
What drives wage gaps in Europe?

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Jan Drahekoupil and Agnieszka Piasna

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Abstract

This paper compares wages across Europe in relation to the characteristics of workers and firms. Worker and workplace endowments can be taken as a proxy for labour productivity. We estimate the extent to which wage differences observed at an aggregate level can be related to the different compositions of workforces and workplaces, as well as the types of jobs conducted in separate countries. We also decompose the observed differences in returns on endowments by identifying the sectors and occupational groups that contribute most to the wage gaps observed at the aggregate level.

The wage gaps in low-wage countries actually appear larger once differences in worker, work and workplace characteristics are controlled for. In contrast, the differences in wages between high-wage countries diminish when we control for these endowments. The wage gap between East and West thus seems to be explained by a much lower return on skills and other characteristics rather than by differences in the composition of workforces and firms. Sectoral and occupational analysis suggests that CEE countries have developed a generalised low-cost and low-wage model, with relative returns particularly low on higher skills. There is much less wage disparity across European countries in more labour intensive and lower-paid services sectors, such as accommodation and food service activities. The magnitude of the wage gap seems to be driven by the relative position of sectors and occupations in high-wage countries.

Introduction

Differences in wages between member states constitute the main source of inequality in the European Union. In particular, wages in central and eastern Europe (CEE) are much lower than wages in western Europe. The large differences remain also if adjusted for differences in price levels. Lower wages are commonly explained by lower productivity (i.e. value added per hour worked). By implication, the argument goes, any increase in wages higher than that of productivity harms competitiveness and thus also employment prospects. Differences in workers' skills, technology employed, managerial efficiency and quality of infrastructure could indeed lead to a productivity gap justifying wage differentials.

Yet, there are reasons to be sceptical about such arguments. In fact, wage differences between East and West do not seem to correspond to the differences in productivity levels. Nor can changes in unit labour costs be directly linked to changes in competitiveness. As shown by Galgóczi (2017), the value added produced by a unit of labour costs in manufacturing is much higher in East European countries than in Germany, suggesting a scope for wage increases in the sector most exposed to international competition.¹ An alternative estimation based on differences in capital stock, rather than labour productivity (Collignon and Esposito 2017), also showed significant wage undervaluation in CEE countries. This econometric exercise demonstrated a significant scope for wage increases without bringing returns to capital stock below the average level across the European Economic and Monetary Union.

However, measuring and comparing levels of productivity, defined as value added per unit of labour (or capital) input, is problematic. Much of the analysis informing policy-making thus focuses on relative changes in unit labour costs, proceeding from an arbitrary starting point, a point in time when wage levels are assumed to be in equilibrium. Another problem in measuring productivity is that productivity differences can be an accounting artefact, reflecting differences in wage levels and/or in profit margins. This is most apparent in the public sector where productivity is often measured by wages paid to employees. Moreover, wage levels can determine recorded value added also in the private sector. Hence, a shift of an activity within a network of a multinational corporation from a high-wage location to a lower-

1. The comparison is only suggestive as wage-adjusted productivity is an inversion of wage share. Differences in the latter can be related to structural differences in the economy, such as capital intensity.

wage one is likely to lead to a lower value added through the activity even if capital infrastructure and labour input remain the same. In a lower-wage country, the same activity will thus record lower productivity because of the wage differential alone (Myant 2016).

In this paper, we address this problem by comparing wages across Europe in relation to the characteristics of workers and firms. A measure independent of value added and hence wage levels, worker and workplace characteristics can be taken as a proxy for labour productivity. Such a measure remains imperfect as productivity is likely to be determined also by other factors that are not directly related to the observed worker and workplace characteristics. These can include better infrastructure or differences in innovation intensity. However, our data allow us to take into account much more detailed information about workers and workplaces than in other empirical studies that use worker endowments as a proxy for labour productivity. Our analysis allows us to distinguish between the differences in workforce and workplace endowments and the differences in returns on these endowments. For instance, a higher prevalence of low-paid jobs, such as those typically found in agriculture or catering, could explain why a country records lower average wage levels. Similarly, a country employing more experienced engineers can be expected to record higher wage levels than a country specialising in low-skilled assembly operations. Our analysis controls for these differences, taking into account differences in the observable characteristics of workers and workplaces as well as the differences in sectoral structures.

Our data also allow us to provide a comprehensive picture of wage differences between sectors and occupational groups. We are able to take into account the public sector, smaller firms and the self-employed that are typically excluded from analysis due to data limitations. In this way, we are able to decompose the observed differences in returns on worker and workplace characteristics by identifying the sectors and occupational groups that contribute most to the wage gaps observed at the aggregate level.

The analysis shows that, once the differences in productivity-related worker, work and workplace characteristics are controlled for, the differences in wages between low-wage countries in eastern Europe and European high-wage countries actually appear larger than in a simple comparison of average wages. In contrast, the differences in wages between high-wage countries diminish when we control for productivity-related endowments. The wage gap between East and West thus seems to be explained by a much lower return on skills rather than by differences in the composition of workforces and firms. In other words, the actual wage gaps are higher than apparent in the aggregate figures.

A decomposition of the differences in returns reveals which sectors and occupational groups in low-wage countries suffer from the highest negative returns. In the old member states in southern Europe, the information and communications sector is particularly undervalued, followed by professional, scientific and technical activities, public administration, manufacturing and construction. In CEE countries, a broader set of sectors – including

manufacturing, construction, professional sectors and public sector activities – is characterised by a larger wage gap. Larger relative wage undervaluation is thus common to a wider set of activities. However, there is much less wage disparity across countries in more labour intensive and lower-paid services sectors, such as accommodation and food service activities, administrative support activities and wholesale and retail. Finally, wage gaps by occupational categories largely correspond to the sectoral pattern. There are notable differences across country groups, but the overall picture shows a higher relative wage premium for high-skilled workers in high-wage countries, both among manual and clerical occupations.

Theory and research on wage differences

The explanation of wage differences with reference to productivity is embedded in the neoclassical economics that explain wage levels with reference to the value created in the production process. In the neoclassical model, assuming perfect market competition in labour and capital markets, production factors, including labour and capital, will be rewarded in line with their productivity. Profit is thus determined by the level of the marginal productivity of capital, and the wage of workers is in turn determined by the marginal productivity of labour. The production process, according to this model, determines not only the division of the social product, or value added, between capital and labour, but also among individual workers, whose individual productivity is determined by their tasks and skills. Therefore, the argument goes, if unions succeed in raising wages, the inevitable result will be economic inefficiency, hence unemployment.

