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Employment Protection and Gender Wage Gap in Europe

Summary: In this paper we investigate gender wage disparities in 25 EU countries before and after the crisis, focusing on the role employment protection legislation played in shaping the gap across the wage distribution. Results of quantile regressions reveal a remarkable cross-country diversity in the size of the gap and confirm the widespread existence of glass-ceiling effects. Stricter rules for temporary contracts mitigate the gender gap, especially at the top of the distribution; stronger protection for permanent workers is found to increase the gap at the bottom of the distribution and to decrease it at the middle and at the top.

Key words: Gender wage gap, Employment protection, Quantile regression, EU.

JEL: J16, J31, J71.

Labour market gender disparities have attracted a considerable attention in the European Union and their reduction has become a policy priority, to be achieved by encouraging female labour market participation, narrowing gender gaps in employment and unemployment rates and by mitigating pay gaps due to vertical and horizontal segregation and discriminatory practices. To these aims, changes of labour market institutional settings, even though not primarily designed to address gender issues, are expected to play a relevant role.

The aim of this paper is to provide a comparative analysis of the levels and drivers of gender wage disparities in EU countries before and after the crisis. The paper adds to the existing knowledge by: (i) providing empirical evidence on the gender pay gap before and after the crisis in all EU countries (except Malta, Cyprus and Croatia); (ii) showing the variability of the gap along the wage distribution and how this variability changed in response to macro-economic conditions; (iii) focusing on the role which employment protection legislation (EPL) played in shaping the gap at different parts of the wage distribution. The last contribution is particularly relevant since, to our knowledge, no studies exist which focus explicitly on the heterogeneity across the wage distribution of the relationship between EPL and gender pay gap throughout Europe.

The article is structured as follows: the first section provides a summary of the theoretical and empirical literature related to the focus of the paper. In Section 2 we describe the data and present some cross-countries descriptive evidence on wage levels and raw gender gaps in the two years considered (2007 and 2012). In Section 3 we describe the methods used to estimate the adjusted gender wage gaps at country level and to investigate the effects of EPL (on regular and on temporary workers) on the gap. In Section 4 we present and discuss the outcomes of our econometric analysis. Section 5 concludes.

1. Employment Protection and Gender Wage Gap in the EU: A Survey of the Existing Literature

The literature on gender pay gap in EU is very extensive. Examples of studies providing comparative analyses for EU countries include Wiji Arulampalam, Alison L. Booth, and Mark L. Bryan (2007), Sara de la Rica, Juan J. Dolado, and Vanesa Llorens (2008), Claudia Olivetti and Barbara Petrongolo (2008), James Albrecht, Aico Van Vuuren, and Susan Vroman (2009), Catia Nicodemo (2009), Louis N. Christofides, Alexandros Polycarpou, and Konstantinos Vrachimis (2013). These studies, despite their methodological differences, agree in depicting a picture of strong heterogeneity in gender pay gaps across Europe, in attributing a role to labour market institutions and in emphasising how greater disparities materialize especially at the top of the wage distribution (glass ceiling effect).

During the last two decades, the evolution of institutional settings has gained importance as one of the main explanations of rising inequality in general (see Thomas A. Di Prete 2005, for a review) and of increasing gender disparities, although with no univocal and conclusive evidence (see Francine D. Blau and Lawrence Kahn 2003; Anja Heinze and Elke Wolf 2010). Since the pioneering contribution by Richard B. Freeman and Lawrence F. Katz (1995), the main debate has been mainly focused on the relation between the gender wage gap (GWG) and wage-setting institutions, unions and minimum wage provisions. Stronger labour market institutions are expected to mitigate the GWG by compressing the wage structure, reducing differences within and across sectors and firms and inhibiting discriminatory practices (Blau and Kahn 2003; Seamus McGuinness et al. 2011). However, both theoretical and empirical contributions emphasise how opposite outcomes may emerge. This can be the result of an asymmetric presence of unions (or enforcement of labour market institutional settings) across sectors in which the gender distribution of employment is not random (Booth, Marco Francesconi, and Jeff Frank 2002; Jill Rubery, Damian Grimshaw, and Hugo Figueiredo 2005). This could reinforce the existence of dualities in the labour market (incumbent/new-hire or temporary/permanent workers), with the secondary segment being disproportionally populated by women (Kahn 2007).

Labour market deregulation, the focus of this paper, is another institutional dimension expected to affect wage inequality. Although there are substantial differences across countries in regard to EPL, the dominant trend since the late 1990s has been the easing of protection in countries that traditionally had strict EPL (Organisation for Economic Co-operation and Development - OECD 2015a)[1]. This has typically materialised in terms of expansion in the scope for temporary contracts rather than of reduction in job security for permanent employees. However, the International Labour

[1] **Organisation for Economic Co-operation and Developmen (OECD).** 2015a. Employment Outlook. http://dx.doi.org/10.1787/19991266 (accessed July 25, 2015).

Organization (ILO 2012) has found that, since the beginning of the financial crisis, the majority of countries reforming EPL have mainly relaxed dismissal provisions for permanent workers too. The result of these reforms has been an increase in the share of non-permanent employment and therefore in job and income insecurity (Brian Burgoon and Fabian Dekker 2010), with a consequent reinforcement of dualistic market structures (e.g., Tito Boeri and Pietro Garibaldi 2007; Samuel Bentolila, Dolado, and Juan F. Jimeno 2011; Boeri 2011). The rules governing employment protection also impact the side of inequality of interest here, i.e., gender disparities, despite the literature on this specific aspect is scanty. By affecting wage inequality in general, EPL patterns also impacts on gender disparities. On the side of quantity, more stringent employment protection legislation has been found to affect negatively especially female employment levels (Giuseppe Bertola, Blau, and Kahn 2007; Kahn 2007). On the side of wages, the asymmetric impact of EPL on male and female workers to some extend depends on their different bargaining strength *vis a vis* the employers. The latter is related to the position held by a worker in the labour market, her/his characteristics and the aggregate labour market conditions shaping the outside options (Marco Leonardi and Gustavo Pica 2013). If the selection of workers by gender into groups with different bargaining strength is not random, a change in EPL may contribute to re-shaping the gender wage gap, especially in the presence of asymmetries in EPL for different segments of workers that may favour the new dual labour market structures already described. In case of substantial firing and hiring costs for permanent contracts and low protection for fixed-term positions, firms will prefer placing new entrants into temporary jobs. Since new entrants often include a significant share of women (due to lower female employment rates), deregulation of temporary work may lead to a higher incidence of temporary employment among women (Booth, Francesconi, and Frank 2002; Kahn 2007), to an expansion of the gender experience/informal skills gap and, ultimately, to larger wage gaps (Michelle Belot, Jan Boone, and Jan Van Ours 2007). Even within the same group of workers (temporary or permanent), lower labour protection could exacerbate gender wage disparities, by rendering even easier and more likely employment discontinuities of women during their working life, therefore favouring a poor accumulation of specific, on-the-job skills. Especially in contexts in which the institutional framework and welfare state provisions do not facilitate reconciliation of family and working time and in which the distribution of the family loads within the family is unbalanced, women are more exposed to shorter and more discontinuous working lives. As a consequence, they tend to accumulate less labour market experience than men, also because neither them nor the employers have incentives in investing in training and accumulation of skills specific to the firm, fearing not to gain a full return on that investment. To the extent that complementarities exist between formal education and firm-specific human capital (Edward P. Lazear 2003), this translates into a larger skill- and wage-gap. Since this mix of formal and informal knowledge is more likely to be associated to high pay jobs, the impact on the gender wage gap could be greater on the upper part of the wage distribution. Lower wages paid to women by employers might also simply be a way to discount (and load on the worker) the expected costs related to provide firm-specific training to a new worker in the (perceived more likely) case that the current one will have to quit the job.

Besides exposing female workers to higher risks of falling into secondary labour market segments, less strict EPL rules also increase the room for purely discriminatory practices. A weaker employment protection, despite intended to facilitate reallocation processes and flows of labour across firms, sector and labour market positions, in fact places more bargaining power in the hands of the employers, and this reverberates more on the wages of the workers traditionally exposed to discriminatory practices (in our case, women). This might particularly hold for the pool of the most disadvantaged workers (stuck into low-pay and discontinuous employment tracks), who cannot counteract in any way the employers' bargaining power; similarly, the effect could be even greater when the general conditions of the labour market deteriorate, further weakening their bargaining power.

2. Data and Descriptive Statistics

Our empirical analysis relies on the 2008 and 2013 releases of the European Union Statistics on Income and Living Conditions (EU-SILC) (Eurostat 2015)[2] cross-section samples. The corresponding reference years (2007 and 2012) allow carrying out a comparative analysis before and after the outburst of the global crisis. Geographically, our analysis covers 25 EU countries (all EU members minus Malta, Cyprus and Croatia). The number of individuals, aged between 16 and 65 years, included in the two samples is 297,161 (for 2007) and 309,838 (for 2012). Of them 171,783 and 154,850, respectively, are employed as dependent workers and are the object of our descriptive empirical analysis (see Table 1 and Tables A1 and A2 in the Appendix) and of the country-by-country estimation of the wage drivers (see Figure A1 in the Appendix). The remaining individuals (not in employment, in education, self-employed or retired) are used in the estimates to account and correct for sample selection bias. Given the focus of the paper (the impact of employment protection on the gender wage gap), we did not consider self-employment in the analysis. Gender earnings gap for self-employment is normally examined separate from gender wage inequality, due to the intrinsic differences in the nature of the remuneration and the related issues of comparability. In principle, a strategy to avoid discrimination by employers is being your own employer, i.e., becoming self-employed. Hence, if employer discrimination plays a major role, the gender gap in self-employment earnings could be expected to be significantly lower than the gender wage gap in paid employment (Robert L. Moore 1983). There is some empirical evidence, however, suggesting that this is not necessarily the case – both adjusted and unadjusted gender earnings gaps seem to be higher in self-employment than in paid employment (see, e.g., Kristy Eastough and Paul W. Miller 2004). For a recent literature survey and an analysis of self-employment gender earnings gap, see Daniel S. J. Lechmann and Claus Schnabel (2012).

