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EARNINGS DYNAMICS AND INEQUALITY IN THE EU, 1994-2001[*]

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ABSTRACT

Relying on a consistent cross-national comparative data set – ECHP, we explore the extent to which changes in cross-sectional earnings inequality in 14 EU countries over the period 1994 and 2001 reflect an increase in lifetime earnings inequality or in earnings instability. Equally weighted minimum distance methods are used to estimate the covariance structure of earnings and decompose earnings inequality into its permanent and transitory components. The increase in inequality reflects an increase in lifetime earnings inequality in four countries, and in earnings instability in two countries. Decreases in inequality reflect decreases in earnings instability in four countries, in lifetime inequality in two, and in both in rest.

Keywords: earnings inequality, earnings dynamics, permanent inequality, transitory inequality, minimum distance estimation

JEL Classification: C23, D31, J31

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Interest in earnings dynamics has increased greatly in recent years and was fuelled mainly by the rise in earnings inequality experienced by many developed countries during the 1980s and 1990s, which triggered a strong debate regarding the driving factors and the implications of this increase. A considerable progress has been made towards understanding the increase in wage inequality in the U.S. and Europe, but the economic literature still lacks a consensus on why inequality did not increase, or increased much less, in (continental) Europe over the same time period (see, for example, Freeman and Katz, 1995, Nickell and Bell, 1996, Blanchflower, Loveman, and Katz, 1995). In the US, there is a widespread consensus that wage inequality increased because the relative demand for skills rose faster than the relative supply under the impact of the skill-biased technological change (e.g., Katz and Murphy, 1992, Katz and Autor, 1999, Acemoglu, 2002). There are three broad explanations why Europe has not experienced a similar increase in the skill premia, despite the same technological developments: first, the relative supply of skills increased faster in Europe than in the US (Freeman and Katz 1994, Acemoglu 2002), second, the European wage-setting institutions prevented inequality from increasing (Freeman and Katz 1994, Acemoglu 2002), and third, Europe faced a less skill-biased technological change due to the labour market institutions which compressed wages and encouraged more investment in technologies, increasing the productivity of less-skilled workers (Acemoglu 2002).

However, it is inaccurate to think of one "European Model", as European countries are, and are becoming increasingly heterogeneous in their welfare state characteristics (Palier, B. 2010). The heterogeneity across the European countries is one of the motivations behind studying cross-national earnings differentials across Europe: countries with different systems are expected to trigger different distributional outcomes. The economic reality of the 1990s in Europe, when the single market was implemented (1992) and the single currency was being prepared (Maastricht criteria adopted in 1993), increased the pressure on the European labour markets to change. Since 1995, several EU labour market policy changes were implemented, influenced by the 1994 OECD Job Strategy, which recommended policies to increase wage flexibility, lower non-wage labour costs and allow relative wages to better reflect individual differences in productivity and local labour market conditions (OECD, 2004; Dew-Becker and Gordon, 2008). Thus since the early 1990s, Europe has been moving towards more flexible labour markets, from labour shedding to employment-friendly reforms. But the pace of change was different across the 14 EU countries (Palier, B. 2010), supporting the expectation of increased country-heterogeneity with respect to the labour market structure and the distribution of labour market income across the EU. These changes appear to have worsened the trade-off between a strong employment performance and a more equal distribution of earnings, consistent with the relative labour demand having shifted towards highly skilled workers (OECD, 2004).

The qualitative evidence that comes out of the literature on earnings inequality across Europe indicates considerable cross-country differences in the level of inequality, the structure of inequality by education, age, sex and sector of employment, and the patterns of inter-temporal change in hourly earnings inequality in Europe (Cholezas and Tsakloglou, 2008, OECD 1996, 1997). However, most studies explore earnings inequality from a static perspective at the EU level, and fail to account for the factors that drive the evolution in inequality. A recent attempt to account for the dynamics in a comparative perspective at the EU level is made by Cholezas and Tsakloglou (2008), which used national data sets to decompose the trend in inequality by groups (education, age, sex and sector of employment). They showed that the main factor behind the change in earnings inequality was the change in "within-groups" inequality irrespective of the partitioning criterion. The national datasets, however, are not comparable across countries, thus the comparison across countries is not consistent.