Critics of the neoclassical model have pointed out that the marginal productivity of workers cannot, in fact, be separated from the marginal productivity of the capital that they use (Robinson and Eatwell 1973). Accordingly, profits are not determined in the production process, but should rather be understood as a residual that remains after the capitalist pays for the costs of capital and labour. Similarly, the contribution of individual workers to the overall value added, whether they are managers, skilled workers or routine workers, cannot be measured separately for each participant in the cooperative production process. In this view, the profits and wages of individual classes of workers are determined historically and in a political struggle. The outcomes are conditioned by the relative power of individual classes – as conditioned by supply and demand on the labour market, social policies that change the external options for workers, or by the abilities of workers to organise collectively – and also by the productivity levels that determine the value to be distributed. Moreover, a capitalist may withdraw new investment should wage claims bring profits below an acceptable level, or what is on offer in other investment locations.

Mainstream economics has largely ignored this critique but it addresses the inadequacy of the perfect competition assumptions through bargaining models that are somewhat more realistic about the process of wage determination and that allow bargained wages also to be economically efficient (i.e. not harmful

to employment, or even involving better employment outcomes).² Accordingly, wage levels are determined through bargaining over the distribution of value added between capitalists and workers. In this context, both employees and firms can enjoy rents from their market power. Such rents are then split between employers and employees in bargaining over wages (see Boeri and Ours 2013). High-profitability firms can thus be expected to pay higher wages. The low rate of unionisation and higher levels of unemployment are likely to undermine the market power of employees, and this has often been seen as an explanation for the low wage share that can be observed in many CEE countries.

Empirical studies of wage differences across Europe, independently of the recorded value added, have included three types of research. They all aim to distinguish the relative effect of differences in endowments (i.e. workforce and, less often, workplace characteristics) and that of returns on endowments. They typically find high differences in returns on endowments, undermining the assumption of a perfectly competitive labour market. There is, in turn, considerable support for the importance of a contextual historical process of wage formation or, in the language of bargaining models, that of rents³ and the ability of workers to secure their share in them.

First, there is a body of research, albeit rather small, that examines wage differences across countries in Europe (Behr and Pötter 2010; Brandolini *et al.* 2011; Pereira and Galego 2016). These studies attribute wage differences between countries to differences in returns on individual attributes (or returns-to-skill functions) rather than to differences in workforce composition.⁴ Comparing the 2008 wages of male workers in eight EU countries in relation to the UK, the recent study by Pereira and Galego (2016) finds that, while wage differences in the richer countries (namely, Austria, Spain and Ireland) are not statistically significant compared to the UK, there are significant wage differentials in comparison to the UK in south-western Europe (Spain, Greece, Portugal) and particularly CEE countries (Hungary and Poland). They find compositional effects – mainly a higher percentage of university graduates, workers with supervisory responsibility and those in top occupations in the UK – but the return effects are dominant. However, in all these studies, the large variation in returns on skills may be also attributed to omitted variables. Pereira and Galego (2016) suggest that these are likely to be other factors than human capital variables, such as innovation systems or the quality of public infrastructure, but this line of research has yet to identify such factors.

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2. Efficiency wage models, for instance, relax the neoclassical assumption of productivity being exogenous and allow for a reverse causation in which higher wages lead to higher productivity by, for instance, inducing higher work effort or better work organisation (Shapiro and Stiglitz, 1984).
 3. Rents refer to returns in the context of imperfect competition. The latter can be related to quasi-monopolies, labour unionisation or social policy that changes the external options for workers through, e.g., benefit payments.
 4. Behr and Pötter (2010) decomposed wage differences between EU countries in different quintiles, employing a proportional hazard model on the 2001 European Community Household Panel (ECHP) dataset including thirteen European countries. Brandolini *et al.* (2011) analysed the distribution of earnings on the 2007 wave of the European Union Statistics on Income and Living Conditions (EUSILC) dataset.

It is to this body of research that this paper contributes. Our analysis suffers from similar limitations, but our dataset allows us to take into account more detailed information about worker and workplace characteristics.⁵ Our indicators should thus represent a better proxy for labour productivity. We are also able to report more recent data and compare differences across sectors and occupational groups in greater detail.

Differences between sectors have been typically analysed within (the same) countries. This second, much larger, body of literature aims to identify also the factors behind the differences in returns on endowments (e.g. Martins 2004; Magda *et al.* 2008; Du Caju *et al.* 2010).⁶ Controlling for both worker and workplace characteristics, the studies find large differences between sectors in returns on endowments. These are attributed to differences in rent-sharing mechanisms including, at the aggregate level, corporatist institutions narrowing the differences in inter-industry wage differentials (Magda *et al.* 2008). At the sectoral level, a higher degree of (firm-level) collective agreement coverage is associated with higher rent sharing between firms and workers (Du Caju *et al.* 2010). There is also evidence that sectoral wage differentials (i.e. higher returns on characteristics) are positively correlated with profits (e.g. Kouwenberg and van Opstal 1998), as expected in the bargaining models. International exposure is also found to influence the extent to which workers can secure rents: workers in industries facing intensive import competition have lower wage premia, while those in export-intensive sectors enjoy larger wage premia (see overview in Rycx and Tojerow 2007). Finally, returns on attributes are positively associated with product market regulations restraining competition (Jean and Nicoletti 2002).

Third, the relative importance of endowments and the returns on them has been analysed in comparative inequality studies. This literature tends to point to the importance of differences in returns on workplace and workforce attributes in explaining wage inequality within countries rather than the differences in endowments (e.g. Blau and Kahn 1996, 1999; Devroye and Freeman 2001; Simón 2010). However, when measured through cognitive tests, differences in endowments still appear important, particularly when net supply is taken into consideration (Leuven *et al.* 2004).

In addition, wage levels across CEE countries have been analysed in studies of the effects of FDI and trade in the region. The dependence of the region on FDI is seen as a factor constraining wage growth in the more theoretical literature on the varieties of capitalism in the region (Nölke and Vliegenthart 2009). However, empirical support is, at best, limited. Sectoral analysis typically finds that foreign owned firms pay higher wages in jobs with higher productivity (Galgóczy *et al.* 2015). Econometric analysis by Faggio (2001) also

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5. Behr and Pötter (2010) measure skills through education, tenure with current employer and general working experience. Brandolini *et al.* (2011) relies on education (secondary, university) and worker age. Pereira and Galego (2016) analyse educational, supervisory responsibility and being a native worker.
 6. European Structure of Earnings Survey.

found FDI to be associated with higher local wages. Stehrer and Woerz (2009) gave some evidence for the downwards pressure of FDI on wage growth in CEE countries, suggesting that industries with relatively lower wages (and slower wage growth) are more attractive for FDI. A more comprehensive assessment of determinants of wages by Onaran and Stockhammer (2008) found positive effects of FDI in capital- and skill-intensive sectors in the short-term, but the overall effect of FDI turned negative in the medium-term. The study also found productivity to have a weak effect on wages in general, but somewhat positive, in capital intensive sectors; unemployment to have a strong positive effect; and exports a negative effect on wages but imports a positive one.

Our approach, data and method

We analyse wage differences between countries in the EU using the 2015 wave of the European Working Conditions Survey (EWCS).⁷ The use of the EWCS dataset allows us to include detailed information on the properties of the worker (related to human capital formation), job content as well as on those of the establishment. In this way, we partially address the unobserved characteristics problem encountered in other studies that use more limited information on worker skills and experience. The EWCS covers also a wide range of establishments, including smaller firms and the public administration sector that are not covered by the European Structure of Earnings Survey (SES).