[2] **Eurostat.** 2015. European Union Statistics on Income and Living Conditions (EU-SILC). https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions (accessed July 27, 2015).

Table 1 Mean Hourly Wage and Raw Gender Gap (Male/Female) in EU Countries (2005 Euro PPP) 2007 and 2012

Country		Obs.		Wage		Gender gap	
		2007	2012	2007	2012	2007	2012
AT	Austria	4665	4209	15.56	17.19	1.21	1.24
BE	Belgium	4948	4557	16.18	17.00	1.10	1.09
DE	Germany	9845	9681	15.98	16.28	1.28	1.30
DK	Denmark	5796	4888	17.67	18.94	1.15	1.13
EL	Greece	4029	3024	11.47	8.53	1.09	1.12
ES	Spain	10863	7184	10.87	10.88	1.11	1.12
FI	Finland	8499	8019	13.81	15.55	1.17	1.20
FR	France	9034	8284	12.77	13.62	1.12	1.11
IE	Ireland	3189	3011	16.88	18.65	1.14	1.09
IT	Italy	13890	11428	12.45	12.50	1.03	1.11
LU	Luxembourg	4019	3657	18.81	19.57	1.16	1.04
NL	Netherlands	9617	9132	22.60	22.23	1.23	1.20
PT	Portugal	3337	4557	7.83	7.19	1.06	1.09
SE	Sweden	7743	5699	16.27	14.94	1.06	1.18
UK	Un. Kingdom	6317	7542	14.44	12.95	1.24	1.21
West EU		**105791**	**94872**	**14.86**	**15.08**	**1.14**	**1.16**
BG	Bulgaria	4170	3884	2.89	3.12	1.22	1.15
CZ	Cz. Republic	9648	6469	6.31	6.24	1.26	1.23
EE	Estonia	4915	4940	5.10	5.25	1.41	1.40
HU	Hungary	6802	8128	4.58	4.27	1.07	1.11
LT	Lithuania	4152	3845	5.20	4.44	1.19	1.06
LV	Latvia	4508	4451	4.79	4.16	1.16	1.15
PL	Poland	10397	9282	6.06	6.53	1.04	1.04
RO	Romania	5081	4723	2.72	2.29	1.13	1.13
SI	Slovenia	10015	8666	9.80	9.97	1.03	1.06
SK	Slovakia	6304	5590	4.67	5.39	1.20	1.19
East EU		**65992**	**59978**	**5.71**	**5.61**	**1.13**	**1.13**
Total		**171783**	**154850**	**11.35**	**11.41**	**1.14**	**1.15**

Source: Own elaborations on EU-SILC data (Eurostat 2015).

Due to unavailability of data on institutional variables (the OECD indicators, see below) the following countries had to be excluded from the cross-country econometric analysis of the effects of EPL on the wage gap: Romania, Bulgaria, Lithuania, and Luxemburg in 2007 and 2012; Estonia and Slovenia in 2012 only. As a consequence, the number of observations for the pooled sample is 272,870, of which 134,923 refer to 2007 and 137,947 to 2012.

Employees' income (variable PY010G) is defined as the gross total (yearly) remuneration, in cash or in kind, payable by an employer to an employee in return for the work done in the reference period. It includes wages and salaries paid in cash, holiday payments, thirteenth month and overtime payments, profit sharing, bonuses and productivity premia, allowances paid for transport or for working in remote locations, as well as the social contributions and income taxes payable by employees. The use of gross wages is common in the literature that considers within-countries wage and earnings inequality (Dirk Antonczyk, Bernd Fitzenberger, and Katrin Sommerfeld 2010) and employs EU-SILC data (Andrea Brandolini, Alfonso Rosolia, and Roberto Torrini 2010). In order to account for differences in hours worked, we computed all earning measures on hourly basis using the information on the number of hours usually worked per week in the main job and the number of months spent at work. Top and bottom 1% of the hourly wage distributions in each country and year were trimmed in order to avoid distortions by outliers. All monetary values are expressed in 2005 Euro PPPs.

As explanatory variables of wages, besides the gender of the worker, we use a large set of individual information which include: education (primary, secondary and tertiary, corresponding to the ISCED classification levels 0-2, 3-4, and 5-6, respectively), employment status (temporary or permanent), age (and its square), marital status, self-reported health status (on a 1-very good to 5-very bad scale), localisation (urban/non-urban region), presence of a second job, controls for part-time employment, type of occupation, sector and size of the firm in which the individual is employed. Occupations are classified into six categories: (1) Managers & Senior officials; (2) Professional & Technicians; (3) Clerks; (4) Skilled agricultural & Craft workers; (5) Machine operators; (6) Elementary occupations. Industry breakdown has been limited to eight sectors: (1) Agriculture; (2) Industry; (3) Constructions; (4) Trade; (5) Transports; (6) Hotels & Restaurants; (7) Business services; (8) Other services. Lastly, we consider three firm size classes: 0-10, 11-49, 50 and over employees.

Some basic characteristics of the sample are detailed in Tables A1 and A2 in the Appendix; average values of the explanatory variables by country and gender highlight significant differences across EU and genders (particularly in terms of education, employment contracts and size of the employer). The picture is largely consistent with the one provided by Eurostat aggregate indicators and previous studies (e.g., Jens Hölscher, Cristiano Perugini, and Fabrizio Pompei 2011), with a still persisting East/West divide and remarkable differences emerging for countries belonging to alternative capitalistic models.

As regards to the analysis of the impact of labour market institutional variables, we consider the widely used OECD indicators on the strictness of employment protection legislation for regular (EPL_r) and temporary (EPL_t) employment. Specifically, EPL_r is the OECD synthetic indicator defining conditions under which both individual and collective dismissals are possible (provisions for notice periods, involvement of third parties, such as courts and workers' councils, specification of severance payments and additional provisions in the case of collective dismissals). EPL_t describes the conditions under which workers can be hired on fixed-term or temporary work agency contracts. These rules concern the type of jobs and activities in which these contracts are allowed, their maximum duration, and the conditions for their renewal or termination. For each year, indicators refer to regulation in force on the 1st of January. Data range from 0 to 6 with higher scores representing stricter regulation (see OECD 2015b)[3].

As shown in Table 1, average hourly wages (in 2005 Euro PPPs) vary remarkably across countries, with a still very visible East/West divide (all country-level statistics discussed in the paper are calculated using personal cross-sectional weights (PB040) which sum to the country population of household members aged 16 and over). For the majority of countries average wages were stable or increased slightly in 2012 compared to 2007; the countries in which hourly wages are still below the ones observed in the initial year are, besides Greece, Portugal, Sweden and UK, mainly Central-Eastern EU economies. As regards the raw gender gap, it remained virtually

[3] **Organisation for Economic Co-operation and Developmen (OECD).** 2015b. OECD Indicators of Employment Protection. http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm (accessed July 27, 2015).

stable in all Western EU countries, except for Italy and Sweden (where it increased) and Luxembourg (where it declined). The generalised tendency in Central-Eastern Europe was instead an increase of the unadjusted gender gap. Still in 2012, we observe a remarkable variety of gender disparities across Europe, with the extremes of the distribution being occupied by Eastern countries (Estonia at the top and Slovenia and Poland at the bottom).

Table 2 reports, for each country and year, the employment rate (on working age population) and the part-time and temporary employment rates (on total employment) for men and women in the two years of the analysis. With no exception, employment rates declined remarkably (and in some cases dramatically) in 2012 compared to 2007 across Europe for both genders, highlighting that to a significant extent labour market adjustment during the crisis took place on the side of quantity. The huge gender gap in part-time employment, although persistent, tended to decline for the majority of countries, due to an increase of the male rate. This feature, along with a similarly declining gender gap in temporary employment, anticipates one result of the following econometric analysis, i.e., that the reduction in the gender wage gap observed at the bottom of the distribution is mainly driven by the fact that, due to the crisis, man increasingly ended up in the lowest segment of the labour market (non standard contracts, at risk of low productivity, low pay traps), normally disproportionally populated by women.

