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Effects of Minimum Wage Changes on the Wage Distribution in Low-wage and High-wage Sectors

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Abstract:

Research background: The number of research regarding employment effects of minimum wages is enormous. Another problem examined by prior studies is the impact of minimum wage increases on the wages. The evidence shows that minimum wage increases compress the wage distribution. The same literature brings conflicting evidence regarding minimum wage spill-over effects.

Purpose of the article: The study analyses the effects of a minimum wage increase on the wage distribution of low- and high-wage sectors and possible spill-overs. The analysed period 2014-2018 is characterized by relatively stable economic conditions, while the minimum wage increased by 25%.

Methods: We follow case study method and as example Poland, the EU country with high share of minimum wage workers. We use individual data on wages and worker characteristics from the Structure of Earnings Survey in Poland for 2014–2018. We use reweighting and decompose counterfactual wage distribution.

Findings & value added: In low-wage sector, a wage increase in the left tail of the distribution is almost entirely due to the increase in the minimum wage level and spill-over effects are present throughout the distribution. In high-wage sector the role of the minimum wage growth is weaker and also the workers' characteristics have substantial impact on wages; no spill-over effects of a minimum wage increase are observed. We demonstrate that the conflicting evidence on the effects of minimum wage changes on the wage distribution may occur because the effects differ across the low- and high-paid economic sectors. They depend on sector productivity and openness.

Keywords: Minimum wage, wage distribution, reweighting, low-wage sector, high-wage sector, spill-over effects

JEL codes: J21, J31

Introduction

In most of the new EU member states the wage inequalities in the recent years decreased, while in many developed European countries the overall inequalities in wages increased (see Pereira & Galego, 2019). Several public policies may affect the distribution of wages and hence wage inequalities across individuals. Local and national taxes, minimum wage legislation, social insurance policies, transfer programs, trade union density and coverage, the level of coordination and centralisation of wage bargaining, and employment protection legislation are the examples. Most of the wage-oriented policies aim to redistribute income towards a more socially satisfactory distribution, that is, to decrease wage inequalities.

Minimum wage increases can affect the wage distribution by boosting the wages of low paid workers relative to high paid workers (Redmond et al., 2021). Moreover, since employees account for both their wage levels and their relative standing in the wage distribution, minimum wage changes may increase the not only the wages of low-wage workers, but also impact the level of wages in higher deciles. Such spill-over effects are observable up to 125% of the minimum wage (Butcher et al., 2014).

The drivers behind diverging patterns of wage inequality are not evident. The economic theory suggests that workers are paid accordingly to their marginal product (McCausland et al., 2020). Differences in wages across industries may result either from the structure of the industry or from human capital characteristics of the employed labour force. Among structural factors the level of international competition is the most important. Since the distribution of workers across industries is not uniform, the differences in labour productivity between economic sectors translate to differences in wages. The increases in the national minimum wage may therefore affect the wage distribution of workers in high- and low-wage sectors differently.

The aim of this study is to compare the effects of a change in the national minimum wage on the wage distribution in the low- and high-paid economic sectors. In particular, we would like to assess how wages in different economic sectors react to the minimum wage policy established at the national level. We have chosen five economically important NACE sections. Two of them are sections with a high share of low-wage workers: *Accommodation and food service activities* (section I) and *Administrative and support service activities* (section N). Then, we compare the distributional effect of the minimum wage to three other sections: *Manufacturing* (section C) and

two high-paid sections *Information and communication* (section J) and *Financial and insurance activities* (section K). The analysis at the sectoral level allow to observe existing heterogenous reactions in different sectors, which are not visible at the economy level.

This study contributes to the existing literature by providing new evidence on the effects of minimum wage increases on the wage distribution. We demonstrate that the conflicting evidence on the effects of minimum wage changes on the wage distribution may occur because the effects differ across the low- and high-paid economic sectors. Also, we show that the impact of the minimum wage policies on wage distribution and the size of spill-over effect depends on the industry and on the point of the distribution where the employee lies. To the best of our knowledge this is the only study of impact of minimum wage on wage distribution at sectoral level.

As a case study we choose Poland, one of the Central and Eastern European Union countries. Analysing the effects of minimum wage changes in Poland is interesting for several reasons. First, the minimum wage policy, conducted at a national level, is simple and has a long history; moreover, all regions, occupations, and sectors have the same minimum wage. Second, according to Eurostat data, Poland's share of minimum wage workers is one of the highest amongst the European economies. Third, there has been a sustained increase in the national minimum wage in Poland in recent years. Fourth, Poland is one of the largest EU economies, with workers present in all NACE economic sections and the minimum wage coverage is extensive.

Several important changes in minimum wage were observed since Poland joined European Union in 2004. The average yearly minimum wage increase was 4% in real terms over the period of 2006-2014. Additionally, the government boosted minimum wage by 26% in 2008-2009. Importantly, the growth of minimum wage was above the growth of average wages; as a consequence, the Kaitz index increased by 9 pp. (Pereira, Galego 2019). Those changes significantly reduced wage inequality in Poland. The greatest change was a reduction of distance between median and the bottom of the wage distribution.

We use individual data on wages and employment characteristics from the Structure of Earnings Survey (SES) in Poland which is a part of the large European-wide survey coordinated by the Eurostat. The analysed period is 2014-2018, characterized by relatively stable economic activity. In the analysed period, the minimum wage increased by 25% in nominal and by almost 23% in real terms. Methodology applied in this study use reweighting decomposition based on non-parametric approach of DiNardo et al. (1996) for wage equation.

The results show that minimum wage growth impacts economic sectors differently. In both low-wage NACE sections analysed, minimum wage legislation forced wage growth in the left tail of the wage distribution; up to the third decile, wage growth was equal to minimum wage growth. Without national minimum wage growth, the wage growth among these groups of workers would not occur or would be significantly lower. The evolution of wages differs in the right tail of the wage distribution of the low-wage sectors because of the base effect. In the NACE section with the lowest wages, the wage increases which occurred in the study period were higher than minimum wage growth. Additionally, we found that the spill-over effects differ significantly between the low- and high-paid economic sectors. In the former, we observe strong spill-over effects for the entire wage distribution; in the latter, we found no spill-over effects from the minimum wage increase.

The remainder of this article is structured as follows. Part 2 reviews the relevant literature. Part 3 describes the data, minimum wage policy in Poland, and the macroeconomic background in 2014–2018. Parts 4 and 5 present the methodology and empirical results, respectively. Part 6 concludes.

