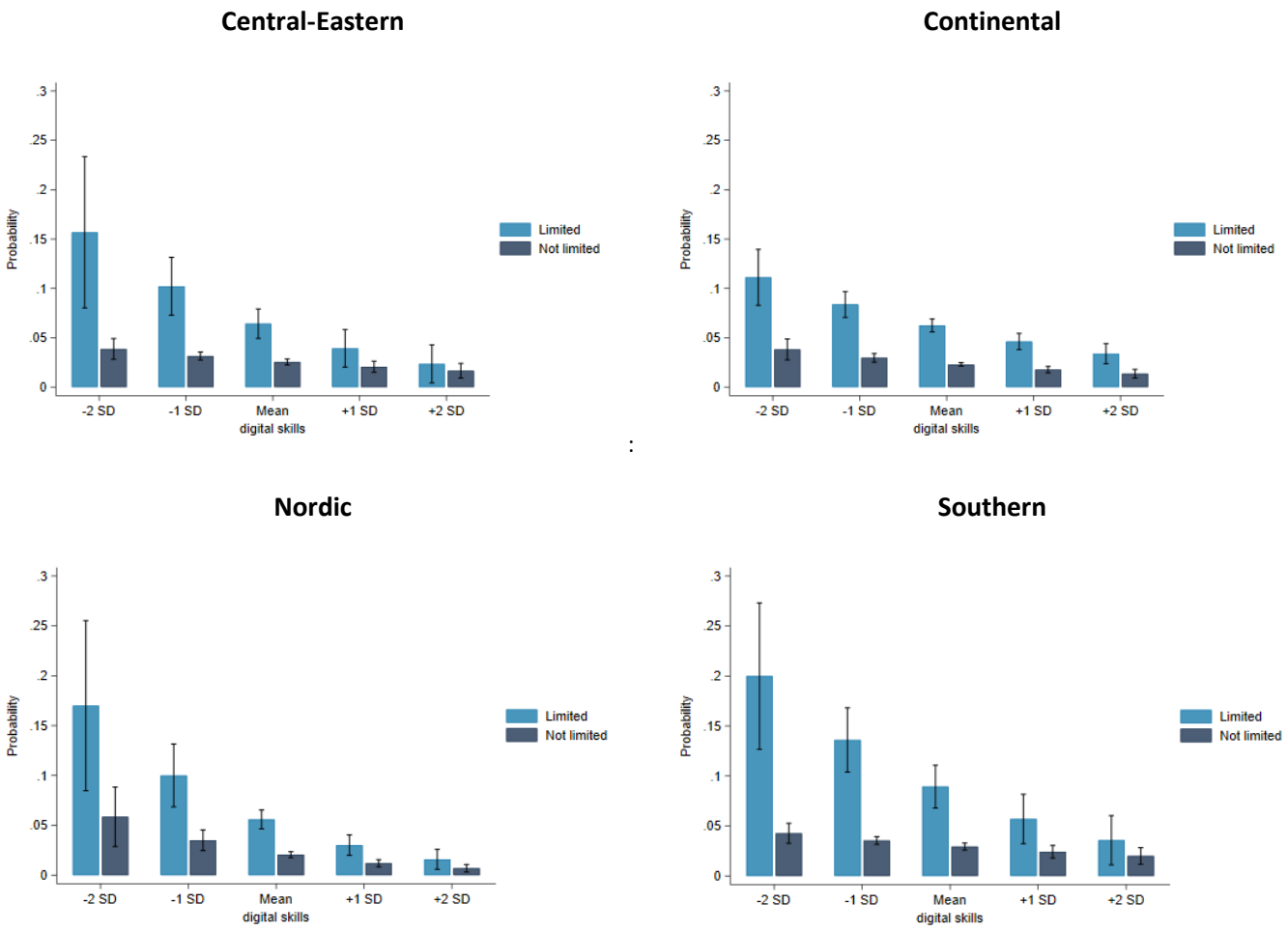
Health limitations are also related to a higher probability of unemployment in the total sample of countries and the country groups (Table A1 in the Annex). On average, persons with health limitations have a 1.7 pp. higher probability of unemployment. This effect differs between the country groups, with the biggest effect of health limitations on the probability of unemployment in the Southern countries (2.9 pp.) and the smallest in the Nordic (0.8 pp.) (Table A1 in the Annex). Contrary to inactivity, the effect of health limitations on unemployment does not differ by individual skill use. As the focus of this text is on the interplay between health and skills, the results of unemployment models are included in the Annex (Table A1 and Figure A2).

Figure 4 Predicted probabilities of inactivity by health limitations and skill use levels, total sample



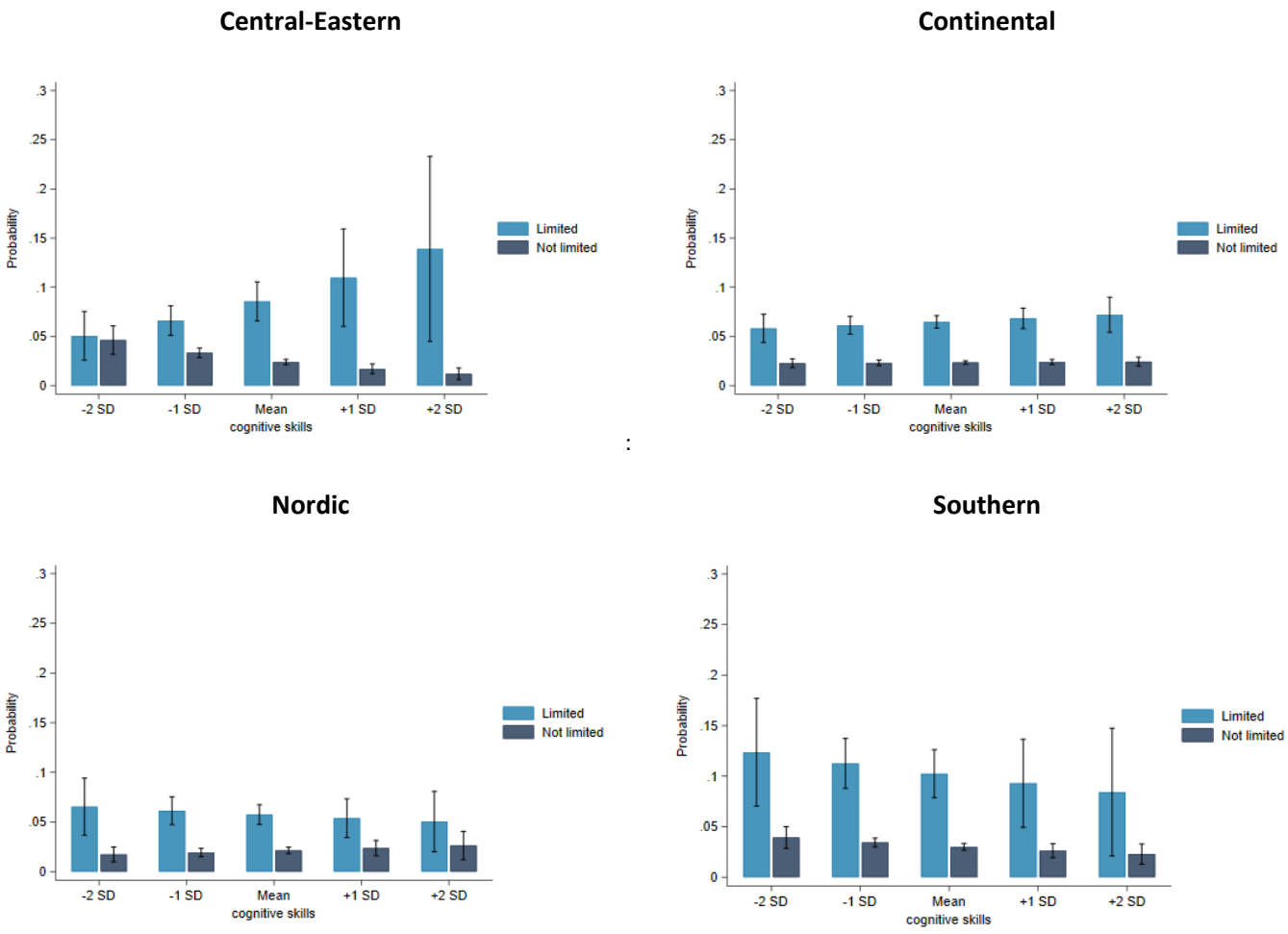
Note: The sample comprises current and former employees who left their last employment within 24 months. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)).
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 5 Predicted probabilities of inactivity by health limitations and levels of digital skills use in 4 country groups



