Changes in the Wage Structure in EU countries

Rebekka Christopoulou (Hellenic Observatory, LSE)
Juan F. Jimeno (Banco de España)
Ana Lamo (ECB)

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Abstract

This paper documents changes in the wage structures in nine EU countries (Austria, Belgium, Germany, Greece, Hungary, Italy, Ireland, the Netherlands and Spain) over the period 1995-2002. Using comparable cross-country microeconomic data (from the *Structure of Earnings Survey*), we compute, at each decile of the wage distribution, the part of the observed wage change that is due to changes in the composition of workers' and jobs characteristics and the part due to changes in the returns to these characteristics, i.e. the so called composition and returns (or price) effects. In the Netherlands, Germany, Greece, Italy and Belgium the wage structure has widened, but in the case of Netherlands, Germany and Greece, this is exclusively due to compositional effects, while in Belgium, and Italy the widening of the wage structure is less pronounced but remains after controlling for compositional affects. In Austria changes in real wages have been very small and constant along the wage distribution. In contrast, in Hungary, Ireland and Spain the wage distribution has become more compressed, as the larger wage increases have taken place for low paid jobs, mainly due to changes in returns. We also show that these changes in the wage structure in EU countries are associated with macroeconomic and structural trends. In particular, technology and globalisation are positively associated with wage increases. Finally, increases in migration are associated with declines in wages.

Keywords: *Wage Structure, Quantile Regressions.*
JEL Codes: J31

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1. Introduction

The determinants of relative wages, wage inequality and, in general, the wage structure are among the most recurrent themes in Labour Economics. Over the last two decades, studies on these topics have proliferated taking advantages of the wealth of microeconomic data sets that are becoming available, including those that contain matched employer-employee characteristics. This literature has provided relevant insights on the reasons for wage differentials among workers of different skills (i.e. returns to education, etc.), among similar workers performing different jobs (i.e. compensating differentials), theories of wage determination, the impact of labour market institutions on the wage structure, the nature of complementarities among production factors, or, most recently, wage dispersion within firms of some particular characteristics.

Many of these studies have concluded that in the US and the UK, the wage distribution has been widening since the 1980s, but there is an open debate about the nature, causes and timing. Some authors claim that the widening of the US wage distribution was an one-time event associated with changes in labour market institutions (de-unionisation, changes in the minimum wages) and compositional effects (changes in labour force features), while others claim that it has continued throughout the 1990s and 2000s and was due to skill-biased technological change. [1] This literature is too wide to be adequately quoted here (a comprehensive survey is Katz and Autor, 1999), with several hypothesis, besides skilled technological and institutional changes, been tested, among them, the impact of trade integration and the occupational bias in technological change towards reducing the demand for "routine tasks".[2]

Regarding Europe, the conventional wisdom was that changes in the wage structure have been less marked than in the US (with the exception perhaps of the UK), and that the lack of wage flexibility and some labour market institutions have resulted in wage compression, which is in turn responsible of the increase in unemployment among unskilled workers in the 1980s and early 1990s (Krugman, 1994). More recently, some studies start showing changes in the wage structure of some European countries that seem similar to those observed in the US but happening a few years later. For

[1]For evidence on the first view see DiNardo et al. (1996) and Lemieux (2006a, 2006b); for evidence on the second, see Autor, Katz and Kearney (2008) and Machin and van Reenen (1998).

[2]Studies claiming that there has been a change in the relative demand for skills originated in the technology are, for instance, Bound and Johnson (1992), Krueger (1993), Berman, Bound, and Griliches (1994), Autor, Katz, and Krueger (1998), Machin and van Reenen (1998) and Chennells and van Reenen (1999). On the impact of institutions, see DiNardo et al. (1996); on trade integration and the wage structure, see Lawrence and Slaughter (1993) and Leamer (2000). On the "routinization" hypothesis, see Autor, Levy and Murnane (2003) and Goos and Manning (2007). Regarding wage dispersion within firms, see Lazear and Shaw (forthcoming).

example, the 2007 OECD Employment Outlook (OECD, 2007) shows that in all OECD countries with the exception of Ireland, Japan and Spain, the earning of the 10% best paid workers increased more than that of the 10% least paid workers from 1994 to 2005 with the consequent widening of the wage distribution. Another study that documents increasing inequality for a number of OECD countries using macro data is Koeniger, Leonardi and Nunziata, (2007). Some empirical studies using micro data have very recently documented changes in the wage structure in some European countries see for example, Schönberg, Dustmann and Ludsteck (2009) for Germany, and Machado and Mata (2005) for Portugal.

However, there is no systematic accounting of cross-country differences in changes in the structure of wages in EU countries over the past decade.[3] Cross-country comparisons of changes in the wage structure face one main difficulty, namely, the lack of comparable cross-country microeconomic data that could allow the computation of wage variables controlling for workers and job characteristics. Thus, cross-country comparisons in this regard often rely on raw indicators of either wage inequality or dispersion of the wage structure obtained from several sources (as those presented in Table A1). Nevertheless, without a proper control for changes in personal and job characteristics, cross-country comparisons of wage changes are contaminated by employment compositional effects. Thus, any observation of how the wage structure has been adjusting in response to macroeconomic shocks and institutional changes is blurred.

The current paper is an attempt at filling this gap. We first, document the magnitude and characteristics of changes in the wage structure of some EU countries. Second, we investigate to what extent they are due to changes in the composition of labour force and jobs, or to changes in returns due to demand and supply shifts. Finally, we exploit cross-country heterogeneity in our sample to draw some conclusions about the influences of macroeconomic or structural developments as well as institutions in shaping the wage changes along the wage distribution.

Hence, this paper is *not only* about the evolution of wage inequality in some EU countries. In addition, we are particularly interested in learning about rigidities constraining wage adjustments. How relative wages adjust to macroeconomic developments affects the level and composition of

[3]Recent work on wage differentials for European countries includes several papers produced within the Pay Inequality and Economic Performance project (PIEP) which used 1995 data (see Marsden, 2005). Currently, several studies within the Wage Dynamic Network (WDN) analyse relative wages across industries using 1995 and 2002 data. Du Caju et al (2008) summarise the WDN evidence on industry wage differentials for a sample of 8 EU countries. In addition a number of detailed country specific projects that look at changes in the wage distribution along deciles are ongoing work within the WDN (see Pointner and Stiglbauer, 2008, for Austria, Dybczak and Galuscak, 2008 for Czech Republic, and Christopoulou and Kosma, 2008 for Greece).

unemployment; moreover, the degree of price inertia depends upon the adjustment of the wage structure and relative wages in response to macroeconomic shocks, so that price setting and inflation persistence are not immune to changes in the wage structure.[4] Our analysis contributes to the analysis of wage determination by unveiling whether wage changes in the countries of our sample respond to market forces or are explained by more or less mechanical changes in personal characteristics (age, gender, education) or changes in jobs characteristics (type of contract, sector, etc.). Thus, we can observe changes in relative wage that are informative about either plausible changes in wage determination or the impact of macroeconomic and structural trends on the remuneration of particular "tasks". For instance, the fact that there exist sizeable wage differentials across workers of similar characteristics in different jobs (sectors**,** regions, etc.) and that these differentials are relatively stable through time and across countries is typically interpreted as the result of non-competitive features of the labour markets, such as efficiency wages (Krueger and Summers, 1988) or rent-sharing. Hence, changes in these differentials are usually read as changes in the degree of competition of the labour market (see, for instance, Saint-Paul, 2005, Koeniger, Leonardi and Nunziata, 2007). Finally, cross-country comparisons allow gauging the impact of technological changes, globalization and other macro trends and institutions on the wage distribution, thus helping to understanding their relevance as sources of the declining wage share observed in many EU countries, and to identifying reforms that have significant impact on the wage structure and facilitate the adjustment of relative wages**.**

Our sample is composed of nine countries (Austria, Belgium, Germany, Greece, Hungary, Italy, Ireland, the Netherlands and Spain) over the period 1995-2002 (with some exception) for which comparable cross-country microeconomic data (from the *Structure of Earnings Survey*) are available. The period of analysis, although imposed by data availability, is very interesting as in many EU countries over this period there have been substantial labour demand shocks, as derived, for instance, from technological change and globalisation, and significant labour supply shocks, as those coming from demographic trends (e.g. immigration, population ageing, and changes in female participation and in the composition of the labour force by educational levels, etc.). Deregulation in product markets and labour market reforms have also been prevalent, affecting the way labour markets operate.

By using Mincerian (quantile) wage regressions and the Machado and Mata (2005) procedure, we compute for each of the nine countries in our sample, the part of the observed wage changes at each

[4]On the sources of inflation persistence in countries of the euro area, see, for instance, Rumler (2005) and Altissimo, Ehrmann and Smets (2007),

decile of the wage distribution, that is due to changes in the composition of workers' and jobs characteristics and the part of wage changes that is due to changes in the returns to these characteristics (i.e. the composition and price components of wage changes). As the data makes possible to control for personal and job characteristics, we can perform two different sets of regressions, one, closer to the type of exercises performed in the wage inequality literature, in which only changes in returns to personal characteristics such as education, gender and age, are analysed, and another in which also jobs characteristics are included as covariates, so that changes in the remunerations to specific workers-jobs matches can be observed.

We find substantial differences across countries regarding changes in wage inequality and in the wage structure. In the Netherlands, Germany, Greece, Italy and Belgium wage growth rates trend upwards along the wage distribution (i.e. wages have increased more the higher the initial wage level), with the consequent widening of the wage distribution and an increase in wage inequality. This widening of the wage distribution in Netherlands, Germany and Greece is fully explained by the so called composition effects. In Belgium and Italy the observed widening of the distribution is less pronounced but remains after controlling for compositional affects. In contrast, in Hungary, Ireland and Spain the wage distribution has become more compressed, as the larger wage increases have taken place for low paid jobs. This is mostly due to changes in the so-called returns effects (changes in the returns to jobs and worker's characteristics). Then, once employment composition effects have been accounted for, we investigate how changes in the wage structure across countries respond to macroeconomic and institutional changes. We show that observed changes in technology are positively associated with wage increases, and that the effect of technology seems to be stronger for very high and very low paid jobs. Globalisation is associated with wage increases, but less so for the lowest wages. Finally, increases in migration are associated with declines in wages.

The paper has the following structure. Section 2 describes the data and the methodological approach for measuring changes in the wage distribution. Section 3 displays the main results regarding the changes in wage structures in EU countries, and the component of these changes. Section 4 interprets these changes in relationship with cross-country variability in institutions and macroeconomic and structural trends. Finally, Section 5 concludes.

2. Data and methodology

We use microdata from the *Structure of Earnings Survey* (SES henceforth) of nine countries. This is a firm-level survey. A large sample of firms randomly selected from the Social Security General Register records or similar firm registers is interviewed to obtain information on both the firm's characteristics and on a random sample (ca. 20%, depending on the size of the firm) of their employees. Information obtained about the workers includes several measures of the pay and hours of work, age, gender, and educational attainment and some characteristics that are job specific as type of contract, sector, and occupation. Information obtained about the firm includes number of employees, whether it is privately owned, the nature of the pay bargaining regime etc.

The SES is uniquely suitable for our study as (i) it is comparable across countries: this survey has been run by the national statistical office of 20 European countries on comparable basis, first occasionally and now every four years, so that currently two harmonised waves exist, 1995 and 2002, (ii) the SES is a matched employer-employee database and, therefore, will allow us to control for individual, job-specific and firm-specific features when estimating a comparable measure of (residual wages) and "conditioning out" composition effects from both workers and firms, and (iii) the data is collected at the firm level, which gives us more accurate information on pay and earnings, variables that are usually very noisy in household surveys.