Our study argues for using earnings dynamics to understand the driving factors behind the evolution of cross-sectional inequality across Europe, relying on a consistent cross-national comparative data set. The fundamental question is why is it relevant to look at earnings dynamics in the context of rising earnings inequality? Two perspectives need to be considered. On the one hand, shifting earnings distributions involve the movement of individuals in the earnings distribution over time. Thus earnings dynamics is one of the main drivers behind the change in the distribution of earnings. Therefore, understanding earnings dynamics is a prerequisite for understanding the changes in earnings inequality. On the other hand, earnings dynamics is seen as the bridge between 2 types of inequality: a short-term, temporary inequality and a long-term, permanent (lifetime) inequality. Complementing the evidence on the evolution of short-term earnings inequality with the evidence on earnings dynamics allows us to form expectations regarding the likely lifetime earnings differentials outcomes. In this line of thought, some analysts argue that rising annual inequality does not necessarily have negative implications. This statement relies on the "offsetting mobility" argument, which states that if there has been a sufficiently large simultaneous increase in mobility[i], the inequality of income measured over a longer period of time, such as lifetime income or "permanent" income - can be lower despite the rise in annual inequality, with a positive impact on social welfare (Friedman, 1962).

Starting with the US, Canada, and the UK, recent studies on earnings dynamics have stressed the importance of decomposing the growth in earnings inequality into permanent and transitory components, to see whether the increase reflects an increase in lifetime earnings differentials or an increase in earnings instability (e.g. Gottschalk and Moffitt 1994; Moffitt and Gottschalk 1995; Dickens 2000; Haider 2001; Baker and Solon 2003; Kalwij and Alessi 2003; Cappelari 2003; Ramos 2003; Daly and Valetta 2008).

We attempt to answer the same question, but in a comparative fashion at the EU level, over the period 1994-2001, of high interest given the labour market policy reforms across the EU: To what extent do

changes in cross-sectional earnings inequality in Europe reflect changes in permanent inequality and/or earnings instability? Which countries signal widening lifetime earnings inequalities? Foremost, our study responds to the stringent need of exploring earnings dynamics and the contribution of earnings dynamics to the change in the earnings inequality in a comparative setting at the EU level. While there have been a few single country analyses (e.g. UK - Dickens 2000; UK - Kalwij and Alessi 2003; Italy - Cappelari 2003; Spain - Ramos 2003), until now, the contribution of dynamics to the evolution of earnings inequality has not been explored in a comparative fashion, nor has it been a comparative study of earnings dynamics at the EU level. The existing EU studies lack the comparative perspective, as their results are usually compared with other studies using different datasets, different countries, different periods, different samples, and therefore lack comparability. We aim to fill part of the gap with the first comparative study on earnings dynamics at the EU level, using the 8 waves (1994-2001) of the European Community Household Panel (ECHP). The consistent comparative perspective on earnings dynamics at the EU level offers a valuable insight with respect to the impact of earnings dynamics on the distribution of earnings in countries belonging to a common economic area, but with different systems and with different rates of adaptation to the economic reality of the 1990s.

An increase in cross-sectional earnings inequality triggered by an increase in the permanent component, e.g. an increase in the returns to education and other persistent characteristics, signals an increase in lifetime earnings differentials, meaning that the individuals with relatively high lifetime earnings are earning relatively even more. Moreover, the increase in earnings persistency has implications for another distribution aspect – earnings mobility: the larger is the contribution of permanent inequality in the overall inequality, the higher is the correlation of individual earnings over time, and the lower is the year-to-year mobility (Katz and Autor, 1999). Thus increasing inequality triggered by an increase in persistent differential implies both a worsening of the relative lifetime earnings position of the chronically poor and a decrease in the year-to-year mobility. If the increase in cross-sectional earnings inequality reflects an increase in earnings instability, lifetime earnings inequality may have increased very little or at all. Thus, in a lifetime perspective, the chronically rich have not gotten richer and the chronically poor have not gotten poorer, but there has been an increase in the year-to-year earnings mobility (Baker and Solon 2003).

The distinction between permanent (lifetime) earnings inequality and earnings instability it is also useful in evaluating the welfare implications of the evolution in cross-sectional earnings inequality. Permanent or lifetime earnings is a measure of long-term resources, thus it reflects the individual consumption (Friedman 1957; Cutler and Katz 1992; Attanasio and Davis 1996). Individual or household consumption (expenditure) has been increasingly used in the measurement of the individual or household welfare (Blundell and Preston, 1998). Thus increasing persistent differentials imply increasing

consumption differentials, with a negative impact on social welfare for most social welfare functions (Haider 2001).