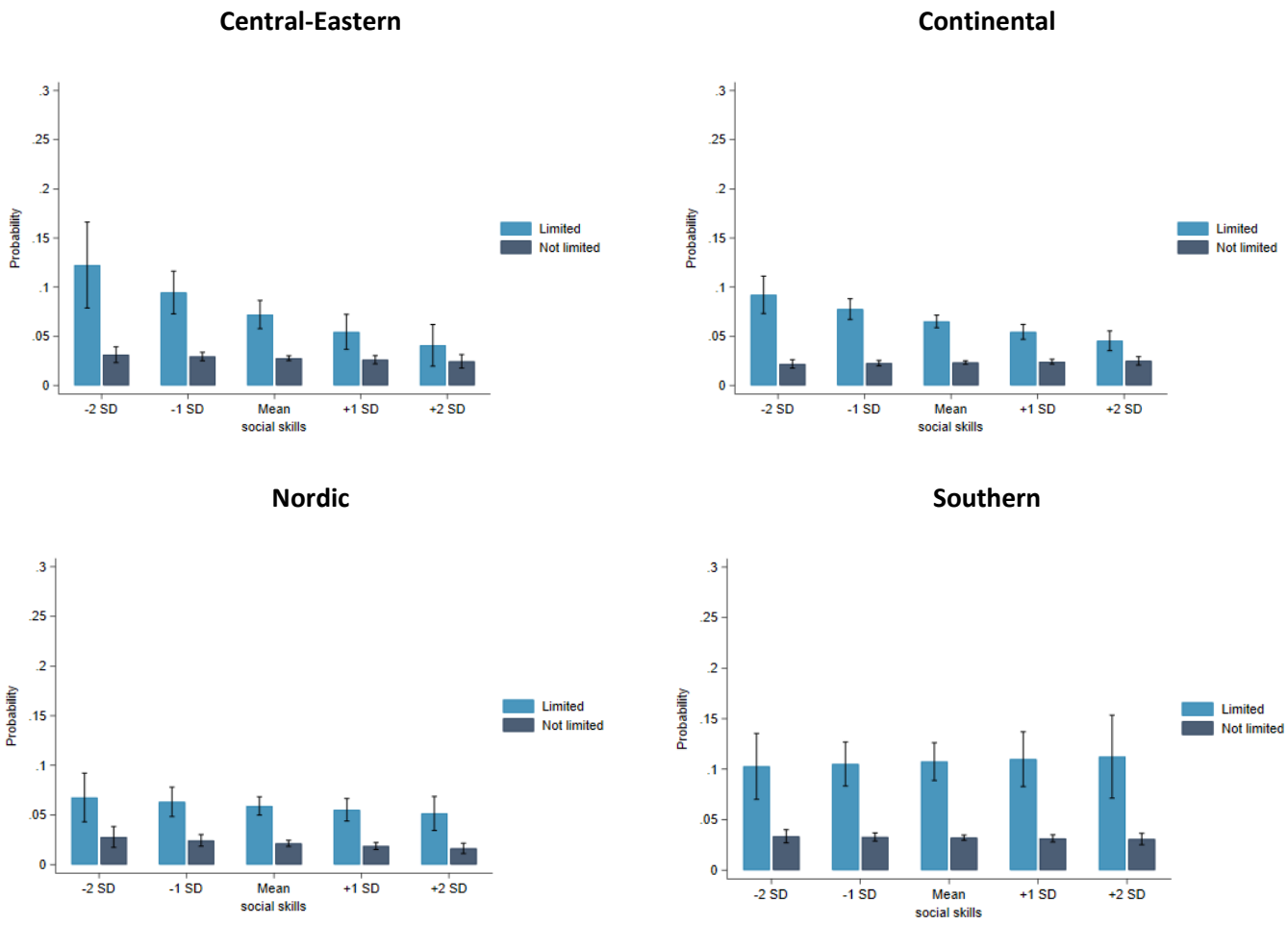
Note: The sample comprises current and former employees who left their last employment within 24 months. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)).
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 6 Predicted probabilities of inactivity by health limitations and levels of cognitive skill use in 4 country groups



Note: The sample comprises current and former employees who left their last employment within 24 months. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)).
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 7 Predicted probabilities of inactivity by health limitations and levels of social skills in 4 country groups



Note: The sample comprises current and former employees who left their last employment within 24 months. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)).
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

4.2 Mismatch between actual and preferred working hours

This section explores how skills moderate the relationship between health limitations and working hours mismatch. People experiencing health limitations are more likely to be overemployed in the total sample and across all country groups. This effect ranges from 3.2 p.p. in CEE to 5.2 p.p. in Continental countries (Table 4, model [4]). In the case of underemployment, the relationship is not that uniform. Health limitations increase the chances of underemployment only in CEE (by 1.7 p.p). All in all, these results are in line with previous literature (Antal et al., 2024; Pagan, 2018) where the relationship between health limitations and underemployment is weaker than with overemployment.

Adding controls for occupations to the baseline specification increases the effect of health limitations on overemployment by 10-15% in the total sample and all country groups except for Southern countries (Table 4, models [1] and [2]). This implies that when we compare people within occupations working in similar conditions, people with health limitations feel overemployed even more. There are some regional differences. The increase in the effect of health limitations on overemployment ranges from 5% (Southern) to 18% (Continental). In the case of underemployment, the effect of health limitations within occupations is insignificant. Only in CEE do health limitations matter within occupations, increasing the probability of underemployment by 1.7 p.p. (Table 4, model [4]).

Next, we look at the moderation role of skills used at work. Digital skill use correlates positively with overemployment in all regions and negatively with underemployment in Southern and Nordic countries (Table 6). The probability of overemployment increases by 2.6 p.p. in the total sample and ranges between 1.6 p.p. (Southern) to 4.7 p.p. (Nordic). The effect on underemployment in the total sample amounts to 0.8 p.p., driven by Continental, at 0.8 p.p., and Nordic countries at 1.2 p.p. Digital skill use does not moderate the effect of health limitations (Table 6). That implies that the higher probability of being overemployed and underemployed among individuals with health limitations does not depend on their use of digital skills.