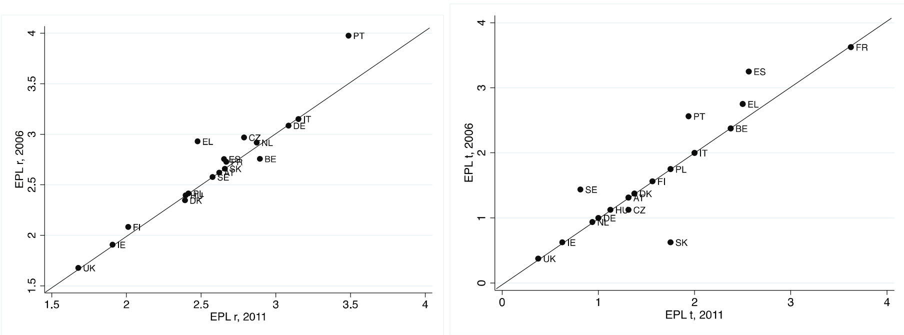
Table 2 Gender Labour Market Differences in EU Countries 2007 and 2012

	Employment rate				Part-time rate				Temporary employment rate			
	M 2007	F 2012	M 2007	F 2012	M 2007	F 2012	M 2007	F 2012	M 2007	F 2012	M 2007	F 2012
AT	76.3	76.2	63.5	66.7	6.2	40.8	8.0	44.6	7.4	7.9	8.0	8.4
BE	68.7	66.9	55.3	56.8	7.1	40.5	9.0	43.5	5.7	5.9	9.6	8.3
DE	74.7	77.9	63.2	68.1	8.5	45.6	8.9	45.3	12.7	11.9	13.4	12.7
DK	80.8	75.2	73.2	70.0	12.4	35.1	14.8	35.8	6.8	7.0	9.7	8.8
EL	74.2	60.1	47.7	41.7	2.5	9.9	4.7	11.8	5.8	5.4	9.3	8.1
ES	76.1	60.3	55.3	51.2	3.9	22.1	6.4	23.9	24.4	17.5	28.6	21.8
FI	72.1	70.5	68.5	68.2	8.3	18.8	9.1	19.4	10.3	10.5	17.8	16.7
FR	69.2	68.1	59.6	60.1	5.5	30.3	6.4	30.0	12.0	12.2	15.0	14.9
IE	77.5	62.7	60.6	55.1	6.5	31.7	13.3	34.9	5.4	7.6	9.1	9.5
IT	70.6	66.3	46.6	47.1	4.6	26.8	6.6	30.9	7.9	9.3	12.8	12.2
LU	72.3	72.5	56.1	59.0	2.6	37.1	4.7	35.9	5.7	6.5	7.2	7.5
NL	82.2	79.3	69.6	69.4	22.5	74.8	24.6	77.0	13.9	14.8	17.5	17.9
PT	73.6	64.5	61.8	58.5	4.7	13.7	8.4	14.2	16.9	16.3	18.8	17.5
SE	76.5	75.6	71.8	71.8	10.3	38.0	12.5	38.6	12.7	12.0	18.6	17.0
UK	77.6	75.0	65.5	64.9	9.3	41.3	11.6	42.2	4.2	4.6	5.8	6.0
BG	66.0	61.3	57.6	56.3	1.1	1.9	2.0	2.5	4.0	4.2	4.8	3.6
CZ	74.8	74.6	57.3	58.2	1.7	7.9	2.2	8.6	5.2	5.4	8.4	8.6
EE	73.5	69.7	66.2	64.7	3.9	10.6	5.1	13.3	2.4	4.1	1.5	2.3
HU	63.7	61.6	50.7	51.9	2.5	5.5	4.3	9.4	6.5	9.0	6.2	7.8
LT	68.2	62.2	62.0	61.8	7.0	10.2	6.9	10.7	4.3	3.0	2.2	1.7
LV	72.7	64.4	63.9	61.7	4.1	7.1	6.7	11.0	4.9	5.5	2.5	3.0
PL	63.6	66.3	50.6	53.1	5.8	11.7	4.5	10.6	21.4	20.6	22.3	21.3
RO	64.8	67.6	52.8	52.8	8.3	8.9	8.7	10.0	1.1	1.3	1.1	0.8
SI	72.7	67.4	62.6	60.5	6.5	10.0	6.3	12.2	13.7	12.8	18.4	16.4
SK	68.4	66.7	53.0	52.7	1.0	4.3	2.8	5.5	4.0	5.1	4.7	6.4

Notes: Employment rate (employment on 15-64 years old population); part-time workers and temporary contracts - in % of all employed.

Source: Eurostat (2015).

Figure 1 provides a picture of the levels of employment protection for temporary and permanent workers in 2006 and 2011 (for the reasons explained in the next section we use values of the institutional indicators lagged one year). The number of countries is restricted to those for which the OECD EPL indicators are available. Data show heterogeneity of employment protection across EU, with UK and Ireland presenting the most deregulated labour markets. The highest protection is enjoyed by regular workers in Portugal, Italy and some continental EU countries (Germany, Netherlands, Belgium); France, Spain, Greece and Belgium grant the strongest protection to temporary workers. Figure 1 also shows that the general picture of EPL is virtually unchanged in 2011 compared to 2006, with only Portugal, Greece and the Czech Republic having introduced stricter regulation for regular workers and Spain, Greece, Portugal and Sweden for temporary jobs. The Czech and the Slovak Republic, on the contrary, implemented reforms aimed at relaxing EPL on fixed-term contracts. The fact that the EPL indicators do not vary for the majority of countries in the two years is not a concern for our analysis, since our emphasis is on the cross-country variation of EPL. As mentioned in the introduction and explained in more detailed in Section 3, our aim is to investigate whether the level of EPL has an impact on the adjusted wage gap before and after the crisis. Therefore, we are not interested in exploiting the variation of EPL over time, but in investigating whether EPL had a different effect in two points in time characterized by very different macroeconomic circumstances.



Source: OECD (2015b).

Figure 1 Employment Protection Legislation for Regular (EPL_r) and Temporary (EPL_t) Workers in 2006 and 2011

3. Empirical Model and Methods

The gender wage gaps presented in Table 1 do not account for the characteristics relevant to shaping male and female earnings, such as the level of education, experience, skills, employment status, occupation and sector of employment. The computation of those raw wage gaps is therefore not comparing like with like. To account for the impact of observable characteristics we estimate a log hourly wage (*lhwage*) equation in which the coefficient of the gender dummy (*male* = 1) provides, *ceteris paribus*, an estimate of the *per cent residual gender earnings gap* (Andrew T. Newell and Barry Reilly 2001).

The microeconomic model of the determinants of wages relies on the human capital approach as the theoretical basis for the earnings function (Jacob Mincer 1958; Gary J. Becker 1964). Higher labour income levels are therefore associated, first of all, to accumulated (formal) education. Other explanatory variables are: age, which is a proxy for experience and, as usual, is included in its quadratic term (*age* and *age*^{2}), permanent or temporary employment status (*temp*); marital status (*married*); health status (*health*); urban/non-urban region of residence (*urb*); second job (*secjob*); part-time job position (*part*); sector of employment (*sec*); occupation (*occ*); size of the firm (*size*). All these variables, but especially those referring to sectors and occupations, are expected to play a role in explaining gender wage differences, particularly related to vertical and horizontal segregation (see, for example, Alan Manning and Barbara Petrongolo 2008). This wide range of information allows interpreting the gender dummy variable (*male*) as a measure of the discrimination effect due to gender, once all remaining (observable) characteristics are controlled for. This approach, as any other relying on a statistical residual, is exposed to the question as whether all the necessary independent variables were included in the regression. If some factors are not measurable or not accountable for (say, firm-specific tenure) and for example men are more highly endowed with respect to such omitted variables, this would overestimate discrimination. Conversely, if some of the factors controlled for in such regressions, like occupation and industry of employment, themselves describe a form of discrimination, then the true size of the gap will be underestimated. However, as Blau and Kahn (2000) explain, results obtained using such approaches may nonetheless be instructive, if carefully interpreted in the awareness of the information included in the discrimination coefficient.

Equation (1) describes the baseline empirical model used to estimate the adjusted gender wage gap for each country included in the sample:

$$\begin{gathered} lhwage_i = c_i + \omega_1 male_i \cdot Year07 + \omega_2 male_i \cdot Year12 + \alpha_1 married_i + \\ \alpha_2 age_i + \alpha_3 age_i^2 + \alpha_4 health_i + \alpha_5 urb_i + \textstyle\sum_{e=1}^{2} \beta_e \, educ_{i,e} + \varphi_1 sec\,job_i + \\ \varphi_2 temp_i + \varphi_3 part_i + \textstyle\sum_{s=1}^{2} \eta_s \, size_{i,s} + \sum_{n=1}^{7} \upsilon_n \, sec_{i,n} + \sum_{r=1}^{5} \xi_r \, occ_{i,r} + \\ \gamma_1 Year12 + \varepsilon_i . \end{gathered} \tag{1}$$

The k country-specific empirical models (with k = 25) are estimated pooling together the data for 2007 and 2012, so that the difference of the GWG in the two years (before and after the crisis) can be statistically tested. Subscript i stands for individuals, the acronyms indicate the explanatory variables listed above and ε_i is the usual error term.

In order to investigate the impact on the gender wage gap of employment protection legislation, measured at country-level, we need to pool country level information. This originates a multilevel structure of data, in which observations at the individual level are nested within the country level. Relying on Mark L. Bryan and Stephen P. Jenkins (2013), and as done in Perugini and Ekaterina Selezneva (2015), we opt here for a fixed effect (FE) estimation approach, i.e., we pool the country surveys and include distinct country intercepts. In the simplest, baseline case the individual effects are constrained to be equal across countries, but they can be allowed to differ by interacting subsets of individual-level characteristics with the country dummies.

The use of country fixed effects obviously prevents the inclusion of additional country-level predictors in the empirical model, since the country intercepts already fully encapsulate cross-country differences (Tom A. B. Snijders and Roel Bosker 1999). However, additional country level variables can be interacted with individual level variables, so to obtain the additional effect that a country level factor produces on the main (individual level) effect. This is what is needed for the purposes of our analysis, i.e., estimating the effects of country-level EPL on the gender wage gap, and it is done by interacting the (country-level) EPL indicators (EPL_t and EPL_r, in two different empirical models) with the gender dummy.