However, not all the data for EU countries and waves are made available for research. So far, we have been able to gain access to data for nine countries (Austria, Belgium, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, and Spain).[5] After excluding outliers, the top and bottom 1% wages, workers with missing/not accurate observations for some relevant variables, and those in sectors that were missing for most of the countries and or waves (mainly education, health and recreational activities), we end up with the country-samples sizes shown in Table 1. The large number of individual observations allows us, first, to construct detailed measures of earnings including or excluding several kinds of wage components, and, secondly, to control for detailed personal and/or jobs characteristics so that changes in remuneration of particular "tasks" can be measured.

[5]Results for Greece have been borrowed from Christopoulou & Kosma (2008), which is also a WDN research paper, follows the same methodology and uses same data and codes as this paper. Estimations for Italy, Ireland and Spain were done at the Safe Center in Eurostat and the ones for Germany via remote access at Statistics Germany. Alfred Stiglbauer, Philip Du Caju, Steven Poelhekke and Gabor Katay were kind enough to run our codes on the Austrian, Belgian, Dutch and Hungarian SES data available at their respective national central banks.

Table 1. Sample size per country and wave

	1st wave			2nd wave		
	1995	**1996**	**1999**	**2001**	**2002**	**2005**
Austria		93,941			85,481	
Belgium			101,302			97,409
Germany	652,676			467,932		
Greece	38,071				41,449	
Hungary		91,578			119,019	
Ireland	36,727				16,359	
Italy	79,501				73,692	
Netherlands	66,196				37,860	
Spain	170,697				173,487	

Observed wage changes can be thought as the result of the changes due to the different characteristics of workers and jobs and the changes in the returns to those characteristics. To separate these two components we rely on the estimation of extended Mincer (1974) equations for log (real) hourly wages using quantile regressions, as follows:

$$\ln w_{it}^{\vartheta} = Q^{\theta}(\ln w_{it} / X'_{it}) + \varepsilon_{it} = a_{it}^{\vartheta} + \sum_{j} \beta_{jt}^{\vartheta} X_{jit}^{\vartheta} + \varepsilon_{ti} \ , \quad Q^{\theta}(\varepsilon_t / X'_{it}) = 0 \tag{1}$$

where w_{it} is the wage of individual i in year t, $Q^{\theta}(\ln w_{it} / X'_{it})$ refers to the quantile of wages conditional on the vector of characteristics X_{it} and ϑ denotes the quantile. α is a constant, and ε is the stochastic error.

We have used three different measures of wages: basic hourly wage excluding payment for overtime, hourly wage including regular bonuses and payment for overtime, and hourly wage including irregular bonuses and other complements. We only show here results for hourly wage including regular bonuses and payment for overtime. We choose this variable for the sake of comparability with other SES studies that have also used it, and because we can construct it for practically all the countries and waves of our sample.[6] The covariates, x_{jit}, include only workers' characteristics (education, gender, age) and workers and job (type of contact, sector, region etc., in most occasions captured by dummies) observable features. We apply the procedure proposed by Machado and Mata (2005) that partitions the observed changes in the distribution of wages into quantity (changes in characteristics) and price (changes in returns) components, and that computes

[6]Except for Hungary, for which we cannot calculate the payment for overtime in the first wave (1996) and we use a measure that excludes that payments, nevertheless we believe that this is a good proxy as paid overtime is very low in Hungary and the variables with and without overtime payment in 2002 in Hungary are very similar.

the impact of each one of these components on changes in overall wage dispersion. Machado and Mata (2005) do this via simulations based on mean characteristics of the individuals who are in each one of the quantiles of the wage distribution.[7] Taking averages by quantile and subtracting between two periods, equation (1) yields:

$$\ln w_{t_1}^{\vartheta} - \ln w_{t_0}^{\vartheta} = (a_{t_1}^{\vartheta} - a_{t_0}^{\vartheta}) + \sum_j \beta_{t_1}^{\vartheta}(\overline{X}_{jt_1}^{\vartheta} - \overline{X}_{jt_0}^{\vartheta}) + \sum_j (\beta_{t_1}^{\vartheta} - \beta_{t_0}^{\vartheta})\overline{X}_{jt_0}^{\vartheta} + (\overline{\varepsilon}_{t_1}^{\vartheta} - \overline{\varepsilon}_{t_0}^{\vartheta}) \quad (2)$$

where w_t^{ϑ} is the ϑ^{th} quantile of the wage distribution in year *t*, $\overline{X}_{jt}^{\vartheta}$ is the vector of mean characteristics of quantile ϑ and year *t,* and $\overline{\varepsilon}_t^{\vartheta}$ is the mean of the unobserved component. From this, the wage change for each quantile can be decomposed into:

- A quantity component: the so-called composition effect: $\sum \beta_{t_1}^{\vartheta}(\overline{X}_{jt_1}^{\vartheta} - \overline{X}_{jt_0}^{\vartheta})$. This is exclusively due to changes in employer or employee observable characteristics if the returns to these characteristics would have remained unchanged. Composition effects reflect mechanical changes that may not respond to market forces.
- A price component: the so-called returns effect: $(a_{t_1}^{\vartheta} - a_{t_0}^{\vartheta}) + \sum (\beta_{t_1}^{\vartheta} - \beta_{t_0}^{\vartheta})\overline{X}_{jt_0}^{\vartheta}$. This is due to changes in the returns to the characteristics only. Specifically, under the assumption that the characteristics remained unchanged, this term includes changes in the constant (i.e due to changes in unobservable features common among all employees that have not being included in the regression and/or changes in the coefficients of the omitted dummies) and changes in the returns to the observable characteristics. Price or returns effects arise from shifts in supply demand and institutional factors and therefore are informative about changes in wage determination.
- An unobserved or residual component: $(\overline{\varepsilon}_{t_1}^{\vartheta} - \overline{\varepsilon}_{t_0}^{\vartheta})$. This is due to changes in the remaining unobserved factors determining wages, which are not common among employees.

These counterfactual decompositions are accounting decompositions based on the estimated model (1), and their validity relies on the partial equilibrium assumption that prices and quantities can be seen as independent. This could introduce some bias in the estimation of the components as it ignores the feedback between composition and returns.

[7]The Machado and Mata method is an extension of the canonical Oxaca (1973) decomposition of effects on mean wages to the entire wage distribution. Autor, Katz and Kearney (2005) show that the Machado- Mata decomposition corrects shortcomings of the original Juhn, Murphy and Pierce (1993) decomposition and nests the Kernel reweighing in DiNardo, Fortin and Lemieux (1996), and Lemieux (2002, 2005).

3. Wage changes and their components

Figure 1a provides an overview of the magnitude and patterns of the changes observed in (log) hourly wage at each decile of the wage (hourly wage including overtime) distribution for the whole worker population (navy line). Figure 1b and 1c refer to the males and females population respectively. In addition, a set of summary indicators of changes in the wage distribution by country is presented in Table A2 in the Appendix.

Looking first at the observed changes in real wages during the sample period, they have been mostly positive along the whole range of wage levels in the nine countries of our sample, with the only exceptions of wages of the lowest paid jobs in Germany and wages in the middle part of the wage distribution in Spain. Both the magnitude and shape of the changes observed in real wages differ substantially across countries. Observed real wages in the Netherlands, Germany, and Greece have increased more the higher the wage level i.e. real wages changes trend upwards along the wage distribution, with the consequent widening of the wage distribution and an increase in wage inequality. A widening of the observed wage distribution is also observed in Belgium and Italy, but less pronounced. In contrast, the wage distribution in Hungary, Ireland and to a lesser extent in Spain has become more compressed. The observed increase in real wages has been lowest in the middle part of the wage distribution while the largest increases have taken place for low paid jobs. This "U shape" of the wage changes along the wage distribution has been typically identified as being driven by technological changes that replace routine jobs or jobs that require intermediate skills, typically found in middle-wage jobs. This is known as the "routinization" hypothesis; a variant of the skill biased technical change hypothesis (see for example Autor, Levy and Murnane 2003). It is due to demand and supply shifts and, therefore, if technological change is indeed the main driving force of wage changes we will expect returns effects to be responsible for the observed U shape.[8] Finally, in Austria wage changes from 1996 to 2002 are positive, very small and similar along the whole distribution with no noticeable effect on the wage distribution.

Similar patterns, with small variations, prevail after "conditioning out" changes in the age, gender and education composition of the labour force, which are the characteristics in which usually the

[8]Recently, Autor, Katz, and Kearney (2008) have emphasized the complexity of the pattern of wage changes in the US and advocate for a modified version of the skill biased technical change hypothesis that emphasizes the role of information technology, observed in the US and the UK (see also Goos and Manning, 2007). They argue that computers most strongly complement the non-routine tasks of high-wage jobs, substitute for the routine tasks typical of middle-wage jobs, and may have little direct impact on non-routine manual tasks in relatively low-wage jobs. Thus, computerisation can help to explaining the observed polarization of the US and UK labour markets characterized by middle range wages growing the least, high-wages growing the most, and low wages remaining basically unchanged.

inequality literature focuses when analysing the so-called "residual inequality", or inequality within the same age, education and gender groups. This can be seen in Figure A1a-c that plot the observed wage changes clean of compositional effect estimated from model where only personal characteristics are included in the Mincer equation.

Since we are mostly interested in how the wage structure has been adjusting in response to cross-country variability in macroeconomic shocks and institutional changes, we depart somehow from the inequality literature, taking advantage of the nature of our data that allows controlling for a rich set of both workers and jobs' characteristics. Thus, we estimate a model that includes not only personal characteristics (age, education, sex) but also jobs characteristics (industry, type of contract, firm size, region, etc), so that we can break down the observed wage changes, into the part due to changes in characteristics of both workers and jobs on the one hand (compositional effects), and changes in the returns to those workers and jobs' characteristics on the other side (return effects). The estimated models work, overall, rather well, so the residuals explain a very small proportion of the total change.[9]

It turns out that compositional effects have been responsible for the observed widening of the distribution in the Netherlands, Germany and Greece. In fact, the return effects in these countries are roughly constant (red dotted line Figure 1a-c) along the whole wage distribution, which generally remains unaffected by them in terms of dispersion. Return effects even trend slightly downwards in Germany, where composition effects fully account for the negative increase of wages at the lowest end of the distribution (least-paid jobs). Composition effects have been negative for the low and middle wage jobs in all the three countries, mostly due to changes in tenure levels for Greece; change in firm size and permanent contracts composition for Germany; and changes in education, permanent and sectoral composition for the Netherlands. In short the widening observed in the wage distribution of Germany, Greece and the Netherlands is largely due to non-market forces and mechanical effects of changes in labour force and jobs composition –without any noteworthy underlying change in returns. These composition effects have not only shaped the changes in the wage distribution but also contributed to lower observed wage growth in the low and middle wage jobs.

In contrast, in Belgium and Italy the predominant force explaining the slight widening of the observed wage distribution are the return effects. Composition effects have been positive in both

[9] See tables A2a-A2c and figures A2a-A2c in the Appendix for the some break down of the wage changes by countries, a more detailed decomposition is available from the authors.

countries having no impact on the shape of the wage distribution. Return effects turn out to be negative for the low paid jobs in Italy, where compositional effects are mainly due to changes in jobs characteristics. In Ireland, Hungary and Spain the return effects display a U-shape similar to the one of observed wage changes or even strengthened. Return effects are then the predominant force explaining the compression of the wage distribution in these countries, while composition effects are not relevant for changes in the shape of the wage distribution, although in Spain and Hungary they have been sizeable enough across the distribution to keep wages subdued, while in Ireland composition effects account for some improvement of wages at the top of the distribution. In the case of Spain the largest negative component of the changes in wages is that due to changes in tenure composition, while in Hungary job characteristics dominate the compositional effects. The finding that the U shape is mainly driven by changes in returns to characteristic is compatible with the above discussed hypothesis of technological change as a skill-biased demand shift. Finally, in Austria, the very small wage changes from 1996 to 2002 do not hide any composition and return effects working in opposite directions, but simply these return and composition components hardly change along the wage distribution. Interestingly, while composition effects have been negative in Ireland, Belgium, Italy and Austria (very small in the last three cases), returns effects have been positive for all the nine countries of our sample, except for Italy at the lower end of the wage distribution. This result for Italy is consistent with the opening wage gap between younger new entrants and older workers in Italy as documented in Rosolia and Torrini (2008).

