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Abstract

This paper estimates size and impact factors of the gender pay gap in Europe. It adds to the literature in three aspects. First, we update existing figures on the gender pay gaps in the EU based on the Structure of Earnings Survey 2010 (SES). Second, we enrich the literature by undertaking comprehensive country comparisons of the gap components based on an Oaxaca-Blinder decomposition. Overall, we analyze 21 EU countries plus Norway, which clearly exceeds the scope of existing microdata studies. Third, we examine the sources of the unexplained gap. We find that about one third of the gap can be traced back to the role of the explanatory factors included in our analysis. The sectoral segregation of genders is identified as the most important barrier to gender pay equality in European countries. In addition, the fact that part-time positions are more frequent among women notably contributes to the gap. We conclude that policies aiming at closing the gender pay gap should focus more on the sector level than on the aggregate economy.

Keywords: Gender wage gap, Oaxaca/Blinder decomposition, Europe, Structure of Earnings Survey

JEL Classification: J31, J16, J24

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1 | Introduction

The persistence of gender differences in wages belongs to the best documented facts in labour economics. It has been motivation for a tremendous body of work analyzing its roots and implications. This is no surprise, given that questions of wage inequality lie at the crossroads of several schools and disciplines like economics, sociology and social psychology. Despite the variety of research approaches, many facets of the gender gap are still insufficiently explored. This is mainly due to the enormous behavioral complexity created by interlinkages between a person's work- and family-related decisions. Without a profound understanding of the causes of observed wage discrepancies, however, policy-makers are unable to design the right policy mix for addressing the issue.

Our study contributes to the literature in several ways. First, we provide an update of existing figures on the unadjusted and adjusted gender pay gaps in EU countries based on the most recent wave of the Structure of Earnings Survey (SES). As a decomposition method, we apply the most well-known Oaxaca-Blinder-method (Oaxaca, 1973; Blinder, 1973). In this way, we are as close as possible to the methodology Eurostat employs when calculating and decomposing national wage gaps. Second, we enrich the literature by undertaking comprehensive country comparisons of the gap components. Overall, we analyze 21 EU countries (plus Norway), which clearly exceeds the scope of existing microdata studies (e.g. Arulampalam et al., 2007; Simón, 2012). Third, we differ from other studies in that we also examine and compare the sources of the unexplained gap, thus providing additional insights into the sources of the pay differential. Finally, we discuss our decomposition results in the broader context of female labour market participation, pointing to the role of selection effects and unobserved gender segregation in industries and occupations.

Our findings confirm the persistence of gender wage discrepancies in Europe. The estimated unadjusted pay gap amounts to 15.3 % in our cross-country analysis. In line with previous estimations, we detect considerable country heterogeneity. This heterogeneity is not limited to the size of the unadjusted gap, but also concerns its composition. The explained gap is estimated to be negative in six countries, while it reaches levels up to 15 % in other countries. Concerning the contributions of single characteristics, gender differences in the sorting into industries and into atypical employment (part-time work, temporary jobs) are predominantly widening the gap. Differences in educational levels and firm characteristics mitigate the gap. At the same time, the unexplained gap is nowhere found to be smaller than 5 %, pointing to an important role of forces beyond observable worker and job characteristics. Moreover, descriptive analysis reveals a close positive relationship between the size of the pay gaps and female employment rates. Apparently, Europe still faces a trade-off between a high labour market integration of women and equal pay.

The outline of the study is as follows. The next section provides a brief overview of the theories and empirical results regarding size and components of gender pay gaps. Section 3 describes the measurement method and the data and Section 4 the model setup. The results are discussed in Section 5 and Section 6 concludes.

2 | Theory and empirics on the causes of gendered pay

The literature on the determinants of gender gaps in average payment has produced an extensive set of theories helping to explain the persistence of the phenomenon. Comparing these contributions, perspectives differ substantially concerning the relative role of individual versus societal explanatory factors and to what extent they disadvantage women. Generally, two types of discrimination can be distinguished, one that accrues from unequal access of genders to pay-relevant endowments and one that refers to unequal pay for equal work. The former case is associated with human capital theory, which argues that as wages equal productivity, lower wages have to be attributed to a lower amount of human capital. The impact of motherhood on labour supply lies at the center of this reasoning. In a direct manner, researchers refer to the wage penalty working mothers receive due to a birth- and childcare-related absence from the labour market. Particularly, a temporary absence from work can entail a devaluation of their human capital compared to men of similar age, especially with respect to experience-related knowledge (Becker, 1985). Most investigations accounting for the effect of experience yield the result that it makes up a dominating share of the explainable wage gap. In this regard, studies apparently confirm the view of the Human Capital Theory. For instance, Blau and Kahn (1997) in their work with US Panel data estimate full-time work experience to account for almost the complete explained gap. Waldfogel (1998) yields lower but still impressive shares of 30 % to 40 % in a sample including the US and Great Britain. Boll and Leppin (2015) likewise detect a significant contribution for Germany. Furthermore, work experience could also matter with respect to its timing. Light and Ureta (1995) found in an analysis for the US that about 12 percent of the overall wage gap could be attributed to gender differences in the accumulation of experience at the beginning of the career. Finally, child-related effects also disseminate through potential repercussions on education decisions. Polachek (1981) and Goldin and Polachek (1987) argue that the anticipation of future family-related career interruptions lowers the expected returns to education and thus the incentives of young women to invest into education and job-related training. In this line, the narrowing of the gender wage gap in the last decades in industrialized countries is often attributed to the notable increase of women's education and labour market attachment (Polachek 2006).

Although human capital theory provides a plausible explanation for gender wage differentials, it is not a priori clear whether the outcome reflects women's deliberate decisions governed by their preferences or rather the existence of institutional impediments or employer-sided discriminatory practices. One example is taste-based discrimination (Becker, 1957): Some employers might have personal preferences to hire male workers; some workers might prefer to collaborate with male colleagues. Another form of discrimination is highlighted in the context of information asymmetry. In situations of uncertainty, employers tend to rely on their own experiences i.e. assigning an unknown employee the characteristics of the social group it belongs to (statistical discrimination). In this case, gender discrimination refers to unequal pay resulting from assigning a woman a lower productivity, career aspiration and job commitment than she actually has (Blau and Ferber, 1986). As a result, women might be systematically hindered to take over leading positions (Reskin and Roos, 2009).

As noted above, a second strand of theories on pay heterogeneity focuses on unequal pay for equal work. In this case, women and men assume jobs with equal productivity but women are paid less. Once again, individual-level factors like lower bargaining skills of women or discriminating employer behavior might be the reason.[1] Additionally, a systematic underevaluation of female work is discussed as a crucial issue in this context (England, 1992). For centuries, women have been assuming caring and nursing tasks outside the labour market as unpaid work. Nowadays, these tasks are marketable jobs which are for the most part characterized by a lower pay than typical 'male' jobs, thereby contributing to a gender differential in earnings (Marini, 1989). Hence, the lower pay of 'female' work has its roots in history.