Our pooled (by country and by year) empirical model takes therefore the following form:

$$lhwage_{ik} = c_i + \omega_1 male_{ik} \cdot Year07 + \omega_2 male_{ik} \cdot Year12 + \vartheta_1 male_{ik} \cdot EPL_k \cdot Year07 + \vartheta_2 male_{ik} \cdot EPL_k \cdot Year12 + \alpha_1 married_{ik} + \alpha_2 age_{ik} + \alpha_3 age_{ik}^2 + \alpha_4 health_{ik} + \alpha_5 urb_{ik} + \sum_{e=1}^{2} \beta_e\, educ_{ik,e} + \varphi_1 sec\,job_{ik} + \varphi_2 temp_{ik} + \varphi_3 part_{ik} + \sum_{s=1}^{2} \eta_s\, size_{ik,s} + \sum_{n=1}^{7} \upsilon_n\, sec_{ik,n} + \sum_{r=1}^{5} \xi_r\, occ_{ik,r} + u_k + u_k \cdot Year12 + \varepsilon_{ik}, \qquad (2)$$

where subscripts *i* and *k* stand for individuals and countries, respectively. In addition to the variables already included in Equation (1), u_k controls for any other relevant country-specific effects (for example other labour market institutions affecting wages) and ε_{ik} is the individual error term. Since the crisis might have affected EU countries asymmetrically, we also introduce country specific effects interacted with the year 2012 dummy variable. This way, we are able to control for the (unobservable) effect of the crisis of individuals' pay specific to each country. EU-SILC provides data with nationally representative samples of individuals 16 years old (see Kristina Krell, Joachim R. Frick, and Markus M. Grabkathe 2017, on methodological aspects related to data collection and weighting). However, caution is needed to interpret the coefficients of interest (for example the gender gap or the returns to education) as representative at EU level, given the number of observations available for each country included in the analysis (see Table 1). However, the possible distortion introduced by the differences in sample size for the countries considered is not a concern here; in Equation (2) we are indeed not interested in estimating parameters (say, the gender gap) that are representative for the EU. The focus is on the impact of EPL on the gender gap and for this purpose we are exploiting the cross-country dimension of our data (i.e., the heterogeneity of EPL across EU countries).

As customary in the literature (Andrea Bassanini, Luca Nunziata, and Danielle Venn 2009; Renaud Bourlès et al. 2012), the two institutional variables (either EPL_t or EPL_r) are lagged one period in order to alleviate endogeneity issues and to account for the fact that *de jure* institutional reforms take time to become effective. Other endogeneity threats are quite unlikely to emerge given the structure of our data, being EPL a country level institutional feature (dependent on a number of social, economic, policy and historical factors) and the dependent variable of Equation (2) individual wages. Results of the estimation of Equation (2) will provide the size of the gender gap in the two years (coefficients ω_1 and ω_2, indicating the wage premium due to being a male worker) and the (additional) effects of EPL on the gender gap, again in the two years

(ϑ_1 and ϑ_2; if positive, they increase the gender gap; if negative they mitigate it). In order not to divert the attention from the focus of the paper, and to keep the size of the tables reasonable, we decided not to introduce other interaction terms between other covariates and the year 2012 dummy; all coefficients of the remaining covariates can be interpreted as average coefficients in the two years considered.

Equations (1) and (2) allow estimating, through ordinary least squares (OLS) techniques, only average effects of explanatory variables on log hourly wage and would not allow identifying their possible heterogeneity at various points of the wage distribution. This would oversimplify the phenomenon under scrutiny here, since it is extensively documented that the gender gap is not constant along the wage distribution (*sticky floor* and *glass ceiling* effects). In addition, a model limited to average effects only would prevent us from identifying the possible heterogeneity of the effects of EPL on the gender gap for different labour market segments.

The investigation of this heterogeneity across the wage distribution is possible with quantile regression (QR) approaches. Following Roger Koenker and Gilbert Basset (1978), the model of QR can be simply described in terms of conditional θ^{th}quantile (instead of conditional mean as in the standard regression) distribution of y_i conditional on a vector of covariates x_i under the assumption of linear specification:

$$Q_\theta(y_i|x_i) = x_i\beta_\theta, \tag{3}$$

implying $y_i = x_i\beta_\theta + \varepsilon_{\theta,i}$. The semi-parametric nature of the approach lies in the fact that the distribution of the error term $\varepsilon_{\theta,i}$, $F_{\varepsilon,\theta}(\cdot)$, is left unspecified, and $\varepsilon_{\theta,i}$ satisfies $Q_\theta\left(\varepsilon_{\theta,i}|x_i\right) = 0$.

The θ^{th} QR estimator $\hat{\beta}_\theta$ minimizes over β_θ the following objective function:

$$Q(\beta_\theta) = \sum_{i:y_i \geq y_i\beta}^{n} \theta|y_i - x_i\beta_\theta| + \sum_{i:y_i<y_i\beta}^{n}(1-\theta)|y_i - x_i\beta_\theta|. \tag{4}$$

The estimated vector of QR coefficients $\hat{\beta}_\theta$ measures the marginal change in the conditional quantile θ due to a marginal change in the corresponding element of the vector of coefficients on x, and is obtained *via* the optimization techniques described in Colin A. Cameron and Pravin K. Trivedi (2009), as the usual gradient optimization method cannot be applied since the objective Equation (4) is not differentiable. QR estimates are implemented with bootstrap standard errors, which are robust and assume independence over *i* but do not require errors to be identically distributed.

A last important empirical aspect that needs to be carefully addressed refers to a possible estimation bias due to sample selection. If selection of individuals into employment is non-random, the direction in which it may affect the level of earnings is a concern. In the field of gender studies, an extensive literature has recognized that employed women tend to have - more often - characteristics normally associated to high wages (James J. Heckman 1979; Moshe Buchinsky 1998; De la Rica, Dolado, and Llorens 2008). As a consequence, low female employment rates may become consistent with low gender wage gaps simply because low-wage women would not feature in the observed wage distribution. Differences in participation in employment may result from a number of factors, especially at cross-country level (Albrecht, Van Vuuren, and Vroman 2009). They include differences in labour supply behaviour related to household structure or social norms, and in institutional settings such as unionization or minimum wages (Olivetti and Petrolongo 2008). All our empirical models are therefore estimated using a correction based on the Heckman two-stage method, applied in a quantile regression context (Buchinsky 1998; Albrecht, Van Vuuren, and Vroman 2009).

The countries considered in this study show impressive gender differences in terms of remarkably low female employment rates, higher incidence of part-time and temporary contracts and higher education levels (see Table 2).

Heckman (1979) proposed a parametric estimator to estimate covariates with selection bias; Buchinsky (1998) was the first to apply a semi-parametric sample selection model for quantile regression. We follow here the approach by Buchinsky (1998), explained in more detail in Albrecht, Van Vuuren, and Vroman (2009) and Nicodemo (2009). Since the recent literature shows that also men do not randomly select into employment (Christofides, Polycarpou, and Vrachimis 2013), as also signalled by the remarkably low male employment rates for some countries especially in 2012, we control for sample selection for both genders. We therefore estimate the quantile regression of individuals employed (for which we observe the log wage rate) as:

$$Q_\theta(y|x) = x\beta_\theta + h_\theta(z\lambda), \tag{5}$$

where z is the set of observable characteristics that influence the probability that an individual is employed and contains, for the identification, at least one variable that is not included in x. In our case, in addition to the individual characteristics associated to coefficients (α) in Equation (1) and the country level institutional and macroeconomic controls in the case of pooled sample, we add variables related to household structure, namely: number of household components, number of children (less than 3, 4-6 and 7-15 years old), number of elderly (65-74 and over 75 years old). The term $h_\theta(z\lambda)$ corrects for selection at the θ^{th} quantile, playing the role that the Mills ratio plays in Heckman (1979) procedure, but it is quantile-specific and more general so as not to assume normality (Albrecht, Van Vuuren, and Vroman 2009). Following the Buchinky's method, the $h_\theta(z\lambda)$ can be approximated by a power series whose coefficients has to be estimated and should define a function which is larger when the impact of unobservables is larger (Giulio Bosio 2009). This function is the inverse Mill's ratio, being small for those with a high probability of being temporary and increasing monotonically as the probability of being temporary reduces. Following Arulampalam, Alejandra Manquilef, and Jennifer Smith (2006) and Paula Mendez Errico (2013) we therefore control for the selectivity bias in QR earning equation expanding $h_\theta(z\lambda)$ as a power series in the inverse Mill's ratio, derived from a participation equation dependent on the vector of explanatory variables z. The latter is estimated by both: (i) a standard probit approach; and (ii) a single index model (Hidehiko Ichimura 1993) using the semiparametric ML estimator of Roger H. Klein and Richard H. Spady (1993). In the second stage, QR are augmented by the derived inverse Mill's ratio and its square.

4. Results

Using quantile regression methods we first show how the (adjusted) unexplained gender gap varies at different points (quintiles) of the hourly wage distribution. The log-wage equation, Equation (1), is estimated at various percentiles (from 0.05 to 0.95, with a 0.05 interval) of the wage distribution, country by country, using bootstrap standard errors (obtained with 400 replications) and controlling for sample selection of both men and women into employment. The country-by-country estimation results, available upon request, show that the explanatory variables of log hourly wage play the role expected *ex-ante* (see also Tables 3 and 4 below). Wages increase not linearly with age (the age variable has been divided by 10, so to have more readable coefficients in the tables), education, firm size and in urban areas; they decrease as health status deteriorates as well as for those workers holding a temporary or a part-time job. The sector and occupation controls provide expected hierarchies of coefficients (not reported in Tables 3 and 4 for the sake of brevity, but available upon request).