In order to give a more general view of the changes in wages reported above, Table 2 collapses mean observed wage changes and mean changes in returns across countries in three segments of the wage distribution, the three lowest, middle, and top deciles (conditional on country effects). For observed wages, regardless of the sample used (all, males, and females) the changes are increasing along the distribution. However, once compositional effects and any non-observables are "purged out", there is clear evidence of some "polarisation" in the distribution of wage changes, with highest increases at the three lowest and the three top deciles.[10]

[10] This is likely to be driven by Hungary and Ireland; when dropping these countries from our sample the U shape turns into an upward sloping pattern.

Figure 1a. (log) wage changes by decile, all

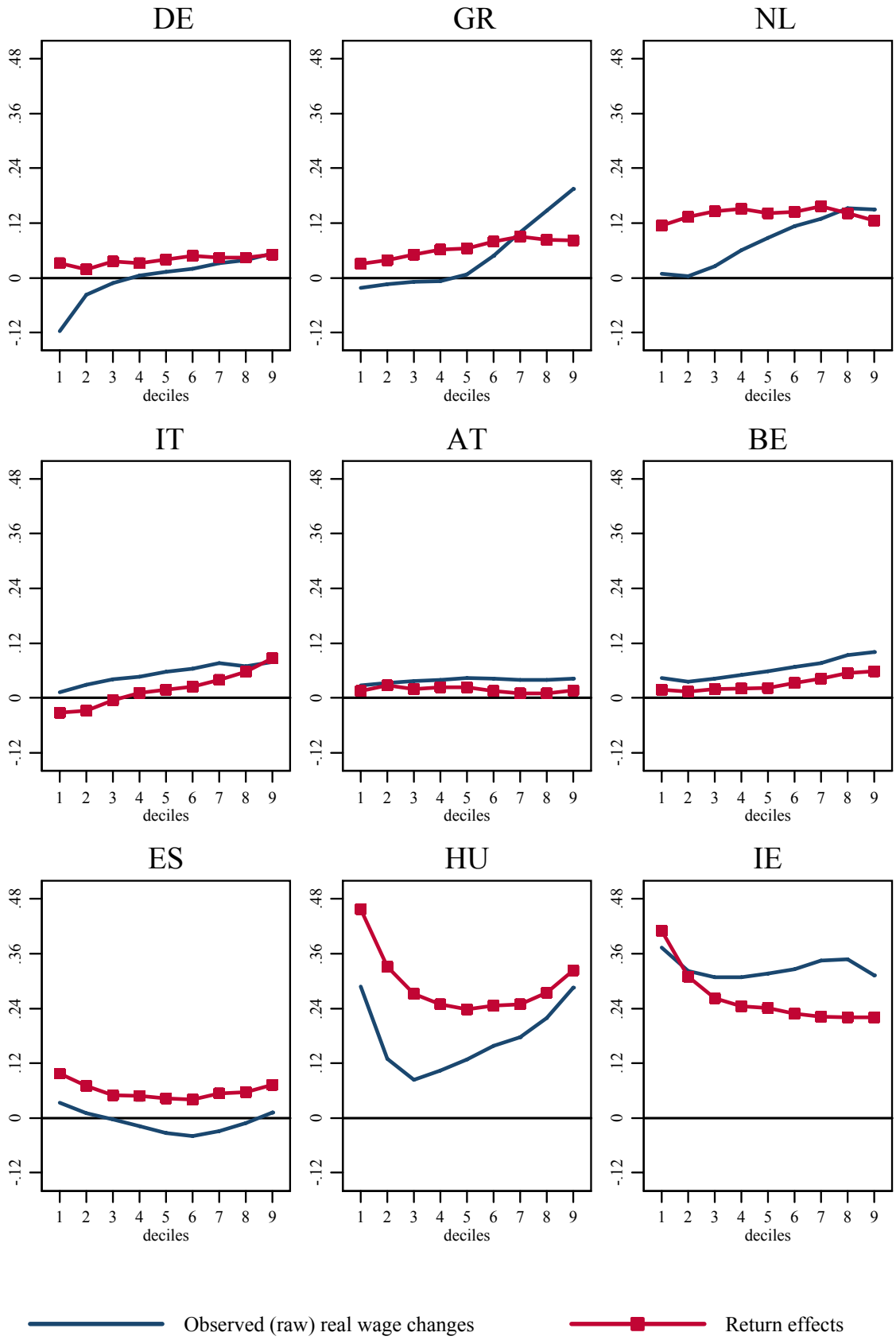

Figure 1b. (log) wage changes by decile, males

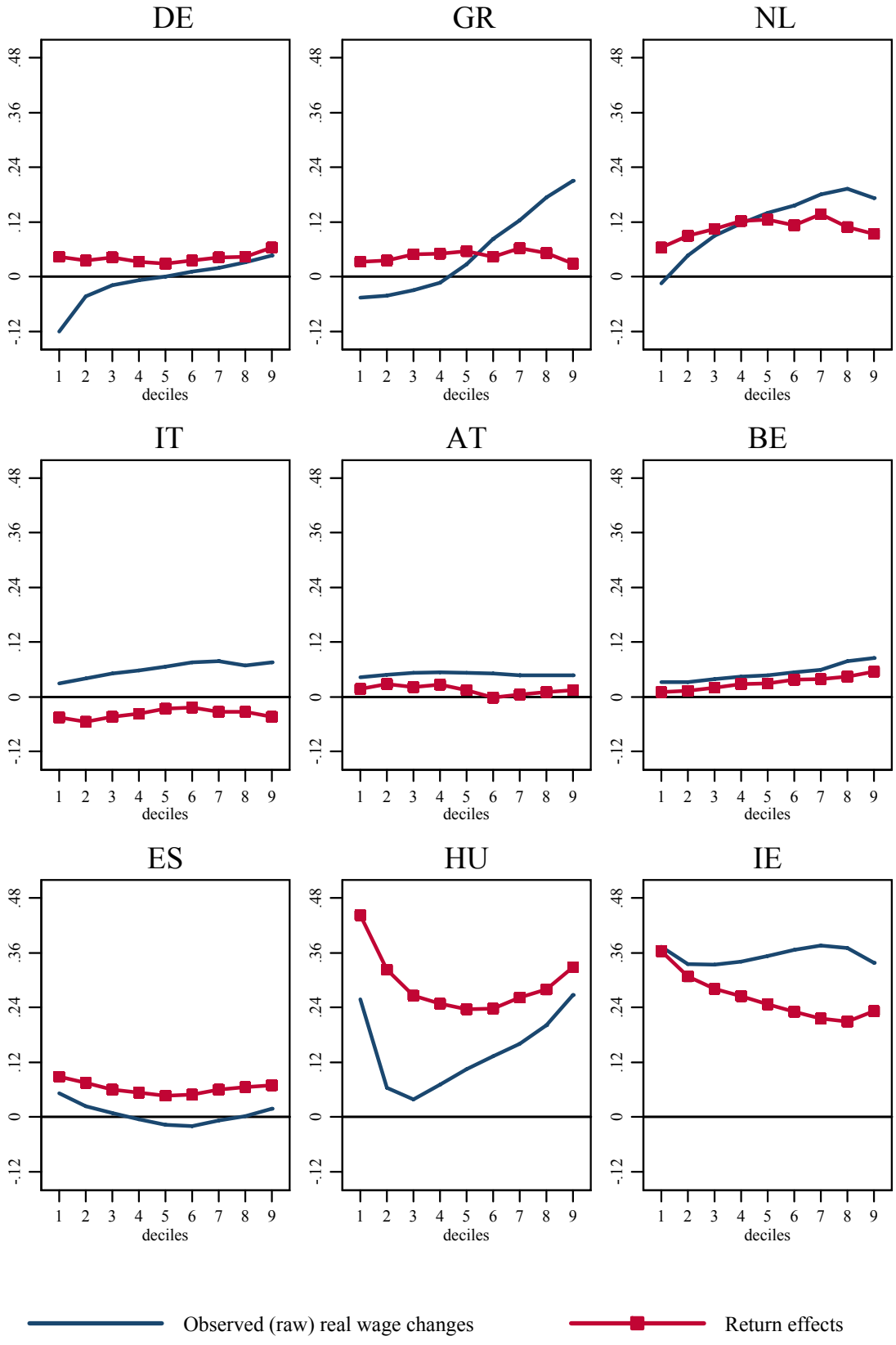

Figure 1c. (log) wage changes by decile, females

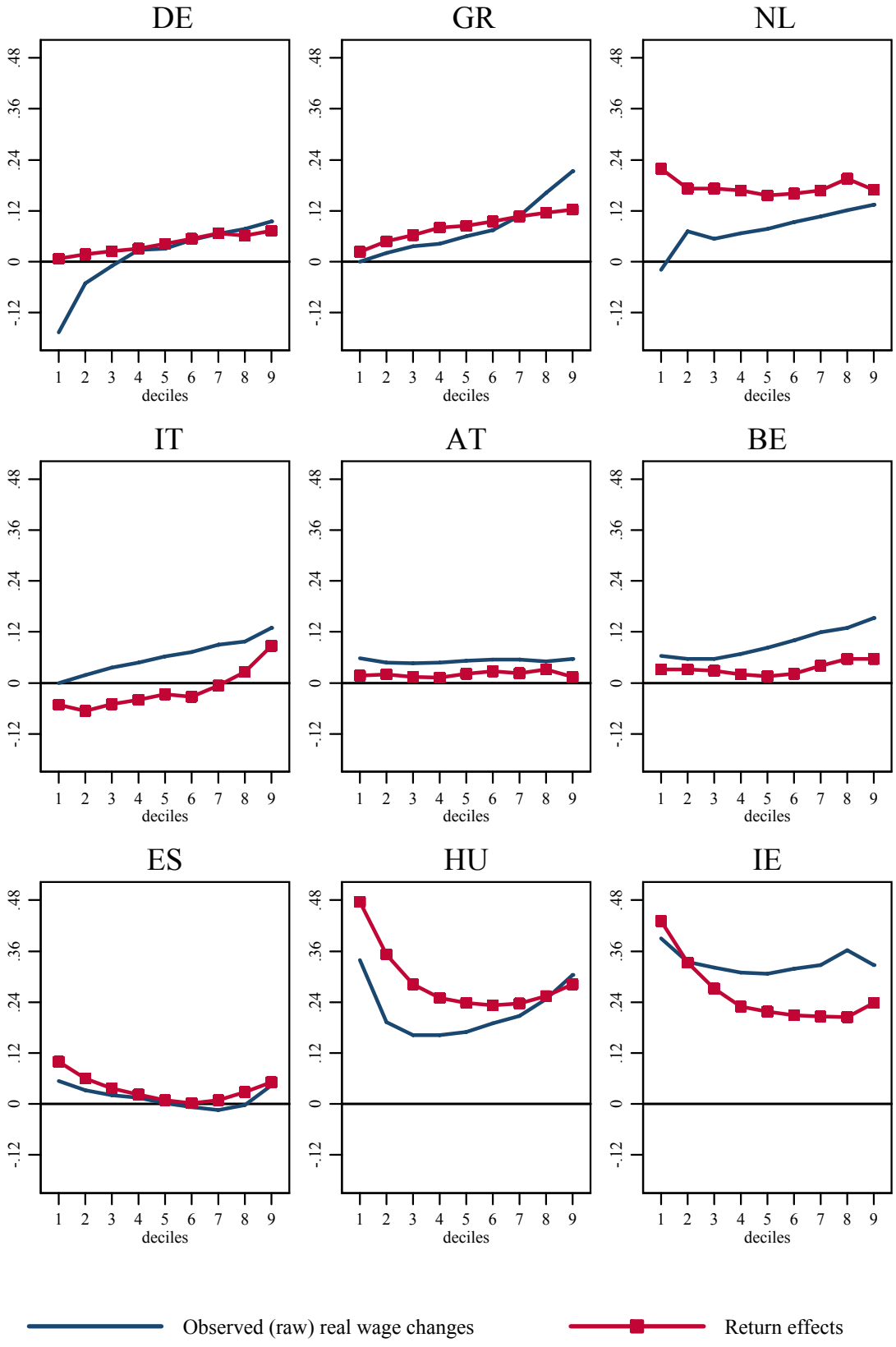

Table 2. Mean Observed Wage Changes and Mean Changes in Returns

	ALL		MALES		FEMALES	
	Observed	Returns	Observed	Returns	Observed	Returns
3 Lowest Deciles	-0.031	0.038	-0.04	0.046	-0.033	0.041
	[0.021]	[0.007]***	[0.020]*	[0.005]***	[0.032]	[0.011]***
3 Middle Deciles	-0.001	0.032	-0.01	0.032	0.016	0.031
	[0.009]	[0.005]***	[0.009]	[0.003]***	[0.013]	[0.008]***
3 Top Deciles	0.032	0.045	0.023	0.046	0.056	0.055
	[0.009]***	[0.004]***	[0.009]**	[0.005]***	[0.015]***	[0.007]***
R-squared	0.84	0.95	0.83	0.96	0.82	0.92

Note: Regressions include country fixed effect. Country omitted: Germany. Total observations: 81. Heteroskedasticity-Robust Standard Errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1% . Weighted by the average sample size of the regressions used to compute changes in returns.

4. Explaining changes in the wage structure

Once we have reported the observed changes in the wage structure of EU countries and their components, we now make an attempt at associating cross-country differences in this regard with plausible factors affecting the wage structure. As mentioned in the introduction, there are several theories about the causes of the changes in the wage distribution. Most of the empirical literature refers to skill-biased technological change and to labour market institutions. Since European countries have been subject to both technological changes and some other institutional and structural transformations (e.g. to monetary integration, or increasing competition and international mobility of labour) to different degrees, we can exploit the observed cross-country variability in wage changes along the wage distribution to account for the role of these macroeconomic and structural medium-run trends at shaping the wage structure. Hence, we can observe to what extent the wage determination process has accommodated those trends by changing the relative remuneration of particular "tasks" and whether the impact of each factor has been different at different segments of the labour market.

Given the wide set of proposed hypothesis to explain changes in the wage structure, there could be many plausible factors to be considered. Here we focus on four: demographics, globalisation, technology and institutional change. As for demographics, there have been two important developments in European countries over the last decade, the rise of female labour force participation, in particular, in Southern European countries, and the acceleration of migration inflows.[11] To measure globalisation, some synthetic indexes available in the literature show that every country in our sample has experienced an increase in international exposure, which is larger

[11] For evidence on the impact of immigration on wage determination, see Bentolila, Dolado and Jimeno (2008).

in Austria, Germany, and Spain than in the rest of the countries.[12] As for technology, there has been a fall of productivity growth in the EU, particularly acute in Italy and Spain. Finally, facing these changes, European product and labour markets have been under stress, and regulatory reforms have been at the core of the political agendas in Europe. As seen in Table A4, there is substantial cross-country heterogeneity in labour and product market institutions in EU countries and, although the process of reform has reduced this heterogeneity to some extent, not all the countries have progressed at the same pace. According to the intensity of the reform indicator by Brandt, Burniaux, and Duval (2005), which give a measure of the closeness to the ideal of labour market competition as recommended by the OECD Jobs Strategy, the leaders in this regard are the Netherlands, Germany and Belgium, with Italy, Greece, Ireland, and Spain lagging behind.

Typically, in international comparisons of changes in wage structures, the number of countries for which data are available is much lower than the number of potential candidates to explain changes in some single indicators of wage dispersion. We face similar problem here. Nevertheless, we take advantage of the wealth of microeconomic data used for the measurement of wage changes in the nine countries in our sample and i) we use alternative measures of wage changes, either observed ones or some of their components identified from the extended Mincer equations using the Machado Mata (2005) decomposition, so that we can investigate to what extent changes in the returns to labour force or job/employer characteristics are relevant when searching for the relationship between macroeconomic and institutional developments and wage changes; and ii) we use wages changes at different positions of the wage distribution, so that we can investigate if macroeconomic and institutional developments had a differential impact on low-paid and high-paid workers. Thus, we estimate the following set of regressions:

