The Euro Area Wage Distribution Over the Crisis

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THE EURO AREA WAGE DISTRIBUTION OVER THE CRISIS

by

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Abstract

This paper analyses the evolution of the distribution of earnings in the Euro Area during the global financial crisis and the determinants of this evolution using data drawn from the EU-SILC. The EU-SILC data show that the wage adjustment between 2007 and 2011 was substantially larger than that measured in national accounts, and driven mainly by the dynamics of earnings in periphery countries. The real monthly full-time equivalent gross earnings in periphery countries has decreased on average by over 4 per cent relative to levels in core countries, but the relative costs of low wage labour have fallen far more in the periphery, by some 6-8 per cent. The changing composition of the pool of salaried employees boosted earnings growth, thus obscuring a sizeable downward real wage adjustment, especially at the bottom of the distribution.
JEL Classification: J31, D33. Keywords: earnings distribution, Euro Area labour markets, global financial crisis.

Contents

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1. Introduction

There is little doubt that the burden of the economic crisis begun in 2008 has not been equally shared by workers across the Euro Area (EA). According to the European Central Bank (2014, p. 51), "the marked rise in euro area unemployment over the course of the crisis has been heavily concentrated temporally, sectorally, demographically and by country. While virtually all euro area economies were affected to some extent during the first recession [global financial crisis], over the course of the second euro area recession [sovereign debt crisis] the brunt of the job losses was (almost exclusively) borne by the stressed economies". As a consequence, as observed in the European Commission's *Employment and Social Developments in Europe 2014*, "the convergence in terms of economic and social performance that had been under way across the EU over the past two decades came to a halt with the crisis, and reversed strongly in the case of employment and unemployment rates. This particularly reflected the adverse impact of the crisis on Southern and peripheral EU-15 Member States, while convergence did continue for most of the Member States that joined the EU in 2004 or later" (Bontout, 2014, p. 232).

The bulk of the analysis, in official documents as well as more academically oriented research, delves into the impact of the crisis on employment and unemployment. For instance, Bachmann et al. (2015) and Casado et al. (2015) investigate the effects on transitions among labour market states, Jauer et al. (2014) and Beyer and Smets (2015) study the role of internal migrations as a response to the downturn, while others try to disentangle structural from demand factors behind the increase in unemployment (e.g. Rosolia, 2014a, for Italy). Less attention has been paid to the effects on wages and salaries. In part, this may reflect their sluggish adjustment during the crisis, due to nominal rigidities, staggered wage negotiations or compositional effects (e.g. D'Amuri, 2014, and Rosolia, 2014b for Italy). Indeed, as observed by an Ad hoc team of the European System of Central Banks (2015, p. 60), "... the wage response in the euro area was rather limited during the first phase of the crisis; however, wages seemed relatively more responsive to unemployment in the second phase of the crisis ... [when] the downward rigidities seem to have become somewhat weaker, partly related to the implementation of structural reforms in labour markets across a number of euro area countries, and/or to public sector wage restraint associated with fiscal consolidation". However, these muted dynamics of wages in the EA are observed *on average*: they may be fully consistent with offsetting movements in the distribution of labour earnings among employees, both within and across countries.

In this paper, we provide novel evidence on the adjustment of the EA labour markets during the recent economic crisis by investigating the evolution of the wage distribution in the EA as a whole. This analysis supplements existing studies focusing on labour force participation by considering the adjustment occurring through "prices" rather than "quantities". The evidence presented in this paper suggests a perceptible wage response, calling for some qualification of the widely held view of downward wage rigidity in many EA labour markets. As known from the extensive research on real wage cyclicality (see Abraham and Haltiwanger, 1995, and Brandolini, 1995, for a survey, and Verdugo, 2015, for a recent analysis of EA countries), the sensitivity measured at the aggregate level may be much less pronounced than that experienced by individuals, especially job-movers. The little change in the value of the means need not imply an immobile earnings distribution, as it may be accompanied by a reshuffling of workers' positions along the wage ladder depending on their personal characteristics, labour contract or sector. In a monetary union, internal devaluations aimed at recovering

competitiveness add a further dimension to the adjustment, as different wage responses across countries entail that national boundaries matter for the whole earnings distribution. In a fully integrated EA labour market, there would be no "country effect" in the explanation of the overall earning distribution, except for the indirect effects due to differences in the sectoral, demographic and skill composition. Abandoning the customary approach of comparing national developments and looking instead at the EA as a whole allow us to see countries simply as an additional dimension of the heterogeneity shaping the overall wage distribution. It implies a fundamental change of perspective, but one that should be natural in studying a monetary union.

In order to allow for a period of adjustment to the new monetary framework, we define the EA as comprising the twelve countries that had joined the union for some years before the start of the recession at the end of 2008. We divide these countries into two groups according to their exposure to the sovereign debt crisis of 2011-12: following a debatable yet common practice, we label "periphery" the group with the five countries hit by the crisis (Greece, Ireland, Italy, Portugal and Spain) and "core" the group with the remaining seven countries (Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands). In Section 2 we describe the data, drawn from the EU Statistics on Income and Living Conditions (EU-SILC) and the national accounts, which are used in the estimation of the distribution of real monthly full-time equivalent gross earnings (MEGE). In Section 3 we summarise the aggregate dynamics of wages and employment in the EA using both the EU-SILC data and the national accounts. In Section 4 we compare the MEGE distributions in the EA in 2007 and 2011. In Section 5 we sketch the decomposition technique that we apply in Section 6 to study the determinants of the MEGE distributions. We draw the main conclusions in the final section.