Wage differentials arising from unequal pay for equal work must not be confused with different occupational choices of women and men. The gendered segregation of occupations is a persistent phenomenon common to all industrialized countries. According to findings of Wood et al. (1993), job setting accounted for one third of the gender pay gap. Petersen and Morgan (1995) using cross-industry data of the US identify differences across occupations to be more important than within-job wage. The quantitative effect of occupational sorting is not clear-cut though. Bettio (2002) argues that a reallocation of jobs such that women imitate the male distribution of occupational positions would notably reduce the pay gap whereas a replication of the male occupational distribution for females would have only a marginal effect for some countries and even increase the pay gap in others. In other words, horizontal de-segregation would not necessarily decrease the pay gap in Europe but vertical de-segregation would.

[1] A prominent example for the latter case is Robinsonian wage discrimination as a rent seeking strategy in monopsonian markets, exploiting the lower firm-level wage elasticity of women's labour supply compared to men's (Robinson 1933, Blundell and MaCurdy 1999, Hirsch et al. 2010)

It cannot be ruled out that also in the context of occupational choice, women and men face unequal opportunities. A related theoretical framework is the theory of segmented labour markets (Sengenberger, 1978). It argues that pay-attractive jobs are offered on internal labour markets only to which external applicants have no access (Doeringer and Piore 1971). Grounding on (not necessarily conscious) everyday operations of firms, men (women) might be channeled into entry jobs in internal (external) markets (Blau and Ferber, 1986), explaining gendered pay. Still, the pay-relevant sorting into occupations has also to be seen as a matter of abilities (Roy, 1951) as well as of structure and preferences. According to sociological theories, gendered behavior is a component of identity formation following role models (Mead, 1934) and societal expectations with respect to gender-specific competences and skills (Correll, 2004; Busch, 2013), whereas economic theories rather refer to individual costs of deviating from gender stereotyped behavior (economics of identity – see Akerlof and Kranton, 2000).

At this point, it becomes clear why prevailing social norms, attitudes and gender stereotypes lie at the crossroads of gendered employment behavior.[2] Not only are women likely to be governed by them in their occupational, career and training decisions, the same is true for employers' decisions on applicants' selection and promotion. Thus, overarching gender-related norms, values and role models may concurrently shape opportunities, preferences and monetary rewards of women and men in the labour market.

3 | Measurement and Data

To analyze the magnitude and causal factors of the gender wage gap, we follow the seminal work of Oaxaca (1973) and Blinder (1973) both because of its widespread use and its relative simplicity. Particularly, we are able to connect our results to the official pay gap statistics issued by Eurostat, supplementing them with decomposition results based on micro data. The classic Oaxaca-Blinder decomposition focuses on the gap in average hourly earnings between male and female workers. Our strategy can therefore be summarized as follows: first, we compute the mean[3] gender gap in average hourly wages for the aggregate sample as well as at country level. Then, an Oaxaca-Blinder-decomposition of these gaps into explained and unexplained parts is executed. In this process, the impact factors underlying the gaps are distilled and assessed with respect to the magnitude of their contribution to the overall pay gap. To this end, a series of worker characteristics is used as explanatory factors for gender differences in wage levels. Finally, the

[2] For a detailed discussion of gender and occupational stereotypes in the context of occupational choice see Boll et al. 2015.

[3] In this study, we refrain from quantile regressions computing and decomposing the gap in distinct segments of the wage distribution; see e.g. Albrecht et al. (2003) or Boll/Leppin (2015).

compositions of the explained and unexplained parts are analyzed and compared across countries.

Our dataset consists of the most recent (2010) wave of the EU Structure of Earnings Survey (SES). The SES is a large enterprise sample survey providing detailed information on the relationships between the level of remuneration and individual characteristics of employees (sex, age, occupation, length of service, highest educational level attained, etc.) and those of their employer (economic activity, size and location of the enterprise). The sample regularly includes enterprises which have at least ten employees and which are from sections C to O of the Statistical Classification of Economic Activities in the European Community (NACE). However, public administration is excluded in some countries, which induces us to drop employees from this sector in our analysis. As further restrictions, no self-employed are included and information on sectors and occupational groups are only available at a limited level of disaggregation.

Given that data availability concerning individual and job-related characteristics differs to some extent between countries, we had to weigh the aim of accounting for as many insightful characteristics as possible against the need to preserve a sufficient number of countries for our analysis. In the end, we were left with 22 countries (21 EU countries plus Norway).[4] The total number of observations is 8,829,191. In the following, the explanatory variables are described. As individual worker characteristics, age and education were included. Age is measured in terms of six categories, where the youngest group comprises the 14-19 years old workers and the oldest group the more than 60 years old. The measure of education is derived from an aggregation of ISCED levels into three categories (ISCED 0-2, ISCED 3-4, ISCED 5-6). As job-related characteristics, contract type, firm tenure, hours of work, occupational group as well as industry, ownership and size of the enterprise were taken into account. Contract type is captured by a dummy variable that is equal to one for temporary and zero for permanent contracts. Firm tenure is split into four time spans (0-1 years, 2-4 years, 15-24 years, > 24 years). Hours of work are also only available as a categorical measure, distinguishing between full-time workers, those who work 60-99 % and those who work less than 60 % of a full-time worker's normal workload. Occupational groups are identified based on the-ISCO-08 classification at the two-digit-level, discriminating between 42 different groups. The industry of the enterprise is assigned based on an own aggregation of the NACE-Rev.2- classification, motivated by the need for cross-country harmonization. It allows us to distinguish between 16 different sectors. Concerning the impact of ownership, we include a dummy variable that is set equal to one if the firm is under public control. This is defined to be the case if a share of more than 50 % is in public ownership. Finally, the size of the enterprise is measured by its number of employees, broadly categorized into enterprises with less than 50 and others with at least 50 employees.

[4] Missing EU countries: Austria, Cyprus, Denmark, Ireland, Luxembourg, Malta, Slovenia.