The survey measures net monthly earnings from the main job in national currencies, which are then converted into Euros. We adjust reported earnings by the PPP index obtained from Eurostat. Moreover, a small number of outliers were removed by coding the top and bottom 0.25 per cent of the income distribution as missing. On this basis, a harmonised monthly income variable was computed, largely following the measurement developed by Green and Mostafa (2012) from the EWCS data as part of their job quality index. With a median (the middle point of the distribution) of €1,213 and a mean of €1,375, net monthly earnings across the EU28 are normally distributed with a slight positive skew due to a small number of respondents with very high earnings.

Adjusting for PPP is common practice as standard models of wage setting work with real, rather than nominal, wages. It accounts for differences in prices between countries and thus compares earnings between countries in real terms. Real wage differences are key to inequality within Europe. They should also be more relevant than nominal wage differences from the perspective of workers. At the same time, it can be argued that differences in nominal rather than real wages are relevant for companies that sell internationally and can decide where to locate production. However, in non-tradeable sectors, labour

7. The EWCS has been conducted by Eurofound every five years since 1990. The sample is representative of persons in employment, both employees and self-employed, working for at least one hour a week, who are aged 15 years and above (16 and above in Spain and the UK). The interviews are conducted face-to-face. Sample sizes, with a few exceptions, are around 1,000 workers per country. The response rate for questions on income was 83 per cent.

costs need to be considered in relation to local prices. In any case, estimated differences in wages expressed in PPP can be reinterpreted in nominal terms through a simple multiplication. Our analysis can also be interpreted as identifying differences in wages beyond differences in price levels which are well-known or readily available. The use of PPP rather than market exchange rates also makes our estimates of wage gaps more conservative.

For data availability reasons, we use net, rather than gross, monthly wages. This is a limitation. For instance, the net figures do not cover subsidiary elements of the reward package, such as employers' contributions to occupational pension schemes. Moreover, deductions of taxes and social insurance contributions vary considerably between countries. The net figures thus differ from the labour costs borne by employers. In addition, taxes and social insurance may be considered as another subsidiary element of the reward package that is consumed by the worker through the use of public services and insurance.

In the analysis, we control for differences in worker, work and workplace characteristics as well as the sectoral composition of economies. The worker and workplace characteristics can be taken as proxies for labour productivity, a measure that is independent of value added and hence wage levels. Individual worker characteristics include gender, age (below 25, 26-35, 36-45, 46-50, 51-59 and 60 or older) and educational attainment (seven groups based on ISCED classification). The work characteristics controlled for in the analysis include tenure in current job measured in years. Supervisory responsibility groups workers into those who do not have anyone working under their supervision and those who supervise up to 9 and 10 or more people. We also control for the use of technology at work (based on frequency of work with computers, laptops, smartphones, etc.) and task complexity. Work characteristics also include form of employment (indefinite contract, fixed-term contract or agency work, work without a formal contract and self-employment). Further control variables used in the analysis include occupational groups according to ISCO⁸ and 21 economic sectors based on 1-digit NACE. Size of establishment differentiates between workers who work alone and workplaces with 2 to 9, 10 to 249 and 250 or more workers. Finally, we adjust for differences in the number of weekly working hours (1-20, 21-34, 35-40, 41-47 and 48 or more).

We estimate wage differences between countries by including country, or country-group, dummies. The country effects then capture the difference in the average return on worker and workplace characteristics in the country relative to the reference category (either Germany or a group of high-wage countries in north-west Europe). The country effects thus include institutional and market power factors that may influence returns on endowments. At the same time, the country effects include the differences in return from unobserved characteristics, which may include other human capital endowments (e.g. quality of the education system) as well as other productivity-determining

8. For the pooled sample of 28 EU countries (results presented in Figure 2) we use a more detailed 2-digit ISCO with 43 occupational groups; for the analysis of country clusters we use nine groups based on 1-digit ISCO (excluding armed forces) to secure sufficient sample sizes.

factors (e.g. the quality of infrastructure and differences in innovation systems).

To analyse the size of wage differences across countries, we employ linear regression (OLS) models. In the first step of the analysis we include 28 countries that were members of the EU in 2015, covering in total 29,683 respondents who provided information on their earnings. The baseline model contains only country dummies. We then include the set of control variables to account for differences in the structure of the economy as well as composition of the workforce across countries.

In the second step, we analyse wage differences between sectors and occupational groups. To ensure sufficient sample sizes across various segments of the workforce, we group countries into six geographic clusters. We then decompose the country effects by modelling interactions between country clusters and sectors as well as country clusters and occupational groups. The interactions allow individual sectors and occupational groups to have a different effect on the returns on skills relative to the group of high-income countries in north-west Europe. The analysis thus allows the identification of those sectors and occupations that contribute to the relative difference in the returns on endowments captured by the country dummies.

The role of economic structure and workforce composition

Figure 1 compares two measures of average monthly wages across Europe, both adjusted for PPP: gross monthly wages as measured by the SES in 2014 (the most recent available year); and net monthly wages in the 2015 EWCS, the dataset we use in the analysis that follows. The comparison shows a familiar pattern of high-income countries in north-west Europe having higher average wages and CEE countries at the bottom of the income ranking. Both means of measurement have their limitations and the two datasets are not directly comparable – most notably, the SES data do not include small enterprises with less than 10 employees.⁹ However, the comparison of gross and net wages points to some possible biases in the EWCS dataset. Most notably, in Lithuania, average net wages, as reported in the EWCS, appear higher than gross wages as reported in SES, suggesting an over-reporting of net income in the country.¹⁰ In contrast, net wages appear under-reported in Hungary. This could be related to the particularly low response rate in that country (46.1 per cent).¹¹ A bias in reporting net wages could also have influenced the

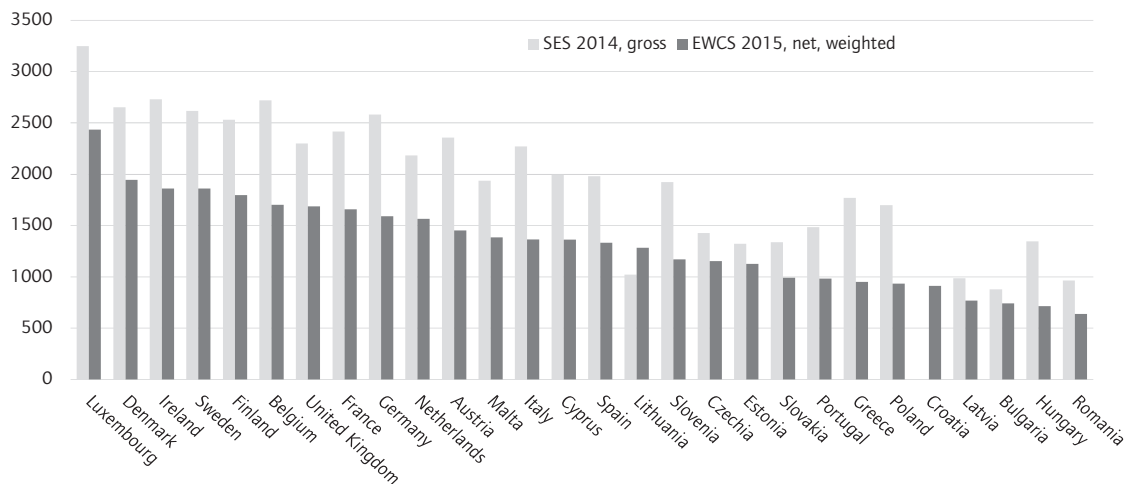
9. The differences between the two means of measurement also include a different sectoral structure (SES does not include agriculture, public administration, defence and compulsory social security) and different age brackets.