2. Data definitions

We base our analysis on data drawn from the EU-SILC Waves 2008 and 2012. This source provides information on various definitions of labour earnings: current gross monthly earnings; annual employee cash or near cash income in the previous year (2007 and 2011), net or gross of taxes and social contributions deducted at source; social insurance contributions paid by employers, allowing for the calculation of total labour cost. The cash income is the employee's compensation including wages and salaries and any other payment in cash (holiday, overtime and piece-rate payments, tips and gratuities, 13th month payment, bonuses, performance premia, allowances for transport and work in remote locations), but excluding allowances and reimbursements for work-related expenses, severance and redundancy payments, and union strike pay. In spite of the efforts of statistical agencies, definitions are not fully comparable across countries, as discussed in detail by Brandolini, Rosolia and Torrini (2010). The EU-SILC data have been used recently by Dreger et al. (2015) to study the evolution of wage dispersion from 2006 to 2011 across the EU member states.

In this paper, we focus on annual (cash) earnings gross of social contributions and income taxes paid by the employee, the only variable which is available for all EA countries, while net annual earnings and current gross monthly earnings are often unavailable (see Brandolini, Rosolia, Torrini, 2012, for a thorough discussion of this issue). As annual earnings reflect both the wage rate and the amount of time spent at work, to gauge the variation of the price of labour across countries, we compute full-time equivalent monthly earnings by dividing the annual value (PY010G) by the number of months worked adjusted for part time. Because of data limitations, we use

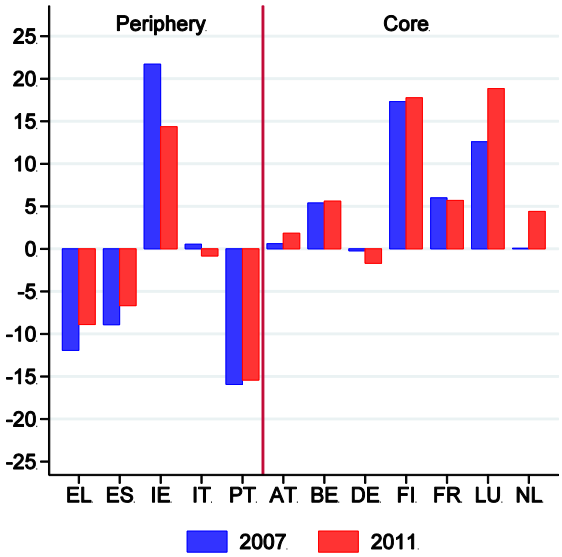
consistent definitions of the number of months worked in full-time jobs and in part-time jobs which do not distinguish between jobs worked as employee or self-employed (PL070 until Wave 2008 and the sum of PL073 and PL075 from Wave 2009, for full-time jobs; PL072 until Wave 2008 and the sum of PL074 and PL076 from Wave 2009, for part-time jobs; a month is spent at work if the respondent worked for two or more weeks). As this choice may lead to wrong estimates of wage rates when persons declare themselves to have been working both as employee and self-employed, we keep only observations without any income from self-employment (PY050G_F equal to 0). To derive the number of equivalent months worked, the number of months in part-time jobs is scaled down by a country-year-sex specific factor equal to the ratio of median hours of work in part-time jobs to median hours of work in full-time jobs. Both the hours of work (PL060) and the job status (PL030 until Wave 2008 and PL031 from Wave 2009) refer to the employment status (with no distinction between salaried employment and self-employment) at the time of the interview. We restrict the attention to employees aged 20 to 69 years who report positive monthly values of the wage rate, which implies dropping observations with positive annual earnings but missing or nil months of work.

The personal cross-sectional weights (PB040) sum to the population of household members aged 16 and over. These weights ensure that the composition of the sample properly reflects the structure of the underlying population, but they do not take into account the number of months worked. Put differently, they ensure that area-wide aggregation is meaningful, but treat equally employees working a different number of months. We then adjust these weights by multiplying them by the number of equivalent months worked: this adjustment implies that the sum of the weights yields the total number of months, adjusted for part time, worked by the country's employees, which is a measure of their aggregate labour input in the year. Using these adjusted weights amounts to estimating the wage distribution among full-year full-time equivalent employees. An alternative way of interpreting this choice is that we are interested in studying the evolution of the EA distribution of the wage rate at a given moment in time; not rescaling by the number of months worked in the year would lead to an overrepresentation of short employment spells and, depending on the correlation of the wage rate with the length of employment spells, to overrepresentation of specific segments of the wage rate distribution. Indeed, a regression of the (logarithm of) the real wage rate on the number of months worked shows that each additional full time equivalent month worked is associated with a 4-5 per cent higher real wage rate. Thus, rescaling the personal cross-sectional weights by the number of equivalent months worked controls, in an admittedly simple way, for such correlation.

Earnings are expressed, as all other EU-SILC income variables, in euros. To transform nominal into real values, we apply a double correction. First, we deflate all current earnings by the Harmonised Index of Consumer Prices for the whole EA (HICP) to express all values at the prices of 2010. Second, we account for cross country differences in the cost of living by dividing earnings by an index of Purchasing Power Parities (PPP), which adjusts for the relative national values of a fixed bundle of consumption goods and services. We take the PPP index for the household final consumption expenditure (PPP-HFC), but consider also the index calculated for GDP (PPP-GDP), which is generally applied to derive all national accounts variables expressed in Purchasing Power Standard (PPS). Both indices are normalised to 1 for the EA. Figure 1 displays, for the two years considered, the percentage difference between the country's price level and the EA average. Not only price levels differ across countries in a given year but also such differences have changed, substantially in some cases, during the crisis. For example, in 2007 the gap between Finnish and Greek wages

narrows, all else equal, by around 33 percentage points after accounting for price level differences; the adjustment falls below 30 points in 2011 because of the (relatively) higher price level in Greece.