4 | Model

Formally, the Oaxaca-Blinder-decomposition consists of two estimation steps. As a first step, estimations of the determinants of hourly wages are carried out separately for male (m) and female (f) workers. This takes the form of separate wage regressions. In a log-linear model, logarithmized hourly wages (W) are regressed on a set of explanatory factors, i.e. a range of worker and job-related characteristics (X) henceforth referred to as *endowments*, as they are viewed as observable indicators of productivity differences partly explaining the wage gap. Formally, the regression equations look as follows (with β^j representing the estimated coefficient of the characteristic indexed with j and ε representing a residual term):

$$\ln W_{m;i} = \beta_m^0 + \sum_j \beta_m^j X_{m;i}^j + \varepsilon_{m;i}$$

$$\ln W_{f;i} = \beta_f^0 + \sum_j \beta_f^j X_{f;i}^j + \varepsilon_{f;i}$$

Afterwards, the resulting coefficient estimates are used to decompose the gender difference in the average wage levels ($\overline{W}$). This is achieved by replacing gender-specific log mean wages by the right-hand side of the two equations above. Following Blinder (1973), rearranging terms leads to the following expression:

$$\ln \overline{W_m} - \ln \overline{W_f} = \sum_j \left(\overline{X_m^j} - \overline{X_f^j}\right) \beta_m^j + \sum_j \left(\beta_m^j - \beta_f^j\right) \overline{X_f^j} + \left(\beta_m^0 - \beta_f^0\right)$$

The overall gender gap in log mean wages is thus split into three components. The first component represents the part of the wage gap attributable to gender differences in observed endowments. It is therefore termed the *characteristics effect* (or *endowment effect).* The second component shows which part of the wage gap is due to the fact that the same endowment generates different market returns for male and female workers. Finally, the third component represents a constant term. It captures the influence of all unobserved wage determinants on the gender wage gap, such as personal ability, negotiating skills and institutional setting. The sum of second and third component is termed *the coefficients effect.* It represents the unexplained part of the gender wage gap, as it cannot be traced back to observed endowment differences.

5 | Results

5.1 | Decomposition in explained and unexplained gender pay gap

As a first result, we measure the cross-country gap in average wages of men and women to be about 15.3 % (2010), subsequently termed the unadjusted gap. Applying the decomposition method outlined above, we find that about one third of the gap can be

traced back to the role of the explanatory factors included in our analysis. A wage difference of 10.9 % remains as the unexplained gap. Hence, the source of the largest part of the gap is not a difference in measured worker attributes.

At country level, the picture however varies drastically, as shown in Table 1. Concerning the unadjusted gap, figures range from 3.6 % for Poland to 25.1 % for Estonia. From a geographical perspective, it is noticeable that most Middle and Eastern European states are exhibiting gaps clearly below average, with the Czech Republic, Slovakia and Estonia marking the exceptions. Among the West European countries, only Italy is exhibiting a very small gap (4.5 %). Further country variation is revealed by the decomposition results. The country ranking with respect to the unexplained gap changes substantially compared to the unadjusted gap. The role of gender differences in average worker features is in some countries not only more pronounced than in others, it also works in opposite directions. For instance, it is striking that the three countries with the smallest raw gap (Poland, Italy, Croatia) all exhibit negative explained gaps. Hence, the average female worker in these countries is endowed with better characteristics than her male counterpart, at least concerning those characteristics included in our dataset. The reason why also in Poland and Italy female workers nevertheless have lower average earnings is exclusively to be found in the unexplained residual.

Table 1: Unadjusted, explained and unexplained gender pay gap based on SES 2010 data, in %

Country	Unadjusted gap	Explained gap	Unexplained gap (adj.)	Country	Unadjusted gap	Explained gap	Unexplained gap (adj.)
Belgium	8.5	2.8	5.8	Latvia	7.4	-3.2	10.6
Bulgaria	8.6	1.3	7.3	Lithuania	5.8	-8.1	13.9
Croatia	5.7	-6.0	11.7	Netherlands	15.2	7.2	8.0
Czech Republic	16.5	3.4	13.1	Norway	14.3	7.6	6.7
Estonia	25.1	10.2	14.9	Poland	3.6	-7.8	11.4
Finland	20.7	9.4	11.4	Portugal	11.4	-0.9	12.3
France	13.5	4.8	8.7	Romania	7.1	0.8	6.2
Germany	22.2	14.5	7.7	Slovakia	16.6	2.2	14.4
Greece	13.1	5.5	7.6	Spain	17.4	5.4	12.0
Hungary	8.4	0.5	7.9	Sweden	14.0	6.3	7.7
Italy	4.5	-6.2	10.7	UK	20.3	6.0	14.3
				Total	*15.3*	*4.4*	*10.9*

Sources: SES (2010), own calculations (see Boll et al. 2016).

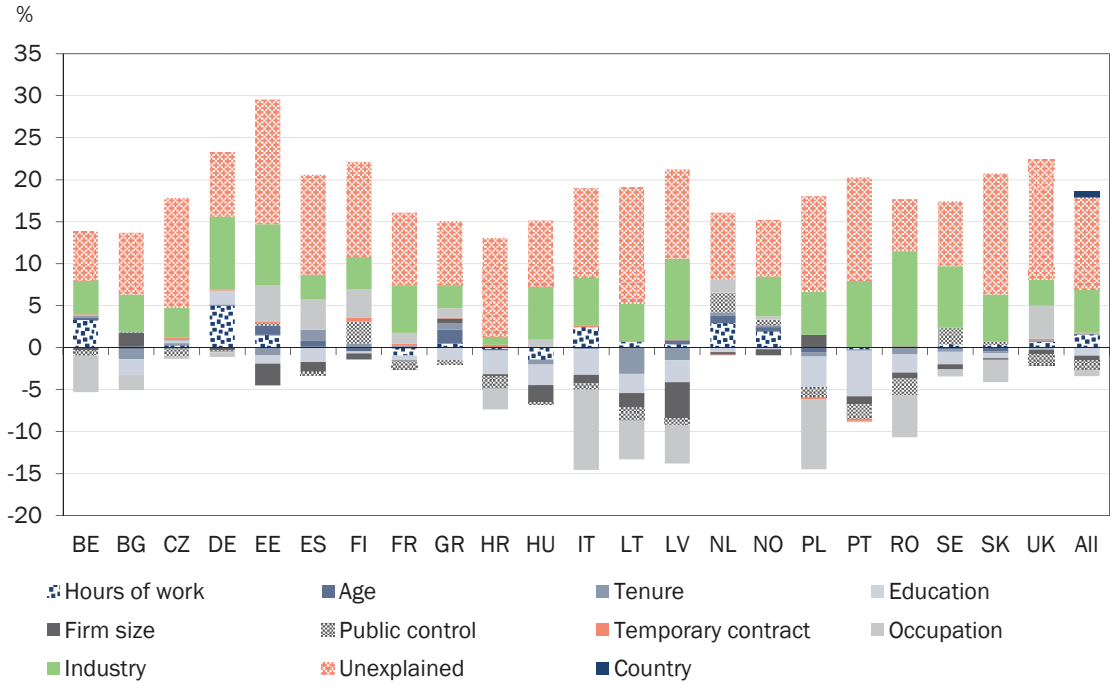
Moreover, this unexplained part is nowhere identified to be negative. It doesn't even get lower than five percent. In most countries, it is thus this term that comprises the bulk of factors that prevent women from catching-up. The only two countries where the explained gap exceeds the unexplained part are Germany and Norway. As explained

above, it consists of two different kinds of effects. First, it acknowledges that the same endowment could be evaluated differently by the market, depending on whether the person is male or female. Second, it includes the impact of gender differences in those market-relevant characteristics not controlled for in our model. This second aspect is of special relevance, as our dataset does not allow us to assess potentially important gender differences related to actual work experience. It is interesting to see that some of the countries with negative explained gaps like Poland and Portugal perform worse than the country average when it comes to the unexplained gap. Apparently, from the fact that women outperform men in attributes like education one cannot conclude on a lower pay gap. This provides justification for a more disaggregated analysis of the sources of the gender pay gap.