Literature review

Many studies investigated the impact of minimum wage changes on employment. Neumark and Shirley (2021) and Wolfson and Belman (2019) present the most recent summaries of evidence from the US. For other countries, Campolieti (2020) provides a meta-analysis for Canada and Dube (2019) summarises the international evidence. Despite many years have passed since the Card and Krueger (1994) findings on positive relationship between minimum wage and employment and the Neumark and Wascher (2000) counterarguments, neither the direction nor strength of this relationship has been unanimously determined. Most recent studies indicate a small and negative impact of minimum wage growth on employment, particularly among the young and less educated. Neumark and Shirley (2021) highlight that disagreement on the impact of minimum wage changes on employment not only exists across individual studies but also in the meta-analyses summarising the body of the literature.

Another problem examined by prior studies is the impact of minimum wage increases on the wages. One aspect is the impact on wage inequality, as increases in minimum wages would affect

the left tail of the wage distribution to higher extent by boosting the wages of low paid workers relative to high paid ones. The literature shows the effect depends on the direction of minimum wage changes. Teulings (2003) confirm that the reduction in minimum wage in the US during 1980s led to the rise in wage dispersion in the lower half of the wage distribution. Moreover, his findings indicate that the effect of changing minimum wages on relative wages is concentrated just above the minimum wage binding point.

Recent studies confirm that increases of minimum wage reduce the wage inequalities and compress the wage distribution in both developed and developing countries. Redmond et al. (2021) analyses the impact of minimum wage increases in Ireland and find that wage inequality, measured by the ratio of wages in the 90th and 10th percentiles and the 75th and 25th percentiles, decreased by approximately 8% and 4%, respectively. For workers under 25 years of age, the effects were greater, with a 24% reduction in the ratio of wages in the 90th and 10th percentiles. Dolton et al. (2012) find that an increased bite of the national minimum wage is associated with falls in lower tail wage inequality in the UK. This study confirms the earlier findings of Dickens and Manning (2004a and 2004b). Similarly, a reduction in wage inequality for the US has been confirmed due to minimum wage increases (Autor et al., 2016; Bauducco and Janiak, 2018).

Similar effects are reported for developing countries. Lin and Yun (2020) find that increasing the minimum wage exerted beneficial effects on the earnings distribution in China by reducing the earnings gap between the median and the bottom decile. Sotomayor (2021) confirms the inequality decline in Brazil underlying that potential unemployment costs were overwhelmed by benefits in the form of higher wages among working individuals. Another aspect of the influence of minimum wage increases on wages concerns spill-over effects, however, neither the presence nor the length have been unanimously determined. Gopalan et al (2021) using administrative data for the US find modest spill-overs extending up to $2.50 above the minimum wage. Spill-overs accrue to both incumbent workers and new hires, but only within firms that employ a significant fraction of low-wage workers. Other researchers: e.g. Bauducco and Janiak (2018), Autor et al. (2016), and Neumark et al. (2004) also confirm the positive spill-over effects on higher wages in the case of the US.

Conversely, the literature for the UK report little to no evidence of minimum wage spill-overs in the UK (see e.g. Stewart, 2012 or Dickens and Manning, 2004a, 2004b). Steward (2012) explains that it may be due to the fact that that the UK minimum wage has always been below the 10th

percentile of the wage distribution. By contrast, Butcher et al. (2012), show evidence of wage spill-overs up to 40% above the national minimum wage which corresponds to the 25th percentile of wage distribution. Additionally, they show that these spill-overs are larger in low-wage segments (women as opposed to men, the young as opposed to the old or low-wage regions as opposed to high-wage regions).

Garcia-Louzao and Tarasonis (2022) analyse the effects of a historically large increase in the minimum wage in Lithuania. Their results indicate that the minimum wage hike significantly increased the earnings of low-wage workers and had spill-over effects that extended up to the median of the pre-treatment earnings distribution. Both direct and indirect effects are strongest just after the minimum wage increase and weaken somewhat a year later. Moreover, the results show that the positive wage effects are particularly salient among groups who exhibit lower average income, i.e., women, young workers, and non-tradable industries.

The spill-over effects are also found in Turkey (see Sefil-Tansever and Yılmaz, 2023). Interestingly, the effects are more pronounced during macroeconomic instability from 2016 to 2022, compared with the relatively stable period of 2004–15. Moreover, the outcomes differ depending on individual attributes like gender, age, education, and other relevant factors. The differences in the spill-over effects due to workers characteristics are found also by Laporšek et al. (2019). This article analyses the effects of a large increase in Slovenia's minimum wage in March 2010. The results show that the minimum wage increase produced sizeable spill-over effects. The spill-over effects are higher among young and older workers, especially for wage levels near the new minimum wage.

Another important remark has been raised by Gregory and Zierahn (2022). They study the impact of a minimum wage introduction on wages and employment in a quasi-experimental setting where the minimum wage is set extraordinarily high during an economic downturn. They find positive spill-over effects for wages of medium-skilled workers with salaries just above the minimum wage. More striking, they find negative wage effects for high-skilled workers who are further up the wage distribution, followed by reduced returns to skills and industry skill supply.

Data

To identify how the minimum wage affects wage distribution across NACE sections, we need comprehensive and reliable data on wages. Thus, we use individual data on wages and employment characteristics from the SES in Poland. The SES is a large representative enterprise sample survey that provides detailed information on the relationships between the level of remuneration and individual worker characteristics (gender, age, occupation, work experience, highest educational level attained, and type of job contract). The SES, conducted biennially, covers around 12–15% of all enterprises that employ more than nine workers in Poland.

The advantages of this database include its high reliability and size. Wages are reported by the accounting departments of the enterprises. Additionally, each sample is very large: over 730,000 observations in 2014 and over 860,000 in 2018. The database represents only entities employing more than nine workers, though the employment structure in Poland has a very high share of self-employed individuals operating without job contracts (own-account workers). The authors estimate that the SES database covers nearly 90% of all contract workers in Poland.[1] Another advantage is that unlike in other counties, the SES is conducted biennially rather than every four years.

From the SES database, we obtained information about monthly salaries and individual worker characteristics. In Poland, almost all employees are paid monthly rather than weekly. The minimum wage level is established at the monthly and hourly basis; using either set of data does not bias our results as all data are recalculated into full-time equivalents. We have information about the education level of individuals, age, work experience, gender, occupational group, type of contract, and firm size. We include both full-time and part-time workers but recalculate the wages of part-time workers as full-time equivalents. Moreover, we limit the sample to private sector workers, because only a small fraction of minimum-wage workers is employed in public sector (below 2%). For this study, we use data from 2014 and 2018.[2] The period is large enough to cover significant increases in the minimum wage, while being short enough to ensure that the structure of the sample, workers' characteristics, and macroeconomic conditions did not change much.