The welfare implications for increasing earnings instability are not straightforward. On the one hand, Attanasio and Davis (1996) bring evidence that consumption is well insulated from transitory shocks, thus increasing earnings instability is unlikely to reduce welfare through consumption. On the other hand, the complexity is augmented by the disagreement found in the literature regarding the value judgement of earnings mobility (Atkinson, Bourguignon, and Morrison, 1992). The transitory component is the one generating mobility, a desired goal linked with the goal of securing equality of opportunity in the labour market and of having a more flexible and efficient economy (Friedman 1962; Atkinson et al. 1992). In this study, mobility is regarded as the opposite of persistency, and can be interpreted as the opportunity for the poor to improve their relative income position in a lifetime perspective. We do not take the stand that that mobility is necessarily good, but that the lack of it is bad, as it signals a lack of opportunity to move in the earnings distribution over the lifetime. Increasing earnings instability, however, reduces social welfare if individuals are averse to earnings variability and future risk (Creedy and Wilhelm, 2001, Gottschalk and Spolaore, 2002). Moreover, mobility may also have disequalizing effects (Dickens, 2000).

Equally weighted minimum distance methods are used to estimate the covariance structure of earnings and decompose earnings inequality into a permanent and a transitory component by cohort (Abowd and Card 1989; Baker 1997; Dickens 2000; Baker and Solon 2003; Cappellari 2003, Ramos 2003, Kalwij and Alessie 2003). Blundell and Preston (1998) argue that there are strong welfare grounds for analysis within cohorts as the evolution of the distribution within the whole population is influenced by changes in the age structure that obscure the role of permanent and transitory components of earnings. The aggregation to obtain the overall inequality from the within-cohort inequalities for each country follows the Shorrocks sub-group inequality decomposition (Shorrocks 1984; Chakravarty 2001).

Section 2 reviews the literature and the theoretical model of the determinants of wage differentials. Section 3 and 4 describe the data and the dynamic autocovariance structure of earnings. Section 5 discusses the estimation method. Sections 6 and 7 reveal the empirical results and discuss the main findings. Section 8 concludes.

1. Theoretical model of the determinants of wage differentials

There is an extensive literature on earnings inequality and its determinants (e.g. Katz and Autor, 1999). Because our focus is on the impact of earnings dynamics on the distribution of earnings, we present below the state of the field on earnings dynamics.

1.1. Determinants of earnings inequality

Following the terminology introduced by Friedman and Kuznets (1954), earnings are composed of a permanent and a transitory component, assumed independent of each other. The permanent component reflects personal characteristics, education, training and other systematic elements. The transitory component captures random events and other factors influencing earnings in a particular period and is expected to average out over time. Thus overall earnings inequality at any point in time is composed of permanent and transitory inequality.

A rise in permanent inequality is consistent with increasing returns to education, on-the-job training and other persistent abilities that are among the main determinants of the permanent component of earnings, meaning enhanced relative earnings position of the high-skilled individuals (Mincer, 1957, 1958, 1962, 1974; Hause, 1980). Increases in transitory inequality can be attributed to the weakening of the labour market institutions (e.g. unions, government wage regulation, and internal labour markets), increased labour market instability, increased competitiveness, a rise in the temporary workforce which increases earnings exposure to shocks. A period of skill-biased technological change can, both, increase the demand for skills, and increase earnings instability (Katz and Autor, 1999). Globalization and international capital mobility can also increase wage instability (Rodrik, 1997). Overall, the increase in the return to persistent skills is expected to have a much larger impact on long-run earnings inequality than an increase in the transitory component (Katz and Autor, 1999; Moffitt and Gottschalk, 2002).

Across age groups, as postulated by Freeman's (1975) "active labour market hypothesis", similarly with overall income, the youngest generations of workers are expected to be affected the most by earnings instability, as they have a weaker attachment to the labour market compared with senior workers, and a lower protection from the labour market institutional factors. Thus we need to account for the differences across cohorts when decomposing inequality into its permanent and transitory components.

1.2. Alternative model specifications for the permanent and transitory components

Earnings dynamics move in a more complicated nature than the simple permanent and transitory inequality. We now describe the underlying mechanism drawing this complexity.

We introduce several models that have been dominating the literature over the past 30 years. The simplest specification:

$$Y_i = \mu_i + v_{it} \tag{1}$$

$$\mu_i \sim iid\left(0, \sigma_\mu^2\right), \qquad v_{it} \sim iid(0, \sigma_v^2), \qquad t = 1, \dots, T_i, \;\; i = 1, \dots, N$$

decomposes earnings into a permanent time-invariant individual specific component, μ_i, (e.g. ability) and a transitory component, v_{it}, which are independent distributed both over individuals and time. This model imposes rigid restrictions on the covariance structure of earnings:

$$Cov(Y_{it}, Y_{is}) = \begin{cases} \sigma_\mu^2 + \sigma_v^2, & t = s \\ \sigma_\mu^2, & t \neq s \end{cases}$$

σ_μ^2 is the persistent dispersion of earnings or permanent earnings inequality. The transitory shocks are captured by the transitory variance σ_v^2. The variance of earnings at a certain point in time as a measure of earnings dispersion: $\sigma_y^2 = \sigma_\mu^2 + \sigma_v^2$.