5.2 | Decomposition of the explained gender pay gap

Figure 1 documents which share of the explained part of the gender pay gap can be attributed to which measured characteristic. Precise numbers can be found in Table A 1 in the Appendix.[5] While some features show similar effects across countries, the role of others is highly heterogeneous.

Figure 1: Decomposition of the gender pay gap (in %), 2010



Sources: SES (2010), own calculations (see Boll et al. 2016).

[5] Results of the wage regressions underlying our decompositions are available on request.

Something that can be noticed for all countries is that the selection of male and female workers into different sectors contributes to the existence of wage differences. Hence, a significant part of the gender gap is due to the fact that women are over-represented in industries with low pay levels (and accordingly under-represented in well-paid industries). This is consistent with recent results by Simón (2012) for the 2002 wave of the same dataset. In the cross-country sample, women are particularly over-represented in Education as well as in Health and Social Work Activities. At the same time, they are highly under-represented in Construction and in manufacturing sectors such as Chemical Products, Electric and Transport Equipment.

In a country comparison, the largest effects of sectoral distribution are measured for Romania and Latvia, where its contribution to the overall gender gap amounts to 11.3 % and 9.7 %, respectively. In both countries, the comparatively small presence of women in well-paid jobs in the area of Manufacturing and Construction is again responsible for this result. At the other extreme, there are two countries where the industry effect remains fairly marginal: the Netherlands (< 0.01 %) and Croatia (0.01 %). In the Netherlands, manufacturing sectors as well as wholesale trade are an important part of the explanation. Dutch women show a lower participation in these sectors than in cross-country average. At the same time, these sectors offered, all else being equal, a comparatively low remuneration compared to other sectors in the Dutch economy, a fact that primarily concerned men.

Among the remaining characteristics effects, there is none that works in the same direction in each country. One that is at least almost homogeneous is the effect of firm size. The fact that the gender distribution of workers differs with firm size mitigates the wage gap. Large firms with 50 employees or more exhibit a higher share of female workers than smaller firms in the aggregate sample. In addition, the payment level in large firms is ceteris paribus higher, a result that is well documented in the labour economics literature (Oi and Idson, 1999). Explanations could be the occurrence of productivity gains through a higher division of labour or the need to pay compensating differentials due to the unpleasantness of working in an impersonal atmosphere (Masters, 1969). As a consequence, the gender pay gap is reduced by 0.6 % in the cross-country estimation. The only conflicting evidence at country level is obtained for Bulgaria, Poland and Greece.

Moreover, the role of schooling tends to contribute to wage convergence. Female workers in most countries exhibit a higher average level of education than their male counterparts, at least when measured on our three-level scale. The consequence is a diminution of the cross-country gender gap by 0.9 %, clearly exceeding previous results by Simón (2012). In two countries, Poland and Portugal, the diminution even exceeds 3 %, foremost due to large gender differences in the shares of college graduates. On the other

hand, we witness with Germany a case where differences in schooling further nourish the wage gap by 1.6 %.

The form of economic control over the firm is another factor which predominantly reduces the gender wage differential, confirming prevous results from Arulampalam et al. (2007). The fact that male and female workers are unequally distributed between private and public companies helps to narrow the gap. In all observed countries at the given point in time, female workers were over-represented in publicly controlled firms. This result accords with findings of Gornick and Jacobs (1998) and may be explained with attractive employment conditions the public sector offers for mothers, due to the high degrees of protection, time flexibility and tolerance towards periods of absence (Kolberg, 1991). At the same time, we find in the majority of countries a higher conditional remuneration in public than in private firms, implying a reduction of the wage gap by 1.1 % in the aggregate and up to 2 % (Romania) at country level. Gregory and Borland (1999) argue that these differences in wage structure are not surprising given that wage setting in the public sector occurs in a political environment, whereas private-sector decision making occurs in a market environment. Moreover, anti-discrimination legislation may be more aggressively enforced in the public sector. However, Finland and the Netherlands stand out in this regard. Here, working in the public sector implied a wage penalty, yielding an increase in the gender gap by 2.7 % and 2.4 %, respectively.

By contrast, a job characteristic that predominantly raises the wage gap is hours of work. In all countries under observation, female workers have more often been employed part-time than male workers. In most of them, part-time work was, all else being equal, associated with lower hourly earnings. This can be rationalized by several explanations, for instance related to the existence of coordination costs and restrictions in the access to internal training. Indeed, Manning and Petrongolo (2008) document the discrepancy in hourly earnings of full-time and part-time working women in Great Britain. According to our findings, women's higher frequency of part-time work contributes to a widening of the cross-country gender pay gap by 1.6 %. This fits recent evidence by Goldin (2014) for the US, who assigns working time arrangements a key role for explaining the incomplete gender convergence on the US labour market. An outlier in our study concerning the magnitude of this effect is Germany, where the part-time effect reaches a level of 5.0 %, the second largest of all measured characteristics effects in this country.

Another channel that tends to widen the gender gap is the distribution of temporary vs. permanent contracts. Working in a temporary position reduces the expected earnings in almost all country regressions. This is consistent with general findings of the literature (Booth et al., 2002). Temporary workers have less incentives to accumulate job-specific human capital, as they face the risk of depreciation when the contract is not prolonged. For the same reason, employers are also less inclined to give them access to internal training. In turn, this contributes to the wage gap because temporary positions are more

frequent among female workers in the majority of countries. This seems intuitive in the presence of self-selection: facing a higher risk of career interruptions through child birth, women on average are less inclined to commit to a certain career path. Nevertheless, the overall effect remains of low magnitude. In our cross-country sample, temporary work widens the wage gap by only 0.1 %. At country level, the maximum contribution is 0.5 % (Finland). Cases where the effect goes in the other direction comprise those countries where the gender distribution of temporary work is reversed. In Poland and Portugal, this implicates a modest reduction in the gender pay gap by 0.3 % and 0.2 %, respectively.