Manual skill use is related to both underemployment and overemployment. The probability of underemployment is increased by 0.3 p.p. with each SD in the whole sample. This effect is driven by Nordic countries, where it reaches 0.6 p.p. The probability of overemployment is increased overall by 1.1 p.p. This effect is significant in Continental, CEE, and Nordic countries at 0.9-2.0 p.p. (Table 6).

Employees with health limitations who use manual skills often are similarly likely to be underemployed, and some may even face overemployment to a greater degree than their counterparts without health limitations confirming that manual work is more challenging for persons with health limitations (Table 6, Figure 9). Manual skill use moderates the influence of health limitations on the probability of underemployment in the whole sample. The more manual skills are used by workers with health limitations, the lower their probability of

underemployment. For workers without health limitations, the probability of underemployment slightly increases (Figure 8). This pattern of results is prominent in CEE countries. Additionally, in CEE countries the probability of overemployment increases with the use of manual skills more for people with health limitations, by 9 p.p., compared to 3 p.p. among workers without health limitations (Figure 9).

Cognitive skill use contributes to underemployment in the whole sample and Continental countries, at 3-5 p.p. increase of probability of underemployment (Table 6).

Using cognitive skills contributes to both overemployment and underemployment in workers with health limitations, but not in healthy workers. The interaction of cognitive skill use with health limitations is also significant for the whole sample. While the probability of overemployment increases by 2 p.p. with the more cognitive skills are used by people with health limitations, it remains the same among the population with no limitations. The pattern is the same for underemployment, with a 3 p.p. increase among workers with health limitations (Figure 8). The effect for underemployment is driven mostly by Continental countries (Figure 10).

Social skills correlate with overemployment in Nordic and Southern countries, but the sign of this relationship differs by region. In the Southern countries, 1 SD increase in the use of social skills decreases the probability of being overemployed by 0.7 p.p., while in the Nordic countries, they add 1.0 p.p. to the probability of being overemployed (Table 6).

Employees with health limitations, but not healthy workers, are less likely to be underemployed if they use social skills often in their jobs. Social skills are related to underemployment only through interaction with health limitations in Nordic countries. Among people with no health limitations, the probability of underemployment is stable at 5%, while for people with health limitations, it drops the more they use social skills at work, from 8% at 1 SD below the mean to 5% at 1 SD above the mean. There is no such moderation in the case of overemployment, however, where the probability of overemployment increases by 2 p.p. for both groups (Figure 11).

As a sensitivity check, we compare these results to those obtained on a sample where observations with severe health limitations were dropped (N=3 632). This follows a suggestion from the literature that workers with moderate limitations tend to be overemployed, while workers with severe limitations are more likely to be underemployed (Antal et al., 2024). The results remain robust (Figure 12). As we find a stronger relation between health limitations and overemployment than underemployment, this partially confirms the results from Antal et al. (2024). Because of a small sample of persons with severe limitations, we cannot verify if the relationship with underemployment is stronger in this group.[6]

[6] Full results are presented in Table A2 and Figure A3 in the Annex.

Table 4 Marginal effects of health limitations on underemployment and overemployment by country groups

	Underemployment				Overemployment			
	Demography	'(1) + ISCO 2 digits	'(2) + skill-use	'(3) + skill-use X limited	Demography	'(1) + ISCO 2 digits	'(2) + skill-use	'(3) + skill-use X limited
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Total sample	0.007*	0.005	0.004	0.006	0.034**	0.038**	0.038**	0.038**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
N	176239	175206	172838	172838	176239	175206	172838	172838
Continental	-0.002	-0.004	-0.005	-0.003	0.044**	0.052**	0.052**	0.052**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)	(0.007)	(0.007)
N	76354	75628	73633	73633	76354	75628	73633	73633
Southern	0.018	0.015	0.015	0.019	0.043**	0.046**	0.047**	0.045**
	(0.011)	(0.011)	(0.011)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
N	33041	33041	32838	32838	33041	33041	32838	32838
Nordic	0.010*	0.008	0.007	0.009	0.030**	0.034**	0.034**	0.034**
	0.025	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)	(0.008)
N	23740	23521	23387	23387	23740	23521	23387	23387
Central-Eastern	0.011	0.011	0.011	0.017*	0.028*	0.029**	0.029**	0.032**
	(0.008)	(0.008)	(0.008)	(0.009)	(0.011)	(0.011)	(0.011)	(0.011)
N	43104	43016	42980	42980	43104	43016	42980	42980

Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise. ** p<.01, * p<.05.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Table 5 Predicted probabilities of underemployment and overemployment depending on health limitations and country group

	Underemployment					Overemployment				
	Total sample	Continental	Southern	Nordic	Central-Eastern	Total sample	Continental	Southern	Nordic	Central-Eastern
Overall	0.064**	0.078**	0.112**	0.054**	0.036**	0.149**	0.174**	0.086**	0.238**	0.126**
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Not limited	0.063**	0.079**	0.111**	0.052**	0.036**	0.145**	0.166**	0.084**	0.232**	0.124**
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)
Limited	0.069**	0.075**	0.129**	0.062**	0.053**	0.183**	0.218**	0.129**	0.270**	0.156**
	(0.003)	(0.004)	(0.012)	(0.004)	(0.008)	(0.004)	(0.007)	(0.013)	(0.008)	(0.011)
N	172838	73633	32838	23387	42980	172838	73633	32838	23387	42980