[1] According to the Central Statistical Office of Poland, only 34% of workers in micro firms in 2016 were employed on a job contract. https://stat.gov.pl/obszary-tematyczne/podmioty-gospodarcze-wyniki-finansowe/przedsiebiorstwa-niefinansowe/dzialalnosc-gospodarcza-przedsiebiorstw-o-liczbie-pracujacych-do-9-osob-w-2016-roku,1,11.html (in Polish).

[2] The 2020 data is affected by the COVID lockdowns.

We investigate how the effects of minimum wage increases differ across low-paid and high-paid economic sectors. To select the economic sections most and least exposed to minimum wage changes, we analysed several economic indicators including share of total employment, gross value added, share of employed in firms with foreign owner, and the share of minimum wage workers. Share of total employment is an indicator of importance of particular section in the economy. We focus on sectors employing at least 2.5% of total contract workers in private sector. In turn, the gross value added is related to profitability and hence wages. Additionally, according to recent study of Strawiński and Broniatowska (2021) wages in firm with foreign owners are on average 5% higher than in those with domestic owners in private sector. Following Eurostat methodology, we calculated the share of minimum wage workers as the proportion of employees earning less than 105% of the minimum wage in a given section in a given year.[3] Moreover, as we are going to calculate half-decile groups, to ensure the reliability of the results we selected only those sections with a large number of workers.

Finally, we end up with two NACE sections with high share of minimum wage workers and the lowest gross value added per worker: *Accommodation and food service activities "Horeca"* (section I) and *Administrative and support service activities "Support services"* (section N). In 2014, 38% and 44% of workers in those sections received 105% of the minimum wage or less, respectively. Then, we choose two high-wage sections: *Information and communication "ICT"* (section J), and *Financial and insurance activities "Finance"* (section K) to compare the distributional effects of minimum wage changes. Both sections have a very low share of minimum wage workers, 6% and 5% in 2014, respectively, and at the same time relatively high gross value added per worker and share of employment by multinational firms (see also, Strawiński and Broniatowska, 2021). The analyses for these sections can show how the wage distribution would change in an economy with scarce minimum wage workers. Additionally, we took *Manufacturing* (section C), which covers approximately 40% of employment in the private sector in Poland; therefore, we can treat it as representative for the entire economy. In 2014, 12% of workers in this section received 105% of the minimum wage or less. Table 1 summarises the information about the minimum wage workers and sample sizes in the sections analysed.

[3]https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Minimum_wage_statistics#Proportion_of_minimum_wage_earners

(Table 1 here)

As far as the minimum wage is concerned, Poland is one of the 22 countries of the 27 EU Member States which have a national minimum wage. The minimum wage in Poland is set up annually through negotiations within the Social Dialogue Council, which consists of representatives from the government, employers' organisations, and trade unions. If the Council is unable to reach a consensus, then the Council of Ministers sets the minimum wage level for the following calendar year. The minimum wage in Poland is set up at the monthly basis. Additionally, in 2017 an hourly minimum wage rate has been introduced. There is one minimum wage rate for all regions, occupations, and sectors. The minimum yearly growth rate of the national minimum wage in Poland is regulated by law. Its annual increase is guaranteed to be at least equal to the projected rise in the price levels for the next year plus two-thirds of the forecasted GDP growth rate.

In 2014, the monthly minimum wage was 1680 PLN. In the 2014-2018 period, it increased to 2100 PLN[4], or by 25%. At the same time the average wage grew by 21.2% from 3783.46 PLN to 4585.03 PLN. In that time Poland had a low inflation rate, which did not exceed 1% per year on average. In real terms, the minimum wage in Poland increased therefore by almost 23% (see Table 2). The sample period of 2014–2018 also saw stable economic growth (GDP grew by 4.4% yearly on average; GVA by 5.7%) and had good labour market conditions, with a stable average growth rate of employment at almost 1% per year. The unemployment rate fell from 9 to 4%. Good macroeconomic situation prevented workers from transitioning to the agriculture sector for labour hoarding purposes, as is common in slowdown periods.

(Table 2 here)

The coverage of minimum wage workers in Poland is extensive; that is, the minimum wage legislation covers all workers in the private sector. Several groups of public workers (teachers, medical workers, public defence, and others) however have separate wage policies. Therefore, in our further analyses we included only private sector workers.

[4] Minimum wage in Poland was equal to approximately 400 EUR in 2014 and approximately 500 EUR in 2018 (Eurostat data).

Methodology

In this study we focus on the impact of minimum wage changes on the wage distribution. Prior studies commonly estimate the effect of changes in policy by conducting difference-in-differences (DID) analysis (Card and Krueger, 1994). In this study we are not able to use this approach because the data we use is from cross-sectional study and not balanced panel. Therefore, we cannot be sure that we observe exactly the same individuals at both points in time, before and after policy change.

Following the seminal work of Mincer (1974), we assume that the wage (w) is a function of individual characteristics (X) and wage policy (P). We write the wage for the group of workers as:

$$F(w) = F(X, P) \quad (1)$$

We estimate the effect of the change between two periods, denoted as t=0 and t=1, which represent the period before and after the policy change, respectively. We can write the outcome of the change in the policy as follows:

$$\Delta = F(X_{t=1}, P_{t=1}) - F(X_{t=0}, P_{t=0}) \quad (2)$$

If we assume that individual characteristics are stable over time; that is, $X_{t=1} = X_{t=0}$, then we can attribute the change in the outcome fully to the change in policy. However, in this study, we cannot directly estimate equation (2) for several reasons. First, there is a serious identification problem; the change in the wage distribution between two periods (2014 and 2018) might occur due to a change in the wage-setting scheme or due to a change in workers' characteristics, and a period of four years makes the latter effect non-negligible. The composition of the labour force might change significantly due to a substantial increase in the average education level, such as young workers with secondary and tertiary education replacing elderly workers with primary education.