10. Lithuania reported much lower wages in the 2010 wave of EWCS. In 2015, the response rate in the country was relatively high (90.7 per cent). This is therefore unlikely to constitute the source of the bias.

11. Response rates lower than 70 per cent were found in Hungary (46.1 per cent), Italy (56.1 per cent), Czechia (59.2 per cent), Poland (60.8 per cent), Greece (61.1 per cent), Portugal (65.1 per cent), Estonia (65.5 per cent), Croatia (67.1 per cent), and Romania (68.4 per cent).

EWCS-based ranking of Poland and Greece (both report much lower wages in EWCS than in SES). Overall, however, CEE countries tend to report higher net, relative to gross, wages than would be justified by differences in the tax wedge.¹² The EWCS dataset that we use in the analysis may thus in fact over-estimate wage levels in CEE, making our estimates of wage differences conservative.

Figure 1 Monthly wages in the EU (adjusted for PPP) – comparison of two surveys



In order to control for the different compositions of workforces and types of jobs conducted in the countries, we compare, using the EWCS dataset, a baseline model with country dummies only and Germany as the reference category with a model that in addition to country dummies includes worker and workplace characteristics. As these characteristics can be expected to be related to the productivity of workers, the productivity explanation, or the perfect labour market competition model, implies that the absolute values of the country residuals – indicating the relative differences in monthly wages across the EU compared to Germany – should drop once firm and workforce characteristics are controlled for. This is, as shown in Figure 2, indeed the case in Luxembourg, the UK, the Scandinavian countries and in Belgium. In all these high-wage countries, the distance from Germany diminishes once economic structure and workforce composition are controlled for. In France, Belgium, the UK and the Netherlands, countries that have similar wage levels to that of Germany, the residual country effects turn negative.¹³ This suggests a possible undervaluation of wages relative to Germany, but the country effects remain low in all of these countries, with the exception of France where it exceeds €100 (adjusted for PPP).

¹². See tax wedge on labour in 2015, in European Commission tax and benefits database, based on OECD data, http://europa.eu/economy_finance/db_indicators/tab/

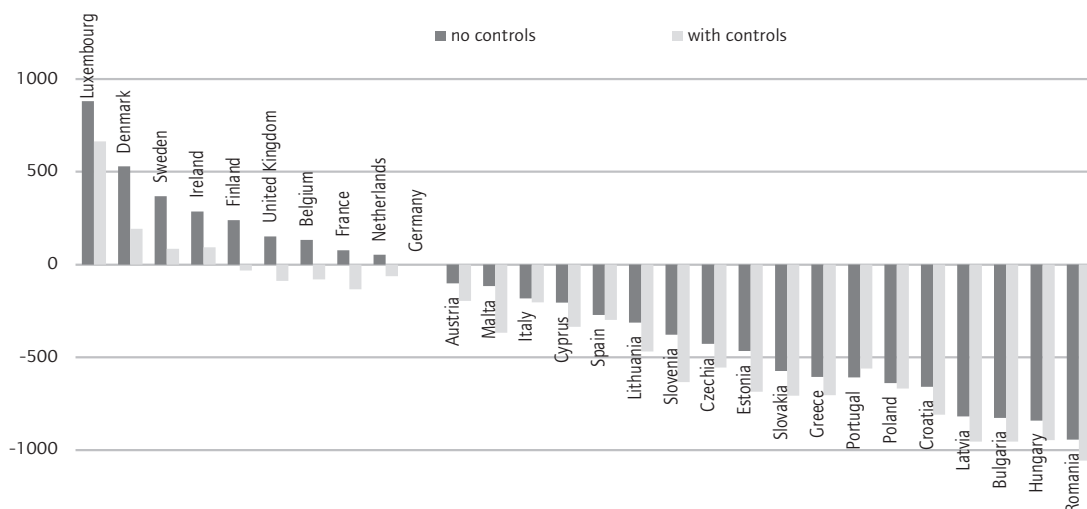
¹³. The small negative effect in Finland is not statistically significant (i.e. different to zero).

Interestingly, however, in countries that have lower wage levels than that of Germany, the country effects actually increase once we control for worker and workplace characteristics. In other words, comparing the same type of workers in the same type of workplaces increases the observed wage gap between Germany and European low-wage countries. The notable exception is Portugal where lower wages compared to Germany are at least partly explained by the prevalence of lower-paid segments of the labour market.

It should be noted that using Germany as a benchmark does not imply that relative wage levels in Germany are at equilibrium level. On the contrary, the persistent current account deficits and long-term trends in ULC development relative to other European countries suggest that German wages are, in fact, undervalued (e.g. Lehndorff, 2016; see also Collignon and Esposito, 2017).

Our analysis of the 2010 data showed a similar pattern. The differences relate to an apparent devaluation of wages relative to Germany – indicated by the residual country effects net of worker and workforce characteristics – between 2010 and 2015 in many old member states (most notably in Cyprus, Greece, Netherlands, Spain, United Kingdom, Ireland, Malta and Austria). However, some countries, namely Estonia, Sweden, Denmark, Finland and Czechia, experienced a modest revaluation of wages between 2010 and 2015.¹⁴ As a result, in 2010, fewer high-wage countries appeared undervalued relative to Germany. Moreover, in 2010, accounting for worker and workforce characteristics also reduced the wage gap in Spain relative to Germany.

Figure 2 Differences in net monthly earnings (in Euro and adjusted for PPP) across EU28 countries compared to Germany



Source: authors' analysis from EWCS 2015.

14. The large revaluation recorded in Lithuania is likely to be related to the over-reporting of wages in 2015.

The analysis thus does not support the argument on the role of economic structure and the skill profile of the workforce in explaining lower wages. The results point to quite the opposite situation: once we compare similar workers in similar jobs, the average wage penalty compared to Germany is even wider in all low-wage countries. Portugal is the only exception: the different composition of the workforce explains, at least in part, the real wage gap to Germany. In the next step, we identify those sectors and occupations that contribute most to the observed wage penalties.