Figure 1: Household final consumption expenditure purchasing power parities (percentage points)



Note: The Figure displays the percentage difference between country and EA price levels as measured by the Purchasing Power Standards for household final consumption expenditures. Core: Austria (AT), Belgium (BE), Germany (DE), Finland (FI), France (FR), Luxembourg (LU), the Netherlands (NL); Periphery: Greece (EL), Spain (ES), Ireland (IE), Italy (IT), Portugal (PT).
Source: Authors' elaborations on data from http://ec.europa.eu/eurostat/data/database (prc_ppp).

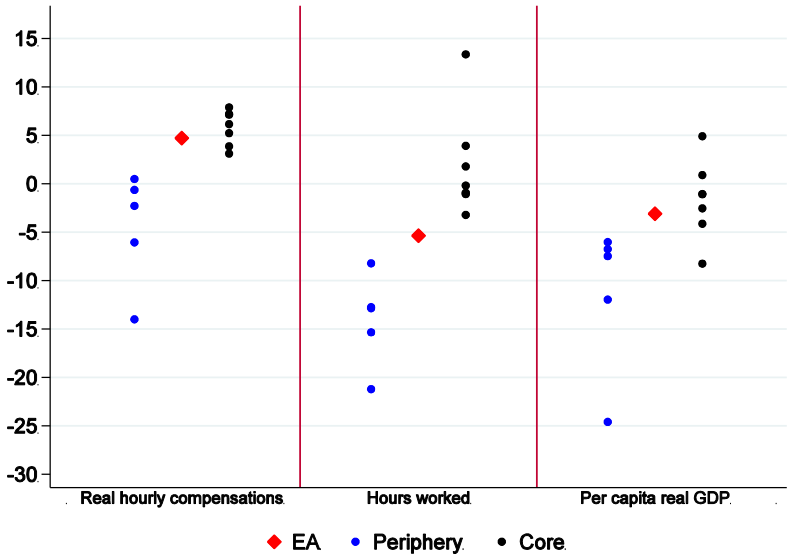
3. The aggregate dynamics of wages and employment

Figure 2 summarises the impact of the economic crisis on a selection of macroeconomic indicators for the EA as a whole and separately for the core and periphery countries. In 2014, the most recent available data, the EA real GDP per capita was 3.1 per cent lower than in 2007, before the crisis begun. The number of hours worked by employees dropped more than GDP per capita (5.4 per cent), while real hourly wages rose by 4.7 per cent, engendering the impression of a very slow response of wage rates to the economic downturn. As suggested by the initial citations, the area-wide developments hide a variety of country-specific dynamics: on average, between 2007 and 2014 real GDP per capita and hours worked by employees fell considerably in periphery countries (-11.4 and -14.1 per cent, respectively), but did not change much in core countries (-1.6 and 1.9 per cent, respectively); real hourly wages declined in the former group of countries but rose in the latter (-4.5 and 5.8 per cent, respectively). The available EU-SILC data allow us to study the evolution of the wage distribution in the EA until 2011 only. Although they cannot capture the effects of the sovereign debt crisis which broke out in that year, they can shed lights on the divergence between core and periphery economies brought about by the global financial crisis.

In Table 1 we report EU-SILC averages for salaried employment and real wages, and provide some comparisons with corresponding figures from the national accounts. The number of employees is 4-5 per cent lower in the EU-SILC than in national accounts, in the EA as well as in the two country groups. In part, the discrepancy may be explained by our restricting the EU-SILC statistics to the age class 20-69 and to

employees who do not receive any additional income from self-employment; the use of the national concept of employment, instead of the domestic concept underlying Table 1, does not make much difference. Variations between 2007 and 2011 are qualitatively aligned, although they are somewhat more pronounced in the EU-SILC than in national accounts for core countries. Total hours worked in the year cannot be computed from the EU-SILC data (Brandolini and Viviano, 2015). However, their variations in national accounts are qualitatively similar to the changes in the EU-SILC number of equivalent months worked, a rough but acceptable approximation.

Figure 2: Selected macroeconomic indicators in 2014 (percentage change since 2007)



Note: Each point in the Figure is the cumulative percentage change between 2007 and 2014 of the corresponding variable for periphery countries (blue), core countries (black) and the EA as a whole (red). Core: Austria, Belgium, Finland, France, Germany, Luxembourg, the Netherlands; Periphery: Greece, Ireland, Italy, Portugal, Spain.
Source: Authors' elaborations on data from http://ec.europa.eu/eurostat/data/database (t_nama).

Table 1: Salaried employment and real wages in national accounts and EU-SILC, 2007 and 2011

Variable	EA			Core			Periphery		
	2007	2011	Change (%)	2007	2011	Change (%)	2007	2011	Change (%)
				National accounts					
Employees (thousands)	123,619	122,428	-1.0	77,506	78,943	1.9	46,113	43,485	-5.7
Hours worked (millions)	187,041	182,438	-2.5	108,180	108,646	0.4	78,861	73,793	-6.4
Real monthly wage per employee (euros)	2,338	2,356	0.8	2,532	2,545	0.5	2,012	2,011	0.0
				EU-SILC (cross-sectional weights)					
Employees (thousands)	117,237	116,741	-0.4	72,972	74,942	2.7	44,265	41,800	-5.6
Equivalent months worked (millions)	1,226	1,202	-1.9	751	766	2.0	474	435	-8.2
Real monthly wage per employee (euros)	2,151	2,141	-0.5	2,373	2,390	0.7	1,785	1,694	-5.1

Note: Core: Austria, Belgium, Finland, France, Germany, Luxembourg, the Netherlands; Periphery: Greece, Ireland, Italy, Portugal, Spain.
Source: Authors' elaborations on data from http://ec.europa.eu/eurostat/data/database (t_nama) and EU-SILC Users' Database January 2010 and May 2013.