To correct the wage distribution to account for the abovementioned effects we adapt DiNardo et al.'s (1996) method. This method allows us to reweight the actual characteristics of workers using estimated propensity scores to construct the counterfactual distribution of workers characteristics (see Majchrowska and Strawiński, 2018). Consequently, we can treat the wage distribution for the reweighted sample as if the workers' characteristics did not change. The counterfactual wage distribution describes the wages in t=1 (2018) if employees possess

characteristics as ones in t=0 (2014). We use weights w_i to transform the actual distributions $F(X_{t=0})$ to the counterfactual one $F(\widehat{X_{t=0}})$. We estimate the change in the wage distribution as:

$$\Delta = F(X_{t=1}, P_{t=1}) - F(\widehat{X_{t=0}}, P_{t=0})$$

(3)

The empirical strategy is divided into two steps. In the first step, we apply the DiNardo et al. (1996) reweighting approach described above. We generate the propensity scores from the logit model estimated from the pooled sample, as this distribution better handles long and heavy tails. The dependent variable is the year dummy, and the independent variables include age, working experience and its square, education dummies, firm size dummies, type of contract dummies, and some of the interactions. The policy variable is the minimum wage change. The outcome variable is the average monthly salary. We use the estimated propensity scores as weights in the reweighting procedure to assess how much of the change in the salary[5] distribution between 2014 and 2018 can be attributed to differences in the distributions of worker and employer characteristics. We then use the counterfactual distribution which assumes that workers characteristics did not change from those in 2014 to eliminate the impact of the changes in workers' characteristics. We compare the differences in wage between two periods given the same workers characteristics, so any differences between the distributions are supposed to be due to factors external to the model, which we identify with minimum wage increases. This assumption is justified since as we showed the macroeconomic conditions in this period were stable and because the impact of trade unions and wage bargaining in the private sector in Poland is marginal. In fact, the minimum wage is the only labour market institution which externally impacts wage growth in the private sector in Poland.

In the second step, we apply the reweighting decomposition to a Mincer-type extended wage equation. This methodological approach provides consistent estimates over time and allows us to separate effect of the policy change from the effect of the change in workers characteristics. While both the standard decomposition and the DiNardo et al. (1996) methods are related to construction of a counterfactual distribution, the former is fully parametric and the latter non-parametric, as it involves the weighted kernel density estimation. The methods also provide different outcomes. The former approach informs of a change in mean wages, while the latter indicates a change in the entire wage distribution. We follow Majchrowska and Strawiński (2018) and take advantage of both methods by simply combining them.

[5] In Poland most of the employees are paid monthly (not weekly) salary.

The method we propose is similar to the ones found in the literature, however, our proposition is more efficient and less computationally burdensome. A recently popular approach is a combination of the recentred influence function regressions with unconditional quantile regressions (Firpo et al., 2009). However, this approach is designed to estimate the effect of covariates on the quantiles of the dependent variable, and especially to decompose an effect into the contribution of each covariate. As we are interested in the policy impact represented by a single dummy covariate on the entire distribution of dependent variable, we use simpler approach.

Empirical results

We start our empirical analyses with looking at the actual wage distribution in each of the NACE section chosen, depicted in Figure 1. We analyse nominal changes in wages since in the 2014-2018 period the inflation rate in Poland was negligible (in 2014-2018 the CPI increased by 1.9%). We can see significant differences in the shape of the distribution, with a much greater concentration of workers in the left tail for the low-wage NACE sections of *Accommodation and food service activities* (section I) and *Administrative and support service activities* (section N). Looking at the changes in the wage distributions over time, we observe that in all sections, the wage distribution moved to the right.

(Figure 1 here)

In the low-wage sections, the wage distribution is concentrated around the minimum wage. In high-wage sections, the wage distribution is spread more evenly. In the low-wage sections 25–30% of workers earn not more than minimum wage, and 80% of workers earn not more than twice the minimum wage (see Table 3). In high-wage sections, less than 5% of workers earn not more than minimum wage, and 20–25% of workers earn not more than twice minimum wage.

(Table 3 here)

We look more deeply into changes in the actual wage distribution in the chosen sections between 2014 and 2018 to determine whether the changes were lump-sum, proportional or whether the

effect was non-linear. For each NACE section, we regressed the values of the half-deciles in 2018 on their values in 2014 and their squares:

$$HD_{t=1,i} = \alpha_0 + \alpha_1 HD_{t=0,i} + \alpha_2 HD^2_{t=0,i} + \varepsilon_i, \quad (4)$$

where HD indicates the value of the *i-th* half-decile of wage distribution in each NACE section at time *t=1* (2018) and *t=0* (2014).

The results are presented in Table 4. In the low-wage sector, the parameter estimated by the squared half-decile is significant at the 10% significance level only, indicating that in these sections, the changes in wages across half-deciles seem to be linear and in the analysed period, wages grew by almost the same percentage in each half-decile. In the high-wage sector, the squared half-deciles are significant at the 1% level and negative. This indicates that the wage growth effects were in those sections non-linear; wage growth was higher in the lower half-deciles than in the higher ones.

(Table 4 here)

We would like to assess the extent to which changes in the wage distribution in analysed NACE sections were the result of changes in workers' characteristics, and to what extent to other factors, which we identify in this study with minimum wage changes. We do it by calculating the counterfactual wage distribution in 2018, which assumes that all workers' characteristics were the same as in 2014. Then, we performed the reweighting decomposition of the estimated difference between the actual and counterfactual wage distribution in 2018. In Table 5, the difference between means of the actual and counterfactual wage distribution varies between 20% and 24%, with the highest differences found in the *Horeca* section. The lowest difference occurs in the high-wage *Finance* section. In all sectors the effects of changes in workers' characteristics are statistically not significant. This shows that the counterfactual wage distribution is properly constructed.

(Table 5 here)

To check for spill-over effects of minimum wage growth across the wage distribution in particular NACE sections, we performed again the reweighting decomposition, but we add the

indicator variables for each half-decile group in the left tail of the wage distribution for each section. In the low-wage sections, all workers in the first five half-deciles receive exactly the minimum wage. Therefore, we add indicators for the sixth and consecutive half-deciles. In the remaining NACE sections, we analyse spill-over effects in the first six half-deciles. We report the results in Tables 6–10.

(Tables 6–10 here)

The results indicate significantly varying length of the spill-over effects across analysed NACE sections. In low-wage sector, we find significant effects of the minimum wage increases throughout the wage distribution. The parameters estimated for the added variables in the unexplained part of the decomposition are significant for all half-deciles (see Tables 6 and 7) and the effects are diminishing. It is due to the fact that in this sector we observe low wages even in the right tail of the distribution; wages in the 8th decile are still lower than twice the amount of the minimum wage.