The role of sectors and occupational levels

In order to decompose the observed differences in returns on endowments, we now analyse the extent to which the country effects differ in individual sectors and types of occupation. We can identify those sectors and occupations that contribute most to the wage gaps observed at aggregate level by employing regression models with interaction terms. In this way, we can estimate, for instance, the extent to which wage gaps are different in manufacturing and construction. To ensure sufficient sample sizes we group the countries into six clusters: north-west Europe (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden, the United Kingdom); southern Europe (Greece, Italy, Portugal, Spain); the Visegrád four (Czechia, Hungary, Poland and Slovakia); south-east Europe (Bulgaria and Romania); the Baltic states (Estonia, Lithuania and Latvia); and former Yugoslav republics (Croatia and Slovenia).¹⁵ The contribution of individual countries in their respective groups is weighted by their population size.

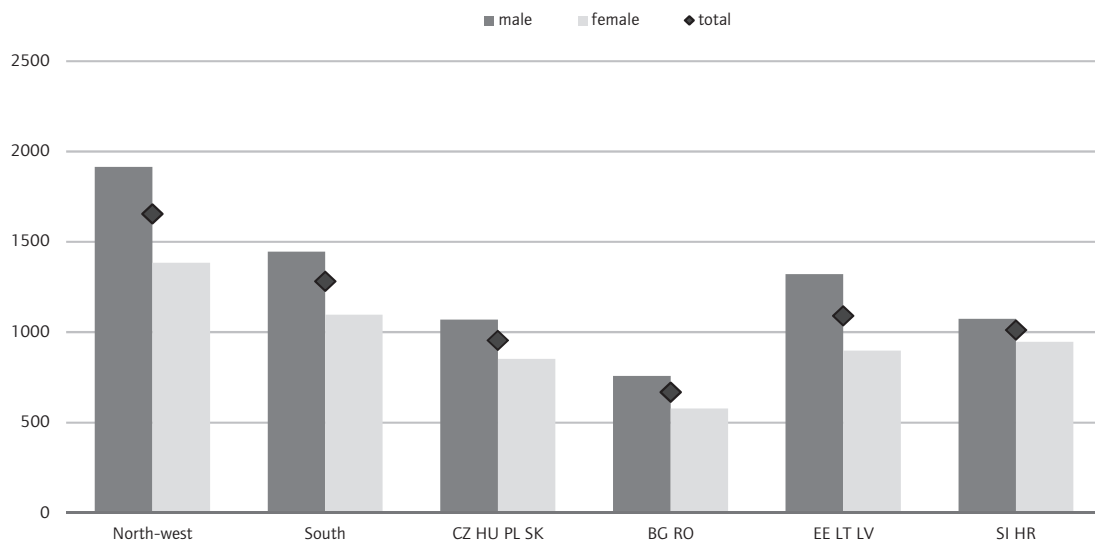
Wage differences across country groupings are shown in Figure 3. Average monthly wages in the north-west group adjusted for the PPP index are approximately €1,654; they are lower by 23 per cent in the southern group (€1,281), 42 per cent in the Visegrád group (€955), 60 per cent in Romania and Bulgaria (€668), 34 per cent in the Baltic group (€1,091) and 39 per cent in Croatia and Slovenia (€1,011). The relative position of the Baltic cluster may be biased by the apparent over-estimation of wage levels in Lithuania. The wage gaps are somewhat lower for female workers, in large part due to the prevalence of low-paid, part-time work among women in some north-west countries, particularly in Germany, and a higher female labour market participation rate in many CEE countries.

Replacing Germany with the north-west group as a reference category somewhat changes the effect of controlling for worker and workplace characteristics. As shown in Figure 4, we observe an increase in the wage gap once economic structure and workforce composition are controlled for in the Baltic group and in Croatia and Slovenia, albeit to a somewhat smaller extent than when compared to Germany only as in Figure 2. The effect remains virtually unchanged in Bulgaria and Romania and drops slightly in the

15. We dropped Malta and Cyprus from the analysis.

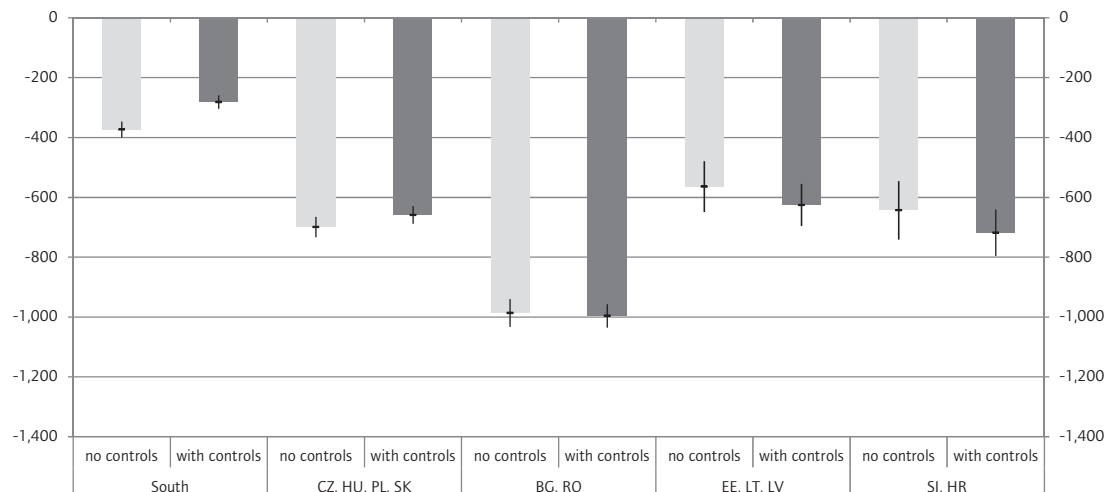
Visegrád group. We observe a significant reduction in the southern group. This can be attributed to the effect of adding to the comparator group a number of countries where high wages can be at least partially explained by the higher incidence of high-paying jobs (see Figure 2).

Figure 3 Average monthly wages (in Euro and adjusted for PPP) by gender and country group



Source: authors' analysis from EWCS 2015.
Notes: weighted means.

Figure 4 Estimates for region effects on wages compared to the north-west country group



Source: authors' analysis from EWCS 2015.
Note: lines represent 95 per cent confidence intervals.

Analysis of the interaction between sectors and country clusters, reported in Figure 5 and Table 1, shows that the undervaluation of wages is found across sectors of economic activity. The size of these wage gaps, however, varies considerably. Figure 5 shows predicted wages in individual sectors in the six country clusters. These are average wages in the sector after holding all analysed factors constant (i.e. differences in workforce and workplace characteristics). It shows larger wage gaps in a number of sectors, including manufacturing; construction; professional, scientific and technical activities; and the financial sector. The public sector activities of public administration and education are also characterised by a large pay gap. We observe much smaller gaps in accommodation and food, wholesale and retail, and administrative and support activities. Finally, household activities are exceptional as the predicted wages are not significantly different in most country groups in this sector.