With both national accounts and EU-SILC data, we calculate the real monthly wage by dividing 1/12 of total gross wages and salaries by the number of employees,

and then deflating by the area-wide HICP. This definition of real monthly wage adjusts neither for part time, nor for cross-national differences in the cost of living. The EU-SILC estimates fall short of national accounts values by 8-9 per cent in the EA, but the discrepancy is more than double in periphery than core countries. Somewhat more worrisomely, a difference between the two sources arises for the change in real monthly wages between 2007 and 2011 in periphery countries: it is nil according to national accounts against a drop by 5.1 per cent in the EU-SILC data.

Overall, the EU-SILC evidence is consistent with that from national accounts. It confirms that the global financial crisis brought about a strong divergence in the performance of labour markets in the EA already in the period 2007-11: both salaried employment and real wages rose in core economies, but fell considerably in periphery economies. If anything, the EU-SILC data show a much sharper divergence than that signalled by national accounts. The discrepancies between the two sources cannot be wholly explained by differences in methods and definitions, calling for a thorough work of statistical reconciliation of the two sources (see also Brandolini, Rosolia and Torrini, 2010, and Atkinson, Guio and Marlier, 2015). The size of discrepancies is unlikely to be such as to alter the overall conclusions of this paper, but their existence should be borne in mind when reading the results discussed below.

4. The evolution of the earnings distribution

We report several statistics on the distribution of the real monthly full-time equivalent gross earnings (MEGE) among working-age full-year full-time equivalent employees in Table 2. The adjustment for cross-country differences in the cost of living has virtually no impact on EA mean wages, but it narrows the gap between core and periphery means, especially when the PPP index for GDP is used. Both adjustments reduce measured inequality in the EA as a whole, as the Gini indices for PPP-adjusted wages are more than half a percentage point lower than those for wages in euros. An even stronger impact is found for the periphery group, but not for the core group, where adjusting for price-level differences appears to increase measured inequality. The extent of the adjustment of wage levels for the cost of living is fairly stable over time, and it does not influence significantly the changes between 2007 and 2011.

Using the PPP-HFC index, in 2007 the monthly full-time equivalent gross earnings in the EA as a whole were on average equal to 2,461 euros, at 2010 prices; in periphery economies they equalled 2,086 euros, 23 per cent less than the 2,698 euros recorded in core economies. In the following four years, the EA real wage went up by 0.9 per cent to 2,483, as a result of a rise by 1.6 per cent to 2,741 in the core and a fall by 2.8 per cent to 2,028 in the periphery. The gap between the two areas of the monetary union rose to 26 per cent. As measured by the Gini index, wage inequality does not appear to have changed much within each country group. Yet, the two distributions moved differently (Figure 3). In core countries, there was a general shift upwards: earnings increased throughout the distribution but far more intensely at the bottom than at the top, and the relative frequency of low earners decreased to the benefit of that of middle earners. The opposite happened in periphery countries, where the mass of the distribution moved downwards and the across-the-board drop of earnings was more pronounced at the bottom (and the very top) than in the middle.

In brief, the EU-SILC data show that the wage adjustment within the EA was substantially larger than that measured in national accounts, with periphery real monthly full-time equivalent gross earnings decreasing on average by over 4 per cent relative to core levels. However, the strikingly different changes across the deciles of the

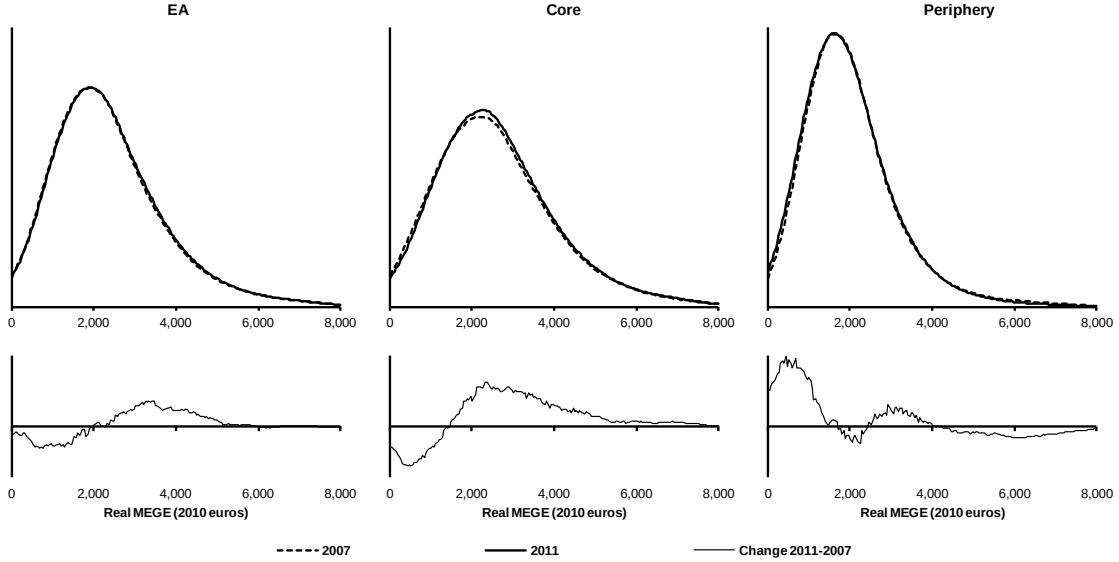
respective earnings distributions imply that the relative costs of low wage labour have fallen far more in the periphery, by some 6 to 8 per cent.

