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Working Conditions in the Context of Global Value Chains and Routinisation: An Example of Polish Workers*

Warunki pracy w ramach globalnych łańcuchów wartości
i rutynizacji na przykładzie pracowników z Polski

Abstract

The paper aims to explore the linkages between global production fragmentation, routinisation and the well-being of workers in Poland. In particular, the focus is placed on the selected measures of working conditions, such as the social environment, work intensity, and working time quality to examine their dependence on involvement in international trade and the routinisation level. We merge individual data describing the working conditions and well-being of workers with sector-level data containing information on involvement in global production processes and occupational data on the job routinisation level. The findings reveal a moderate association between working conditions and global value chain (GVC) involvement among Polish workers. In more GVC-dependent sectors, workers receive lower remuneration on average. The relationship between GVC and other working conditions is significant, but the economic significance is marginal. Similarly, the routinisation of work is negatively correlated with wages and working conditions (except work intensity). The main contribution of this study is its multidimensional approach to analysing working conditions, which significantly expands existing evidence in the literature.

Keywords:

Poland, working conditions, production fragmentation, global value chain (GVC), routinisation

JEL classification codes:

F14, F16

Article history:

submitted: March 10, 2023

revised: June 6, 2023

accepted: July 10, 2023

Słowa kluczowe:

Polska, warunki pracy, fragmentaryzacja produkcji, GVC, rutynizacja

Kody klasyfikacji JEL:

F14, F16

Historia artykułu:

nadesłany: 10 marca 2023 r.

poprawiony: 6 czerwca 2023 r.

zaakceptowany: 10 lipca 2023 r.

Streszczenie

Tematem artykułu jest zbadanie powiązań między globalnymi procesami fragmentacji produkcji (GVC), rutynizacją pracy a dobrostanem pracowników w Polsce. W szczególności skupiono się na wybranych miernikach warunków pracy, takich jak otoczenie społeczne, intensywność pracy i jakość czasu pracy, w celu zbadania ich zależności od zaangażowania w handel międzynarodowy i rutynizacji. Połączone zostały indywidualne dane opisujące warunki pracy i dobrostan pracowników z danymi sektorowymi zawierającymi informacje o zaangażowaniu w globalne procesy produkcyjne. Wyniki wskazują na umiarkowany związek pomiędzy

* Funding source: Gdańsk University of Technology (DEC-3/2022/IDUB/IV.2/EUROPIUM) grant under the EUROPIUM Short-Term Outgoing Visits – “Excellence Initiative – Research University”.

warunkami pracy a zaangażowaniem w GVC wśród polskich pracowników. W sektorach bardziej zależnych od GVC pracownicy otrzymują średnio niższe wynagrodzenie. Ponadto, związek między GVC a innymi aspektami warunków pracy jest statystycznie istotny, jednakże w ujęciu ekonomicznym ma wymiar marginalny. Podobnie rutynizacja pracy jest ujemnie skorelowana z wynagrodzeniami i warunkami pracy (z wyjątkiem wskaźnika intensywności pracy). Najważniejszą zaletą przeprowadzonego badania jest wielowymiarowe podejście do analizy warunków pracy, co znacznie poszerza dotychczasowy stan wiedzy.

Introduction

Job quality is of high importance on the policy agenda. According to the Treaty on the Functioning of the European Union (TFEU), the promotion of employment and improved living and working conditions are among the important goals of the European Union [Eurofound, 2017: 12]. The area of workers' well-being is attracting increasing attention because of its direct association with social and economic performance. It is well known that good working conditions are beneficial for workers, employers and the whole society, and therefore create a win-win situation.

According to the latest report from the European Foundation for the Improvement of Living and Working Conditions (Eurofound), some Eastern European countries have caught up with the countries of Western Europe on selected aspects of working conditions, such as working time quality. Poland, against this background, has improved the dimension of job quality by 13% since 2020 [Eurofound, 2021: 19]. However, there is a strong disparity in the quality of working conditions, both across sectors and occupations [Eurofound, 2020: 1]. Moreover, the main drivers of change in the contemporary labour market, such as globalisation and digitalisation, may affect not only employment and wages, but also working conditions in a broader sense [Barrientos et al., 2011]. In particular, involvement in global production fragmentation processes through the global value chain (GVC) importantly shapes labour market outcomes, including workers' well-being [Barrientos et al., 2016; Lund-Thomsen et al., 2012; Rossi, 2013]. Additionally, the impact on wages and working conditions can be related to the task performed by workers (following the *task approach* proposed by Autor et al. [2003]). The level of routine content in a job is claimed to be important in explaining wages and working conditions (see the empirical study by, e.g., Fonseca et al. [2018], Nikulin et al. [2022]) due to technological bias.