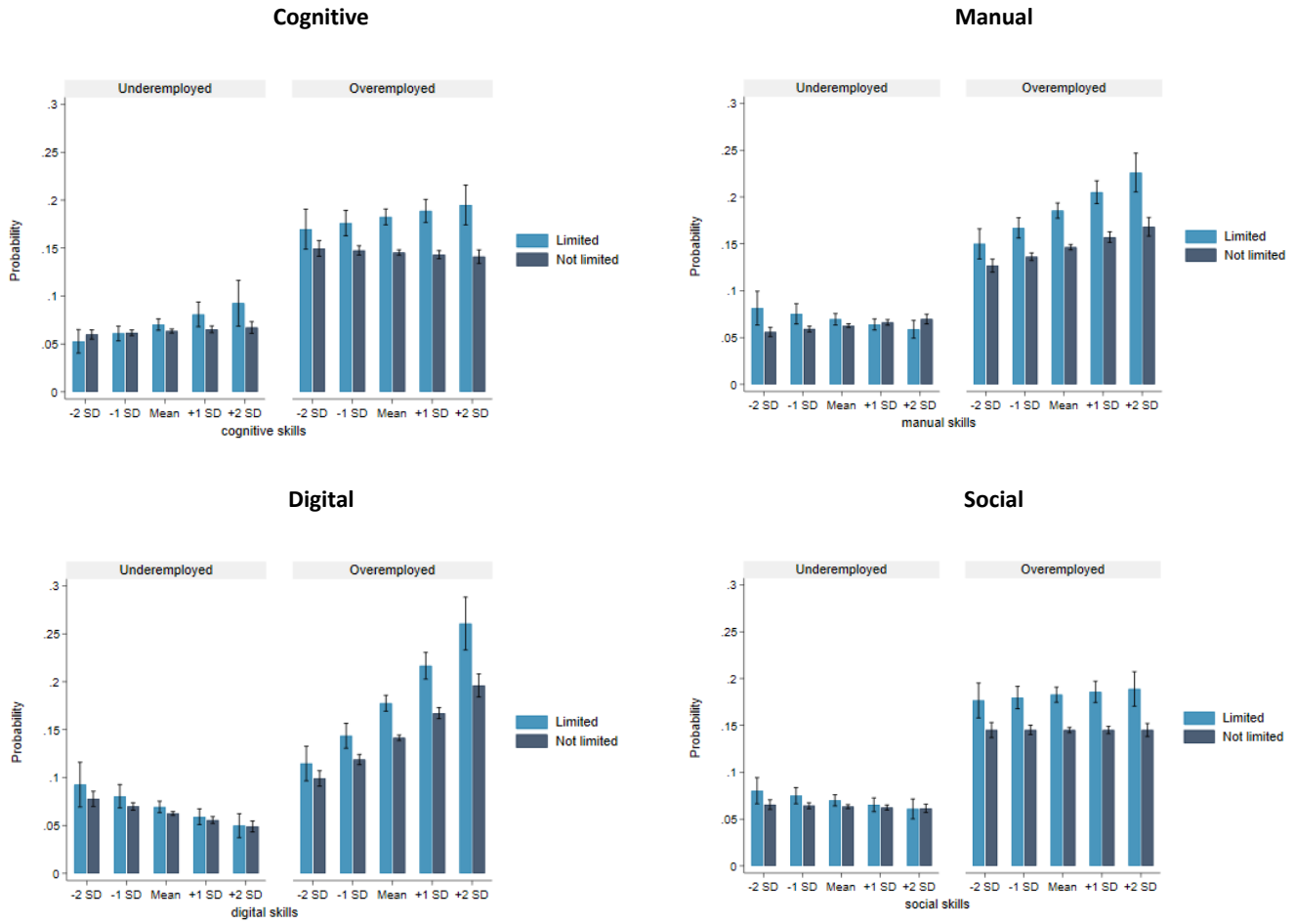
Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise. ** p<.01, * p<.05.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Table 6 Marginal effects of health limitations and skills on underemployment and overemployment

	Underemployment					Overemployment				
	Total sample	Continental	Southern	Nordic	Central-Eastern	Total sample	Continental	Southern	Nordic	Central-Eastern
Limited	0.006	-0.003	0.019	0.011*	0.017*	0.038**	0.052**	0.045**	0.042**	0.032**
	(0.003)	(0.004)	(0.012)	(0.005)	(0.009)	(0.004)	(0.007)	(0.013)	(0.009)	(0.011)
Digital	-0.008**	-0.008**	-0.008	-0.011**	-0.003	0.026**	0.035**	0.016**	0.046**	0.017**
	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.005)	(0.005)
Digital # Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Manual	0.003*	0.002	0.006	0.006**	0.001	0.011**	0.009**	-0.004	0.019**	0.015**
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Manual # Limited	**	*n.s.*	*n.s.*	*n.s.*	*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*
Cognitive	0.003*	0.005**	-0.003	-0.001	0.002	-0.001	0.001	0.001	-0.001	-0.003
	(0.001)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Cognitive # Limited	*	**	*n.s.*	*n.s.*	*n.s.*	*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Social	-0.001	0.000	-0.004	-0.002	0.000	0.000	0.004	-0.007*	0.009*	-0.003
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Social # Limited	*n.s.*	*n.s.*	*n.s.*	**	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
N	172838	73633	32838	22624	42980	172838	73633	32838	22624	42980

Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise. ** p<.01, * p<.05, n.s. – not significant.
Source: Own calculations based on 2022 EU-LFS ad hoc module data

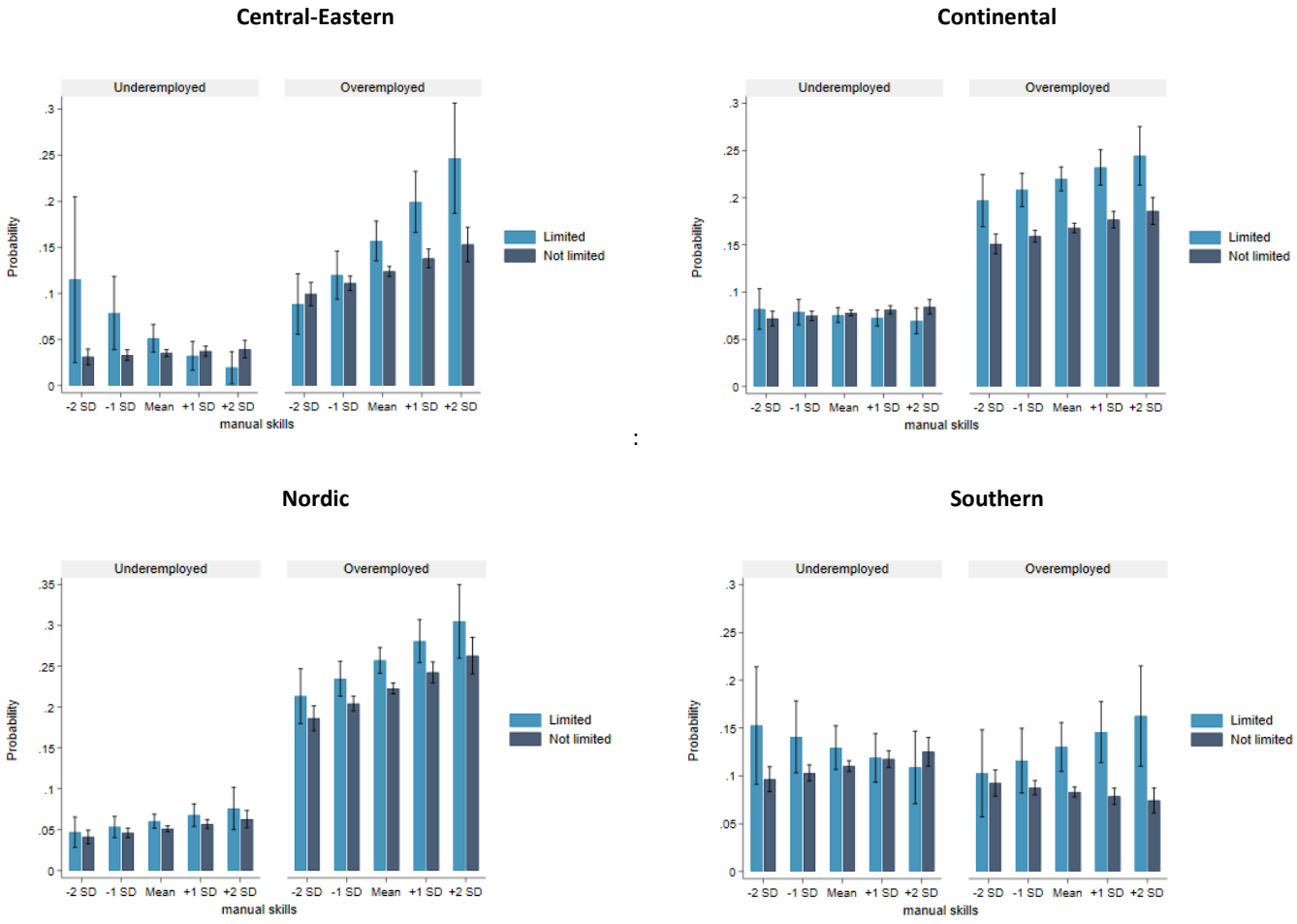
Figure 8 Predicted probabilities of underemployment and overemployment by health limitations and skill levels, total sample



Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise.