Table 2: Distribution of real monthly full-time equivalent gross earnings (MEGE) among working-age full-time full-year equivalent employees, 2007 and 2011

Variable	EA			Core			Periphery		
	2007	2011	Change (%)	2007	2011	Change (%)	2007	2011	Change (%)
Real MEGE (euros)									
Mean	2,469	2,495	1.1	2,765	2,804	1.4	1,999	1,951	-2.4
Gini index (%, p.p.)	32.2	32.1	-0.1	31.1	30.8	-0.3	30.5	30.4	-0.1
Real MEGE (PPS, PPP-GDP)									
Mean	2,466	2,486	0.8	2,666	2,709	1.6	2,149	2,094	-2.6
Gini index (%, p.p.)	31.4	31.3	-0.1	31.5	31.0	-0.5	29.4	29.3	-0.1
Real MEGE (PPS, PPP-HFC)									
Mean	2,461	2,483	0.9	2,698	2,741	1.6	2,086	2,028	-2.8
Gini index (%, p.p.)	31.6	31.5	-0.1	31.5	31.0	-0.5	29.4	29.3	-0.1
1st decile	981	988	0.8	1,055	1,108	5.0	924	892	-3.5
2nd decile	1,360	1,357	-0.2	1,501	1,546	3.0	1,207	1,166	-3.4
3rd decile	1,611	1,629	1.1	1,775	1,822	2.6	1,422	1,375	-3.3
4th decile	1,845	1,876	1.7	2,060	2,107	2.3	1,618	1,583	-2.2
Median	2,109	2,144	1.7	2,360	2,419	2.5	1,812	1,777	-1.9
6th decile	2,421	2,470	2.0	2,695	2,743	1.8	2,024	2,003	-1.1
7th decile	2,794	2,843	1.7	3,087	3,137	1.6	2,314	2,296	-0.8
8th decile	3,301	3,349	1.5	3,604	3,677	2.0	2,725	2,685	-1.5
9th decile	4,197	4,207	0.2	4,555	4,606	1.1	3,446	3,346	-2.9

Note: Estimates computed using cross-sectional weights adjusted by the number of equivalent months worked. Core: Austria, Belgium, Finland, France, Germany, Luxembourg, the Netherlands; Periphery: Greece, Ireland, Italy, Portugal, Spain.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

Figure 3: Distribution of real monthly full-time equivalent gross earnings (MEGE) among working-age full-time full-year equivalent employees in the EA, core and periphery countries, 2007 and 2011 (kernel densities)



Note: Estimates computed using cross-sectional weights adjusted by the number of equivalent months worked. Core: Austria, Belgium, Finland, France, Germany, Luxembourg, the Netherlands; Periphery: Greece, Ireland, Italy, Portugal, Spain.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

The evolution of the EA-wide distribution reflects the combination of within-country-group changes with the falling share in employment of the periphery vis-à-vis

the core. In the rest of the paper we try to disentangle changes in the wage schedules from changes in the socio-demographic composition of the pool of employees.

5. Decomposition techniques

Intuitively, the change of a given statistic of the wage distribution between two periods can be split into a part due to the change in the *composition* of the underlying population and a part due to the change of the *wage* of any given individual profile. To identify the two components we can construct a fictitious intermediate distribution in which each individual profile in a given year is assigned the same weight that the profile has in another year. In this Section, we sketch the reweighting technique developed by DiNardo, Fortin and Lemieux (1996), Biewen (2001) and Bover (2010), which we use to decompose the change between 2007 and 2011 in the EA distribution of MEGE in the following Section.

Let earnings *w* be distributed at time *t* according to the distribution $F(w, x \mid t)$, where *x* is a vector of individual attributes. The density of earnings at time *t* can be written as

$$f_t(w) = \int dF(w, x \mid t) = \int f(w \mid x, t) dF(x \mid t),$$

where the conditional density of earnings $f(w \mid x, t)$ is the wage schedule at time *t*. Under the assumption that it does not depend on the distribution of attributes, the conditional wage density at time t_0 can be combined with the marginal distribution of attributes *x* at time t_1 to generate the counterfactual wage distribution

$$f^c(w) = \int f(w \mid x, t_0) dF(x \mid t_1).$$

Counterfactuals can be derived by assuming different marginal distributions for the individual attributes. If the vector *x* is split into the two sub-vectors x_a and x_b, it is

$$F(x_a, x_b \mid t) = F(x_a \mid x_b, t) F(x_b \mid t)$$

and the marginal distribution of earnings at time *t* is

$$f_t(w) = \int dF(w, x_a, x_b \mid t) = \int\int f(w \mid x_a, x_b, t) dF(x_a \mid x_b, t) dF(x_b \mid t).$$

Specific counterfactuals can be constructed by choosing alternative periods for the three conditional densities above. In practice, under appropriate assumptions, the estimation of counterfactual distributions amounts to suitably reweighting the actual densities.