Figure A1 in the Appendix plots, country by country, the OLS (dotted lines) and the quantile regression (solid lines) coefficients of the *male* dummy variable interacted with the 2007 and the 2012 year dummies. As for the size of the wage gap, our results indicate a remarkable heterogeneity across EU countries, with many Central-Eastern economies (especially the Baltic countries) showing the highest disparities. The lowest differences are instead observed for Hungary, Romania, Slovenia, Belgium, Denmark and Italy. These outcomes are in general consistent with the unadjusted figures presented in Table 1, especially in terms of ranking of the countries and changes from 2007 to 2012. However, there are also important exceptions. Among them we find Austria, Germany and the UK for Western Europe, where the adjusted pay gap is remarkably lower than the unadjusted measure, signalling that the raw gender gap was significantly driven by asymmetries (favourable to men) in individual characteristics affecting productivity and wages. Poland and Slovenia represent a second important case of interesting differences between the adjusted and the unadjusted gap, with the former this time being remarkably higher. In these cases the low raw gap is due to richer endowment of productive characteristics owned by the female segment of the labour market, as also confirmed by some descriptive statistics on our sample (see Tables A1 and A2 in the Appendix), showing for example that in these three countries the average levels of education are very unbalanced in favour of women.

The country diagrams shown in Figure A1 support our decision of investigating the variability of the gender gap over time and across the wage distribution, since the position of the dotted lines and the upward slope of the solid ones clearly indicate that the size of disparities was far from constant. This is confirmed by specific tests (available upon request) that describe the statistical significance of the differences between the gender variable coefficients: (i) between years on average (OLS) and at different points of the pay distribution (10^{th}, 50^{th} and 90^{th} percentiles); and (ii) across the distribution in each year. With the only exception of Belgium, the gender gap is statistically different in 2012 from 2007 for all countries either on average, on median, or at top/bottom of the distribution. Only very few countries show a significant decline in the gap (Luxembourg, Ireland and Lithuania), homogeneous across the wage ladder. The choice of emphasizing the variability across the distribution of the gender pay gap is also strongly supported by the evidence that the size of discrimination against female workers changes remarkably as hourly wages increase. Apart from the case of Belgium, the gender gaps at the bottom, at the middle and at the top of the distribution are always significantly different. It is therefore widely confirmed that, in case of developed countries, the gap typically widens towards the top of the wage distribution (the *glass ceiling* effect) (Dolado and Llorens 2004). In few cases (Germany and, to a lesser extent, Spain), it also widens at the bottom (the *sticky floor* effect) (Arulampalam, Booth, and Bryan 2007). Hence, consistent with the evidence provided by Christofides, Polycarpou, and Vrachimis (2013), we can conclude for the majority of countries on lower gender inequality (gender discrimination) at the bottom of the conditional wage distribution and on important *glass ceiling* effects.

We now focus our attention on the effects of EPL for temporary and regular jobs on the gender wage gap. To this aim, Figures 2 and 3 and Tables 3 and 4 report the outcomes of the estimation of Equation (2) (pooled sample of all countries and years). The first three columns of Table 3 present the results of the OLS estimations; columns 4 to 6 of Tables 3 and 4 provide the results of the quantile regression estimation for the 10^{th}, the 50^{th} (median) and the 90^{th} percentiles.

As already explained, the coefficients of the gender dummy variable (*male*) measure the residual earnings gap, once all observable workers' and job characteristics are controlled for. The interactions between the EPL indicators and the gender dummy variable measure the impact of EPL on the gender wage gap. The first column of Table 3 shows that, all other conditions being equal, men earn on average 15.5% and 17.2% more than women in 2007 and 2012, respectively. The test at the bottom of the table indicates that the difference in the two years is statistically significant. The second column of Table 3 explains that, on average, each increase by one point of the EPL indicator for temporary workers decreases the gap by 2.7% in 2007 and 3.1% in 2012 (although the difference in the two effects is not statistically significant). Similarly, column 3 indicates that EPL for permanent workers was on average uninfluential on the wage gap in 2007, while in 2102 higher EPL was able to mitigate the wage gap. These first outcomes have their graphical counterparts in the dotted horizontal lines in Figures 2 and 3.

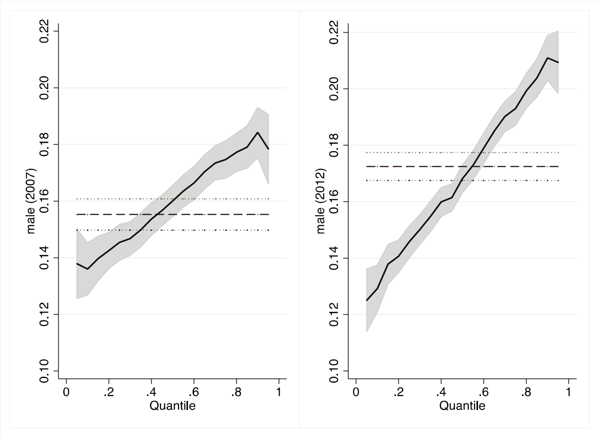
Columns 4 to 6 of Table 3 (baseline quantile regressions, with no interactions) show that the size of discrimination varies across the distribution, getting higher as wages grow (see also Figure 2). This confirms the presence of a glass ceiling effect. Also, the size of the gap is not statistically different in 2012 compared to 2007 at the bottom of the distribution, whereas it is significantly higher at the median and for the top incomes. Therefore, empirical evidence indicates that the crisis exacerbated the glass ceiling effect.

Table 3 OLS and Quantile Regression Estimates, Pooled Model (2007 and 2012)

	(1) OLS	(2) OLS	(3) OLS	(4) QR θ = .10	(5) QR θ = .50	(6) QR θ = .90
Male*2007	0.155***	0.201***	0.160***	0.136***	0.160***	0.184***
	(0.003)	*(0.005)*	*(0.015)*	*(0.005)*	*(0.003)*	*(0.005)*
Male*2012	0.172***	0.225***	0.256***	0.129***	0.168***	0.211***
	(0.002)	*(0.005)*	*(0.014)*	*(0.005)*	*(0.003)*	*(0.004)*
Male*EPL_t *2007		-0.027***				
		(0.003)				
Male*EPL_t *2012		-0.031***				
		(0.002)				
Male*EPL_r *2007			-0.002			
			(0.005)			
Male*EPL_r *2012			-0.032***			
			(0.005)			
Temporary	-0.169***	-0.169***	-0.169***	-0.232***	-0.164***	-0.109***
	(0.003)	*(0.003)*	*(0.003)*	*(0.005)*	*(0.003)*	*(0.005)*
Married	0.035***	0.034***	0.035***	0.029***	0.034***	0.040***
	(0.002)	*(0.002)*	*(0.002)*	*(0.003)*	*(0.002)*	*(0.003)*
Age	0.195***	0.191***	0.195***	0.244***	0.163***	0.173***
	(0.016)	*(0.016)*	*(0.016)*	*(0.029)*	*(0.016)*	*(0.027)*
Age2	-0.014***	-0.014***	-0.014***	-0.020***	-0.011***	-0.011***
	(0.002)	*(0.002)*	*(0.002)*	*(0.003)*	*(0.002)*	*(0.003)*
Health status	-0.016***	-0.016***	-0.016***	-0.016***	-0.015***	-0.014***
	(0.001)	*(0.001)*	*(0.001)*	*(0.002)*	*(0.001)*	*(0.002)*
Secondary educ.	0.096***	0.094***	0.095***	0.067***	0.094***	0.117***
	(0.003)	*(0.003)*	*(0.003)*	*(0.006)*	*(0.003)*	*(0.005)*
Tertiary educ.	0.277***	0.275***	0.277***	0.198***	0.272***	0.358***
	(0.004)	*(0.004)*	*(0.004)*	*(0.008)*	*(0.004)*	*(0.007)*
Part-time	0.001	0.003	0.001	-0.089***	-0.010***	0.111***
	(0.003)	*(0.003)*	*(0.003)*	*(0.004)*	*(0.003)*	*(0.004)*
Second job	-0.081***	-0.082***	-0.081***	-0.191***	-0.026***	0.005
	(0.004)	*(0.004)*	*(0.004)*	*(0.006)*	*(0.004)*	*(0.006)*
Firm size (11-49)	0.079***	0.079***	0.079***	0.125***	0.062***	0.027***
	(0.002)	*(0.002)*	*(0.002)*	*(0.004)*	*(0.002)*	*(0.004)*
Firm size (over 50)	0.172***	0.172***	0.172***	0.222***	0.151***	0.108***
	(0.002)	*(0.002)*	*(0.002)*	*(0.004)*	*(0.002)*	*(0.003)*
Urban	0.036***	0.036***	0.036***	0.020***	0.041***	0.054***
	(0.002)	*(0.002)*	*(0.002)*	*(0.003)*	*(0.002)*	*(0.003)*
Constant	-0.334***	-0.518***	-0.349***	-1.451***	-0.648***	0.073
	(0.041)	*(0.042)*	*(0.041)*	*(0.070)*	*(0.040)*	*(0.065)*
Sector/occup/country/country*2012 dummies	yes	yes	yes	yes	yes	yes
Sample-selection correction	yes	yes	yes	yes	yes	yes
Tests						
(q10 = q50 = q90): male*2007					32.96***	
(q10 = q50 = q90): male*2012					147.60***	
male*2007 = male*2012	29.25***	12.15***	22.09***	2.69	10.07**	21.47***
male*EPL*2007 = male*EPL*2012		1.29	15.83***			
Observations	272870	272870	272870	272870	272870	272870
Adj. R^2	0.645	0.645	0.645	0.419	0.459	0.371

Notes: Robust (OLS) and bootstrap (QR) in parentheses. ***, ** and * denote significance at the 1, 5 and 10%, respectively. EPL lagged one year.