The situation is different in the high-wage sections. The parameters estimated by the added variables in the unexplained part of the decomposition are insignificant or significant but quantitatively very small. They are statistically significant, though their significance is a side effect of the large sample size. Hence, in the high-wage sector, we do not observe spill-over effects of a minimum wage increase. In the *Finance* section we found small distributional effect related to the number of minimum wage workers in the second half-decile.

Similarly, in *Manufacturing* section there is also distributional effect related to the number of minimum wage workers, however the effect is weak. In this section we also do not observe significant spill-over effects.

Finally, we analyse how changes in minimum wage affected wage inequalities in different sectors in the top and the bottom half of the wage distribution. In most of the analysed NACE sections, the comparison of the 95th to 5th percentile indicate wage compression (Table 11). The exception is *Accommodation and food service activities*. It should be stressed that wages in that NACE section are the lowest in the economy, and ratio of 95th to 5th percentile is just above 3, so wage inequality in that sector is very low.

Additionally, we can notice that the effects of reduction in wage inequality are diversified in the different parts of the wage distribution. In the bottom half we observe the divergence of wages in almost all analysed NACE sections, with exception of ICT, while in the top half of the wage distribution the convergence of wages is observed.

(Table 11 here)

Minimum wage changes affect firms wage setting scheme depending on the degree of international competition and international openness of the economic sector. Among firms that operates locally (*Horeca*, *Administration*, and part of *Financial services*) labour cost expressed as percent of gross value added is not rising. It is due to the fact that those firms are able to increase prices (see also Majchrowska, 2022). However, globally growth of GVA per worker is slower than that of the minimum wage (see Table 12).

(Table 12 here)

Firms that faces international competition or are intermediaries in value chains are not able to rise prices so wage share in value added in that sectors increases (see Nikulin et al., 2022).

The analyses performed in the study allow us to explain the differences in the reaction of wages to the minimum wage changes across low-wage and high-wage NACE sections. The growth of wages of workers in the first 20-30 percentiles was equal to minimum wage growth in that period while wages of workers in the middle of distribution grew more. At the same time wages of the top earners grew at slower pace than the minimum wage.

Conclusions

In this study, we analyse the differences in the impact of minimum wage increases on the wage distribution between the low- and high-wage sectors. We use individual data on wages and worker characteristics from the SES in Poland for 2014–2018. In this period, stable macroeconomic conditions were observed and the minimum wage increased by 25% in nominal and 23% in real terms. We check for differing effects on the wage distributions in low-wage and high-wage sectors.

According to our best knowledge this is the first study that analyses the impact of minimum wage on wage distribution at NACE economic section level. We use reweighting decomposition to determine the extent to which changes in the wage distribution are due to changes in workers' characteristics and to what extent to changes in minimum wage.

Our results explain why the literature reports mixed results when examining the impact of minimum wage changes on the wage distribution. The results indicate that the most important reason is that minimum wage increases affect wages in different parts of the economy to different extents. Prior studies provide conflicting evidence regarding the presence of spill-over effects. We demonstrate that the effects of minimum wage increases affect the wage distribution in low- and high-wage sectors differently. In low-wage sector, we find spill-over effects throughout the distribution; in high-wage sector, we can see no spill-over effects of a minimum wage increase. Finding of this dichotomy is one of the main contributions of this study.

Recent studies point out that minimum wage increases compress the wage distribution in a given country. However, our results show that increasing the minimum wage impacts differently wage inequalities across sectors. In most of the analysed sectors minimum wage increases reduced wage inequalities. These findings are in line with the results of previous research (e.g. Autor et al. 2016). Without the obligatory increases in wages among low-wage workers, the differences between low- and high-wage workers would be higher. In this sense, our results are similar to those of Redmond et al. (2021). However, we find that in NACE sections with very low wages, low productivity and low wage dispersion, the obligatory increase in minimum wages led to a slight increase in wage differences. What is more important, the effects are diversified in the different parts of the wage distribution. In the bottom half we observe the divergence of wages in almost all analysed NACE sections, while in the top half the convergence of wages. Those results may stem from the fact that study covers economic expansion period. In this period the employers are able to increase wages for all workers, not limited to obligatory increases for minimum wage workers.

The results are beneficial for the policymakers. Effects of minimum wage policy differ by the sector. They depend on sector productivity, level of competition and openness. From the point of view of the policy of compressing wage inequalities, the effects of raising the minimum wage turn out to be not so obvious. These findings are also emphasized by the ILO (2020).

This study has some limitations. Not all contract workers are covered by the data. Also, data not cover non-contract workers and B2B contracts. We do not have information on workers in micro

firms, however, this should be not a big issue since the results are significant and robust. Inclusion of these workers in our opinion would strengthen the results obtained in the study.

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Annex

Table 1. Macroeconomic characteristics of selected NACE sections in Poland in 2018

NACE sector	Share of total employment (%)	Share of employment in firms with foreign owners (%)	Gross value added per worker (ths. euro)	Gross average wage (euro)	Share of MW workers (%)*
C: Manufacturing	37.6	37.1	32.1	1034	10.2
F: Construction	6.4	12.1	35.8	899	24.3
G: Trade	20.8	31.9	33.1	946	15.0
H:Transport	5.9	27.3	31.3	942	19.2
I:Horeca	2.5	13.6	19.6	703	31.7
J:ICT	3.7	58.0	45.7	1891	2.7
K:Finance	3.8	53.1	31.2	1768	3.3
M:Professional	3.9	41.8	111.2	1373	8.5
N:Support Services	5.7	13.2	15.6	807	30.0
P:Education	2.6	0.5	33.1	946	7.9
Total	92.9	30.6	27.9	1076	13.7

* Following Eurostat methodology, we calculated the share of minimum wage workers as the proportion of employees earning less than 105 % of the minimum wage in a given section in a given year.

Trade - Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles; Transport – Transportation and storage; Horeca – Accommodation and food service activities; ICT – Information and communication; Finance – Financial and insurance activities; Professional – Professional, scientific and technical activities; Support Services - Administrative and support service activities.