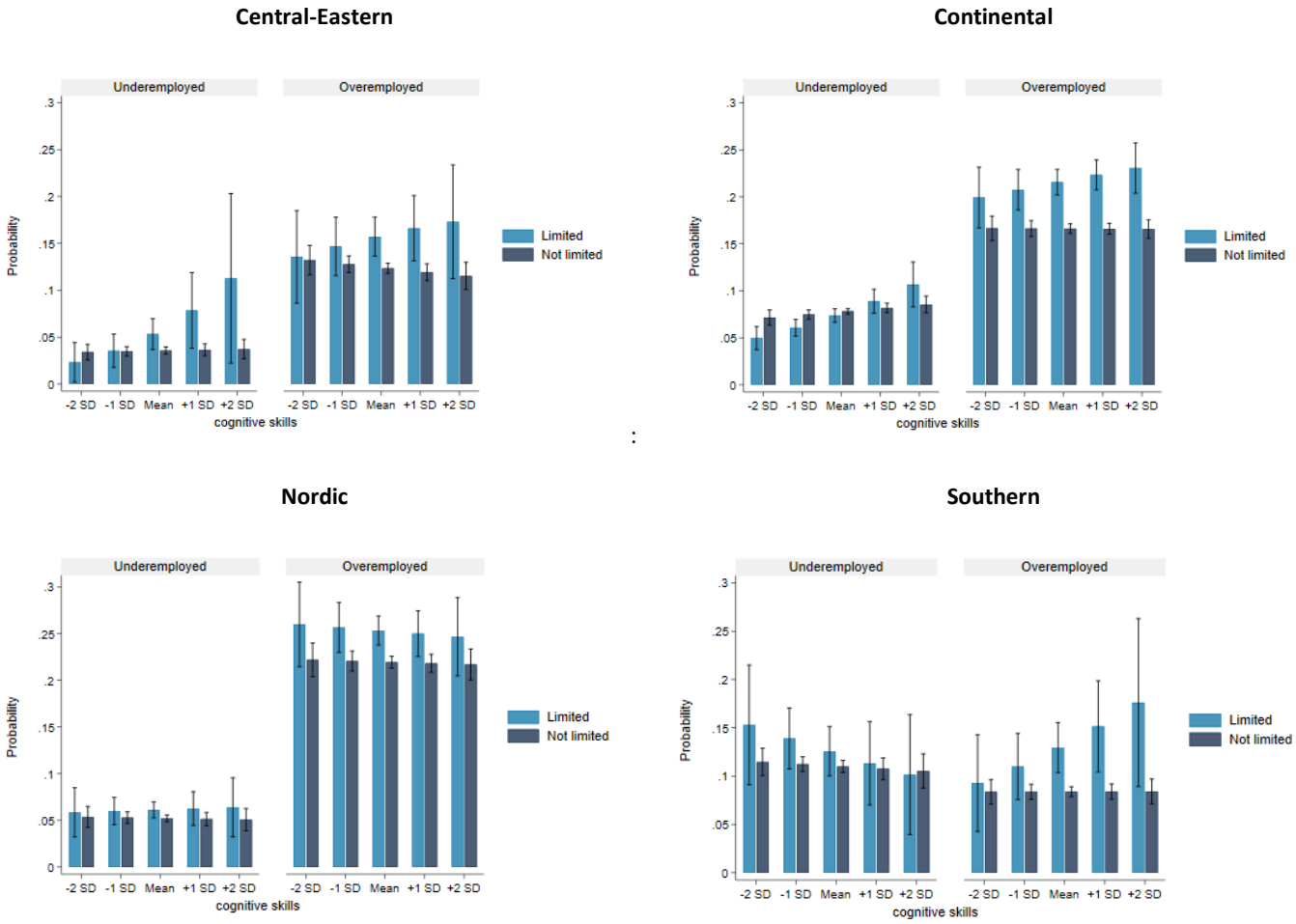
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 9 Predicted probabilities of underemployment and overemployment by health limitations and levels of manual skills in 4 country groups



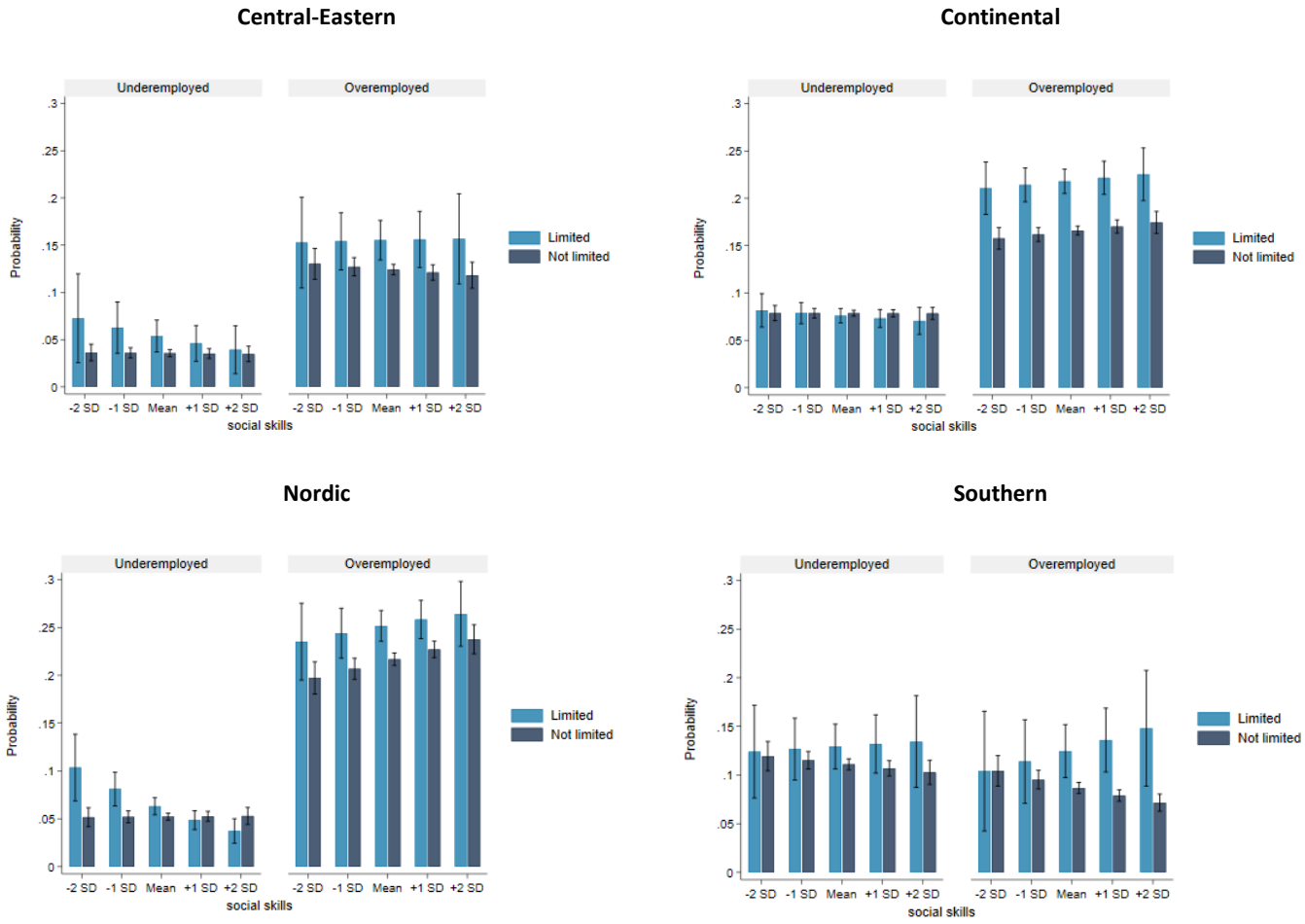
Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 10 Predicted probabilities of underemployment and overemployment by health limitations and levels of cognitive skills in 4 country groups