The role of the remaining characteristics is highly ambiguous in the country comparison. First, this concerns workers' age distribution. In the aggregate estimation, the net effect of age differences is practically zero (0.02 %). Effects of the single age groups are of a similar magnitude. A look at the wage regressions shows that this is not due to an irrelevance of the factor age in wage setting. Compared to the reference group of 40-49 years old workers, workers in most other age groups are estimated to earn significantly less in the cross-country regression for male workers, reproducing the typical inversely U-shaped wage evolution from the literature (Skirbekk, 2004). Rather, differences in the age distribution of male and female workers are simply too small to let this affect the wage gap. Nevertheless, this cross-country average does not adequately describe the situation in many single countries. On the one hand, we see a country like Greece where gender differences in the age distribution of workers are estimated to raise the gender pay gap by 1.7 %. On the other hand, we have a country like Poland, where age differences reduce the gap by 0.5 %. Here, we observe an inversely U-shaped wage structure.

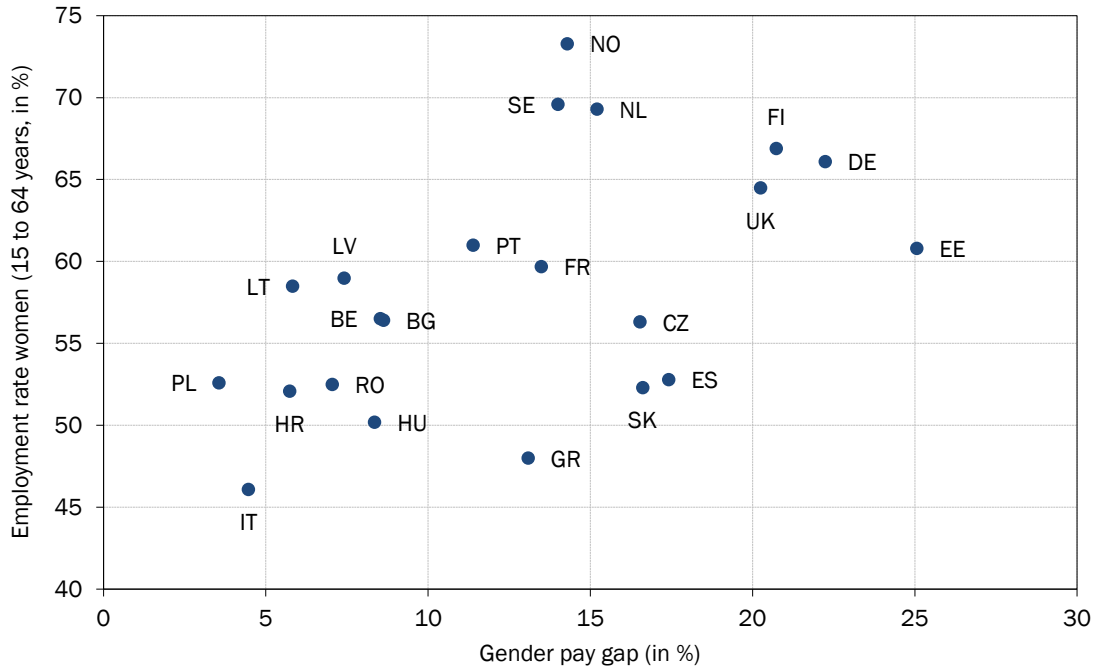
A second highly ambiguous effect is measured for firm tenure. In the aggregate sample, differences in tenure raise the gender pay gap by merely 0.1 %, which is significantly lower than the 0.5 % estimated by Simón (2012) for his dataset of nine European countries. This positive relationship between wages and tenure is generally confirmed at the country level. In line with basic intuition and literature findings (Brown, 1989), longer job tenure is associated with higher earnings in the cross-country regression. This can both be explained by a mechanism of self-selection (higher wages imply higher job satisfaction, thus workers stay longer) and the productivity-enhancing accumulation of job-specific human capital over time (Topel, 1991). In our cross-country sample, women exhibit a slightly larger average tenure than men, contradicting the finding of Macpherson and Hirsch (1995) who identify average tenure to be lower in female-dominated occupations. However, we find that gendered endowments vary at country level. In Finland for example, firm tenure contributes to the overall wage gap with 0.5 %. In Bulgaria, on the other hand, the impact of tenure on the wage gap is measured to be – 1.2 %, reflecting a high local share of female workers with very long tenure.

Finally, the characteristic causing the most heterogeneous effects is occupation. Its contribution to the gender gay gap in the aggregate sample is – 0.8 %. Hence, at the time of observation, women tended to cluster in the better paid occupational groups (from a male perspective). At a first sight, this seems to reject the theories linking occupational segregation to gender pay differences laid out in the previous section. However, we need to remain cautious with our interpretation, due to several data limitations. First, we merely distinguish between 43 occupational groups, thereby not capturing the full extent of gender heterogeneity in occupational sorting. Second, we can expect a high degree of correlation between occupational choice and sector, up to the point that some occupations are only observed within some sectors. Thirdly, with the occupational classification at hand, it is not possible to adequately control for vertical hierarchy. This is an important point since the different allocation of women and men to hierarchical positions within occupations is a robust finding in the literature (e.g. Bettio and Verashchagina, 2009). Last but not least, employment selection matters: in some countries, tasks associated with a female image are still largely executed outside the formal labour market (Bettio, 2002).

Referring to these particularities, the moderate effect measured for occupational endowment achieved from the aggregate sample appears a bit less striking, especially since it does not stand out in the literature (cf. Bettio and Verashchagina, 2009; Ministère du travail, de l'emploi, de la formation professionelle et du dialogue social 2015 for France). Moreover, the overall effect hides tremendous heterogeneity across countries. In Spain and the UK, occupational differences are measured to contribute more than 3.5 % to the overall wage gap, implying this to be the prime factor responsible for the existence of a positive explained gap in these countries. In Italy and Poland, we witness a massive negative impact reaching levels of – 9.5 % and – 8.3 %, respectively, nourishing the result that endowment differences in total work in favor of women. Again, this has to be interpreted in the context of employment selection.

Figure 2 depicts female employment rates and unadjusted pay gaps in the observed European countries. The pattern documents a clear positive relationship between the two measures: countries with high female employment rates tend to exhibit high statistical pay gaps and vice versa. Poland and Italy obviously belong to the group of European countries with low wage gaps and comparatively low female employment rates. Apparently, this is a reflection of the fact that some typically low-paid service tasks like nursing and cleaning, which have traditionally been viewed as women's work, are in these countries to a large part still not delegated through formal work contracts, but mostly executed within households.

Figure 2: Relationship between gender pay gap and female employment in SES



Sources: Eurostat (2015), SES (2010), own calculations (see Boll et al. 2016).