However, while the research area of working conditions (see, among others, Aleksynska [2018], Clark et al. [2021], Piasna [2018]), as well as the association between GVCs and work routinisation and the labour market (see, among others, Acemoglu, Autor [2011], Autor, Dorn [2013], Baumgarten [2015], Goos et al. [2014], Parteka, Wolszczak-Derlacz [2015]) are widely described, there is a research gap common to these streams. The existing studies examining the linkages between GVCs and the labour market are focused mainly on wages as an indicator of working conditions [Baumgarten et al., 2013; Parteka, Wolszczak-Derlacz, 2015]. Moreover, most of the research focuses on developing countries [Kabeer, Mahmud, 2004; Plan et al., 2012]. For Europe, the evidence is modest (see Flecker [2013], Pawlicki [2013]). Recently, Nikulin et al. [2022] went beyond pure wages as an indicator of working conditions and used additional measures of job quality.

This paper aims to examine the linkages between working conditions and GVCs, controlling for the level of job routinisation. Its main goal is therefore to provide a comprehensive overview of job quality in Poland measured by a different set of indicators, and to link them with involvement in global production fragmentation processes and job routinisation.

To this end, a rich dataset containing more than 700,000 observations (workers) is used, derived from the employee-employer database, the European Structure of Earnings Survey (SES), and the European Working Conditions Survey (EWCS) containing detailed information on measures of job quality. To analyse the linkages with international trade involvement, microlevel databases are merged with sectoral data from the World

Input-Output Database (WIOD). The degree of job routinisation is measured by the occupational routine task intensity (RTI) index, proposed by [Lewandowski \[2019\]](#). The paper uses econometric modelling methods such as weighted OLS regression with robust standard errors clustered at the firm level, and a fractional probit model fitting a quasi-likelihood estimator to find the association between GVC involvement, routinisation, and job quality among Polish workers.

The structure of the paper is as follows. Section 1 constitutes the introductory part. Section 2 provides a literature review describing the existing evidence on the linkages between working conditions and international trade and GVCs. Then, in Section 3, the methodology used is explained and the description of data is provided. Section 4 presents the results of the empirical analysis, while Section 5 discusses the obtained results. Section 6 concludes the paper.

Literature review

The literature on job quality and labour standards rarely confronts workers' well-being in the nexus of international trade. Importantly, most existing studies are related to developing countries and describe the association between economic and social upgrading¹. Much of the empirical research consists of specific case studies. [Rossi \[2013\]](#), in an analysis of the garment industry in Morocco, finds that economic upgrading and social upgrading are not necessarily co-occurring processes. She finds diversified linkages between production and social upgrading, especially if unskilled workers from the lowest segments of the Global Production Network (GPN) are considered, which may be excluded from social upgrading. Similar evidence is provided by [Lund-Thomsen et al. \[2012\]](#), who use primary data from factories, stitching centres, and home-based settings in the global football industry in Pakistan, India and China. [Plank et al. \[2012\]](#), in turn, analyse the fast fashion industry in Morocco and Romania and show that irregular workers cannot benefit from social upgrading opportunities. [Barrientos et al. \[2015\]](#) find, meanwhile, that producers and workers with insufficient skills are also excluded from economic and social upgrading. A study based on fresh fruit and vegetable value chains in South and East Africa shows that less skilled workers may not benefit in terms of job opportunities, measurable labour standards and enabling rights. [Lee, Gereffi and Lee \[2016\]](#) analysed mobile phone GVCs in China and India and found that the social upgrading process is not self-evident. [Kabeer and Mahmud \[2004\]](#), in a study of the garment industry in Bangladesh, examined exporting firms and those producing for the domestic market and found that the average earnings and other working conditions (e.g., job stability, maternity leave and other leave entitlements, accommodations, medical care, and overtime pay) are better in exporting firms.

However, when developed countries are considered, the scope of existing research is much narrower. Recently, [Nikulin et al. \[2022\]](#) analysed working conditions among European workers using wages, overtime, working hours and bonus payments as proxies for the social upgrading of workers. They found that the impact of GVCs on working conditions differs, depending on the measure used. Most studies that link the well-being of workers and GVC involvement use pure wages as an indicator of working conditions [[Baumgarten et al., 2013](#); [Parteka, Wolszczak-Derlacz, 2015](#)]. Notably, a rich strand of earlier studies examined the associations between wages and offshoring (see, among others, [Baumgarten et al. \[2013\]](#), [Ebenstein et al. \[2014\]](#), [Parteka, Wolszczak-Derlacz \[2015\]](#)).