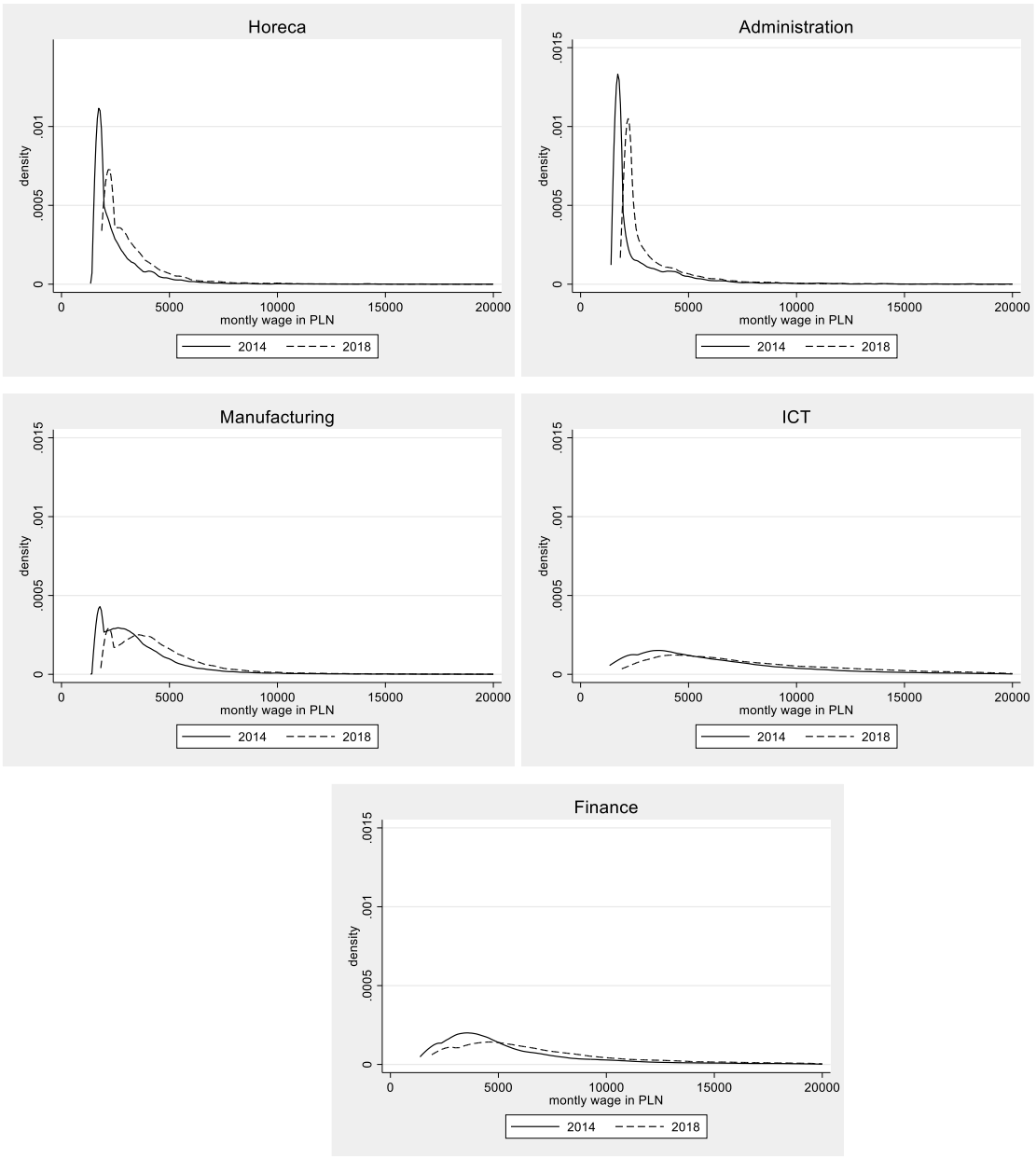
Source: Central Statistical Office of Poland and Structure of Earnings Survey in Poland, 2018 edition; own calculations.

Table 2. Minimum wage and macroeconomic conditions in Poland in 2014–2018

	Nominal minimum wage (PLN)	HICP (2015=100)	Real minimum wage (PLN, 2015 prices)	Nominal minimum wage growth (%)	Real minimum wage growth (%)	Real GDP growth (%)
2014	1680	100.7	1668	5.0	4.9	3.4
2015	1750	100	1750	4.2	4.9	4.2
2016	1850	99.8	1854	5.7	5.9	3.1
2017	2000	101.4	1972	8.1	6.4	4.8
2018	2100	102.6	2047	5.0	3.8	5.4

Source: Central Statistical Office of Poland and Eurostat, own calculations.

Figure 1. Actual wage distributions in analysed NACE sections in 2014 and 2018



Source: Structure of Earnings Survey in Poland, 2014 and 2018 editions, own calculations.

Table 3. Actual wage distribution by half-deciles in analysed NACE sections in 2014 and 2018 (PLN)

Percentiles	2014	2018	2014	2018	2014	2018	2014	2018	2014	2018
	Horeca		Administration		Manufacturing		ICT		Finance	
5	**1680**	**2100**	**1680**	**2100**	**1680**	**2100**	1730	2656	1793	2306
10	**1680**	**2100**	**1680**	**2100**	1699	2200	2219	3263	2200	2720
15	**1680**	**2100**	**1680**	**2100**	1875	2500	2690	3724	2548	3203
20	**1680**	**2100**	**1680**	**2100**	2057	2781	3062	4194	2819	3600
25	**1680**	**2100**	**1680**	2138	2233	3012	3400	4549	3083	4000
30	**1680**	2197	**1680**	2206	2408	3234	3700	5000	3342	4350
35	1720	2300	1682	2246	2578	3450	4075	5500	3585	4708
40	1800	2473	1717	2283	2754	3637	4480	6000	3841	5066
45	1892	2589	1782	2355	2920	3847	4900	6473	4118	5490
50	2000	2741	1840	2463	3098	4048	5327	7031	4402	5948
55	2095	2879	1944	2600	3282	4258	5818	7650	4726	6417
60	2214	3024	2078	2788	3487	4500	6356	8408	5093	6972
65	2378	3207	2307	3000	3710	4764	6986	9121	5533	7575
70	2540	3458	2658	3289	3992	5062	7617	10050	6125	8321
75	2773	3675	3048	3656	4300	5429	8437	11179	6808	9209
80	3039	4007	3559	4167	4692	5882	9497	12431	7770	10483
85	3403	4437	4204	4713	5209	6486	10851	14000	9179	12311
90	4000	5129	5000	5630	6059	7431	12852	16218	11289	14965
95	5035	6551	6884	7400	7867	9495	16772	20398	16039	19700

We bolded half-deciles with wage not higher than minimum wage and we marked in grey the half-deciles with wage not higher than twice minimum wage binding in a given year. Minimum wage in 2014 equalled 1680 PLN, in 2018 equalled 2100 PLN.

Source: Structure of Earnings Survey in Poland, 2014 and 2018 editions, own calculations.