Source: Author's calculations.



Source: Own elaboration on EU-SILC data (Eurostat 2015).

Figure 2 Adjusted Gender Wage Gap in Europe, Pooled Sample 2007 and 2012

Table 4 describes the impact of EPL on the gender wage gap at different parts of the wage distribution. Our findings show that higher protection for temporary workers (columns 1-3) mitigates gender wage disparities in all parts of the distribution, but especially at the upper tail. These impacts are not statistically different in the two years, suggesting that the effect is not related to specific macroeconomic and structural conditions. Higher levels of EPL for regular workers (columns 4-6) have a more heterogeneous effect across the wage distribution: it exacerbates the gender wage gap for the low-paid segment of workers (significant only in 2007), while reducing gender differences at the middle and at the top of the distribution. These GWG mitigating effect is stronger in 2012 than in 2007. This evidence complements the one provided, in terms of employment opportunities, by Aurélien Abrassart (2015) who reported that stricter EPL for regular contracts weakened the effect of economic fluctuations for men only.

The results on EPL for temporary workers are consistent with previous empirical evidence (Christopher Pissarides et al. 2005) and our expectations that higher EPL reduces the room for pure discrimination. When these contracts are governed by stricter rules (e.g., limitations on the type of jobs and activities in which fixed-term contracts are allowed, on their maximum duration, and on the conditions for their renewal or termination) employers face more constraints in their hiring practices and the improper use of fixed-terms contracts is somehow restrained. This means that if they assign, for whatever reason, a lower productivity to a group of workers (i.e., women), or fear that the returns to firm-specific training investments will not materialize, their capacity to penalize them in term of wages is reduced. For example, when little constraints to maximum duration, renewals, or quitting of the contract exist, employers are able to impose lower wages to workers they regard as potentially less productive by simply using the termination of the contract as a threat. When it is highly arbitrary, the renewal of the contract can also be used as an effort-incentive device instead of wages, with fixed-term workers willing to accept lower wages because firms link their performance to the promise of a contract renewal or their hiring on a permanent basis.

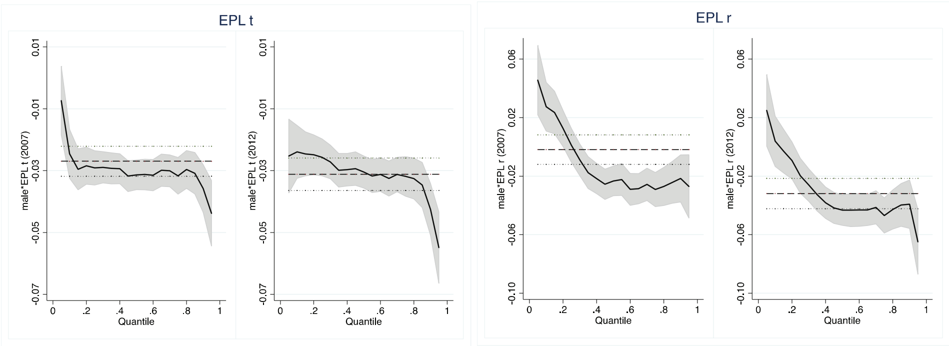
Table 4 The EPL and Gender Wage Gap, QR Estimates (Pooled Model 2007 and 2012)

	(1) OLS	(2) OLS	(3) OLS	(4) QR θ = .10	(5) QR θ = .50	(6) QR θ = .90
Male*2007	0.178***	0.212***	0.245***	0.063**	0.223***	0.243***
	(0.009)	*(0.005)*	*(0.009)*	*(0.026)*	*(0.015)*	*(0.024)*
Male*2012	0.171***	0.220***	0.284***	0.119***	0.282***	0.314***
	(0.010)	(0.005)	(0.009)	(0.026)	(0.015)	(0.024)
Male*EPL$_t$ *2007	-0.025***	-0.031***	-0.036***			
	(0.005)	(0.003)	(0.004)			
Male*EPL$_t$ *2012	-0.024***	-0.030***	-0.043***			
	(0.005)	(0.003)	(0.005)			
Male*EPL$_r$ *2007				0.027***	-0.023***	-0.022**
				(0.009)	(0.005)	(0.009)
Male*EPL$_r$ *2012				0.004	-0.043***	-0.039***
				(0.010)	(0.006)	(0.009)
Temporary	-0.233***	-0.163***	-0.110***	-0.232***	-0.163***	-0.109***
	(0.005)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)
Married	0.028***	0.033***	0.038***	0.029***	0.034***	0.039***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
Age	0.244***	0.155***	0.176***	0.246***	0.165***	0.176***
	(0.029)	(0.016)	(0.027)	(0.028)	(0.016)	(0.027)
Age2	-0.020***	-0.010***	-0.012***	-0.020***	-0.011***	-0.012***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
Health status	-0.017***	-0.015***	-0.015***	-0.017***	-0.015***	-0.014***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Secondary educ.	0.066***	0.092***	0.114***	0.068***	0.094***	0.115***
	(0.006)	(0.003)	(0.005)	(0.006)	(0.003)	(0.005)
Tertiary educ.	0.194***	0.268***	0.354***	0.199***	0.273***	0.358***
	(0.008)	(0.004)	(0.007)	(0.008)	(0.004)	(0.007)
Part-time	-0.085***	-0.007***	0.112***	-0.089***	-0.011***	0.110***
	(0.005)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)
Second job	-0.192***	-0.024***	0.003	-0.192***	-0.025***	0.007
	(0.006)	(0.004)	(0.006)	(0.006)	(0.004)	(0.006)
Firm size (11-49)	0.125***	0.062***	0.026***	0.124***	0.062***	0.027***
	(0.004)	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)
Firm size (over 50)	0.222***	0.150***	0.108***	0.222***	0.151***	0.109***
	(0.004)	(0.002)	(0.004)	(0.004)	(0.002)	(0.003)
Urban	0.021***	0.040***	0.054***	0.021***	0.041***	0.053***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
Constant	-1.431***	-0.602***	0.107	0.119	0.745***	0.962***
	(0.070)	(0.040)	(0.066)	(0.076)	(0.044)	(0.072)
Sector/occup/country/country* 2012 dummies	yes	yes	yes	yes	yes	yes
Sample-selection correction	yes	yes	yes	yes	yes	yes
Tests						
(q10 = q50 = q90): male*2007		15.97***			33.75***	
(q10 = q50 = q90): male*2012		56.55***			31.29***	
male*2007 = male*2012	0.45	0.88	8.61**	3.91**	12.08***	4.59**
(q10 = q50 = q90): male*EPL*2007		1.74			21.75***	
(q10 = q50 = q90): male*EPL*2012		9.90***			14.90***	
male*EPL*2007 = male*EPL*2012	0.01	0.06	1.12	4.10**	9.22**	2.12
Observations	272870	272870	272870	272870	272870	272870
Adj. R^2	0.420	0.460	0.372	0.419	0.460	0.371

Notes: Bootstrap s.e. in parentheses. ***, ** and * denote significance at the 1, 5 and 10%, respectively. EPL lagged one year.

Source: Author's calculations.

The stronger impact of EPL for temporary workers in the upper part of the wage distribution can instead be explained in the light of the complementarities and skill mix that normally favour productivity and higher rewards (Perugini and Pompei 2009, 2017). We have already emphasised that the coefficient of the dummy variable *male* is a measure for discrimination, but includes the potential effects of unobservable variables (not included in the wage equation as controls), such as informal and firm-specific skills gained through experience. Labour protection could exacerbate gender wage disparities, as measured by our coefficient, by rendering even easier and more likely employment discontinuities of women during their working life and a poor accumulation of specific, on-the-job skills. If complementarities exist between formal education and firm-specific human capital, a stronger fragmentation of careers favoured by weak employment protection rules translates into a larger skill- and wage-gap. Since this mix of formal and informal knowledge is more likely to be associated to higher pay jobs, this kind of impact on temporary contracts materializes and affects only the upper part of the wage distribution, augmenting the gap-reducing effect of stronger EPL.



Source: Own elaboration on EU-SILC data (Eurostat 2015).

Figure 3 Impact of Employment Protection Legislation for Regular (EPL_r) and Temporary (EPL_t) Workers on the Gender Wage Gap 2007 and 2012

The impact of EPL on regular contracts seems to corroborate the idea that higher employment protection for permanent workers (especially if coupled with low protection for temporary ones) favours the formation of dualities in the labour market (as already reported by Pissarides et al. 2005), forcing some disadvantaged categories of workers into low-productivity, low-pay, low-security jobs (Bentolila, Dolado, and Jimeno 2011; Boeri 2011). This is consistent with the evidence we provide here of stronger EPL for regular contracts favouring gender disparities at the bottom of the distribution as, for the reasons already explained, women are more likely to fall into the kind of traps just described. For the other segments of the labour market (middle and top of the wage distribution), higher job security limits, as expected, discriminatory practices, especially when the macroeconomic conditions tend to be unstable and processes or reallocation are at work (in our case in 2012 compared to the pre-crisis scenario).