As far as routinisation is concerned, empirical studies [[Acemoglu, Autor, 2011](#); [Autor et al., 2003](#); [Goos et al., 2014](#)] mainly utilise the framework of routine-based technological change (RBTC). The main assumption within this concept is that changes in the labour market may be biased, according to the level of routine content of a job. Technological progress may disproportionately affect workers, according to the routine content

¹ Economic upgrading is defined as "the process of improvement in the rights and entitlements of workers as social actors, which enhances the quality of their employment," while economic upgrading consists of four dimensions: process, product, functional and chain upgrading and may be identified as moving "to higher value-added activities in production" [[Barrientos et al., 2011](#): 324].



of their job, whereas tasks that are routine and repetitive in nature might be easily automated, which, in consequence, leads to a decline in employment and wages [Autor et al., 2003]. The empirical evidence mainly presents the association between the level of routinisation and the displacement effect [Autor et al., 2003; Frey, Osborne, 2017] and to a lesser extent, the linkages between the routinisation level of jobs and working conditions [Das, Hilgenstock, 2022; Nikulin et al., 2022].

The literature review shows that there is a need to analyse the association between GVCs, routinisation and working conditions, considering a broader perspective, particularly by using more indices measuring workers' well-being. The existing studies show that greater involvement in international trade, measured by offshoring, may reduce wage growth for some groups of workers, especially medium- and low-skilled workers (see, among others, Baumgarten et al. [2013], Parteka, Wolszczak-Derlacz [2015]). Moreover, as Parteka [2018] finds, the global import intensity of production results in downward pressure on wages, mainly in the most routinised occupations; for workers performing routine tasks, see Keister and Lewandowski [2017] for more details. Given the scarcity of research on European workers, this study on the Polish economy will fill this gap.

Based on the presented literature review, the following hypotheses are formulated:

H1: Workers in sectors more involved in global value chains receive lower remuneration.

H2: Workers performing more routine intensive tasks earn less than those entrusted with non-routine tasks.

H3: Greater involvement in GVCs is associated with worsening working conditions.

Research methodology

To verify these hypotheses, the focus is placed on worker-level data derived from the latest available wave (2014) of the European Structure of Earnings Survey (SES) [Eurostat, 2014]². This dataset contains a rich set of individual characteristics of both employees and employers. To provide a rich perspective of the working conditions among Polish workers, the study uses data on job quality indices from the European Working Conditions Survey (EWCS 2015)³. Six job quality indices are included in our study: physical environment, work intensity, working time quality, social environment, skills and discretion, and prospects. The purpose of using job quality indices is to describe “how workers perform their work and under what conditions” [Eurofound, 2017: 36]. Each of the indices is built based on indicators of positive and negative job features. The indicators describe job resources (physical, psychological, social and organisational aspects) as well as job demands. Importantly, the job quality indices were measured from an objective perspective. This means that they describe specific job quality features which were empirically proven as affecting the health and well-being of workers. The list of measures of working conditions is presented in Table 1 in the Appendix, while their diversity across different education levels is shown in Figure 1, and across occupations, in Figure 2. We see that workers with tertiary education (high education levels) have higher working conditions in all aspects except work intensity (higher work intensity, worse working conditions). Not surprisingly, workers with the lowest level of education (less than primary, primary, and lower secondary) are characterised by the worst working conditions (except work intensity). When we look closer at different occupational levels (Figure 2), we see that professionals are characterised by the best working conditions, measured by the physical environment, prospects, and skills and discretion. Skilled agricultural and fishery workers have the best working conditions in the case of the social environment and work intensity but the worst in the case of working time quality. By contrast, there are elementary workers with the worst social environment, prospects, skills and discretion. Clerical support workers are characterised by the lowest job quality as far as work intensity is concerned.

² Access to the microlevel data was granted under project No. 225/2016-EU-SILC-SES.

³ Access to the EWCS is free of charge after registration on the website <https://ukdataservice.ac.uk/>. Because our task was to merge microdata (SES, EWCS) with sectoral data (WIOD), we were limited by the end year of GVC measures from WIOD, which is 2014; consequently, we use SES 2014 and EWCS 2015.

After merging these two datasets, an additional sectoral variable is included, measuring involvement in GVCs (the measure of foreign value added in exports obtained from export decomposition; Wang et al. [2013]) from the World Input-Output Data, 2016 release. The summary statistics of the used variables are presented in Table 2 in the Appendix.