$$\Delta w_s^{\theta} = \lambda_s + \lambda_{\vartheta'} + \sum_{j=1}^{3} \beta_j \lambda_{\vartheta'} x_s + \varepsilon_s$$

where Δw^{θ}_s are alternative measures of the wage change at decile θ in country s, λ_s is a country dummy, $\lambda_{\theta'}$ is a dummy for position at the wage distribution (three lowest, middle and top deciles) and x_s is a variable representing either demographic, macroeconomic or institutional changes. As for these covariates (included separately in alternative regressions) we choose some demographic variables (change in the female participation rate and change in the stock of foreigners in the labour force from the OECD datasets), some representing changes in the international economy (changes in trade balance in goods and services as a percentage of GDP, from the OECD, and change in the

[12] Table A3 in the Appendix gives some indication of the cross-country variability of a globalisation index, computed from data on goods and capital flows (international trade, FDI, portfolio investments and income payments to foreign nationals) and restrictions (import barriers, tariffs, taxes on international trade and capital account restrictions). For details see, Dreher (2006).

globalisation index, as computed by Dreher, 2006), some technological variables (change in Total Factor Productivity and change in the contribution of ICT capital to GDP growth from the EU KLEMS database), and some indicators of labour markets institutions (levels of centralisation and coordination of collective bargaining in 2000, and changes in union density as computed by the OECD).

Some results are displayed in Tables 3 to 6 below. There are four sets of conclusions that can be drawn from these results. First, there is the issue of the impact on wages of each particular factor. Secondly, we can observe the association of each factor with wage changes due only to returns, that is, with wage changes after "conditioning out" composition effects, which are closer to the "price" of a particular job task than the observed wage changes. Thirdly, as we run two sets of regressions, one for males another for females, we can observe the "gender-bias" of each factor as far as change in the wage distribution is concerned. Finally, as already mentioned, we can investigate the different impact of each factor on workers' wages at different deciles of the wage distribution.

In fact, there is some statistical association between wage changes and the demographics, macroeconomic and structural trends mentioned above: female labour participation, globalisation, technological change, and centralization and coordination of collective bargaining are positively associated with wage changes; while immigration and changes in union density are negatively associated with them. However, changes in observed wages associated with female participation, globalisation, and coordination and centralisation of wage bargaining are typically larger than the changes in pure returns. On the contrary, technological change and change in union density display a stronger association with changes in returns than with observed total changes. With respect to the "gender-bias" in the association between these factors and observed wage changes, we only find some significant differences regarding immigration, which is more negatively associated with observed wage changes in the case of females. Finally, as for differences along the wage distribution, we find a stronger association of wage changes with immigration and globalisation at the top of the wage distribution, while with labour market institutions is stronger at the bottom. Variables capturing technological changes, such as the change in the contribution of ICT capital to GDP growth, are positively associated with wage changes, with a larger coefficient at the top and bottom of the distribution (U shape). This holds mainly for the observed wage changes and, to a lesser extent, also for the changes in returns. Thus, there is some evidence in favour of the "polarisation" hypothesis based on the idea that technological change affects most negatively to routine tasks which are more prevalent at the middle of the wage distribution.

Table 3. Regressions on demographic variables

Dependent variable	Observed wage changes		Total returns or price effects	
Independent variable	Change in female labour force part. rates	Change in the proportion of foreign labour force	Change in female labour force part. rates	Change in the proportion of foreign labour force
	All			
Interacted with three lower deciles	0.0446 [0.0055]***	-0.003 [0.0056]	0.0289 [0.0042]***	-0.0155 [0.0041]***
Interacted with three middle deciles	0.0341 [0.0027]***	-0.0329 [0.0036]***	0.0262 [0.0021]***	-0.0256 [0.0019]***
Interacted with three highest deciles	0.034 [0.0017]***	-0.0369 [0.0044]***	0.0264 [0.0021]***	-0.0241 [0.0023]***
R-squared	0.85	0.88	0.95	0.95
	Males			
Interacted with three lower deciles	0.0458 [0.0056]***	-0.0103 [0.0066]	0.0281 [0.0033]***	-0.0073 [0.0036]**
Interacted with three middle deciles	0.0383 [0.0028]***	-0.0386 [0.0040]***	0.0296 [0.0020]***	-0.0131 [0.0025]***
Interacted with three highest deciles	0.0363 [0.0017]***	-0.0436 [0.0043]***	0.0251 [0.0016]***	-0.0148 [0.0027]***
R-squared	0.84	0.86	0.96	0.96
	Females			
Interacted with three lower deciles	0.0532 [0.0076]***	0.0103 [0.0083]	0.0354 [0.0047]***	-0.0251 [0.0060]***
Interacted with three middle deciles	0.0363 [0.0033]***	-0.0247 [0.0052]***	0.0251 [0.0025]***	-0.0434 [0.0032]***
Interacted with three highest deciles	0.0327 [0.0020]***	-0.0364 [0.0067]***	0.0253 [0.0022]***	-0.0454 [0.0043]***
R-squared	0.84	0.86	0.92	0.93
Decile fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Observations	81	81	81	81

Notes: Heteroskedasticity-Robust Standard Errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1% . Weighted by the average sample size of the regressions used to compute changes in returns.