Table 4. The estimates of equation (4) separately for analysed NACE sections

	Horeca	Administration	Manufacturing	ICT	Finance
HD_2014	1.572***	1.156***	1.328***	1.368***	1.607***
	(0.141)	(0.075)	(0.040)	(0.027)	(0.021)
$(HD\_2014)^2$	-0.111*	-0.048*	-0.043***	-0.023***	-0.051***
	(0.056)	(0.024)	(0.011)	(0.004)	(0.003)
Constant	-323.497	315.998**	72.457	112.038	-730.467***
	(193.252)	(116.346)	(79.606)	(96.094)	(69.715)
Adj. R^2	0.994	0.996	0.999	0.999	0.999
Number of observations	19	19	19	19	19

HD – half-decile of the wage distribution. Estimated parameters (standard errors).

Source: own estimates.

Table 5. The estimated differences between actual and counterfactual mean wages for analysed sections in 2018

	Horeca	Administration	Manufacturing	ICT	Finance
CF_wages_2018	7.775*** (0.021)	7.793*** (0.029)	8.125*** (0.009)	8.656*** (0.041)	8.536*** (0.026)
AC_wages_2018	8.012*** (0.020)	8.003*** (0.018)	8.338*** (0.007)	8.885*** (0.029)	8.740*** (0.042)
Difference	-0.237*** (0.029)	-0.211*** (0.034)	-0.213*** (0.011)	-0.229*** (0.050)	-0.204*** (0.050)
Explained part	-0.001 (0.023)	0.001 (0.026)	0.003 (0.008)	0.003 (0.031)	-0.006 (0.024)
Unexplained part	-0.236*** (0.017)	-0.211*** (0.021)	-0.215*** (0.008)	-0.233*** (0.038)	-0.198*** (0.042)
Number of observations in CF_2018	8,497	20,209	171,999	17,204	22,265
Number of observations in A_2018	9,955	26,505	201,955	20,554	24,658

CF_wages – counterfactual wages; AC_wages – actual wages. Estimated parameters (standard errors).

Source: Structure of Earnings Survey in Poland, 2014 and 2018 editions, own estimates.

Table 6. Estimated difference between actual and counterfactual wage distribution in section Horeca with additional dummies for low-wage half-deciles

	Eq_0	Eq_1	Eq_2	Eq_3	Eq_4	Eq_5	Eq_6	Eq_7
CF_2018	7.775***	7.775***	7.775***	7.775***	7.775***	7.775***	7.775***	7.775***
AC_2018	8.012***	8.012***	8.012***	8.012***	8.012***	8.012***	8.012***	8.012***
difference	-0.237***	-0.237***	-0.237***	-0.237***	-0.237***	-0.237***	-0.237***	-0.237***
explained	-0.001	-0.062**	-0.067***	-0.077***	-0.078***	-0.086***	-0.089***	-0.095***
unexplained	-0.236***	-0.174***	-0.170***	-0.160***	-0.159***	-0.150***	-0.147***	-0.142***
Explained								
HD_6		-0.062***	-0.068***	-0.075***	-0.079***	-0.085***	-0.089***	-0.094***
HD_7			0.001	0.001	0.002	0.002	0.002	0.002
HD_8				-0.003	-0.003	-0.004	-0.004	-0.004
HD_9					0.003**	0.003**	0.004**	0.004**
HD_10						-0.002	-0.002	-0.003
HD_11							0.001	0.002
HD_12								-0.000
Unexplained								
HD_6		-0.011***	-0.015***	-0.021***	-0.024***	-0.034***	-0.041***	-0.052***
HD_7			-0.006***	-0.007***	-0.008***	-0.010***	-0.012***	-0.014***
HD_8				-0.009***	-0.010***	-0.012***	-0.014***	-0.016***
HD_9					-0.006***	-0.008***	-0.009***	-0.011***
HD_10						-0.011***	-0.013***	-0.016***
HD_11							-0.009***	-0.011***
HD_12								-0.013***
constant	-0.203***	-0.037	-0.023	0.007	0.016	0.080	0.099*	0.127**
Number of observations	18,452	18,452	18,452	18,452	18,452	18,452	18,452	18,452

CF_wages – counterfactual wages; AC_wages – actual wages.

HD_6 (and further) – additional dummy for the 6-th half-decile.

Source: own estimates.

Table 7. Estimated difference between actual and counterfactual wage distribution in section Administration with additional dummies for low-wage half-deciles

	Eq_0	*Eq_1*	*Eq_2*	*Eq_3*	*Eq_4*	*Eq_5*	*Eq_6*	*Eq_7*
CF_2018	7.793***	7.793***	7.793***	7.793***	7.793***	7.793***	7.793***	7.793***
AC_2018	8.003***	8.003***	8.003***	8.003***	8.003***	8.003***	8.003***	8.003***
difference	-0.211***	-0.211***	-0.211***	-0.211***	-0.211***	-0.211***	-0.211***	-0.211***
explained	0.001	-0.076***	-0.072**	-0.080***	-0.088***	-0.095***	-0.102***	-0.110***
unexplained	-0.211***	-0.134***	-0.138***	-0.130***	-0.123***	-0.116***	-0.109***	-0.100***
Explained								
HD_6		-0.078***	-0.080***	-0.086***	-0.094***	-0.103***	-0.112***	-0.121***
HD_7			0.006***	0.007***	0.008***	0.010***	0.011***	0.013***
HD_8				-0.002	-0.003	-0.003	-0.003	-0.004
HD_9					-0.000	-0.001	-0.001	-0.001
HD_10						0.000	0.000	0.000
HD_11							0.001	0.001
HD_12								-0.000
Unexplained								
HD_6		-0.016***	-0.017***	-0.023***	-0.031***	-0.041***	-0.055***	-0.075***
HD_7			-0.004***	-0.005***	-0.006***	-0.007***	-0.009***	-0.011***
HD_8				-0.010***	-0.011***	-0.014***	-0.017***	-0.021***
HD_9					-0.012***	-0.014***	-0.018***	-0.022***
HD_10						-0.013***	-0.016***	-0.020***
HD_11							-0.015***	-0.020***
HD_12								-0.020***
constant	-0.196	-0.133	-0.135	-0.123	-0.114	-0.094	-0.074	-0.010
Number of observations	46,714	46,714	46,714	46,714	46,714	46,714	46,714	46,714

CF_wages – counterfactual wages; AC_wages – actual wages.

HD_6 (and further) – additional dummy for the 6-th half-decile.

Source: own estimates.