To examine the nexus between GVCs, routinisation and working conditions, two types of regressions are estimated. The first one relates wages to the characteristics of individuals, firms, sectors and GVCs, according to equation (1):

$$\ln(\text{wage}_i) = \alpha + \beta_1 \ln \text{Prod}_s + \beta_2 \text{GVC}_s + \beta_3 \text{RTI}_i + \sum_{j=1}^m \gamma_j X_{ij} + \sum_{k=1}^n \delta_k X_{kf} + D_s + \varepsilon_i, \quad (1)$$

where: i – worker, f – firm, s – sector.

The different characteristics of individuals, m , are represented by X_i (sex, age, education level, full-time versus part-time, type of contract: permanent or temporary), while X_f is a set of n firm and job controls (type of contract: permanent/temporary, full-time or part-time job, firm size, length of service in the enterprise). Additionally, sectoral variables are included: log of sector productivity: value added divided by the number of hours worked ($\ln \text{Prod}$), GVC – the measure of involvement in production fragmentation proxied by the share of FVA in exports (expressed in %) and the RTI routinisation index as developed by Lewandowski et al. [2019]. Finally, D_s stands for individual sector effects. The regression could be called the augmented Mincer model, because wages are explained not only by personal, job and firm characteristics, but also sectoral variables, including GVCs. The regression is estimated using weighted OLS with robust standard errors clustered at the firm level, to limit the bias connected with the fact that the information used in the study is about individuals either from the same or different enterprises. The weights are based on the grossing-up factor for employees (from SES), which should mitigate the differences between the sample and the population in terms of the number of both enterprises and employees. Specifically, the weight is calculated as (number of local units in the population/number of local units in the sample) \times (number of employees in local units/number of employees in the sample). For more information about the weight calculation, see the SES manual [Eurostat, 2014: 18].

The second model is for the working condition index (this time expressed as a ratio between 0 and 1):

$$\text{working_condition}_{io} = \alpha + \beta_1 \ln \text{Prod}_s + \beta_2 \text{GVC}_s + \beta_3 \text{RTI}_i + \sum_{j=1}^m \gamma_j X_{ij} + \sum_{k=1}^n \delta_k X_{kf} + D_s + \varepsilon_i, \quad (2)$$

where: i – worker, o – occupation, f – firm, s – sector.

The set of control variables, including RTI and GVC, is analogous to the previous equation. As the estimation method, this time a fractional probit model fitting a quasi-likelihood estimator is used, which is appropriate when the dependent variable takes values between 0 and 1⁴ [Papke, Wooldridge, 1996; Wooldridge, 2010]. Regression (2) is estimated for six different working condition indices.

Results

The results of the wage regression are presented in Table 3. The two main variables of interest are GVC and RTI. Specification 1 includes the labour productivity of a sector and personal characteristics; specification 2 includes labour productivity, personal and basic firm characteristics; while specification 3 considers all previous control variables plus the length of experience in the unit. The results indicate that, on average, workers who are male, older, and have a higher education earn more. Similarly, those with permanent contracts, working in public and large enterprises, and with more experience earn more. These results are not a surprise, confirming the specific role of the characteristics of an individual, job and firm. Next, in all the specifications, negative and statistically significant coefficients on GVC and RTI were obtained. Other things equal, workers with more routine jobs and working in sectors more involved in GVCs receive lower remuneration.

⁴ The original working indices are expressed in the range of 0–100; we rescaled them to be in the range of 0–1.

However, this study not only concerns the level of an individual's wages, but also other measures of working conditions. Table 4 presents the results of fractional probit estimates for six different working condition indices. Please note that the working condition indices are now expressed as fractional variables (0, 1) and working time intensity is reversed to have the same interpretation as in the case of other indices: the higher the index, the better the working conditions. For illustration purposes, only variables of interest to the study are presented, but all other controls are included, as in the most augmented specification 3 in Table 3. In the case of fractional probit, the coefficients *per se* are meaningless, which is why the lower panel of Table 4 presents marginal effects. As far as RTI is concerned, for most of the indices a negative correlation is obtained: on average, for more routine jobs, the working conditions are worse. The exception is the work intensity index, for which the correlation is positive. As far as the magnitude of the marginal effect is concerned, the highest (absolute) value is reported for the skills and discretion index: if RTI increases by 1%, the skills and discretion index drops by 0.116% (Table 4, specification 2). In the case of GVC, the correlation is positive for most of the indices: the higher the GVC, the higher the working conditions index. The exception is the skills and discretion index, for which the parameter is negative: the higher the GVC, the lower the index. Based on the values of marginal effects, it can be deduced that if GVC increases by 1%, the working conditions index increases by up to 0.045% (in the case of skills and discretion, it drops by 0.045%). It can be concluded that although evidence is found of a statistically significant correlation between GVCs and working conditions, the economic significance is marginal. We also must admit that our methodology is based on partial correlations and a static model, and consequently the causal interpretation should be made with caution. We should rather interpret the results as general characteristics of GVCs, routinisation and working conditions than the impact of GVC and RTI on wages and working conditions.