Another way of presenting the interaction showing the relative role of individual sectors in contributing to the pay gap can be found in Table 1. It shows the effect of country groups on wages in selected sectors relative to wages in those same sectors in the north-west group. In other words, the values show by how much, on average, wages are lower in a sector compared to wages in that sector in north-west countries. The values in bold indicate statistically significant differences from the average negative premiums observed in manufacturing.¹⁶ There are more significant differences between sectors in southern Europe than in CEE groups, as manufacturing in southern Europe has a somewhat different position relative to other sectors: it is less representative of overall relative wage levels. We do not find statistically significant sectoral differences in Croatia and Slovenia, but that may be due to the small size of this cluster.

In CEE regions, the negative wage premiums in construction, the financial sector, professional activities, public administration and education, and health and social work are as large as in manufacturing. In contrast, the wage gap is much lower in accommodation and food service activities, wholesale and retail, and in administrative support. Transportation and storage, arts and entertainment, and other services appear less undervalued in the Visegrád group. Finally, information and communications is less undervalued in Bulgaria and Romania.

In the southern group, information and telecommunications appears to be the most undervalued sector. It is followed by professional, scientific and technical activities; public administration; manufacturing; and construction. Accommodation and food are also among the least undervalued sectors in this country group. Unlike in the CEE groups, finance and insurance, education, and arts and entertainment are among the less undervalued sectors.

The empirical literature on sectoral wage premiums, discussed above, identifies a number of factors that explain differences between sectors, including profitability, import competition, export intensity, product-market regulation,

¹⁶ Non-significant values should thus be considered as having the same wage penalty as manufacturing in the given country.

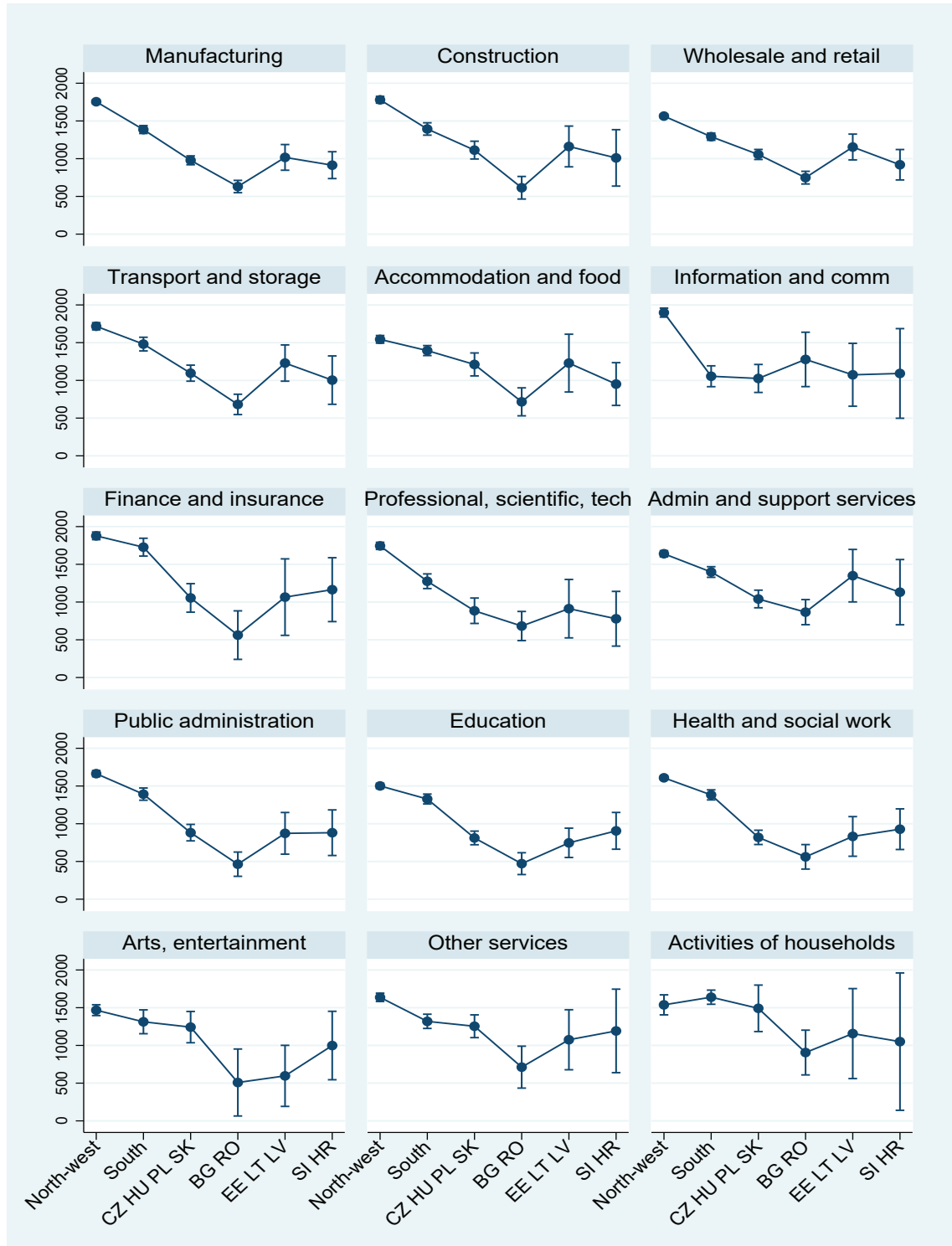
FDI intensity and exposure to imports. However, these factors are not directly applicable to our analysis: rather than comparing wages across sectors in a country, our analysis compares sectoral wage premiums across country groups. The observed differences in sectoral wage premiums could thus be explained by the different profitability or export intensity of an individual sector in the north-west and in other country groups. However, the basic properties of individual sectors, such as exposure to imports, are not likely to differ significantly between the regions. One factor that does differ is FDI intensity which is higher in CEE, particularly in manufacturing and non-tradeable services (most notably banking and telecommunications). The returns on FDI in CEE are high in international comparison.¹⁷ Telecommunications, utilities and finance, typically controlled by foreign investors, enjoy particularly high profits (Chmelař *et al.* 2016). However, profitability and FDI intensity were found in the empirical literature to be associated positively with sectoral wage premiums. The fact that manufacturing, information and communications, and finance and insurance are characterised by the largest wage gaps in CEE groups, but not in southern Europe, is thus indicative of a limited ability of workers to capture rents in these sectors, but cannot be linked to FDI dependence.

There is much less wage disparity across countries in more labour intensive and lower-paid services sectors, such as accommodation and food service activities, and also administrative support activities and wholesale and retail. The fact that the latter sector is among those business activities predominantly owned by foreign investors raises further doubts about the importance of FDI intensity. What seems to matter most is that workers in these sectors in the north-west group report relatively low incomes and, while the wage penalty in the new member states is still significant, it is much narrower than in the rest of the economy due to the relative position of these sectors in the north-west group.