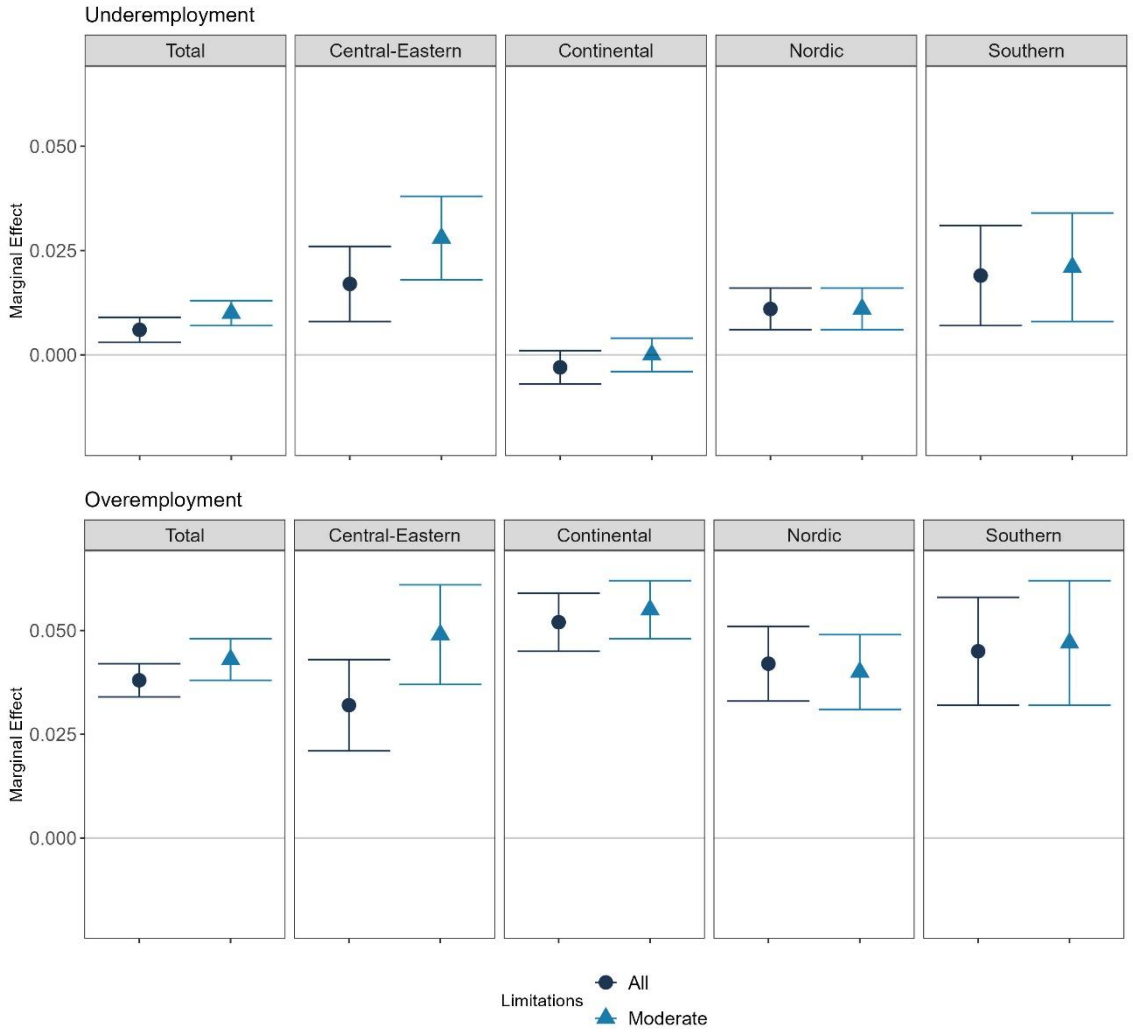
Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 11 Predicted probabilities of underemployment and overemployment by health limitations and levels of social skills in 4 country groups



Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. All predicted probabilities significantly differ from zero unless indicated otherwise.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure 12 The comparison of marginal effects of two alternative definitions of health limitations on underemployment and overemployment in the total sample and 4 country groups



Note: The sample comprises current employees. Results from the specification include all control variables, skills, and skills in interaction with health status. Vertical bars represent standard errors. "All limitations" refer to the definition of health limitations adopted in this paper (moderate and severe limitations analysed jointly as health limitations) while "moderate limitations" take into account only moderate limitations with observations with severe limitations dropped from the sample.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

5. Conclusions

This paper shows that the negative relationship between health limitations and labour market outcomes is weaker if individuals use specific skills more frequently. Social and digital skills moderate the influence of health limitations on the probability of inactivity. We found that the probability of inactivity among individuals with health limitations is lower in those using social and digital skills more often. In contrast to inactivity, the relationship between health limitations and unemployment is unrelated to an individual's skill use. Moreover, manual and cognitive skills moderate the influence of health limitations on the probability of underemployment. The more manual (cognitive) skills are used by workers with health limitations, the lower (higher) their probability of underemployment. Moreover, the more cognitive skills are used, the higher the probability of overemployment among people with health limitations.

A potential explanation for the positive relationship between digital skills and economic activity among persons with health limitations could be the possibility of remote work opened up for persons with digital skills. As persons with health limitations face barriers concerning entering, remaining in and progressing within employment, digital skills might enable them to work from home and thus overcome at least some of the barriers related to commuting, lack of flexibility, or a stressful work environment (Schur et al., 2020).

A mechanism behind the positive relationship between social skills and economic activity among persons with health limitations could be a better position for negotiations with employers as the demand for social skills increases (Deming, 2017). Individuals with better social skills might be able to negotiate flexible work arrangements, a prerequisite for starting or continuing work for some persons with health limitations.

More intensive use of cognitive skills is related to underemployment among workers with health limitations. One possible explanation is that, despite being able to perform cognitively demanding work, such workers face more barriers in the labour market compared to workers without health limitations. This is also the case in jobs that use other skills. These barriers might include not only taste-based discrimination but also the workers' need for additional accommodations or more flexible working arrangements.

At the same time, cognitive skills are positively associated with overemployment among workers with health limitations. Jobs where cognitive skills are intensely used, are often demanding on workers' time. As such, workers may remain without the time necessary to accommodate their health limitations, hence their dissatisfaction with the actual hours worked.