Discussion

Based on the obtained results, the proposed hypotheses can be verified. It can be confirmed that in more GVC-dependent sectors, workers receive lower remuneration on average (when other factors are controlled for). However, the drop in wages is not accompanied by a deterioration of working conditions. By contrast, except for skills and discretion, workers employed in more GVC-dependent sectors are characterised by better working conditions. These dichotomous results indicate that workers from sectors with stronger fragmentation of production lose out as far as their wages are concerned, but gain because of better working conditions measured by a broader set of indicators. This can happen when the pure monetary wage is the proxy for labour standards, which may be enhanced, e.g., by fair work intensity or career prospects. Additionally, workers performing more routine tasks earn less and their working conditions are also worse (except the index of work intensity). It must be remembered that routine-intensive occupations tend to be associated with low and medium skills [Frey, Osborne, 2017], which may result in worse working conditions.

The findings of this study concerning the nexus between wages and GVCs are consistent with the evidence for 22 European countries, including Poland, provided by Nikulin et al. [2022]. For other working conditions, a direct comparison with previous studies is difficult because the existing evidence is mostly focused on developing countries. As indicated in the literature review, in the case of developing countries, working conditions tend to be rather worse along with higher GVC integration [Barrientos et al., 2015; Plank et al., 2012; Rossi, 2013]. However, as Kabeer and Mahmud [2004] found, some aspects of working conditions, such as job stability, maternity leave and other leave entitlements, accommodation, medical care, and overtime pay may be upgraded.



Conclusions

This paper addresses the association between GVCs, routinisation and working conditions in Poland. Working conditions constitute an important aspect of social life as they are directly associated with the health and general well-being of workers. Moreover, better working conditions are reflected in a higher level of motivation, and therefore economic performance. Studies on the well-being of workers are also gaining importance due to demographic changes and the need to keep workers healthy for a longer period.

Importantly, an examination of workers' well-being should be rooted in the contemporary drivers of labour market changes. In particular, the process of global production fragmentation significantly affects the outcomes of the labour market worldwide. In this paper, two streams of research were combined, working conditions and GVCs, to gauge the association between involvement in GVCs and a variety of measures of working conditions.

The results presented in this study show that stronger links with international trade fragmentation processes are associated with lower levels of remuneration. However, if working conditions are considered in a broader sense, and other aspects of workers' well-being are included, such as the social and physical environment, work intensity, working time, quality, and prospects, they do not deteriorate with involvement in GVCs. A positive association is found between involvement in GVCs and other measures of working conditions. However, the economic significance of this impact is marginal. This can mean that the Polish economy is still competitive owing to labour costs (lower wages in sectors more involved in GVCs), but the opening of sectors can also improve workers' working conditions, e.g., the working conditions of employees improve (do not worsen), for instance, as a result of the activities of foreign companies or learning by importing or learning by exporting. Going further, the results of this study confirm that workers performing more routine tasks experience worse working conditions, both in terms of monetary wages and other measures of working conditions.

At this stage, some limitations of the study should also be pointed out. First, with the data available, it is not feasible to conduct a panel analysis (with the workers observed over time). The problem will not be solved by merging previous SES waves (2006, 2010) since the data are of a cross-section character. Additionally, there could be some endogeneity issues: a two-way relationship between GVCs and wages/working conditions. It is possible that sectors with lower wages or worse working conditions undergo higher international production fragmentation because, due to lower wages/worse working conditions, they are more competitive. However, since this study uses the wages of individual workers, this problem should be negligible. It is highly unlikely that an individual worker could cause the sector he/she works in to undergo production fragmentation. Finally, because the methodology is based on partial correlations, the causal interpretation should be made with caution. We should rather interpret the results as a general tendency, not as the impact of GVCs/routinisation on working conditions.

As the contemporary labour market is changing rapidly, there is a need for up-to-date research. Regarding job quality, the main concern is the existing inequalities and the fact that not all workers may benefit to the same extent. Future research could address the problem of digitalisation as a determinant of job quality. Additionally, the COVID-19 pandemic will certainly have caused changes in the economic situation of workers as well as requiring adjustments in working style (e.g., moving to work from home) and this, in turn, is critical for employees' working conditions.