Interestingly, in the CEE group, a broader set of public sector activities, including education, contributes to driving down wages, thus being a factor in preserving wage differences between western and eastern countries. Public sector wage differentials are typically not investigated in the empirical literature and the factors identified in these studies, such as profitability, are irrelevant to this sector. The wage differentials in this sector should be attributable to political factors and thus may be indicative of weak labour power resources in CEE countries.

17. Source: OECD International Direct Investment statistics database.

Figure 5 Interactions with sectors: predicted wages in country clusters (margins plot)



Source: authors' analysis from EWCS 2015.

Notes: predictive margins: predicted values from the regression analysis, all control variables included, with interaction terms between country cluster and sectors. Wages adjusted for PPP index. Only sectors with a sample size of at least 25 for each country group are reported.

Table 1 Differences in net monthly earnings (in Euro and adjusted for PPP) relative to the north-west group, selected sectors

	North-west	South	CZ HU PL SK	BG RO	EE LT LV	SI HR
Manufacturing	0.0	-368.7	-776.3	-1124.0	-737.6	-840.6
Construction	0.0	-386.7	-667.1	-1165.9	-618.7	-770.1
Wholesale and retail	0.0	-273.1	-508.9	-816.0	-410.1	-644.8
Transport and storage	0.0	-236.2	-621.5	-1035.9	-487.5	-713.8
Accommodation and food	0.0	-148.8	-332.6	-828.2	-314.9	-592.6
Information and communication	0.0	-843.4	-872.6	-620.4	-824.2	-806.1
Finance and insurance	0.0	-150.1	-822.7	-1315.8	-812.0	-713.5
Professional, scientific and tech	0.0	-469.0	-860.2	-1062.5	-832.5	-966.4
Admin and support services	0.0	-242.1	-599.6	-773.8	-290.8	-509.2
Public administration	0.0	-271.7	-782.3	-1200.2	-791.5	-782.8
Education	0.0	-173.5	-689.5	-1030.3	-754.4	-595.7
Health and social work	0.0	-226.5	-790.0	-1047.6	-777.1	-681.2
Arts, entertainment	0.0	-154.4	-224.7	-958.9	-870.9	-468.5
Other services	0.0	-318.3	-383.3	-925.3	-562.3	-445.4
Activities of households	0.0	101.5	-46.1	-632.1	-381.0	-487.4

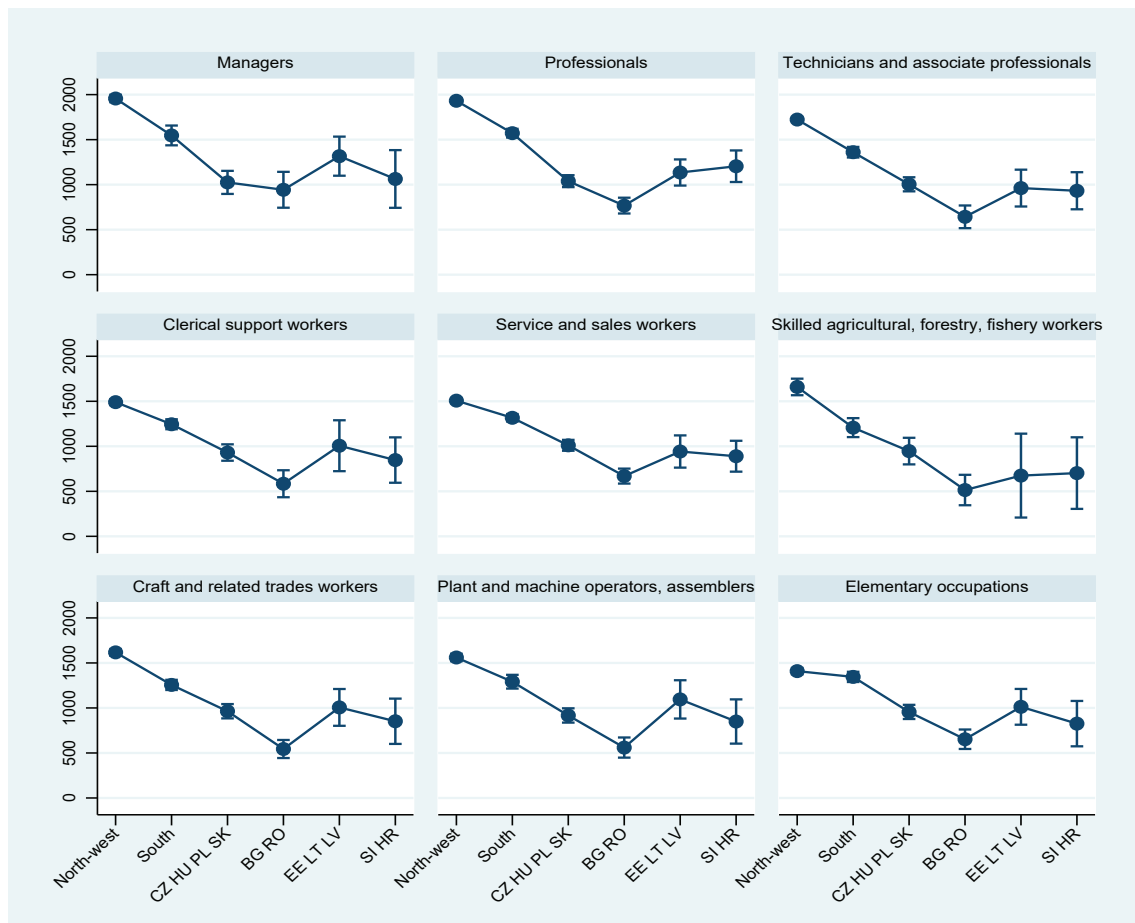
Note: marginal means estimated from the regression model, adjusted for all control variables. In bold = differences from the negative return in manufacturing that are statistically significant ($p \leq 0.05$).

A comparison of the wage gaps between the main occupational categories is presented in Figure 6 and Table 2. Statistical significance in Table 2 refers to a comparison with the wage penalty for professionals.¹⁸ The wage penalty for the latter group is not significantly different from that faced by managers in any country group. Again, we do not find statistically significant occupational differences in Croatia and Slovenia. The analysis for other country groups shows that elementary occupations are significantly less undervalued than professionals. Moreover, in southern Europe, clerical and support workers, services and sales workers are also less undervalued than professionals. In the Visegrád group, all occupational groups, apart from managers, are less undervalued than professionals. In Bulgaria and Romania, technicians and associate professionals, clerical and support workers, and plant and assembly workers are among the less undervalued occupational groups. Finally, in the Baltic group, services and sales workers and plant and assembly workers are among the less undervalued groups.

18. Non-significant values should thus be considered as having the same wage penalty as professionals in the given country.