In our application in the next Section, we include a limited set of observable attributes in the vector *x*: sex, age, education, citizenship and country of residence. We cannot consider other relevant individual characteristics, such as sector of activity, job title and hours worked, because the corresponding information collected in the EU-SILC refers to the job held at the time of the interview, whereas earnings normally refer to the previous year. We denote by *c* the socio-demographic group defined by the interaction of sex, age, education and citizenship, by *k* the country of residence, and by *G* the two country groups. If p_{it} indicates the weight of employee *i* at time *t*, as defined in Section 2, $Q_{Gct} = \sum_{i \in G,c} p_{it}$ is the weight of the socio-demographic group *c* in country group *G* at *t*, $Q_{Gt} = \sum_{i \in G} p_{it}$ is the overall weight of country group *G* at *t*, and $Q_t = \sum_i p_{it}$ is the sum of the weights across the EA. The (normalised) weight of employee *i* at *t* can be written as

$$\omega_{it} = \left(\frac{p_{it}}{Q_{Gct}} \right) \left(\frac{Q_{Gct}}{Q_{Gt}} \right) \left(\frac{Q_{Gt}}{Q_t} \right).$$

This expression guides us in defining the reweighting to construct relevant counterfactual wage distributions. Specifically, we construct two counterfactual weighting schemes:

$$(CF1) \qquad \omega_{iCF1} = \left(\frac{p_{i2011}}{Q_{Gc2011}} \right) \left(\frac{Q_{Gc2007}}{Q_{G2007}} \right) \left(\frac{Q_{G2007}}{Q_{2007}} \right)$$

and

$$(CF2) \qquad \omega_{iCF2} = \left(\frac{p_{i2011}}{Q_{Gc2011}} \right) \left(\frac{Q_{Gc2011}}{Q_{G2011}} \right) \left(\frac{Q_{G2007}}{Q_{2007}} \right).$$

The reweighting scheme *CF*1 is applied to the 2011 sample and preserves the 2011 density of wages conditional on (G,c), while imposing the 2007 marginal distribution of (G,c). Hence, the comparison of statistics computed on the actual 2007 distribution with those computed on the *CF*1 counterfactual distribution returns the effect of changes between 2007 and 2011 in the wage schedules only, the *wage effect*; the difference between the wage effect and the overall change is the *composition effect*. The reweighting scheme *CF*2 is applied to the 2011 sample and preserves the 2011 density of wages conditional on (G,c) and the marginal distribution of attributes *c* conditional on group *G*, while imposing the 2007 marginal distribution of employment between core and periphery. Therefore, the comparison of statistics computed on counterfactuals *CF*1 and *CF*2 returns the effect of changes only in the distribution of attributes within each group *G*. The difference between this effect and the overall composition effect returns the effect on the EA wage distribution of changes in the distribution of employees between core and periphery.

By using the estimated counterfactual distributions to decompose the deciles of the earnings distribution and denoting the *d*-th decile of MEGE computed on the distribution F^j by $\theta^{d,j}$, where $F^j(\theta^{d,j}) = d$ and $j = (2007, 2011, CF1, CF2)$, it follows that:

- $\Delta^T = \left(\theta^{d,2011} - \theta^{d,2007}\right)$ is the *total change* between 2007 and 2011;
- $\Delta^W = \left(\theta^{d,CF1} - \theta^{d,2007}\right)$ is the *wage effect*;
- $\Delta^X = \left(\theta^{d,2011} - \theta^{d,CF1}\right)$ is the *composition effect*;
- $\Delta^G = \left(\theta^{d,CF2} - \theta^{d,CF1}\right)$ is the *composition effect net of changes in the distribution of employees between core and periphery*.

With a slight abuse of notation, in the following we use Δ^h, with $h = T, W, X, G$ to indicate the percentage differences rather than absolute differences of the deciles.

6. Decomposing changes in the earnings distribution in the EA

Table 3 shows the changes in the composition by sex, age, education, citizenship and country group of the EA employees between 2007 and 2011. The employment share of core countries increased by 1.9 percentage points; the weight of younger employees fell in both core and periphery, although more markedly in the latter; the less educated suffered similarly in both country groups; the shares of females and natives declined only in the periphery. How did this different composition of salaried employment impact on the earnings distribution in the EA? And how did it interact with variations in the wage schedules?

Table 3: Changes in the socio-demographic composition of the full-time full-year equivalent employees between 2007 and 2001in the EA (percentage points)

Variable	EA	Core	Periphery
Sex			
Male	-1.7	-0.1	-1.6
Female	1.7	2.1	-0.4
Age class			
20–29 years	-2.9	-0.8	-2.1
30–39 years	-1.4	-0.2	-1.2
40–49 years	0.2	-0.2	0.4
50–59 years	2.5	1.8	0.7
60–69 years	1.5	1.3	0.2
Educational achievement			
Compulsory schooling or less	-4.1	-1.8	-2.3
High school	0.6	0.6	0.0
College or more	3.4	3.1	0.3
Citizenship			
Native	-1.6	0.8	-2.4
Foreign-born	1.6	1.2	0.4
Total	–	1.9	-1.9

Note: The Table reports the change between 2007 and 2011 in the share of each socio-demographic group in the total EA salaried employment. The horizontal summation of the core and periphery figures yields the EA figures; the vertical summation by socio-demographic characteristic yields the figures in the last line for each country group. Figures might not add up exactly because of rounding. Core: Austria, Belgium, Finland, France, Germany, Luxembourg, the Netherlands; Periphery: Greece, Ireland, Italy, Portugal, Spain.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