Table 4. Regressions on trade openness variables

Dependent variable	Observed wage changes		Total returns or price effects	
Independent variable	Change in Dreher globalization index	Change in trade balance of goods and services as a percentage of GDP	Change in Dreher globalization index	Change in trade balance of goods and services as a percentage of GDP
	All			
Interacted with three lower deciles	0.0026	0.0228	0.004	0.0175
	[0.0031]	[0.0038]***	[0.0017]**	[0.0032]***
Interacted with three middle deciles	0.0081	0.0313	0.0071	0.0218
	[0.0021]***	[0.0029]***	[0.0011]***	[0.0025]***
Interacted with three highest deciles	0.0072	0.0274	0.006	0.0182
	[0.0018]***	[0.0032]***	[0.0005]***	[0.0026]***
R-squared	0.85	0.86	0.95	0.95
	Males			
Interacted with three lower deciles	0.0033	0.0257	0.0037	0.0199
	[0.0034]	[0.0040]***	[0.0015]**	[0.0025]***
Interacted with three middle deciles	0.0079	0.0327	0.0039	0.0222
	[0.0024]***	[0.0031]***	[0.0010]***	[0.0020]***
Interacted with three highest deciles	0.0076	0.029	0.0043	0.0209
	[0.0021]***	[0.0035]***	[0.0005]***	[0.0021]***
R-squared	0.84	0.84	0.96	0.96
	Females			
Interacted with three lower deciles	0.0006	0.017	0.0016	0.0124
	[0.0041]	[0.0050]***	[0.0021]	[0.0044]***
Interacted with three middle deciles	0.0113	0.029	0.0083	0.0205
	[0.0023]***	[0.0037]***	[0.0013]***	[0.0035]***
Interacted with three highest deciles	0.0114	0.0277	0.0087	0.0189
	[0.0017]***	[0.0040]***	[0.0006]***	[0.0037]***
R-squared	0.85	0.84	0.93	0.93
Decile fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Observations	81	81	81	81

Notes: As in table 3

Table 5. Regressions on technical change indicators

Dependent variable	Observed wage changes		Total returns or price effects	
Independent variable	Change in TFP (value added based) growth	Change in contribution of ICT capital services to output growth	Change in TFP (value added based) growth	Change in contribution of ICT capital services to output growth
	All			
Interacted with three lower deciles	0.0052 [0.0026]*	0.0542 [0.0285]*	0.0162 [0.0023]***	0.1538 [0.0249]***
Interacted with three middle deciles	0.0051 [0.0012]***	0.03 [0.0096]***	0.0122 [0.0008]***	0.0962 [0.0053]***
Interacted with three highest deciles	0.0078 [0.0013]***	0.0663 [0.0147]***	0.0124 [0.0011]***	0.1053 [0.0099]***
R-squared	0.85	0.79	0.96	0.96
	Males			
Interacted with three lower deciles	0.0026 [0.0028]	0.0357 [0.0315]	0.0185 [0.0020]***	0.1487 [0.0233]***
Interacted with three middle deciles	0.0033 [0.0012]***	0.0223 [0.0102]**	0.0146 [0.0006]***	0.0921 [0.0032]***
Interacted with three highest deciles	0.0066 [0.0013]***	0.0662 [0.0146]***	0.0158 [0.0008]***	0.1126 [0.0092]***
R-squared	0.85	0.77	0.97	0.97
	Females			
Interacted with three lower deciles	0.0079 [0.0028]***	0.0752 [0.0275]***	0.018 [0.0026]***	0.1564 [0.0273]***
Interacted with three middle deciles	0.0066 [0.0012]***	0.0373 [0.0103]***	0.0142 [0.0010]***	0.0983 [0.0063]***
Interacted with three highest deciles	0.009 [0.0016]***	0.0602 [0.0142]***	0.0135 [0.0012]***	0.0924 [0.0082]***
R-squared	0.82	0.78	0.93	0.94
Decile fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Observations	72	63	72	63

Notes: As in table 3

Table 6. Regressions on labour market institutions

Dependent variable	Observed wage changes			Total price effects		
Independent variable	Change in union density	Bargaining coordination (2000 levels)	Bargaining centralization (2000 levels)	Change in union density	Bargaining Coordination (2000 levels)	Bargaining centralization (2000 levels)
	All					
Interacted with three lower deciles	-0.0038 [0.0016]**	0.0064 [0.0315]	0.1444 [0.0230]***	-0.0078 [0.0013]***	0.0848 [0.0225]***	0.0718 [0.0278]**
Interacted with three middle deciles	-0.0022 [0.0007]***	0.1068 [0.0173]***	0.1237 [0.0103]***	-0.0049 [0.0002]***	0.1039 [0.0122]***	0.0748 [0.0140]***
Interacted with three highest deciles	-0.004 [0.0009]***	0.1296 [0.0087]***	0.1157 [0.0031]***	-0.0056 [0.0005]***	0.0894 [0.0077]***	0.0943 [0.0092]***
R-squared	0.85	0.87	0.83	0.96	0.94	0.94
	Males					
Interacted with three lower deciles	-0.0024 [0.0018]	0.0055 [0.0303]	0.1545 [0.0213]***	-0.0079 [0.0012]***	0.0899 [0.0170]***	0.1086 [0.0165]***
Interacted with three middle deciles	-0.0013 [0.0008]	0.1162 [0.0144]***	0.1396 [0.0100]***	-0.0054 [0.0002]***	0.098 [0.0106]***	0.1103 [0.0094]***
Interacted wih three highest deciles	-0.0034 [0.0010]***	0.138 [0.0081]***	0.1222 [0.0024]***	-0.0064 [0.0005]***	0.0882 [0.0063]***	0.0838 [0.0052]***
R-squared	0.84	0.9	0.85	0.97	0.96	0.96
	Females					
Interacted with three lower deciles	-0.0051 [0.0014]***	-0.0123 [0.0496]	0.1568 [0.0353]***	-0.0078 [0.0014]***	0.0579 [0.0328]*	0.086 [0.0343]**
Interacted with three middle deciles	-0.0024 [0.0005]***	0.1039 [0.0260]***	0.1158 [0.0168]***	-0.0045 [0.0003]***	0.0891 [0.0187]***	0.0679 [0.0205]***
Interacted with three highest deciles	-0.0036 [0.0008]***	0.1382 [0.0127]***	0.1224 [0.0052]***	-0.0043 [0.0004]***	0.0954 [0.0107]***	0.0962 [0.0112]***
R-squared	0.82	0.8	0.76	0.94	0.9	0.89
Decile fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	72	63	63	72	63	63

Notes: As in table 3

5. Concluding remarks

In this paper we document changes in the wage structure of nine EU countries over the 1995-2002 using micro data on wages and on workers and jobs characteristics that are comparable across countries. We disentangle the composition effects and the returns effects that are behind observed wage changes and, exploiting the cross-country variability in this regard, relate observed wage changes and returns component to some demographics, structural and macroeconomic trends.

Our results provide some evidence in two fronts. First, given the nature of the data, they yield new insights on changes in the wage distribution across EU countries, and whether these changes are mostly due to a different composition of personal and job characteristics or to changes in the remuneration of particular tasks. We find that real wages have increased from 1995 to 2002 along the whole range of wage levels in the nine countries of our sample, with the only exceptions of wages of the lowest paid jobs in Germany and wages in the middle part of the wage distribution in Spain. Both the magnitude and shape of the changes observed in real wages differ substantially across countries. While observed real wages in the Netherlands, Germany, Greece, Italy and Belgium trend upwards along the distribution, what leads to a widening of the wage distribution and an increase in wage inequality. In contrast, the wage distribution in Hungary, Ireland and Spain has become more compressed. The magnitude of the changes is relatively small in Italy, Belgium and Spain, and there is virtually no change in Austria. Changes in the workers and job characteristics, the so-called composition effects, are responsible for the widening of the wage distribution in Netherlands, Greece and Germany, while changes in returns to workers and jobs characteristics explain the compression of the wage distribution in Hungary, Ireland and Spain and the (slight) increase in inequality in Italy and Belgium.

Secondly, we have searched for associations between observed wage changes and their returns component with several demographic, structural, and macroeconomic trends. Our results suggest that the wage structure in EU countries has responded to macroeconomic and structural trends. In particular, observed changes in technology are positively associated with wage increases, the effect of technology seems to be stronger for very high and very low paid jobs. Globalisation is associated with wage increases, but less so for the lowest wages. Increases in migration are associated with declines in wages. Finally, as for technological

change, there is some evidence in favour of the polarisation hypothesis, with larger wages changes observed at the bottom and the top of the distribution than in the middle.

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APPENDIX

Table A1. Measures of wage inequality by country and sex-group

		All (Males & Females)					Males					Females				
		Std. Dev.	Median	P90/P10	P50/P10	P90/P50	Std. Dev.	Median	P90/P10	P50/P10	P90/P50	Std. Dev.	Median	P90/P10	P50/P10	P90/P50
AT	1996	0.36	2.23	1.52	1.22	1.24	0.34	2.30	1.46	1.18	1.24	0.35	2.07	1.53	1.21	1.26
	2002	0.37	2.28	1.52	1.23	1.24	0.35	2.35	1.45	1.18	1.23	0.36	2.13	1.51	1.20	1.25
	Change	0.01	0.04	0.00	0.01	-0.01	0.01	0.05	-0.01	0.00	-0.01	0.01	0.05	-0.02	-0.01	0.00
BE	1999	0.32	2.41	1.39	1.15	1.21	0.32	2.43	1.38	1.13	1.22	0.31	2.32	1.38	1.15	1.2
	2005	0.35	2.46	1.41	1.15	1.22	0.35	2.48	1.40	1.14	1.23	0.34	2.41	1.41	1.16	1.22
	Change	0.03	0.05	0.02	0.00	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.09	0.03	0.01	0.02
DE	1995	0.35	2.64	1.40	1.19	1.18	0.33	2.71	1.37	1.17	1.17	0.31	2.46	1.37	1.17	1.17
	2001	0.47	2.65	1.51	1.26	1.20	0.47	2.71	1.47	1.23	1.19	0.44	2.49	1.54	1.29	1.19
	Change	0.12	0.01	0.11	0.07	0.02	0.14	0.00	0.10	0.06	0.02	0.13	0.03	0.17	0.12	0.02
ES	1995	0.48	1.83	1.90	1.39	1.37	0.47	1.90	1.85	1.38	1.34	0.45	1.61	1.91	1.35	1.41
	2002	0.46	1.80	1.86	1.33	1.40	0.45	1.89	1.79	1.32	1.36	0.43	1.61	1.86	1.29	1.44
	Change	-0.02	-0.03	-0.04	-0.06	0.03	-0.02	-0.02	-0.05	-0.06	0.02	-0.02	0.00	-0.05	-0.06	0.03
GR	1995	0.38	1.88	1.69	1.30	1.30	0.38	1.98	1.67	1.32	1.27	0.32	1.67	1.59	1.21	1.31
	2002	0.47	1.89	1.85	1.33	1.40	0.48	2.01	1.86	1.37	1.36	0.41	1.73	1.74	1.25	1.39
	Change	0.09	0.01	0.16	0.02	0.10	0.10	0.03	0.20	0.06	0.09	0.09	0.06	0.15	0.04	0.08
HU	1996	0.53	5.82	1.27	1.12	1.13	0.53	5.89	1.27	1.13	1.12	0.51	5.74	1.26	1.12	1.12
	2002	0.53	5.95	1.25	1.09	1.15	0.55	5.99	1.26	1.10	1.15	0.50	5.91	1.23	1.08	1.14
	Change	0.00	0.13	-0.01	-0.04	0.02	0.01	0.11	-0.01	-0.03	0.02	-0.01	0.17	-0.02	-0.04	0.02
IE	1995	0.48[a]	2.11	1.84	1.36	1.35	0.50	2.20	1.79	1.34	1.34	0.45	1.98	1.78	1.35	1.32
	2002	0.47[a]	2.43	1.65	1.26	1.30	0.49	2.56	1.63	1.27	1.29	0.44	2.29	1.59	1.23	1.29
	Change	-0.01	0.32	-0.20	-0.10	-0.05	-0.01	0.35	-0.16	-0.07	-0.05	-0.02	0.31	-0.20	-0.12	-0.04
IT	1995	0.35	2.09	1.46	1.17	1.25	0.36	2.12	1.48	1.17	2.27	0.29	1.99	1.40	1.14	1.23
	2002	0.36	2.15	1.50	1.19	1.25	0.36	2.19	1.49	1.19	1.25	0.33	2.05	1.48	1.18	1.26
	Change	0.01	0.06	0.03	0.02	0.00	0.01	0.07	0.02	0.02	-1.01	0.04	0.06	0.08	0.04	0.03
NL	1995	0.43	2.41	1.50	1.24	1.22	0.40	2.47	1.44	1.19	1.21	0.43	2.20	1.55	1.28	1.21
	2002	0.49	2.49	1.57	1.28	1.23	0.47	2.61	1.54	1.27	1.21	0.47	2.28	1.64	1.34	1.23
	Change	0.07	0.09	0.07	0.04	0.02	0.07	0.14	0.09	0.08	0.00	0.04	0.08	0.10	0.06	0.02

Note: Median figures are in euros for al countries except for HU, for which they are measured in national currency (HUF). [a] indicates inferred number.