5. Final Remarks

The goal of this paper was to provide a detailed picture of gender wage disparities along the wage distribution in 25 EU countries, before and after the crisis, and to investigate whether different levels of employment protection legislation (EPL) have an impact on the gender wage gap. To this aim, we used EU-SILC data for 2007 and 2012 and estimated the adjusted gender wage gap and the effects of EPL using quantile regression techniques.

Overall, our findings support the idea that lower levels of employment protection goes along with higher gender inequality; however, the effects vary remarkably depending on the segment of labour market involved. This means that policy makers should be aware that the effects of labour market reforms are heterogeneous and entail important trade-offs. The dominant trend since the late 1990s in Europe has been the easing of employment protection (OECD 2015a, b) and the scenario is not likely to change abruptly in the coming years (Richard Hyman 2015). Despite intended to facilitate reallocation processes and flows of labour across firms, sector and labour market pools, those reforms have also reinforced labour market dualities and polarisation patterns, especially when they were implemented asymmetrically for permanent and temporary workers. Our research shows that an increase of gender inequality should be added to the list of the unintended side effects of further labour market deregulation.

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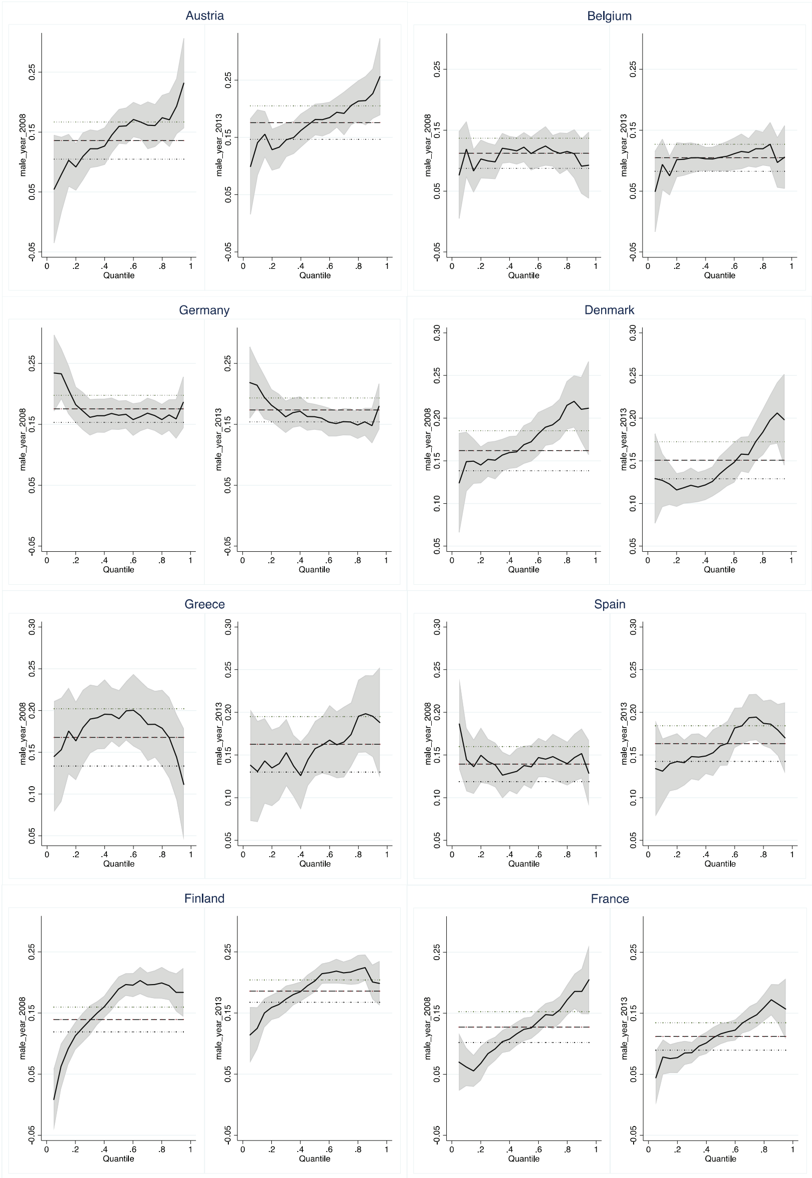
Appendix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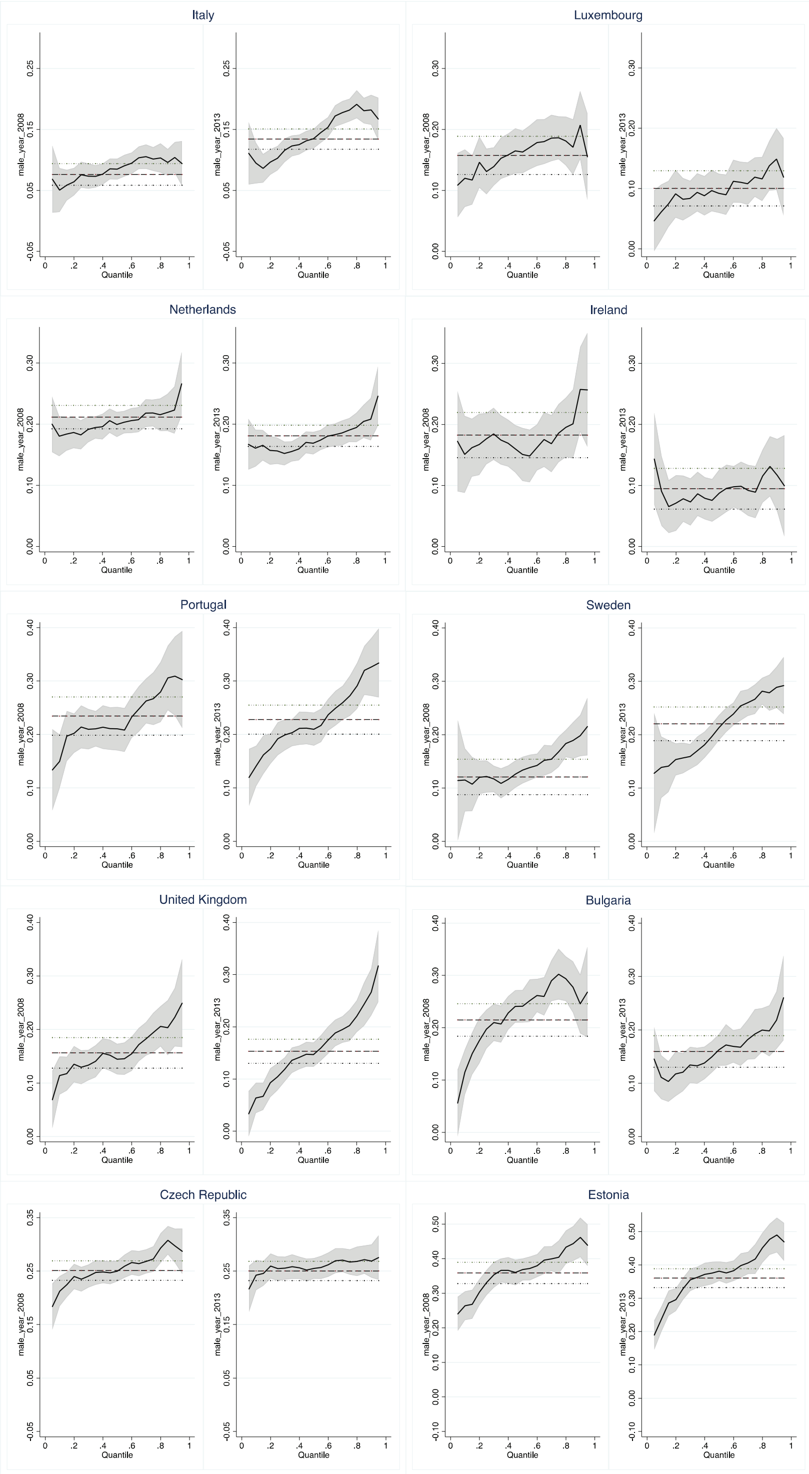
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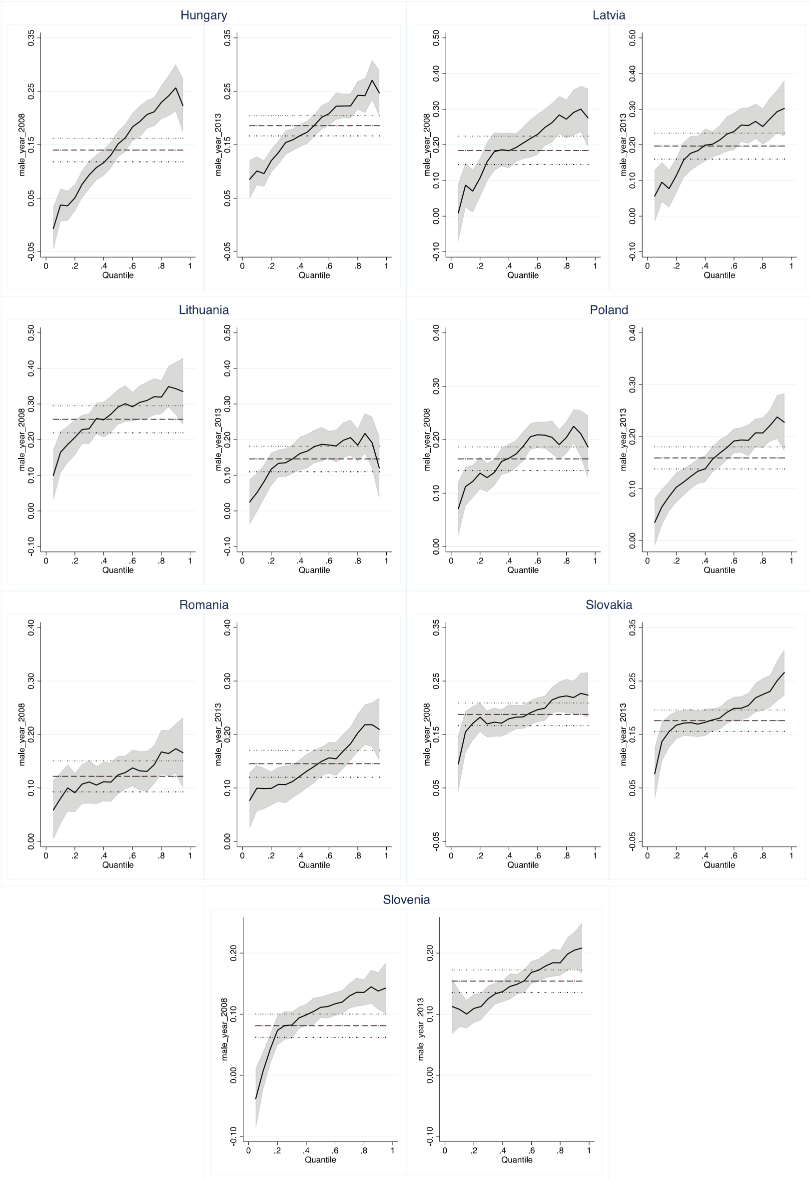