Analysis of the wage gaps by occupational type largely corresponds to the results of the sectoral analysis. There are notable differences across country groups, but the overall picture shows the relative wage premium for high-skilled workers to be higher in north-west Europe, both among manual and clerical occupations. On the other hand, the wages of workers with lower skills do not differ to such an extent across the analysed countries. This is particularly visible for elementary occupations, clerical support workers, services and sales workers, and, in CEE groups, for plant and assembly workers. Similar to the sectoral analysis, it is the relative position of occupations in north-west Europe that drives the differences in the wage gaps (see Figure 6).

Figure 6 Interactions with occupations: predicted wages in clusters (margins plot)



Source: authors' analysis from EWCS 2015.

Notes: predictive margins: predicted values from the regression analysis, all control variables included, and interaction terms between country cluster and sectors

Table 2 Differences in net monthly earnings (in Euro and adjusted for PPP) relative to the north-west group, by occupational groups

	North-west	South	CZ HU PL SK	BG RO	EE LT LV	SI HR
Managers	0.0	-410.3	-932.1	-1014.0	-640.8	-893.8
Professionals	0.0	-360.1	-893.1	-1164.5	-796.7	-727.3
Technicians and associate professionals	0.0	-362.9	-719.4	-1080.9	-761.5	-791.2
Clerical support workers	0.0	-245.8	-559.9	-906.6	-484.4	-643.6
Services and sales workers	0.0	-190.4	-496.2	-838.1	-565.0	-617.5
Skilled agricultural, forestry and fishery workers	0.0	-451.8	-712.6	-1145.1	-984.7	-956.9
Craft and related trades workers	0.0	-361.3	-653.8	-1073.3	-611.5	-765.4
Plant and machine operators, and assemblers	0.0	-269.2	-644.1	-1000.9	-465.8	-711.3
Elementary occupations	0.0	-64.4	-453.5	-757.0	-396.9	-583.6

Note: marginal means estimated from the regression model, adjusted for all control variables. In bold = differences from the negative return for professionals that are statistically significant ($p \leq 0.05$). Armed forces occupations not displayed because of the low numbers of respondents in this category.

Conclusions

In this paper, we analysed the extent to which differences in the observable productivity-related characteristics of workers and firms, independent of recorded value added, can account for wage differentials. The results suggest that, in high-wage countries, the positive wage premium can be attributed to the structural differences between economies: wage premiums diminished once productivity-related characteristics were controlled for. In other words, these differences reflect the better-paying segments – think engineers in comparison with care workers – in these countries. In contrast, in most European low-wage countries, controlling for worker and workplace characteristics in fact increases the wage gap. In other words, the wage differences are even higher when similar workers doing similar types of jobs are compared.

The results thus reveal higher wage gaps than are apparent in the aggregate data. This does not support the productivity-based explanation or the perfect labour market competition model: once we control for productivity-related characteristics, wage gaps in fact increase. At the same time, however, we cannot completely discard the role of productivity differences: the residual country (cluster) effects indeed also include, apart from differences in the returns on observed characteristics, the differences in returns on unobserved characteristics, which may include other human-capital endowments (e.g. quality of the education system) as well as other productivity-determining factors (e.g. innovation systems, the quality of infrastructure or second-rank integration into global production networks). Negative wage premiums can thus be related to productivity-determining factors that are unrelated to observed worker and workplace characteristics (as suggested by Pereira and Galego 2016). This remains a limitation of our approach, but the results of the empirical studies on wage differences, discussed above, strongly suggest that

institutional and market-power factors, including the role of unions and that of collective bargaining, are key in accounting for the residuals. Moreover, the capital stock productivity method, which takes into account the role of productivity-determining factors other than human capital, also shows significant wage undervaluation in CEE (Collignon and Esposito 2017).¹⁹ Similar to our estimates, this shows wages in CEE to be most undervalued in manufacturing (motor vehicles in particular, according to Collignon and Esposito), as well as in knowledge-intensive services and the public sector.

Negative wage gaps could, in theory, be linked to differences in labour supply. More specifically, higher levels of unemployment could put downwards pressure on wages in affected countries. One can find some support for this mechanism in data from the 2010 wave of the EWCS, but that seems to have been driven by a spike in the unemployment rate in Baltic States in the context of the post-2008 recession. However, with employment indicators improving substantially in the Baltic States in subsequent years, the weak correlation between unemployment and wage levels disappeared completely (see Myant and Piasna 2014).

One should be cautious in making inferences from the actual magnitudes by which we estimate wages to be under-, or over-, valued, in individual countries. These should be taken only as indicative. As discussed above, survey-based data are likely to be biased and contain measurement errors. We are also limited by a reliance on net, rather than gross, wages. However, these limitations mostly underestimate the extent of wage undervaluation. We suspect the biggest bias for Lithuania, where respondents seem to have over-reported their wage levels. Furthermore, relying on gross, rather than net, wages would increase the wage gap for all CEE countries apart from Hungary.²⁰ Finally, by adjusting for differences in purchasing power parities, we can compare differences in real wages, but that also makes a conservative estimate of the wage gap. Furthermore, the adjustment for purchasing power is absolutely irrelevant from the perspective of companies making decisions on production locations in Europe. For them, wages expressed in nominal exchange rates are more relevant, hence supporting the argument that there is a higher scope for wage increases than is identified in our analysis.

The high wage gaps observed in CEE manufacturing, on the one hand, and the relatively lower gaps in some non-tradeable services on the other seem to support claims of the importance of low wages in the context of international competition for markets and FDI. Identifying the factors behind sectoral and occupational variations would require a more systematic assessment that is

19. The capital productivity method leads to somewhat more conservative estimates of wage gaps, but these can be related to a reliance on observed differences in value added that reflect differences in wages rather than differences in actual labour productivity. Moreover, as indicated by the high undervaluation of wages in Ireland and Luxembourg, the results are biased by the recording of profits in favourable tax jurisdictions (hence the large recorded return on capital stock in these countries).

20. See tax wedge on labour in 2015, in European Commission tax and benefits database, based on OECD data, http://europa.eu/economy_finance/db_indicators/tab/

beyond the scope of this paper, but our results do not support a link between actual exposure to international competition, FDI intensity and wages. It is more appropriate to conclude that CEE countries have developed a generalised low-cost and low-wage model, with relative returns particularly low in higher skills. The negative returns observed in manufacturing are thus common to a larger set of sectors. Importantly, wages in the public sector in CEE are as undervalued as in manufacturing and hence contribute significantly to the wage gap. Moreover, wage gaps in non-tradeable complex services in CEE are as high as in manufacturing. In fact, the magnitude of the wage gap seems to be driven by the relative position of sectors and occupations in high-wage countries. The latter is characterised by low-wage service sectors and a higher occupational wage dispersion.

This analysis thus suggests a scope for wage increases particularly in CEE countries. Persisting cross-national disparities in wage levels, especially for highly skilled workers, strengthen the incentive for human capital outflow. This risks undermining productivity and economic growth potential thus further deepening regional divergences. Indeed, sustained convergence with the west requires a steady shift from the generalised low-cost and low-wage model observed in central and eastern Europe.

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