Table A2a. Basic decomposition of observed wage changes by country and decile, all

	10	20	30	40	50	60	70	80	90
AT									
Observed pay change (in logs)	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Composition effects	0.00	0.00	0.03	0.01	0.04	0.03	0.04	0.03	0.04
Return effects	0.01	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.02
Residual effects	0.01	0.01	-0.01	0.00	-0.02	-0.01	-0.01	0.00	-0.01
BE									
Observed pay change (in logs)	0.04	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10
Composition effects	0.02	0.04	0.02	0.04	0.06	0.04	0.05	0.04	0.07
Return effects	0.02	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06
Residual effects	0.01	-0.01	0.01	-0.01	-0.02	-0.01	-0.02	0.00	-0.02
DE									
Observed pay change (in logs)	-0.12	-0.04	-0.01	0.01	0.01	0.02	0.03	0.04	0.05
Composition effects	-0.13	-0.09	-0.07	-0.03	-0.01	-0.01	0.01	0.00	0.06
Return effects	0.09	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07
Residual effects	-0.07	-0.01	-0.02	-0.05	-0.06	-0.06	-0.05	-0.03	-0.07
ES									
Observed pay change (in logs)	0.03	0.01	0.00	-0.02	-0.03	-0.04	-0.03	-0.01	0.01
Composition effects	-0.01	-0.01	-0.05	-0.07	-0.06	-0.07	-0.08	-0.07	-0.04
Return effects	0.10	0.07	0.05	0.05	0.04	0.04	0.05	0.06	0.07
Residual effects	-0.06	-0.05	0.00	0.00	-0.02	-0.01	0.00	0.01	-0.02
GR									
Observed pay change (in logs)	-0.02	-0.01	-0.01	-0.01	0.01	0.05	0.10	0.15	0.20
Composition effects	-0.08	-0.07	-0.08	-0.09	-0.09	-0.05	0.00	0.06	0.15
Return effects	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.08	0.08
Residual effects	0.03	0.01	0.02	0.02	0.03	0.02	0.01	0.00	-0.04
HU									
Observed pay change (in logs)	0.29	0.13	0.08	0.10	0.13	0.16	0.18	0.22	0.29
Composition effects	-0.07	-0.12	-0.14	-0.07	-0.06	-0.05	-0.07	-0.05	-0.03
Return effects	0.46	0.33	0.27	0.25	0.24	0.25	0.25	0.27	0.32
Residual effects	-0.10	-0.09	-0.05	-0.07	-0.05	-0.04	0.00	0.00	0.00
IE									
Observed pay change (in logs)	0.37	0.32	0.31	0.31	0.32	0.33	0.35	0.35	0.31
Composition effects	0.05	0.09	0.04	0.07	0.09	0.10	0.12	0.13	0.10
Return effects	0.41	0.31	0.26	0.25	0.24	0.23	0.22	0.22	0.22
Residual effects	-0.09	-0.07	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.01
IT									
Observed pay change (in logs)	0.01	0.03	0.04	0.05	0.06	0.06	0.08	0.07	0.08
Composition effects	0.07	0.08	0.08	0.08	0.08	0.07	0.06	0.06	0.01
Return effects	-0.03	-0.03	0.00	0.01	0.02	0.02	0.04	0.06	0.09
Residual effects	-0.02	-0.02	-0.04	-0.04	-0.04	-0.03	-0.03	-0.04	-0.02
NL									
Observed pay change (in logs)	0.01	0.00	0.03	0.06	0.09	0.11	0.13	0.15	0.15
Composition effects	-0.20	-0.14	-0.14	-0.09	-0.02	0.01	0.03	0.07	0.07
Return effects	0.11	0.13	0.15	0.15	0.14	0.15	0.16	0.14	0.13
Residual effects	0.09	0.01	0.02	0.00	-0.03	-0.04	-0.06	-0.06	-0.05

Table A2b. Basic decomposition of observed wage changes by country and decile, males

	10	20	30	40	50	60	70	80	90
AT									
Observed pay change (in logs)	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Composition effects	0.01	0.00	0.04	0.05	0.02	0.03	0.04	0.03	0.04
Return effects	0.02	0.03	0.02	0.03	0.01	0.00	0.01	0.01	0.01
Residual effects	0.02	0.02	-0.01	-0.02	0.01	0.02	0.00	0.01	-0.01
BE									
Observed pay change (in logs)	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.08	0.09
Composition effects	0.00	0.01	0.03	0.01	0.02	0.00	0.05	0.05	0.02
Return effects	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.05	0.06
Residual effects	0.02	0.01	-0.01	0.00	0.00	0.01	-0.03	-0.02	0.01
DE									
Observed pay change (in logs)	-0.12	-0.04	-0.02	-0.01	0.00	0.01	0.02	0.03	0.05
Composition effects	-0.16	-0.08	-0.07	-0.05	-0.02	-0.02	-0.01	0.02	0.00
Return effects	0.10	0.08	0.08	0.07	0.07	0.07	0.09	0.09	0.10
Residual effects	-0.06	-0.05	-0.03	-0.03	-0.05	-0.04	-0.06	-0.08	-0.06
ES									
Observed pay change (in logs)	0.05	0.02	0.01	-0.01	-0.02	-0.02	-0.01	0.00	0.02
Composition effects	0.01	-0.01	-0.05	-0.04	-0.07	-0.06	-0.04	-0.03	-0.03
Return effects	0.09	0.07	0.06	0.05	0.05	0.05	0.06	0.07	0.07
Residual effects	-0.05	-0.04	0.00	-0.02	0.00	-0.01	-0.03	-0.03	-0.02
GR									
Observed pay change (in logs)	-0.05	-0.04	-0.03	-0.01	0.03	0.08	0.12	0.17	0.21
Composition effects	-0.11	-0.09	-0.09	-0.07	-0.08	0.04	0.05	0.14	0.19
Return effects	0.03	0.04	0.05	0.05	0.06	0.04	0.06	0.05	0.03
Residual effects	0.03	0.02	0.01	0.00	0.05	0.00	0.01	-0.02	0.00
HU									
Observed pay change (in logs)	0.26	0.06	0.04	0.07	0.11	0.13	0.16	0.20	0.27
Composition effects	-0.08	-0.14	-0.14	-0.11	-0.10	-0.08	-0.08	-0.02	-0.01
Return effects	0.44	0.32	0.27	0.25	0.24	0.24	0.26	0.28	0.33
Residual effects	-0.10	-0.11	-0.09	-0.07	-0.03	-0.02	-0.02	-0.06	-0.05
IE									
Observed pay change (in logs)	0.37	0.34	0.33	0.34	0.35	0.37	0.38	0.37	0.34
Composition effects	0.09	0.05	0.05	0.08	0.11	0.13	0.14	0.15	0.14
Return effects	0.36	0.31	0.28	0.26	0.25	0.23	0.22	0.21	0.23
Residual effects	-0.08	-0.03	0.00	-0.01	0.00	0.01	0.02	0.01	-0.03
IT									
Observed pay change (in logs)	0.03	0.04	0.05	0.06	0.07	0.08	0.08	0.07	0.08
Composition effects	0.08	0.09	0.10	0.10	0.09	0.09	0.10	0.06	0.07
Return effects	-0.04	-0.05	-0.04	-0.04	-0.03	-0.02	-0.03	-0.03	-0.04
Residual effects	-0.01	0.00	0.00	-0.01	0.00	0.01	0.01	0.04	0.05
NL									
Observed pay change (in logs)	-0.01	0.05	0.09	0.12	0.14	0.16	0.18	0.19	0.17
Composition effects	-0.16	-0.08	-0.01	0.03	0.05	0.07	0.07	0.11	0.11
Return effects	0.06	0.09	0.10	0.12	0.13	0.11	0.14	0.11	0.09
Residual effects	0.08	0.04	0.00	-0.03	-0.03	-0.03	-0.03	-0.02	-0.03

Table A2c. Basic decomposition of observed wage changes by country and decile, females

	10	20	30	40	50	60	70	80	90
AT									
Observed pay change (in logs)	0.05	0.00	0.06	0.04	0.03	0.03	0.01	0.00	0.02
Composition effects	0.02	0.02	0.01	0.01	0.02	0.03	0.02	0.03	0.01
Return effects	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.06
Residual effects	-0.01	0.02	-0.03	-0.01	0.00	-0.01	0.02	0.02	0.02
BE									
Observed pay change (in logs)	0.06	0.06	0.06	0.07	0.08	0.10	0.12	0.13	0.15
Composition effects	0.00	0.01	0.03	0.03	0.08	0.10	0.08	0.12	0.09
Return effects	0.03	0.03	0.03	0.02	0.01	0.02	0.04	0.06	0.06
Residual effects	0.03	0.01	-0.01	0.02	-0.01	-0.03	0.00	-0.05	0.01
DE									
Observed pay change (in logs)	-0.17	-0.05	-0.01	0.03	0.03	0.05	0.07	0.08	0.10
Composition effects	-0.15	-0.09	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.05
Return effects	-0.02	0.00	0.01	0.01	0.03	0.04	0.05	0.04	0.04
Residual effects	0.00	0.04	0.04	0.05	0.02	0.01	-0.01	0.00	0.00
ES									
Observed pay change (in logs)	0.05	0.03	0.02	0.02	0.00	-0.01	-0.01	0.00	0.04
Composition effects	0.02	0.01	0.01	-0.01	-0.03	-0.02	-0.01	-0.02	0.04
Return effects	0.10	0.06	0.04	0.02	0.01	0.00	0.01	0.03	0.05
Residual effects	-0.06	-0.04	-0.02	0.01	0.02	0.01	-0.01	-0.01	-0.05
GR									
Observed pay change (in logs)	0.00	0.02	0.04	0.04	0.06	0.07	0.11	0.16	0.21
Composition effects	-0.06	-0.05	-0.04	-0.05	-0.04	-0.01	-0.01	0.07	0.13
Return effects	0.02	0.05	0.06	0.08	0.08	0.10	0.11	0.12	0.12
Residual effects	0.04	0.02	0.01	0.01	0.01	-0.01	0.01	-0.03	-0.04
HU									
Observed pay change (in logs)	0.34	0.19	0.16	0.16	0.17	0.19	0.21	0.25	0.30
Composition effects	-0.03	-0.07	-0.06	-0.03	-0.02	0.01	-0.02	0.00	0.04
Return effects	0.48	0.35	0.28	0.25	0.24	0.23	0.24	0.25	0.28
Residual effects	-0.10	-0.09	-0.06	-0.05	-0.05	-0.05	-0.01	-0.01	-0.02
IE									
Observed pay change (in logs)	0.39	0.33	0.32	0.31	0.31	0.32	0.33	0.36	0.33
Composition effects	0.02	0.06	0.09	0.09	0.09	0.12	0.13	0.14	0.16
Return effects	0.43	0.33	0.27	0.23	0.22	0.21	0.21	0.20	0.24
Residual effects	-0.06	-0.06	-0.04	-0.01	0.00	-0.01	-0.01	0.02	-0.07
IT									
Observed pay change (in logs)	0.00	0.02	0.04	0.05	0.06	0.07	0.09	0.10	0.13
Composition effects	0.07	0.09	0.10	0.10	0.10	0.13	0.12	0.06	0.04
Return effects	-0.05	-0.07	-0.05	-0.04	-0.03	-0.03	-0.01	0.03	0.09
Residual effects	-0.02	0.00	-0.02	-0.01	-0.01	-0.03	-0.02	0.01	0.00
NL									
Observed pay change (in logs)	-0.02	0.07	0.05	0.07	0.08	0.09	0.11	0.12	0.13
Composition effects	-0.30	-0.08	-0.10	-0.09	-0.05	-0.04	-0.01	0.00	0.06
Return effects	0.22	0.17	0.17	0.17	0.16	0.16	0.17	0.20	0.17
Residual effects	0.07	-0.02	-0.02	-0.01	-0.03	-0.03	-0.05	-0.08	-0.09

Table A3. Globalization and immigration

	Index of Globalisation[a]			Proportion of foreign labour force (%)[b]		
	1995	2002	Change	1996	2002	Change
	(1)	(2)	(2)-(1)	(4)	(5)	(5)-(4)
Austria	74.84	87.90	13.06	10.0	10.9	0.9
Belgium	90.71	94.00	3.29	8.4	8.6	0.2
Germany	63.78	76.56	12.78	8.9	9.2	0.3
Greece	63.66	69.72	6.06	3.7	5.5	1.8
Hungary	75.00	82.29	7.29	0.5	1.0	0.5
Ireland	91.89	95.06	3.17	3.5	5.5	2.0
Italy	66.07	75.04	8.97	2.9	3.8	0.9
Netherlands	89.36	92.95	3.59	3.9	3.7	-0.2
Spain	72.90	83.86	10.96	1.0	4.5	3.5
US	63.27	64.49	1.22			

Source: [a]Dreher (2006), [b]OECD.