This study is not without limitations. First, the analysis of inactivity and unemployment concentrates on persons with some recent work experience because of the data availability. Therefore, the conclusions cannot be directly generalized to the general population. Second, for individuals in employment we have the measure of current skill use at work, but for those out of work, we rely on a lagged measure of skill use at a last job. Third, the data did not allow us to rule out endogeneity concerns, as the health measures and labour market outcomes are contemporaneous. Nonetheless, exploratory studies like this one extend our knowledge of the role of skills for labour market outcomes of persons with health limitations and can thus help design further research on the topic. Future studies could, therefore, concentrate on

investigating the causal mechanisms between skills and labour market attachment of persons with health limitations.

Our results indicate that some of the relationships under investigation are consistent across country groups, while others are specific to certain regions. Explaining the cross-country variation in the moderating role of skills among individuals with health limitations lies beyond the scope of this study. Future research could focus on identifying which aspects of the institutional context or social norms account for the observed regional differences. The results of our study have significant policy implications.

Our findings show that the labour market attachment of individuals with health limitations is strongly linked to their skills, even within occupations. This suggests that skill adjustments could improve their situation without requiring a change of occupation. Given the potentially limited opportunities for occupational adjustments available to individuals with health limitations, policies promoting digital and social skills could help mitigate the negative effects of health limitations on labour market participation.

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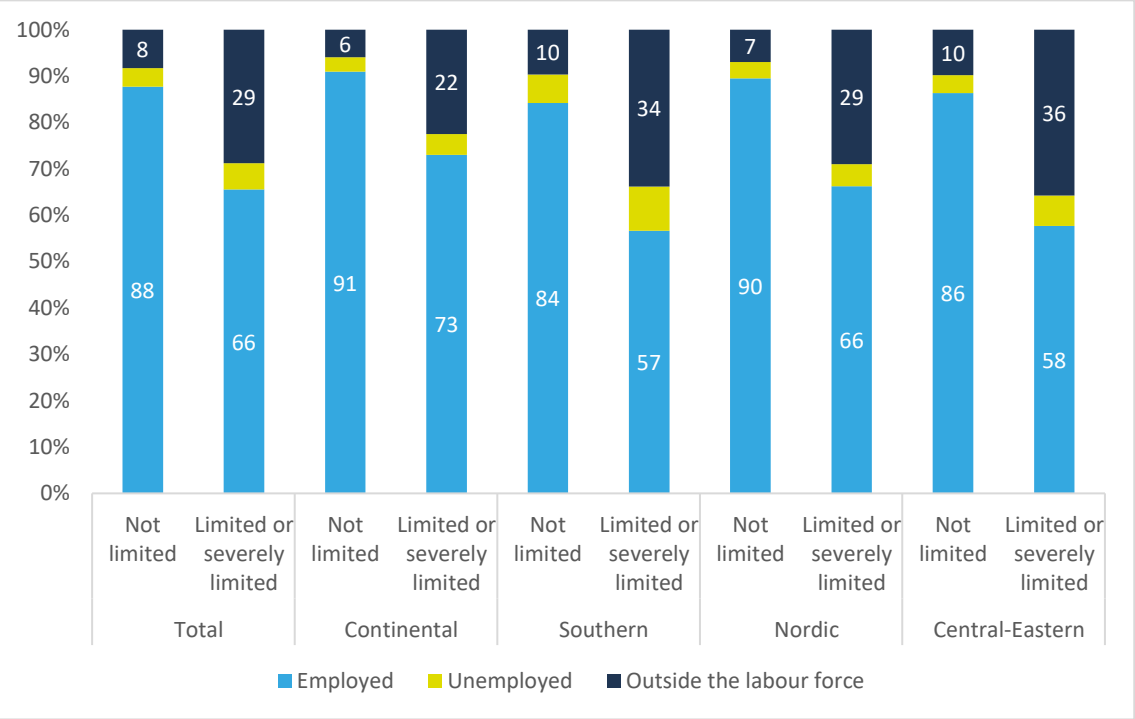
Annex

Figure A1 Labour market status by health status and region in the general population (25-54 years old)



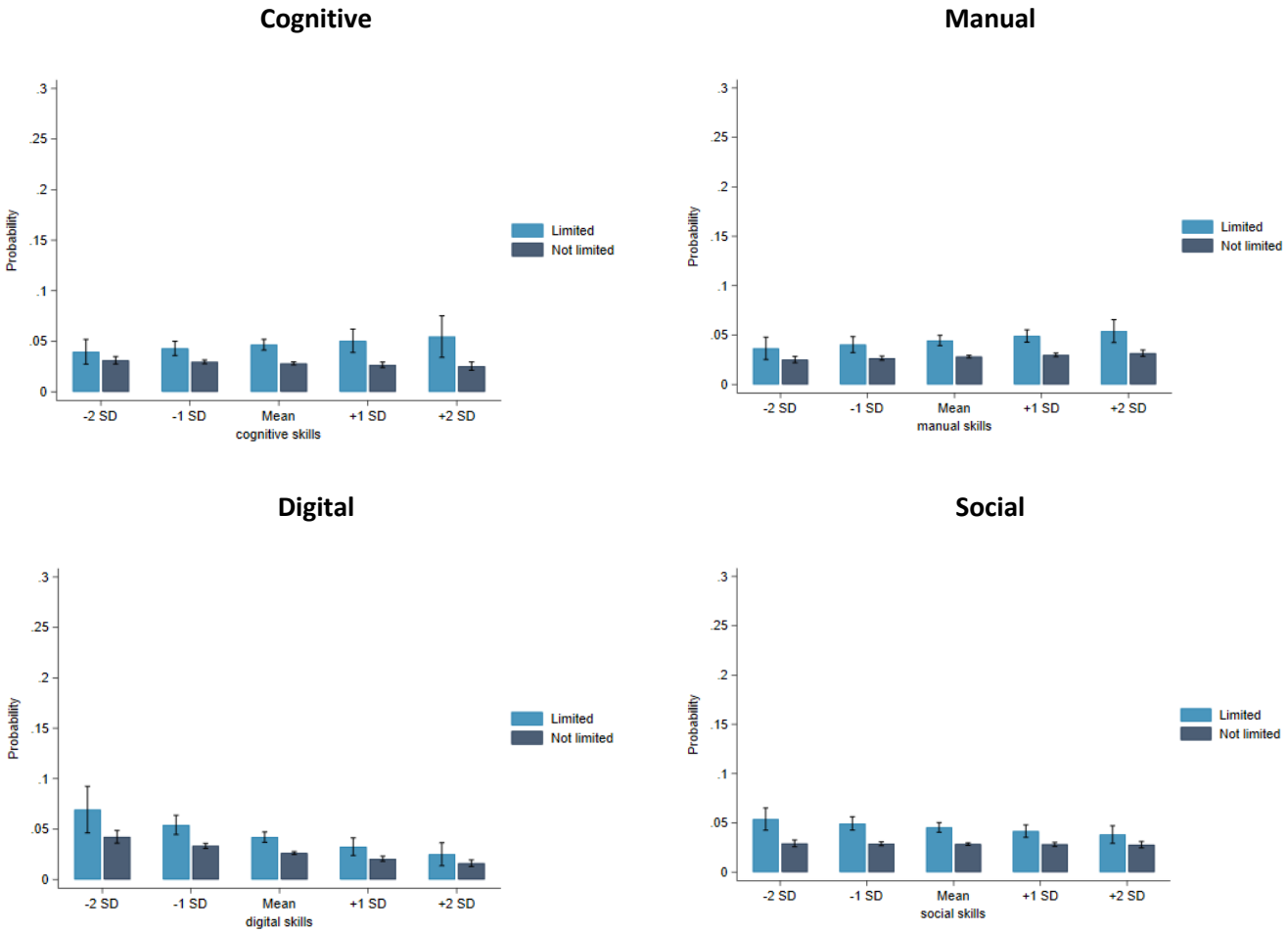
Source: Own calculations based on 2022 EU-LFS ad hoc module data. Sample size: N=239 419.