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Appendix

Table 1. Measures of working conditions

Measures of working conditions	Main indicators
social environment	– adverse social behaviour – social support – management quality
skills and discretion	– cognitive dimension – decision latitude – organisational participation – training
physical environment	– posture-related (ergonomic) – ambient (vibration, noise, temperature) – biological and chemical
work intensity	– quantitative demands – pace determinants and interdependency – emotional demands
prospects	– employment status – career prospects – job security – downsizing
working time quality	– duration – atypical working time – working time arrangement – flexibility

Note. A detailed description of the calculation of the working condition indices is available in Eurofound [2017].

Source: Authors' own elaboration based on the EWCS 2015 report [Eurofound, 2017].

Table 2. Summary statistics

	N	Mean	Std. Dev.	1st Perc.	Median	99th Perc.
Working condition indices:						
<i>social environment</i>	723,704	77.378	5.945	44.444	77.512	89.051
<i>skills and discretion</i>	723,704	56.884	12.278	38.43	59.682	76.402

	N	Mean	Std. Dev.	1st Perc.	Median	99th Perc.
<i>physical environment</i>	723,704	84.517	9.034	64.799	87.574	96.154
<i>work intensity</i>	723,704	29.117	5.366	13.403	29.734	43.75
<i>prospects</i>	723,704	61.585	6.315	45.417	62.798	71.615
<i>working time</i>	723,704	71.768	4.936	58.986	72.432	81.374
<i>hourly wage</i>	723,704	24.422	15.815	9.13	19.49	95.11
Individual characteristics:						
<i>sex</i>	723,704	0.497	0.5	0	0	1
<i>ageyoung</i>	723,704	0.16	0.367	0	0	1
<i>ageaverage</i>	723,704	0.554	0.497	0	1	1
<i>ageold</i>	723,704	0.285	0.452	0	0	1
<i>loweduc</i>	723,704	0.055	0.228	0	0	1
<i>mededuc</i>	723,704	0.528	0.499	0	1	1
<i>higheduc</i>	723,704	0.417	0.493	0	0	1
<i>FT</i>	723,704	0.923	0.266	0	1	1
<i>indefinite</i>	723,704	0.747	0.435	0	1	1
<i>shortdur</i>	723,704	0.097	0.296	0	0	1
<i>meddur</i>	723,704	0.268	0.443	0	0	1
<i>longdur</i>	723,704	0.377	0.485	0	0	1
<i>vlongdur</i>	723,704	0.258	0.437	0	0	1
Company characteristics:						
<i>public</i>	723,704	0.423	0.494	0	0	1
<i>small</i>	723,704	0.234	0.423	0	0	1
<i>medium</i>	723,704	0.285	0.452	0	0	1
<i>large</i>	723,704	0.481	0.5	0	0	1
<i>RTI</i>	723,704	0.537	0.427	-0.387	0.62	1.248
<i>GVC</i>	723,704	12.982	7.953	4.846	9.243	32.938

Notes: Sex (1=male), age: ageyoung (below 30), ageaverage (30–49), ageold (50 and more), education: loweduc (less than primary, primary, lower secondary), mededuc (upper secondary and post-secondary), higheduc (tertiary education), FT (1 if full-time employed), indefinite (1 if permanent contract), length of service in enterprise: shortdur (less than 1 year), meddur (1–4 years), longdur (4–14 years), vlongdur (more than 14 years), public (1 if public company), size of the enterprise: small (1–49 employees), medium (50–249 employees), large (250 and more employees)
Source: Own elaboration based on SES (2014), EWCS (2015), WIOD (2016) and [Lewandowski et al. \[2019\]](#).

Table 3. Estimation of wage regression

	(1)	(2)	(3)
<i>ln_prod</i>	-0.316*** [0.022]	-0.212*** [0.020]	-0.208*** [0.020]
<i>Sex</i>	0.133*** [0.004]	0.129*** [0.003]	0.134*** [0.003]
<i>ageyoung</i>	-0.256*** [0.006]	-0.178*** [0.005]	-0.118*** [0.005]
<i>ageaverage</i>	-0.046*** [0.003]	-0.026*** [0.003]	0.003 [0.003]
<i>loweduc</i>	-0.347*** [0.016]	-0.348*** [0.011]	-0.360*** [0.012]
<i>mededuc</i>	-0.303*** [0.005]	-0.292*** [0.005]	-0.305*** [0.005]
<i>RTI</i>	-0.494*** [0.007]	-0.463*** [0.006]	-0.453*** [0.006]
<i>GVC</i>	-0.018*** [0.002]	-0.013*** [0.001]	-0.013*** [0.001]