Table A4. Labour market institutions and reforms

	Empl. protection legislation		Unemp. benefits indicator		Minimum relative to median wages		Bargaining coord/tion index	Bargaining centr/tion index	OECD Reform Intensity Indicator	Product Market Regulation indicator		Admin. Regulation indicator		Economic Regulation indicator	
	1995	2002	1995	2002	1995	2002	Constant in 1995-2000	Constant in 1995-2000	1994-2004	1998	2003	1998	2003	1998	2003
Austria	2.6	2.5	7.8	10.3	NA	NA	4	3	17.8	1.8	1.4	1.8	1.9	2.3	1.5
Belgium	2.7		10.2		0.51	0.47	4.5	3	21.4	2.1	1.4	2.1	1.9	2.6	1.8
Germany	2.6	2.1	20.0	23.2	NA	NA	4	3	23.9	1.9	1.4	2.5	1.9	2.2	1.8
Greece			12.7	10.7	0.53	0.49			13.8	2.8	2.0	2.5	2.0	3.4	1.9
Ireland	1.3	1.3	19.2	17.5		0.39	4	4	17.4	1.5	1.1	1.4	1.1	1.9	1.5
Italy	3.7	3.3	6.1	6.4	NA	NA	4	2	21.7	2.8	1.9	3.1	1.6	3.7	2.6
Netherlands	2.3	2.4	23.5	15.8	0.50	0.52	4	3	25.7	1.8	1.4	2.0	1.9	2.4	1.6
Spain	2.4	2.3	16.7	14.6	0.34	0.30	3	3	10.5	2.3	1.6	2.8	2.0	2.5	2.1
US	0.6	0.6	1.1	1.3	0.35	0.33	1	1	11.6	1.3	1.0	1.4	1.1	1.4	1.3

Notes: NA stands for Not Applicable. *Employment protection legislation* series is taken from Allard (2005a). This series uses the OECD methodology generating an index increasing on the range {0,5}. The series describing *unemployment benefits* is a new indicator which combines the amount of the subsidy with their tax treatment, their duration and the conditions that must be met in order to collect them, by Allard (2005b). The relevant numbers for Greece are unpublished and tentative. The *bargaining coordination* & *bargaining centralization* indicators are from OECD (2004), Table 3.5. They range from 1-5 and are increasing in the degree of coordination in the bargaining process on the employers' as well as the unions' side, and in the degree of centralization, respectively. The *Overall Product Market Regulation indicator* is from Conway *et al* (2005), Table 24. The indicator summarises information on 139 economy-wide or industry specific regulatory provisions and has a range {0,4}. The *Administrative Regulation Indicator* as well as the *Economic Regulation indicator* are also from Conway *et al* (2005), Table 24. All the above are available at the CEP – OECD Institutions Data Set (1960-2004). The *OECD reform intensity indicator* is from Brandt, Burniaux and Duval (2005).

Figure A1a. (log) wage changes by country and decile (model including only personal characteristics), all (males & females)

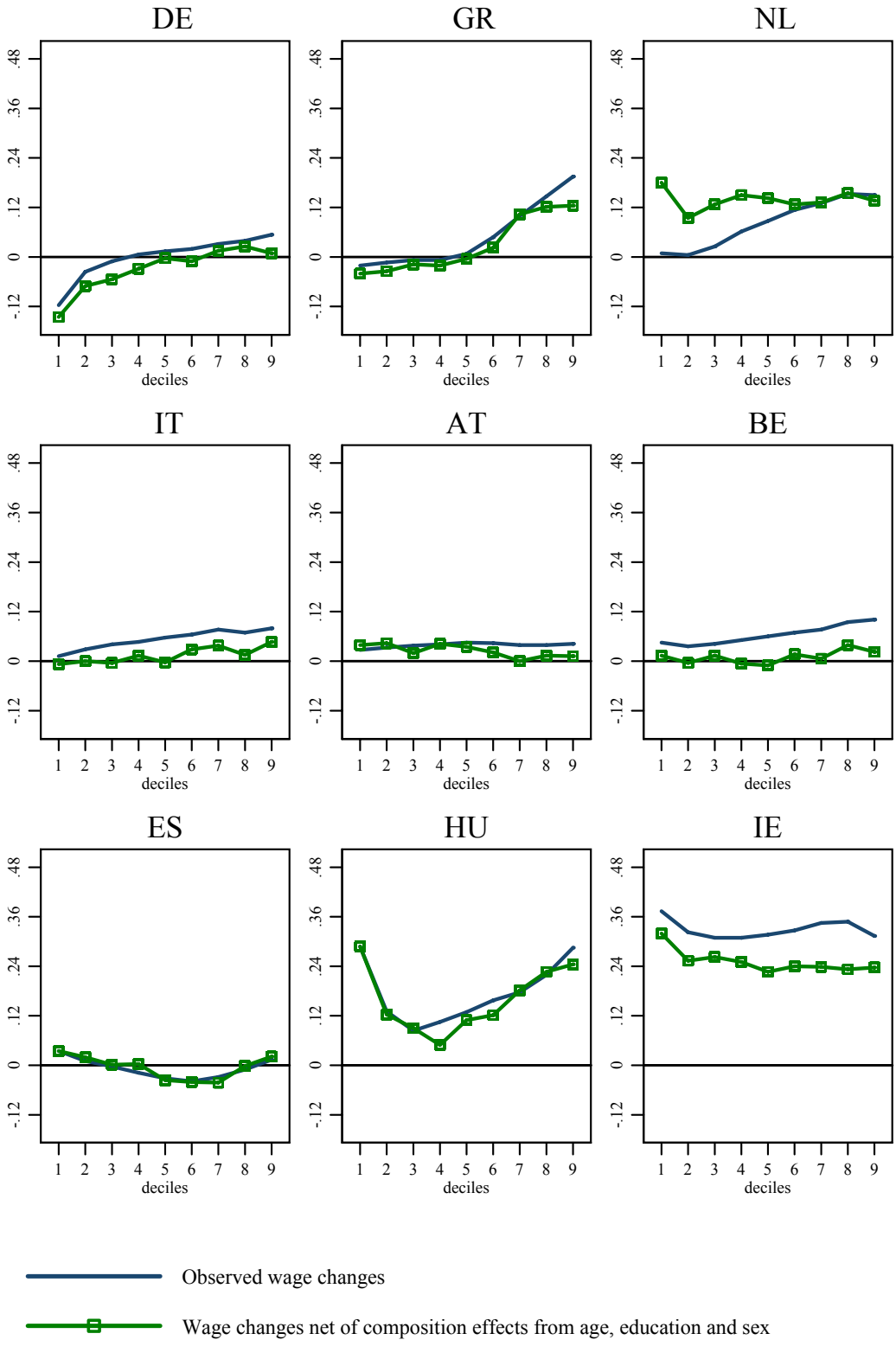

Figure A1b. (log) wage changes by country and decile (model including only personal characteristics), males

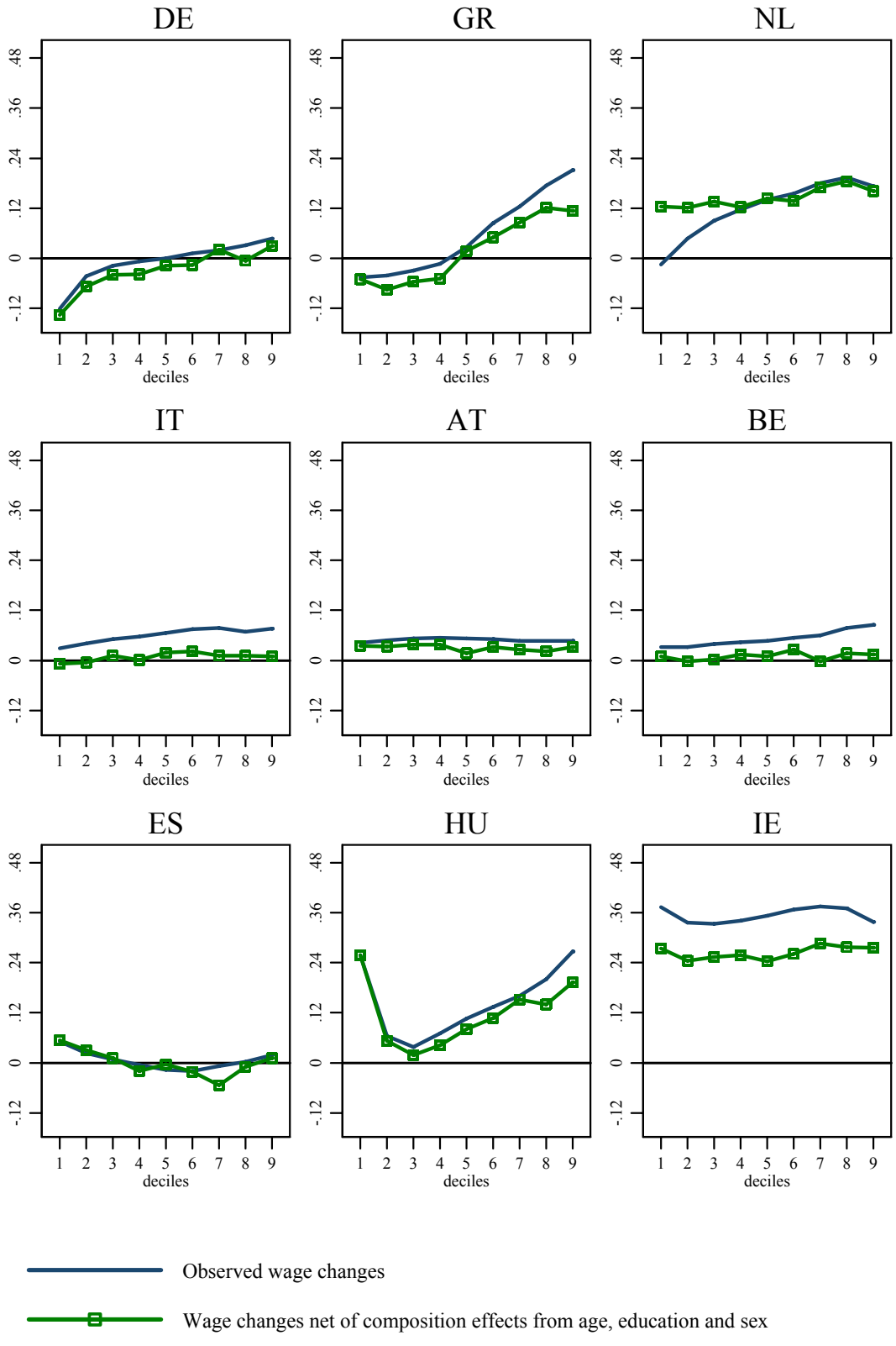

Figure A1c. (log) wage changes by country and decile (model including only personal characteristics), females