5.3 | Factors behind the unexplained gender pay gap

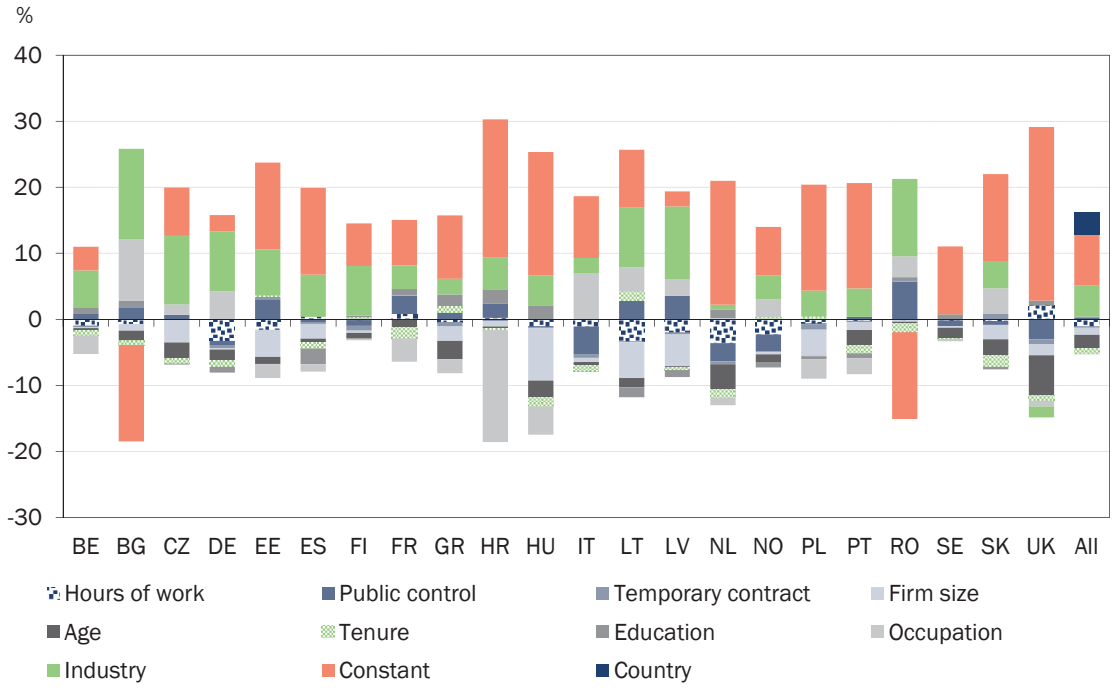
Results in Table 1 have shown that the unexplained gap is everywhere positive and makes up the largest part of the overall gender wage gap in almost all countries under observation (with Germany and Norway marking the exceptions). Given the unavoidable data limitations, this does not come as a surprise. Foremost, this results from the lack of a measure for actual work experience.[6] Endowment effects resulting from these differences are implicitly included in the residual gap. Moreover, it is also likely to include those effects of hierarchical and occupational sorting, which cannot be captured by the precision and aggregation level of an occupation measure like ours. Similar unobserved effects could stem from factors like personal abilities and negotiating skills.

Nevertheless, this does not mean that the sources of the unexplained gap have to remain completely in the dark. As a result of our decomposition method, the residual gap also includes the effect of a different evaluation of measured characteristics in the male and

[6] An approximation by potential experience as measured by a worker's age and years of education would have had to remain highly imperfect, as it does not account for gender differences in labour market absence, especially related to birth and child caring.

female subsamples (coefficient effect). These effects can again be assessed in their magnitude for the single characteristics. Figure 3 plots the contributions to the unexplained gap at country level. Precise numbers can be found in Table A 3 in the Appendix.

Figure 1: Decomposition of the unexplained part of the gender pay gap (in %), 2010



Sources: SES (2010), own calculations (see Boll et al. 2016).

As it is the case for the characteristics effect, sources of the coefficients effect differ substantially between countries. Nevertheless, some major patterns can be identified. First, industry is estimated to exert a sizeable positive coefficients effect in almost all countries except the Netherlands, Sweden and UK. For the aggregate sample, this effect equals 4.7 %. In Belgium, Sweden and Romania, the magnitude even exceeds 10 %. That is, there is a within-sector male wage premium in all countries except the three named above. This indeed hints at considerable intra-sectoral gender heterogeneity with respect to the sorting into occupations and hierarchical positions. Apparently, much of the sorting takes place within rather than between industries. Goldin (2014) argues that firm level differences in the cost of time flexibility play a crucial role in this context. Based on American Community Survey data, she shows that occupations of different sectors differ in their ability and cost to provide employees with reduced working hours in the occasion of family events. For some industries, this results in a nonlinear relationship between earnings and hours of work. By contrast, industries which had successfully adapted to flexibility demands of their (not only female) workforce are characterized by almost linear earnings-hours worked relationships and hence smaller gender pay gaps. With this differential compensation approach, Goldin presents a different reasoning for hourly wage penalties of part-timers compared to full-timers which has so far rather

been related to additional training costs of the former (Kalleberg, 2000). The new aspect here is that these penalties varies with industry. Goldin concludes that to further reduce the gap, sectors should strive to develop strategies to decrease the cost of time flexibility.

The second consistent pattern is the negative coefficients effect of the age composition. It reduces the gender pay gap by 2.1 % in the aggregate sample. It is also negative throughout the single country estimations, but not always significant. Finally, the constant term represents a major contributing factor in the majority of countries. With a contribution of 7.7 % in the cross-country sample, it is almost exclusively responsible for the existence of an unexplained wage variation. It captures the influence of unobserved variables. As discussed earlier, gender differences in actual work experience over the lifecycle are expected to make up the bulk of this amount. The wage-reducing effect of a temporary labour market absence of women due to birth and childcare is nowhere explicitly accounted for in our approach. Moreover, Becker (1985) and Fuchs (1989) speculate that most of the wage gap not attributable to experience is due to unmeasured differences between men and women in their commitment to parenting which once again points to the importance of gender roles.

6 | Conclusion

This study has investigated size and sources of gender wage gaps in the most recent wave of the EU-SES. Our first result was already a crucial one: a significant wage gap between male and female workers is still an undeniable reality in every single EU country under observation. Nevertheless, our wage decomposition analyses revealed a tremendous degree of country heterogeneity concerning the roots of this phenomenon. This holds in particular for the size of the gap that is attributable to gender differences in the measured wage-related worker and job characteristics. While this explained gap operates in some countries like Germany and Estonia decisively in favor of men, in others like Poland and Italy it advantages women. Concerning the contributions of the single observed characteristics, gender differences in the sorting into industries are identified as the strongest contributing factor by our decomposition method. On the other hand, factors that mitigate the pay gap in the majority of countries are the distribution of male and female workers into firms of different size as well as gender differences in schooling. Finally, our results for the composition of the unexplained gap confirm our intuitions on the role of intra-sectoral pay equity and the role of selection effects. First, it is likely that sectors with high costs of time-flexibilty in terms of working hours and temporary employment breaks compensate their employees who stick to the 'full-time full year' (FTFY) standard with high wage premiums. We conclude that policies aiming at tackling the gender gap in pay should focus on the sector level, supporting sectors to develop strategies to decrease the cost of time flexibility.