Table 8. Estimated difference between actual and counterfactual wage distribution in section Manufacturing with additional dummies for low-wage half-deciles

	Eq_0	*Eq_1*	*Eq_2*	*Eq_3*	*Eq_4*	*Eq_5*	*Eq_6*
CF_2018	8.125***	8.125***	8.125***	8.125***	8.125***	8.125***	8.125***
AC_2018	8.338***	8.338***	8.338***	8.338***	8.338***	8.338***	8.338***
difference	-0.213***	-0.213***	-0.213***	-0.213***	-0.213***	-0.213***	-0.213***
explained	0.003	0.004	0.010	0.014*	0.016*	0.019**	0.021**
unexplained	-0.215***	-0.216***	-0.223***	-0.227***	-0.229***	-0.231***	-0.234***
Explained							
HD_1		0.001	0.001	0.001	0.001	0.001	0.001
HD_2			0.007***	0.008***	0.008***	0.009***	0.010***
HD_3				0.003*	0.003*	0.003*	0.004*
HD_4					0.001	0.001	0.001
HD_5						0.001	0.001
HD_6							0.001
Unexplained							
HD_1		0.001	0.003***	0.004***	0.004***	0.003***	0.003***
HD_2			0.001***	0.001***	0.001***	0.000***	0.000***
HD_3				-0.000	-0.000	-0.000	-0.001
HD_4					-0.001***	-0.001***	-0.002***
HD_5						-0.001***	-0.002***
HD_6							-0.002***
Constant	-0.231***	-0.203***	-0.239***	-0.226***	-0.213***	-0.215***	-0.211***
Number of observations	373,954	373,954	373,954	373,954	373,954	373,954	373,954

CF_wages – counterfactual wages; AC_wages – actual wages.

HD_1 (and further) – additional dummy for the 1-th half-decile.

Source: own estimates.

Table 9. Estimated difference between actual and counterfactual wage distribution in section ICT with additional dummies for low-wage half-deciles

	Eq_0	Eq_1	Eq_2	Eq_3	Eq_4	Eq_5	Eq_6
CF_2018	8.656***	8.656***	8.656***	8.656***	8.656***	8.656***	8.656***
AC_2018	8.885***	8.885***	8.885***	8.885***	8.885***	8.885***	8.885***
difference	-0.229***	-0.229***	-0.229***	-0.229***	-0.229***	-0.229***	-0.229***
explained	0.003	0.015	0.024	0.031	0.036	0.038	0.042
unexplained	-0.233***	-0.244***	-0.253***	-0.260***	-0.265***	-0.267***	-0.271***
Explained							
HD_1		0.012	0.013	0.015	0.016	0.017	0.018
HD_2			0.007	0.008	0.009	0.010	0.010
HD_3				0.005	0.006	0.006	0.007
HD_4					0.003	0.003	0.004
HD_5						-0.000	-0.001
HD_6							0.002
Unexplained							
HD_1		-0.000	-0.001	-0.000	-0.000	-0.000	-0.000
HD_2			-0.005*	-0.005**	-0.006***	-0.006***	-0.006***
HD_3				-0.000	-0.001	-0.001	-0.001
HD_4					-0.001	-0.002	-0.001
HD_5						0.000	0.000
HD_6							-0.001
constant	-0.454**	-0.397**	-0.404***	-0.415***	-0.397***	-0.430***	-0.425***
Number of observations	37,758	37,758	37,758	37,758	37,758	37,758	37,758

CF_wages – counterfactual wages; AC_wages – actual wages.

HD_1 (and further) – additional dummy for the 1-th half-decile.

Source: own estimates.

Table 10. Estimated difference between actual and counterfactual wage distribution in section Finance with additional dummies for low-wage half-deciles

	Eq_0	*Eq_1*	*Eq_2*	*Eq_3*	*Eq_4*	*Eq_5*	*Eq_6*
CF_2018	8.536***	8.536***	8.536***	8.536***	8.536***	8.536***	8.536***
AC_2018	8.740***	8.740***	8.740***	8.740***	8.740***	8.740***	8.740***
difference	-0.204***	-0.204***	-0.204***	-0.204***	-0.204***	-0.204***	-0.204***
explained	-0.006	0.023	0.012	0.017	0.023	0.030	0.033
unexplained	-0.198***	-0.227***	-0.216***	-0.221***	-0.227***	-0.234***	-0.237***
Explained							
HD_1		0.030	0.031	0.033	0.035	0.037	0.038
HD_2			-0.012**	-0.013**	-0.015**	-0.016**	-0.017**
HD_3				0.004	0.004	0.005	0.005
HD_4					0.004	0.004	0.005
HD_5						0.005*	0.006*
HD_6							0.000
Unexplained							
HD_1		0.011**	0.007*	0.006*	0.005	0.004	0.004
HD_2			-0.001	-0.001	-0.000	0.000	0.000
HD_3				0.000	0.001	0.001	0.001
HD_4					0.001	0.001	0.002
HD_5						-0.000	-0.000
HD_6							-0.000
Constant	-0.274	-0.253**	-0.204*	-0.203**	-0.195**	-0.207**	-0.199***
Number of observations	46,923	46,923	46,923	46,923	46,923	46,923	46,923

CF_wages – counterfactual wages; AC_wages – actual wages.

HD_1 (and further) – additional dummy for the 1-th half-decile.

Source: own estimates.

Table 11. Wage inequality measures across analysed sections between 2014 and 2018

	Horeca		Administration		Manufacturing		ICT		Finance	
	2014	2018	2014	2018	2014	2018	2014	2018	2014	2018
95/5	3.00	3.12	4.10	3.52	4.68	4.52	9.69	7.68	8.94	8.54
90/10	2.38	2.44	2.98	2.68	3.57	3.38	5.79	4.97	5.13	5.50
75/25	1.65	1.75	1.81	1.71	1.93	1.80	2.48	2.46	2.21	2.30
50/10	1.19	1.31	1.10	1.17	1.82	1.84	2.40	2.15	2.00	2.19
90/50	2.00	1.87	2.72	2.29	1.96	1.84	2.41	2.31	2.56	2.52

Source: own calculations.

Table 12. Change of labour cost and gross value added 2014 and 2018

NACE section	Labour costs as % of GVA 2014	Labour costs as % of GVA 2018	% change in GVA per worker
Manufacturing	43.6	48.0	11.3
Horeca	43.7	41.1	23.8
ICT	38.6	45.9	1.7
Finance	40.0	38.5	22.3
Administration	56.2	52.5	31.6

Source: CSO, own calculations.

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