	(1)	(2)	(3)
<i>Full time</i>		-0.002	-0.018**
		[0.009]	[0.009]
<i>Perm</i>		0.190***	0.141***
		[0.005]	[0.005]
<i>public</i>		0.090***	0.072***
		[0.013]	[0.013]
<i>small</i>		-0.246***	-0.235***
		[0.009]	[0.009]
<i>medium</i>		-0.085***	-0.080***
		[0.009]	[0.009]
<i>shortdur</i>			-0.176***
			[0.007]
<i>meddur</i>			-0.156***
			[0.005]
<i>longdur</i>			-0.091***
			[0.004]
R ²	0.48	0.53	0.54
N	723,704	723,704	723,704

Notes: Sex (1 male), age: ageyoung (below 30), ageaverage (30–49), default/omitted category: ageold (50 and more), education: loweduc (less than primary, primary, lower secondary), mededuc (upper secondary and post-secondary), default: higheduc (tertiary education), Full time (1 if full-time employed), Perm (1 if permanent contract), length of service in enterprise: shortdur (less than 1 year), meddur (1–4 years), longdur (4–14 years), default: very long duration (more than 14 years), public (1 if public company), size of the enterprise: small (1–49 employees), medium (50–249 employees), default: large (250 and more employees). Constant and sector dummies included. Weighted regression with robust standard errors clustered at firm level (in parentheses), the weights are based on the grossing-up factor for employees (from SES); *p ≤ .10, **p ≤ .05, ***p ≤ .01.

Source: Authors' own elaboration based on data from SES and WIOD.

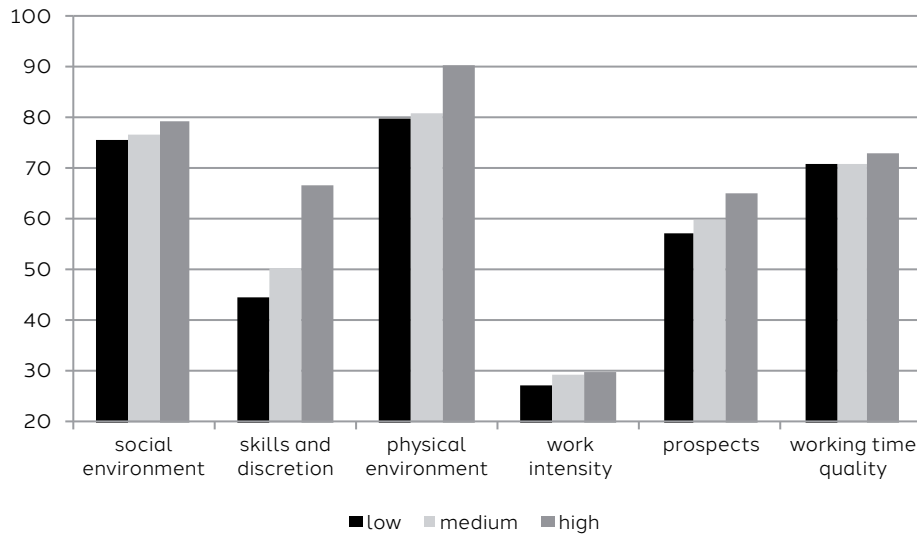
Table 4. Estimation of working conditions

	social environment	skills and discretion	physical environment	work intensity	prospects	working time
	(1)	(2)	(3)	(4)	(5)	(6)
<i>RTI</i>	-0.145***	-0.545***	-0.283***	0.037***	-0.096***	-0.031***
	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
<i>GVC</i>	0.011***	-0.009***	0.081***	0.024***	0.008***	0.002***
	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
ll	-385645	-477094	-299161	-111860	-480216	-429935
Pseudo R ²	0.003	0.036	0.041	0.002	0.004	0.002
N	723,704	723,704	723,704	723,704	723,704	723,704
marginal effects						
<i>RTI</i>	-0.024***	-0.116***	-0.041***	0.002***	-0.020***	-0.006***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
<i>GVC</i>	0.045***	-0.045***	0.270***	0.023***	0.040***	0.011***
	[0.002]	[0.003]	[0.003]	[0.000]	[0.002]	[0.002]

Notes: Working conditions are expressed as its reverse. Personal and firm characteristics are included as in specification (3) of Table 1. Fractional probit model with robust standard errors in parentheses, *p ≤ .10, **p ≤ .05, ***p ≤ .01.

Source: Authors' own elaboration based on data from EWCS, SES and WIOD.