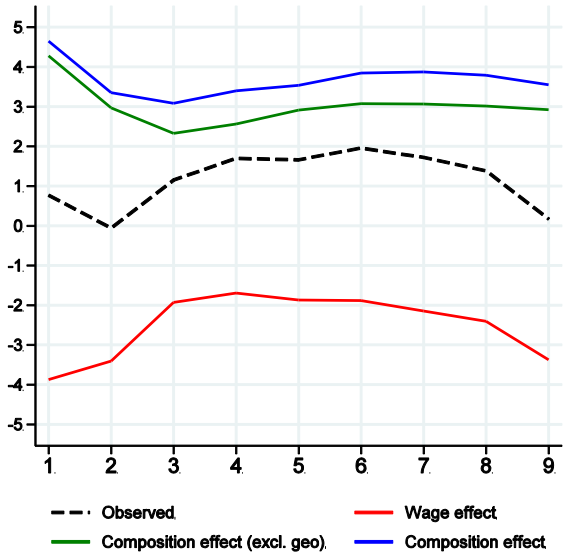
Figure 4 displays the percentage change Δ^T of each decile of the EA real MEGE distribution between 2007 and 2011 (dashed black line) and its decomposition. Between the 3rd and 8th deciles real wages grew by 1-2 percentage points, while the two bottom deciles and the top decile were almost unchanged. (The values discussed here may slightly differ from those reported in Table 2 because of the dropping of observations with missing values for individual characteristics.) The wage effect Δ^W (red line) was consistently negative throughout the distribution, signalling a widespread adjustment of real wages. However, it was smaller in absolute value between the 3rd and 8th deciles (about 2 per cent) and larger, almost double, at the bottom and top ends (around 4 per cent). On the contrary, the composition effect Δ^X (blue line) was consistently positive and overall sustained real wages by 3-4 percentage points. These composition effects reflected only in part the different dynamics of employment among EA countries and the consequent reallocation of salaried employment across the area: the composition effect net of changes in the geographic distribution of employment Δ^G (green line) was less than one percentage point smaller than the total composition effect.

These results highlight a major adjustment of wage rates during the crisis in the EA as a whole, partly masked by significant changes in the composition of employment, especially across personal characteristics.

Although the geographic dimension seems to add little to the evolution of the EA earnings dispersion, the job reallocation across countries implied changes in their relative position. To show this, we compute the shares of employees of core and periphery countries that fell within each fifth of the EA earnings distribution. If residence in either country group did not matter, we would expect these shares to be roughly 20 per cent. Thus, the excess over 20 per cent (shortfall relative to 20 per cent) provides a measure of the extent to which the employees of the core and the periphery are over-represented (under-represented) in each EA fifth. This over- or under-

representation is shown for 2007 by the positive and negative bars, respectively, in Figure 5. Unsurprisingly, periphery countries were over-represented in the bottom 40 per cent of the EA distribution, which contained more than half of the periphery employees, as a reflection of a substantial under-representation in the top fifth, which hosted little more than a tenth of periphery employees. Conversely, core employees were over-represented in the top 40 per cent of the EA distribution by about 8 percentage points. Figure 5 also shows how the over- or under-representation changed between 2007 and 2011 because of the wage and composition effects. The change in wage schedules accentuated the periphery-core divide: the dynamics of relative earnings further shifted periphery employees towards the bottom of the EA distribution, while pushing up core employees. The composition effects amplified the wage effect for periphery employees at the bottom, but mitigated the shift to the top fifths for core employees.

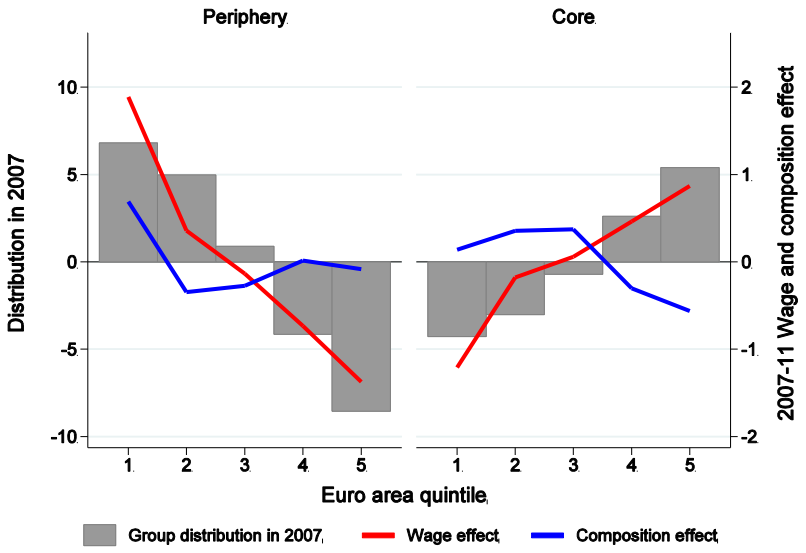
Figure 4: Decomposition of the change of deciles of real MEGE distribution between 2007 and 2011 (percentage points)



Note: The Figure shows the actual change of deciles between 2007 and 2011 (dashed black lines) and how it can be attributed to a wage effect (red line), obtained holding sample composition constant at 2007, and a composition effect (blue line), obtained reweighting the 2011 sample with 2007 weights; the composition effect (excl. geo) (green line) is the part of the composition effect attributable to a change in the distribution across countries.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