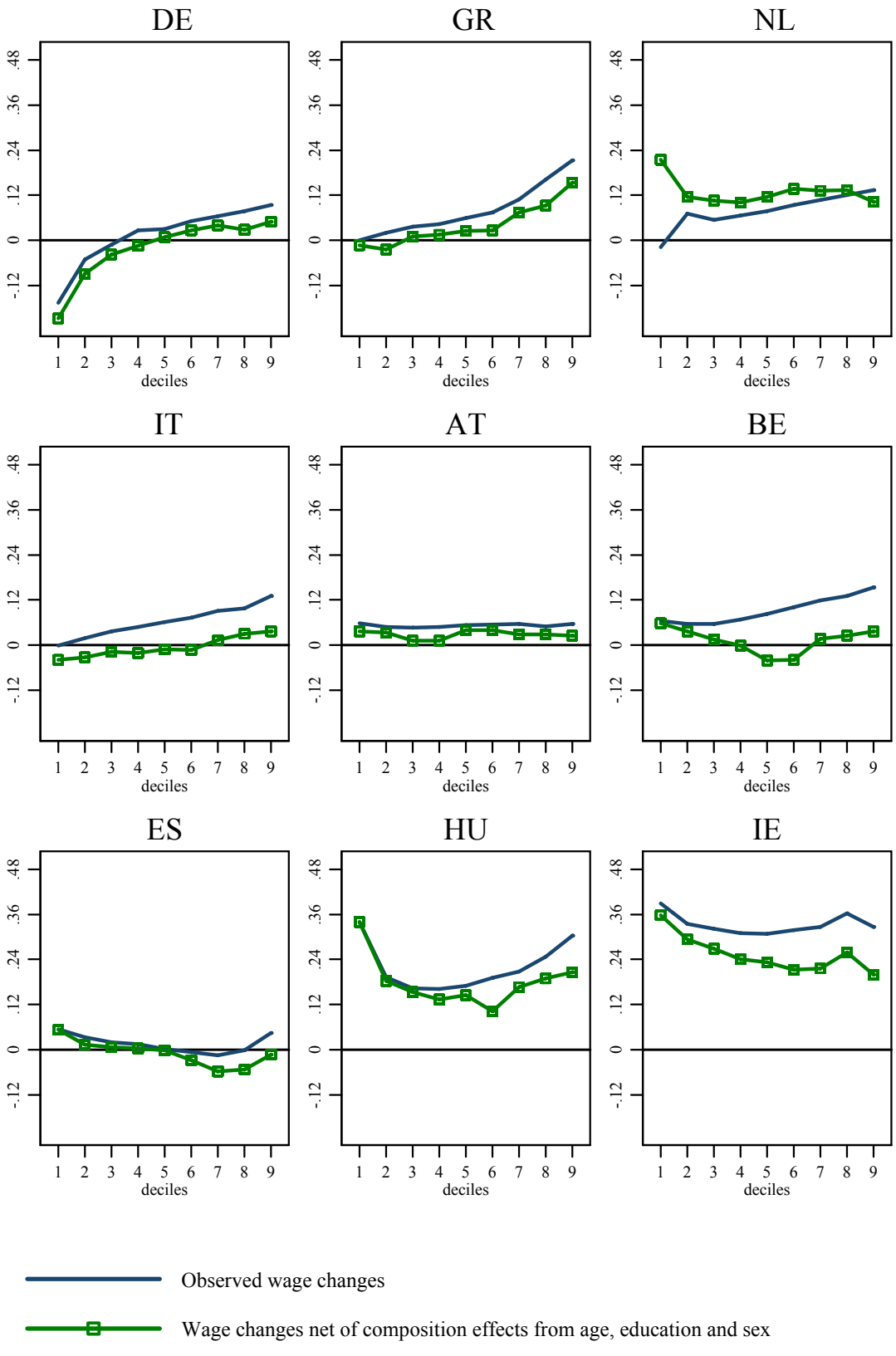

Figure A2a. Break down of observed wage changes by country and decile, all (males & females)

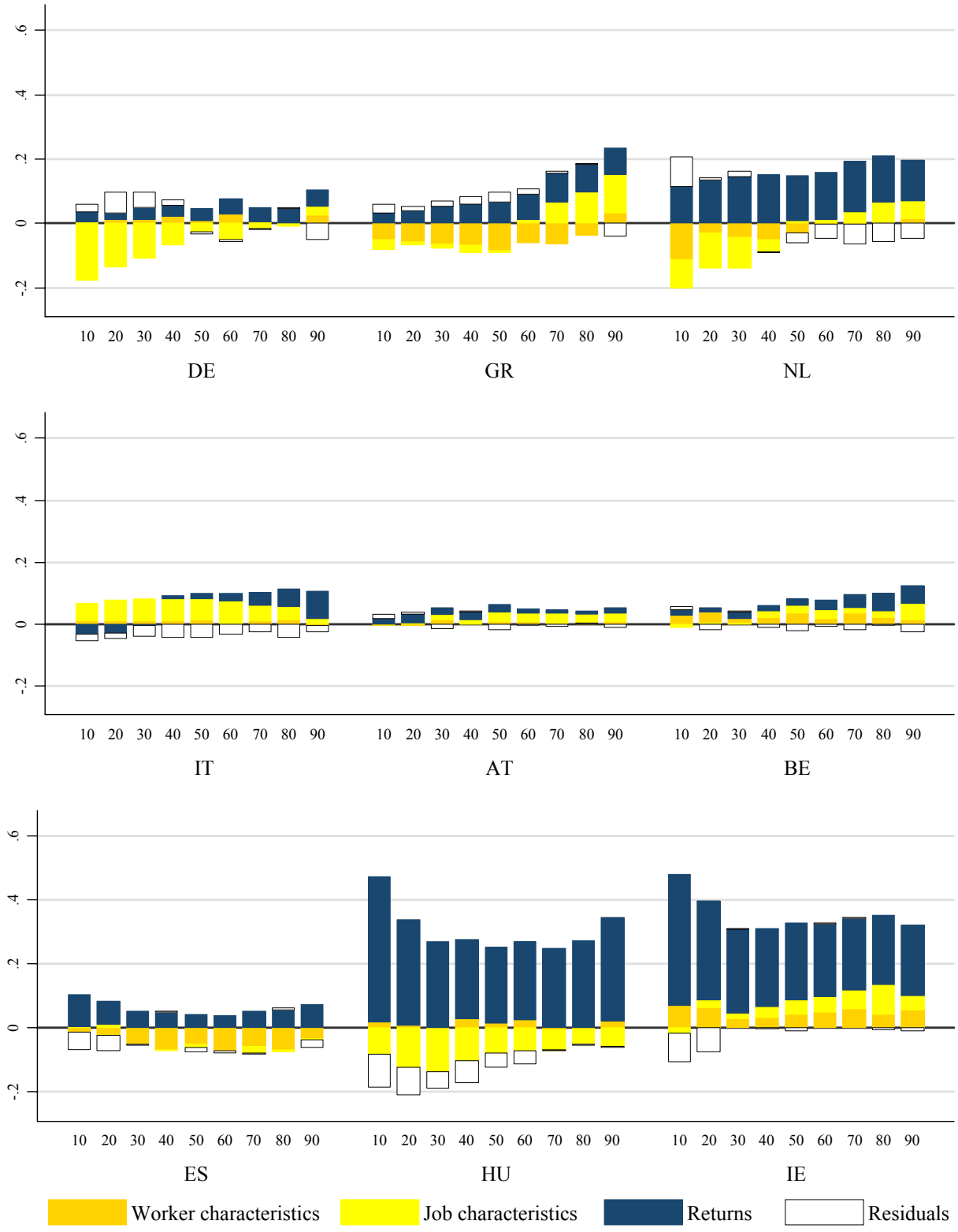

Figure A2b. Break down of observed wage changes by country and decile, males

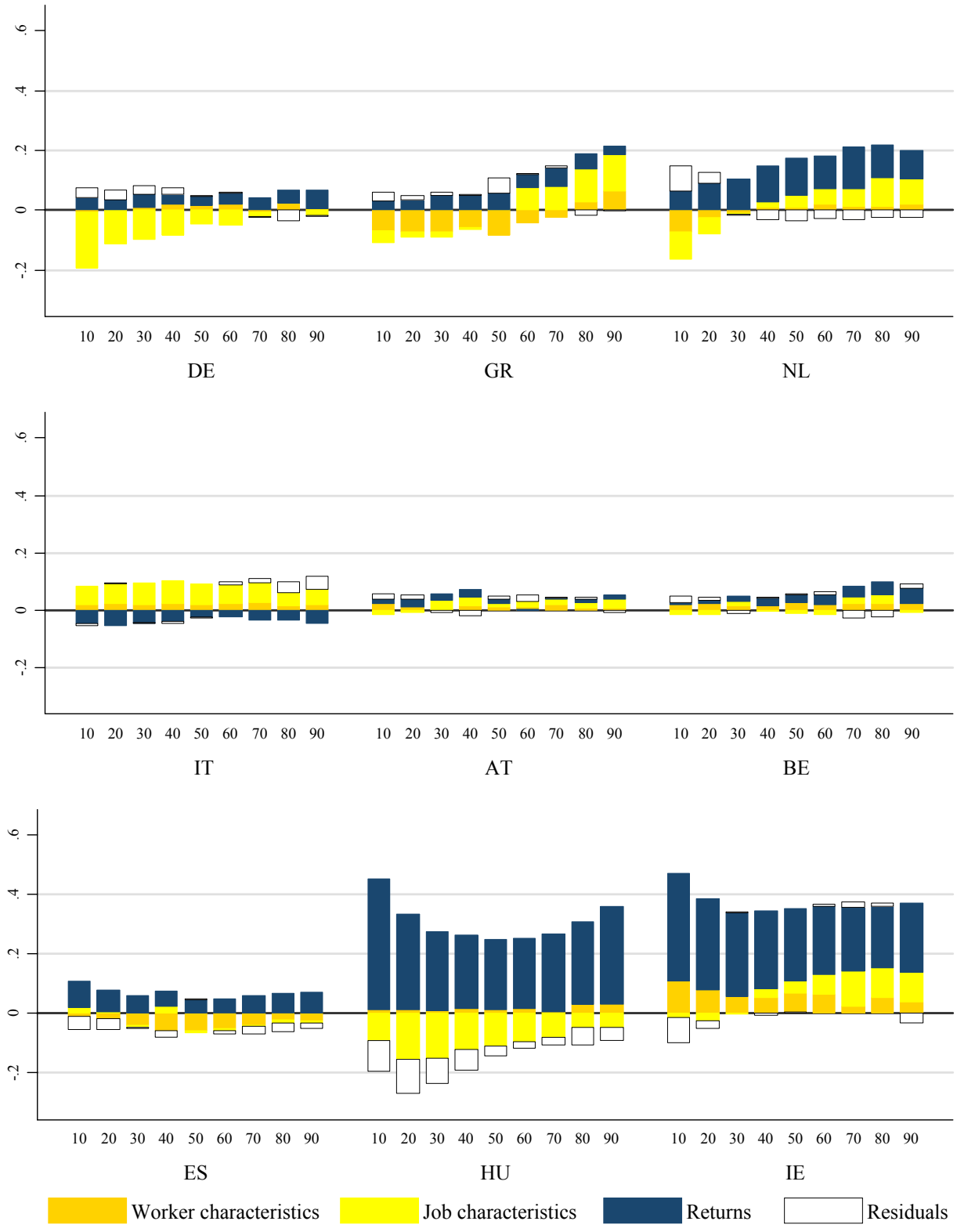

Figure A2c. Break down of observed wage changes by country and decile, females