Table A1 Marginal effects of health limitations and skills on unemployment

	Total sample	Continental	Southern	Nordic	Central-Eastern
Limited	0.017**	0.014**	0.028**	0.008*	0.020**
	(0.003)	(0.003)	(0.008)	(0.003)	(0.006)
Digital	-0.007**	-0.008**	-0.004	-0.006**	-0.008**
	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)
Digital # Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Manual	0.002*	0.003**	0.005**	0.003	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Manual # Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Cognitive	-0.001	0.002	-0.004	-0.004*	-0.001
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)
Cognitive # Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Social	-0.001	-0.001	-0.002	-0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Social # Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
N	178030	75664	34580	23704	44051

Note: The sample consists of current and former employees who left their last employment within 24 months and are economically active. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)).** p<.01. * p<.05, n.s. – not significant.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure A2 Predicted probabilities of unemployment by health limitations and skill levels, total sample



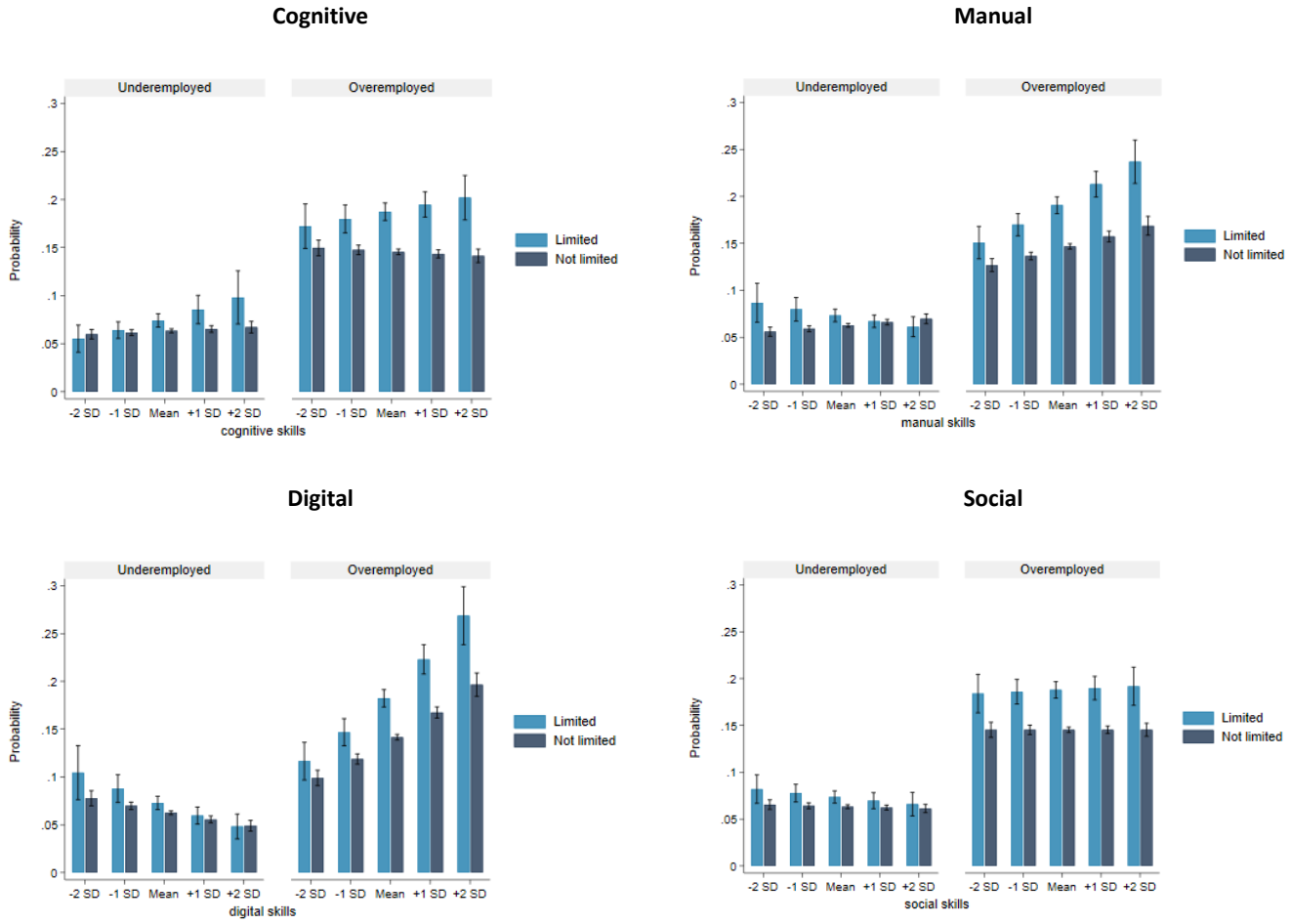
Note: The sample consists of current and former employees who left their last employment within 24 months and are economically active. Results from the full specification including all control variables, skills, and skills interacted with health status.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Table A2 Marginal effects of health limitations and skills on underemployment and overemployment, subsample with moderate health limitations only

	Underemployment					Overemployment				
	Total sample	Continental	Southern	Nordic	Central-Eastern	Total sample	Continental	Southern	Nordic	Central-Eastern
Limited	0.010**	0.000	0.021	0.011*	0.028**	0.043**	0.055**	0.047**	0.040**	0.049**
	(0.003)	(0.004)	(0.013)	(0.005)	(0.010)	(0.005)	(0.007)	(0.015)	(0.009)	(0.012)
Digital	-0.008**	-0.009**	-0.008	-0.011**	-0.005	0.026**	0.035**	0.016**	0.046**	0.019**
	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
Digital ## Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Manual	0.003*	0.002	0.006*	0.006**	0.003	0.011**	0.010**	-0.003	0.019**	0.015**
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Manual ## Limited	*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	**	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Cognitive	0.003**	0.005**	-0.003	-0.001	0.005*	-0.001	0.001	0.002	-0.002	-0.001
	(0.001)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Cognitive ## Limited	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*	*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
Social	-0.001	0.000	-0.004	-0.002	0.000	0.001	0.004	-0.007**	0.009*	0.000
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Social ## Limited	*n.s.*	*n.s.*	*n.s.*	*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*
N	170226	72184	32515	22901	43872	170226	72184	32515	22901	43782

Note: The sample consists of current and former employees who left their last employment within 24 months and are economically active. Results from the full specification including all control variables, skills, and skills interacted with health status (Table 1, column (4)). n.s. – not significant.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

Figure A3 Predicted probabilities of underemployment and overemployment by health limitations and skill levels, total subsample with moderate health limitations only



Note: The sample consists of current and former employees who left their last employment within 24 months and are economically active. Results from the full specification including all control variables, skills, and skills interacted with health status.
Source: Own calculations based on 2022 EU-LFS ad hoc module data.

PATHS 2 INCLUDE

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This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No Project 101094626. *Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. The European Union cannot be held responsible for them. The deliverable is under review by the European Commission*.

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