However, the pay gap statistics have to be interpreted with caution. The unexplained part must not be equated with discrimination as it is sometimes done (e.g. Del Rio et al., 2011). The fact that the unexplained part comprises also the influence of endowment differences in unobserved characteristics between male and female workers could lead to an overestimation of the real level of discrimination. On the other hand, it may not be ruled out that discriminatory practices restrict women's access to pay-attractive endowments as they are measured in the characteristics effect. In this regard, the unexplained part will tend to underestimate the real extent of gender discrimination. Hence, the power of the statistical approach relates more to its capacity to quantify key issues related to gendered pay than to identify distinct actors' responsibilities.

Our results provide motivation for further investigations. When focusing on wages of the employed, a more or less significant part of the female population is not in our sights. The picture drawn by our descriptive statistics is that low wage divides between genders are associated with low female employment rates in European countries. As women's labour market participation likely depends on potential earnings, the calculated gap may be biased. Recently, in analyzing US census data, Jacobsen et al. (2015) find evidence for a switch to a positive selection during the last fifty years. If the opposite response occurs (as estimated by Beblo et al. (2003) for Germany), the implication is an overestimation, respectively. Moreover, an increase in explanatory power could be created by including additional characteristics in the decomposition, which was also impossible with the given dataset.

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Appendix

Table A 1: Composition of the explained gender pay gaps at country level (in %), 2010

	Belgium	Bulgaria	Czech Rep.	Germany	Estonia
Hours of work	3.28	0.12	0.32	5.04	1.53
Public control (>50 %)	-0.61	0.06	-0.95	-0.26	0.32
Temporary contract	0.14	-0.01	0.24	0.17	0.11
Firm size	-0.31	1.68	0.03	-0.28	-2.57
Age	0.26	-0.15	-0.10	0.06	1.11
Tenure	0.24	-1.21	0.20	0.05	-0.87
Education	0.03	-1.92	0.38	1.63	-1.04
Occupation	-4.38	-1.76	-0.26	-0.55	4.32
Industry	4.09	4.49	3.55	8.64	7.28
Total explained gap	*2.76*	*1.31*	*3.41*	*14.5*	*10.19*
	Spain	Finland	France	Greece	Croatia
Hours of work	0.14	-0.01	-0.93	0.5	-0.14
Public control (>50 %)	-0.39	2.68	-1.02	-0.5	-1.38
Temporary contract	0.00	0.47	0.25	0.13	0.31
Firm size	-1.14	-0.74	-0.09	0.53	-0.3
Age	0.68	-0.45	0.17	1.65	-0.19
Tenure	1.32	0.45	0.06	0.79	0.05
Education	-1.72	-0.22	-0.57	-1.49	-2.84
Occupation	3.58	3.38	1.29	1.08	-2.5
Industry	2.93	3.8	5.66	2.77	1.01
Total explained gap	*5.39*	*9.37*	*4.82*	*5.47*	*-5.98*
	Hungary	Italy	Lithuania	Latvia	Netherlands
Hours of work	-1.4	2.45	0.68	0.42	2.94
Public control (>50 %)	-0.27	-0.78	-1.56	-0.75	2.39
Temporary contract	0.02	0.16	0.00	0.04	-0.08
Firm size	-2.08	-1.00	-1.7	-4.32	-0.30
Age	-0.04	-0.03	0.01	0.45	0.84
Tenure	-0.57	-0.17	-3.1	-1.48	0.40
Education	-2.44	-3.03	-2.29	-2.63	-0.53
Occupation	0.96	-9.53	-4.66	-4.63	1.53
Industry	6.26	5.69	4.55	9.71	0.00

Total explained gap	*0.45*	*-6.24*	*-8.07*	*-3.19*	*7.2*
	Norway	Poland	Portugal	Romania	Sweden
Hours of work	2.01	0.08	-0.2	0.06	0.41
Public control (>50 %)	0.65	-1.1	-1.78	-1.96	1.97
Temporary contract	0.02	-0.25	-0.22	0.01	0.00
Firm size	-0.74	1.44	-0.94	-0.70	-0.62
Age	0.45	-0.54	-0.12	0.11	-0.23
Tenure	0.22	-0.54	-0.01	-0.78	-0.27
Education	-0.18	-3.72	-5.45	-2.19	-1.47
Occupation	0.38	-8.32	-0.17	-5.03	-0.82
Industry	4.74	5.11	7.95	11.32	7.33
Total explained gap	*7.55*	*-7.84*	*-0.93*	*0.84*	*6.29*
	Slovak Rep.	United Kingdom			
Hours of work	0.38	0.67			
Public control (>50 %)	0.34	-1.25			
Temporary contract	0.00	0.19			
Firm size	-0.2	-0.65			
Age	-0.39	-0.10			
Tenure	-0.24	0.21			
Education	-0.61	-0.12			
Occupation	-2.69	3.91			
Industry	5.60	3.10			
Total explained gap	*2.19*	*5.97*			

Sources: SES (2010), HWWI (2015).

Table A 2: Drivers of the occupation-related endowment effect (cross-country estimation) in SES (2010)

Classifications	Occupational groups	Effect (in %)
ISCO 23	Teaching professionals	-3.67
ISCO 22	Health professionals	-2.32
ISCO 32	Health associate professionals	-1.33
ISCO 33	Business and administration associate professionals	-1.05
ISCO 41	General and keyboard clerks	-0.83
ISCO 53	Personal care workers	-0.81
ISCO 52	Sales workers	-0.60
ISCO 26	Legal, social and cultural professionals	-0.36
ISCO 42	Customer services clerks	-0.34
ISCO 34	Legal, social, cultural and related associate professionals	-0.23
ISCO 51	Personal service workers	-0.21
ISCO 24	Business and administration professionals	-0.10
ISCO 54	Protective services workers	-0.09