Source: Own elaborations on EU-SILC data (Eurostat 2015).

Figure A1 Country-by-Country Adjusted Gender Wage Gap in 2007 and 2012, by Quantiles

Table A1 Mean Values of Explanatory Variables (Pooled Sample, Males)

	Age	Married	Health	Urban	Prim.	Sec.	Tert.	Temp.	Part	2 job	<10	11-49	>50
AT	42.37	0.59	1.80	0.31	0.09	0.69	0.23	0.03	0.04	0.06	0.33	0.27	0.41
BE	42.50	0.58	1.80	0.48	0.22	0.39	0.39	0.05	0.07	0.02	0.25	0.20	0.55
DE	45.83	0.69	2.06	0.48	0.04	0.49	0.47	0.06	0.04	0.16	0.18	0.21	0.61
DK	46.36	0.71	2.44	0.31	0.17	0.52	0.32	0.08	0.03	0.19	0.65	0.13	0.22
EL	43.31	0.67	1.40	0.38	0.35	0.42	0.23	0.14	0.03	0.07	0.60	0.24	0.16
ES	42.75	0.63	1.97	0.47	0.47	0.23	0.30	0.19	0.02	0.04	0.42	0.28	0.30
FI	45.85	0.63	2.51	0.21	0.20	0.48	0.32	0.03	0.05	0.10	0.74	0.11	0.15
FR	42.64	0.56	1.88	0.42	0.19	0.51	0.30	0.09	0.04	0.18	0.33	0.23	0.44
IE	45.16	0.64	1.55	0.35	0.37	0.33	0.31	0.04	0.09	0.04	0.43	0.21	0.35
IT	43.40	0.64	2.06	0.34	0.39	0.48	0.13	0.08	0.04	0.22	0.48	0.26	0.26
LU	40.52	0.61	1.82	0.50	0.35	0.32	0.33	0.08	0.03	0.05	0.23	0.25	0.52
NL	45.61	0.68	2.44	1.00	0.21	0.42	0.37	0.04	0.13	0.06	0.63	0.11	0.26
PT	43.60	0.68	2.30	0.34	0.77	0.14	0.09	0.15	0.02	0.17	0.44	0.34	0.22
SE	43.73	0.52	2.33	0.20	0.14	0.60	0.26	0.04	0.07	0.11	0.64	0.14	0.21
UK	45.04	0.63	1.65	0.63	0.14	0.50	0.37	0.06	0.07	0.03	0.30	0.23	0.47
BG	43.19	0.65	2.01	0.38	0.24	0.62	0.14	0.05	0.05	0.21	0.24	0.46	0.30
CZ	42.97	0.63	2.18	0.29	0.04	0.81	0.15	0.09	0.01	0.32	0.26	0.33	0.40
EE	42.54	0.55	2.42	0.32	0.15	0.63	0.22	0.01	0.03	0.60	0.26	0.43	0.31
HU	41.32	0.59	2.09	0.30	0.11	0.71	0.18	0.08	0.03	0.06	0.35	0.30	0.35
LT	45.41	0.79	2.55	0.44	0.07	0.70	0.23	0.04	0.03	0.08	0.20	0.36	0.44
LV	42.38	0.57	2.47	0.45	0.22	0.62	0.16	0.05	0.03	0.12	0.27	0.46	0.27
PL	42.42	0.75	2.12	0.33	0.10	0.75	0.15	0.20	0.04	0.08	0.49	0.22	0.29
RO	41.91	0.69	1.80	0.37	0.18	0.68	0.14	0.02	0.05	0.52	0.29	0.36	0.35
SI	43.03	0.57	2.73	1.00	0.18	0.66	0.17	0.03	0.02	0.55	0.32	0.19	0.49
SK	41.47	0.68	2.07	0.27	0.02	0.80	0.17	0.09	0.01	0.19	0.41	0.43	0.17
Total	43.45	0.64	2.12	0.43	0.21	0.55	0.24	0.08	0.04	0.18	0.41	0.26	0.34

Source: Own elaborations on EU-SILC data (Eurostat 2015).

Table A2 Mean Values of Explanatory Variables (Pooled Sample, Females)

	Age	Married	Health	Urban	Prim.	Sec.	Ter.t	Temp.	Part	2 job	<10	11-49	>50
AT	42.65	0.56	1.78	0.32	0.13	0.68	0.18	0.05	0.40	0.05	0.43	0.28	0.29
BE	42.06	0.55	1.83	0.50	0.16	0.36	0.48	0.09	0.43	0.01	0.22	0.24	0.53
DE	45.86	0.61	2.08	0.51	0.07	0.54	0.40	0.09	0.48	0.12	0.29	0.26	0.45
DK	46.05	0.73	2.39	0.31	0.16	0.41	0.43	0.10	0.22	0.22	0.60	0.13	0.27
EL	42.41	0.69	1.44	0.41	0.29	0.38	0.33	0.17	0.14	0.04	0.58	0.27	0.15
ES	41.74	0.56	2.00	0.52	0.36	0.24	0.40	0.25	0.19	0.03	0.44	0.27	0.29
FI	46.92	0.68	2.48	0.24	0.13	0.43	0.44	0.06	0.14	0.09	0.71	0.16	0.12
FR	43.23	0.55	1.95	0.45	0.21	0.43	0.36	0.14	0.31	0.08	0.37	0.22	0.41
IE	43.96	0.55	1.53	0.39	0.23	0.36	0.40	0.07	0.39	0.02	0.35	0.27	0.38
IT	42.71	0.61	2.11	0.36	0.28	0.52	0.20	0.12	0.23	0.22	0.46	0.29	0.25
LU	39.62	0.56	1.86	0.52	0.35	0.29	0.36	0.10	0.36	0.03	0.34	0.24	0.42
NL	44.50	0.65	2.40	1.00	0.20	0.44	0.37	0.06	0.76	0.05	0.58	0.14	0.28
PT	43.58	0.67	2.42	0.40	0.64	0.17	0.19	0.16	0.10	0.04	0.44	0.33	0.23
SE	44.08	0.54	2.36	0.21	0.08	0.53	0.39	0.06	0.35	0.06	0.63	0.17	0.21
UK	44.21	0.58	1.64	0.63	0.12	0.49	0.39	0.09	0.40	0.02	0.25	0.29	0.46
BG	44.02	0.71	2.13	0.43	0.17	0.57	0.26	0.06	0.06	0.09	0.26	0.44	0.30
CZ	43.84	0.64	2.15	0.31	0.08	0.78	0.15	0.13	0.05	0.08	0.27	0.36	0.37
EE	45.13	0.52	2.35	0.35	0.07	0.54	0.39	0.00	0.06	0.62	0.24	0.40	0.36
HU	43.65	0.57	2.21	0.34	0.12	0.59	0.28	0.08	0.06	0.06	0.34	0.31	0.35
LT	46.30	0.71	2.54	0.51	0.03	0.57	0.40	0.03	0.05	0.07	0.20	0.33	0.47
LV	45.35	0.48	2.58	0.49	0.08	0.59	0.32	0.02	0.06	0.23	0.32	0.41	0.27
PL	42.37	0.73	2.18	0.39	0.07	0.65	0.29	0.20	0.09	0.05	0.48	0.23	0.30
RO	42.25	0.71	1.91	0.47	0.22	0.59	0.19	0.02	0.05	0.13	0.31	0.35	0.34
SI	43.01	0.66	2.72	1.00	0.16	0.56	0.27	0.04	0.04	0.56	0.24	0.20	0.56
SK	42.62	0.66	2.19	0.31	0.04	0.76	0.20	0.11	0.05	0.04	0.45	0.38	0.17
Total	43.71	0.62	2.16	0.46	0.17	0.51	0.32	0.09	0.23	0.13	0.41	0.27	0.33

Source: Own elaborations on EU-SILC data (Eurostat 2015).

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