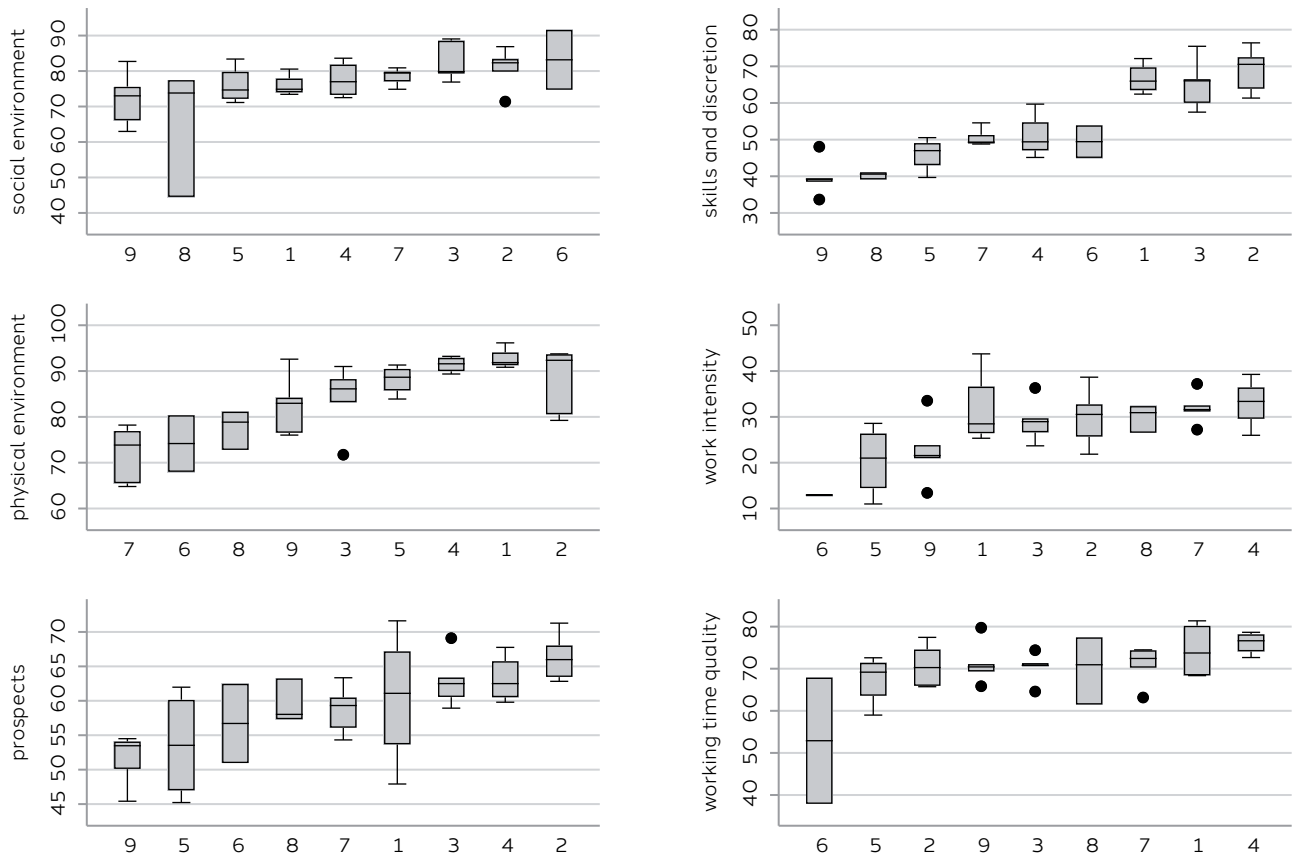
Figure 1. Working conditions across education levels



Note: Education levels: low (less than primary, primary, lower secondary), medium (upper secondary and post-secondary), high (tertiary education); the figures are computed with weights based on the grossing-up factor for employees (from SES).

Source: Authors' own elaboration based on working condition indices from EWCS (2015) merged with SES (2014).

Figure 2. Working conditions in Poland across occupations



Note: Workers grouped into one-digit ISCO-08 occupations: 1 – Managers, 2 – Professionals, 3 – Technicians and associate professionals, 4 – Clerical support workers, 5 – Service and sales workers, 6 – Skilled agricultural and fishery workers, 7 – Craft and related trades workers, 8 – Plant and machine operators, and assemblers, 9 – Elementary workers. The figures are computed with weights based on the grossing-up factor for employees (from SES).

Source: Authors' own elaboration based on working condition indices from EWCS (2015) merged with SES (2014).