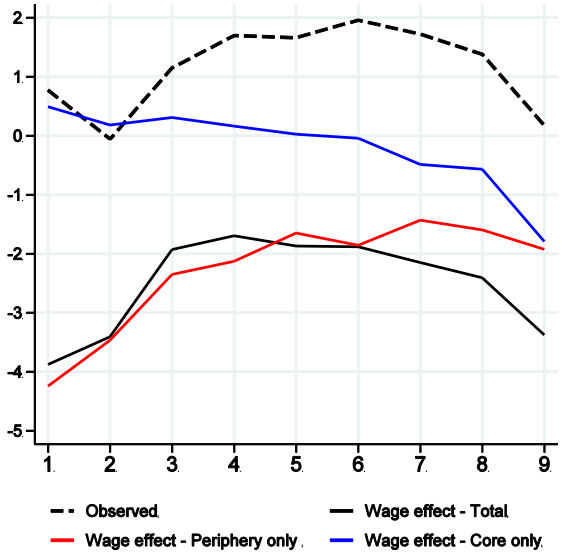
The above evidence captures the effect of the adjustment in the wage schedules, but is silent about the extent to which core and periphery contributed to this adjustment. We hence compute how the EA earnings distribution would have varied, had the only force in place been the wage adjustment in either the core or the periphery: a suitable counterfactual distribution is obtained by combining the actual 2007 distribution for one country group with the counterfactual *CF*1 distribution for the other group. Figure 6 compares the observed change in deciles and the wage effect between 2007 and 2011 with the contributions to the wage effect attributable to core and periphery. Most of the EA wage adjustment is traceable to changes in the periphery wage schedules, which explain the whole drop in the bottom six deciles. If the wage adjustment in the core had been the only one occurring, earnings would have fallen slightly only for the top three deciles, while remaining almost untouched in the other parts of the distribution.

Figure 5: The position of core and periphery employees in the EA earnings distributions in 2007 and 2011
(percentage points)



Note: The bars represent the excess over 20 per cent, if positive, and the shortfall relative to 20 per cent, if negative, of the shares of core and periphery employees in each fifth of the real MEGE distribution in the EA in 2007; if employees from the two areas were equally spread along the overall EA distribution, these shares would equal 20 per cent and the bars would vanish. The red and blue lines represent the changes in these shares between 2007 and 2011 due to the wage effects and composition effects, respectively.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

Figure 6: The core and periphery contributions to the wage adjustment
(percentage points)



Note: The Figure shows the actual change of deciles between 2007 and 2011 (dashed black lines) and how its variation due to the total wage adjustments (black line) was accounted for by wage adjustments in core countries (blue line) and periphery countries (red line). The total wage effect is obtained by holding sample composition constant at 2007; the periphery wage effect is obtained by holding sample composition and wage schedule in core countries constant at 2007; the core wage effect is obtained by holding sample composition and wage schedule in periphery countries constant at 2007.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

This last exercise only shuts down the wage adjustment in either country group. However, it fails to explain whether the difference between the periphery and the core reflects a geographic effect or simply the adjustment of wage rates of professional profiles relatively more represented in either country group. To answer this question, we apply the decomposition technique put forth by Firpo, Fortin and Lemieux (2011). This method involves estimating Recentered Influence functions to quantify (under appropriate identification assumptions) the effect of a given observable variable on the unconditional quantile of the earnings distribution. In practice, we estimate a wage equation including dummies for education, sex and citizenship, a quadratic in age and a dummy for the country group. This equation is estimated for the actual 2007 weighting scheme and the counterfactual *CF*1. As by construction the average of the explanatory variables is the same for both weighting schemes, the comparison of the estimated coefficients for variable x_a gives the contribution of the returns of x_a to the total wage effect. Figure 7 displays the total wage effect, already shown in Figures 4 and 6, and the counterfactual wage effect obtained by neglecting the role of periphery membership in the estimates of deciles, so that it only measures the effect of the changes in the returns to the other characteristics. Absent the adjustment in periphery countries, the overall wage effect would have been non-negative up to the 6th decile, suggesting that the adjustment in the periphery was wider than that caused by the profile-specific changes in returns. For example, the median wage would have been nearly unchanged against a 2 percentage point fall due to the wage effect in the periphery.

Figure 7: The total wage effect and the periphery wage adjustment (percentage points)

Note: The Figure displays the total wage effect and the counterfactual wage effect obtained by neglecting the role of periphery membership in the estimates of deciles.
Source: Authors' elaborations on data from EU-SILC Users' Database January 2010 and May 2013.

7. Conclusions

In this paper, we have explored the evolution of the distribution of the EA wage rates during the global financial crisis and the determinants of this evolution using data drawn from the EU-SILC. From a methodological viewpoint, our results confirm that the microeconomic evidence can qualify, if not reverse, the conclusions about the functioning of labour markets drawn from aggregate data. However, despite their high

quality, the EU-SILC data used here are far from ideal for our purposes. There is a pressing need to improve the information on the earnings distributions in European countries as well as to reconcile micro and macro sources.

The EU-SILC data show that the wage adjustment within the EA between 2007 and 2011 was substantially larger than that measured in national accounts. Real monthly full-time equivalent gross earnings in periphery countries decreased on average by over 4 per cent relative to levels in core countries, but differences across deciles of the core and periphery earnings distributions are significant. These differences imply that the wage adjustment was far more pronounced at the bottom: the relative costs of low wage labour fell in the periphery by some 6 to 8 per cent.

The changing composition of the pool of salaried employees boosted earnings growth along the whole EA wage distribution; only a minor part of these compositional effects are traceable to the relative shift of employment from periphery to core countries. Absent these compositional effects, the downward real wage adjustment would have been sizeable, and larger in absolute value at the low end of the wage distribution. The overall wage adjustment, net of compositional effects, reflected exclusively that of periphery countries until the 6th decile of the EA distribution, while from the 7th decile earnings fell in both country groups. The contribution of periphery to the overall EA wage adjustment does not simply reflect the changing wage rates of specific segments of the workforce more represented in the periphery, but a genuine "country effect", that is an across-the-board drop in wage rates. Against this sizeable adjustment in the periphery, core countries have not displayed any upward pressure on their wage rates.

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