ISCO 44	Other clerical support workers	-0.08
ISCO 43	Numerical and material recording clerks	-0.06
ISCO 96	Refuse workers and other elementary workers	-0.04
ISCO 94	Food preparation assistants	-0.03
ISCO 92	Agricultural, forestry and fishery labourers	-0.01
ISCO 2	Non-commissioned armed forces officers	0.00
ISCO 3	Armed forces occupations, other ranks	0.00
ISCO 61	Market-oriented skilled agricultural workers	0.00
ISCO 62	Market-oriented skilled forestry, fishery and hunting workers	0.00
ISCO 63	Subsistence farmers, fishers, hunters and gatherers	0.00
ISCO 95	Street and related sales and service workers	0.00
ISCO 1	Commissioned armed forces officers	0.01
ISCO 75	Food processing, wood working, garment and other craft workers	0.01
ISCO 73	Handicraft and printing workers	0.06
ISCO 82	Assemblers	0.06
ISCO 14	Hospitality, retail and other services managers	0.21
ISCO 35	Information and communications technicians	0.33
ISCO 81	Stationary plant and machine operators	0.34
ISCO 91	Cleaners and helpers	0.42
ISCO 11	Chief executives, senior officials and legislators	0.47
ISCO 74	Electrical and electronic trades workers	0.51
ISCO 71	Building and related trades workers, excluding electricians	0.68
ISCO 12	Administrative and commercial managers	0.74
ISCO 83	Drivers and mobile plant operators	0.84
ISCO 25	Information and communications technology professionals	1.06
ISCO 13	Production and specialised services managers	1.08
ISCO 72	Metal, machinery and related trades workers	1.29
ISCO 21	Science and engineering professionals	1.45
ISCO 31	Science and engineering associate professionals	1.83

Sources: SES (2010), HWWI (2015).

Table A 3: Drivers of the industry-related endowment effect (cross-country estimation)

Classification	Industry	Effect (in %)
Nace 75_86_to_88	Health and social work activities	-0.42
Nace 47	Retail trade	-0.16
Nace I	Accomodation and food services	-0.07
Nace 10_to_13 + 14_15	Food industry and textiles	-0.05
Nace 68_72_to_74_77_95 + 90_to_93_96	Professional. scientific and creative services	-0.04
Nace 94	Activities of membership organisations	-0.04
Nace 70_71_78_81_82 + 64_to_66_69_80 +53_61_to_63_79	Business services	0.06

Nace 49_to_52	Transportation and storage	0.14
Nace 16_to_18 + 58_to_60	Paper, printing and publishing	0.21
Nace 45_46	Wholesale trade	0.71
Nace B + 35_36 + 37_to_39	Mining, energy and water supply	0.79
Nace 24_25 + 28	Basic metals and metal products	1.00
Nace 26_to_27_33 + 19_to_22 + 23 + 29_30 + 31_32	Chemical products, electric and transport equipment	1.49
Nace F	Construction	1.59

Notes: The reference group is the worst paid compared to all other industries listed here. Therefore, the sign of the effects is exclusively determined by the relative employment shares of men and women.
Sources: SES (2010), HWWI (2015).

Table A 4: Composition of the unexplained gender pay gaps at country level

	Belgium	Bulgaria	Czech Rep.	Germany	Estonia
Hours of work	-0.95	-0.68	-0.08	-3.26	-1.55
Public control (>50 %)	0.82	1.82	0.66	-0.72	3.03
Temporary contract	-0.29	0.22	0.07	-0.41	0.51
Firm size	-0.08	-1.02	-3.41	-0.20	-4.13
Age	-0.44	-1.46	-2.43	-1.70	-1.07
Tenure	-0.67	-0.76	-0.79	-0.88	0.07
Education	1.03	0.80	-0.13	-0.90	-0.05
Occupation	-2.80	9.29	1.55	4.25	-2.08
Industry	5.53	13.70	10.38	9.09	6.99
Constant	3.62	-14.59	7.31	2.47	13.16
Total unexplained gap	*5.78*	*7.32*	*13.12*	*7.74*	*14.88*
	Spain	Finland	France	Greece	Croatia
Hours of work	0.37	-0.09	0.80	-0.41	0.21
Public control (>50 %)	-0.40	-0.88	2.85	1.07	2.19
Temporary contract	-0.31	-0.76	-0.02	-0.68	-0.23
Firm size	-2.24	-0.33	0.03	-2.18	-0.83
Age	-0.59	-0.87	-1.24	-2.75	-0.35
Tenure	-0.89	0.31	-1.62	0.96	-0.19
Education	-2.36	0.25	0.91	1.72	2.13
Occupation	-1.12	-0.25	-3.51	-2.13	-16.98
Industry	6.39	7.53	3.58	2.39	4.84
Constant	13.17	6.46	6.92	9.62	20.94
Total unexplained gap	*12.03*	*11.36*	*8.68*	*7.62*	*11.72*
	Hungary	Italy	Lithuania	Latvia	Netherlands
Hours of work	-1.02	-1.08	-3.31	-1.96	-3.58
Public control (>50 %)	-0.17	-4.28	2.78	3.58	-2.79
Temporary contract	-0.11	-0.47	-0.13	-0.33	-0.43
Firm size	-7.96	-0.64	-5.43	-4.82	0.19

Age	-2.52	-0.45	-1.43	-0.18	-3.83
Tenure	-1.40	-0.98	1.44	-0.40	-1.26
Education	2.14	-0.07	-1.49	-1.06	1.28
Occupation	-4.26	7.02	3.68	2.54	-1.11
Industry	4.53	2.29	9.00	10.98	0.76
Constant	18.68	9.36	8.78	2.26	18.78
Total unexplained gap	*7.90*	*10.70*	*13.89*	*10.61*	*8.00*
	Norway	Poland	Portugal	Romania	Sweden
Hours of work	-2.30	-0.59	-0.21	-0.09	-0.13
Public control (>50 %)	-2.56	-0.22	0.38	5.73	-0.91
Temporary contract	-0.10	-0.75	-0.18	0.23	0.00
Firm size	-0.32	-3.95	-1.22	-0.24	-0.21
Age	-1.29	-0.09	-2.33	-0.36	-1.67
Tenure	0.31	0.49	-1.20	-1.29	-0.04
Education	-0.69	-0.41	-0.73	0.41	0.78
Occupation	2.73	-2.97	-2.44	3.15	-0.36
Industry	3.62	3.84	4.32	11.77	0.01
Constant	7.35	16.05	15.94	-13.10	10.25
Total unexplained gap	*6.74*	*11.40*	*12.32*	*6.21*	*7.72*
	Slovak Rep.	United Kingdom			
Hours of work	-0.24	2.07			
Public control (>50 %)	-0.61	-3.03			
Temporary contract	0.80	-0.78			
Firm size	-2.17	-1.63			
Age	-2.46	-6.17			
Tenure	-1.70	-0.73			
Education	-0.40	0.76			
Occupation	3.89	-0.89			
Industry	4.01	-1.64			
Constant	13.31	26.31			
Total unexplained gap	*14.43*	*14.29*			

Sources: SES (2010), HWWI (2015).

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