The empirical evidence rejected the rigid restrictions imposed by model (1). First, the covariance structure of earnings was allowed to vary over time, by considering time specific loading factors ($\lambda_{kt}, k = 1, 2$) on both components (Katz, 1994, Moffitt and Gottschalk, 1995, Haider, 2001):

$$Y_{it} = \lambda_{1t}\mu_{it} + \lambda_{2t}v_{it}, \quad Var(Y_{it}) = \lambda_{1t}^2\sigma_\mu^2 + \lambda_{2t}^2\sigma_v^2 \qquad (2)$$

λ_{1t} is interpreted as time-varying return to skills or skill price. A rise in λ_{1t} increases the permanent or long-run inequality[ii], suggesting that the relative labour market advantage of high-skilled workers is enhanced. An increase in λ_{2t} increases transitory inequality, indicating an increase in earnings instability. λ_{1t} maintains the rank of the individuals in the earnings distribution, but causes a persistent increase in the spread of the distribution and an increase in λ_{2t} changes the rank of the individual in the short-run (Katz and Autor, 1999).

The second extension was to account for cohort effects. Increased inequality may arise from greater dispersion of unobserved labour quality within younger cohorts, resulting from unequal school quality. Some studies rejected the hypothesis that the return to education is the same across cohorts. These differences could be attributed either to the cohort effects or to the larger impact of the labour market shocks on younger than on older cohorts of workers (Katz and Autor, 1999). In the same line of thought, Freeman (1975) put forward the "active labour market" hypothesis, which postulates that changes in labour market conditions, such as changes in the supply and demand for skills, affect mainly new entrants in the labour market. The cohort effects were incorporated by cohort specific loading factors ($\gamma_{jc}, j = 1, 2$) on both components:

$$Y_{it} = \gamma_{1c}\lambda_{1t}\mu_{it} + \gamma_{2c}\lambda_{2t}v_{it} \qquad (3)$$

Third, regarding the permanent component, some studies brought evidence in favour of the "random growth rate model" ("profile heterogeneity model"): (Hause, 1977; Lillard and Weiss, 1979; McCurdy, 1982; Moffitt and Gottschalk, 1995; Baker, 1997; Cappellari, 2003)

$$\mu_{it} = \mu_i + \varphi_i age_{it}, \qquad (4)$$
$$\mu_i \sim iid(0, \sigma_\mu^2), \quad \varphi_i \sim iid(0, \sigma_\varphi^2), \quad E(\mu_i, \varphi_i) = \sigma_{\mu\varphi}$$

Each individual has a unique age-earning profile with an individual specific intercept (initial earnings μ_i) and slope (earnings growth φ_i).[iii] The variances σ_μ^2 and σ_φ^2 capture individual heterogeneity with respect to time-invariant characteristics and age-earnings profiles. The covariance between μ_i and φ_i, $\sigma_{\mu\varphi}$, represents a key element in the development of earnings differentials over the active life. A positive $\sigma_{\mu\varphi}$ implies a rising inequality in the permanent component over the lifecycle. This is consistent with the school-matching models where the more tenure one individual accumulates, the more is revealed about his ability. Thus highly educated people are expected to experience a faster growth in their earnings as the quality of the match is revealed to their employers. A negative $\sigma_{\mu\varphi}$ implies that the two sources of heterogeneity offset each other, which is consistent with the on-the-job training hypothesis (Mincer, 1974; Hause, 1980). A negative covariance is expected to generate mobility within the distribution of the permanent earnings (Cappellari, 2003).

An alternative/additional specification for the permanent component is the "random walk model" ("unit root model"), used to accommodate earnings shocks with permanent effects: the current value depends on the previous one and an innovation term π_{ia}, which accommodates any permanent re-ranking of individuals in the earnings distribution (McCurdy, 1982; Abowd and Card, 1989; Moffitt and Gottschalk, 1995; Dickens, 2000; Baker and Solon, 2003).[iv]

$$\mu_{ic} = \mu_{i,a-1} + \pi_{ia}, \quad \pi_{ia} \sim iid(0, \sigma_\pi^2), \quad E(\mu_{i,a-1}, \pi_{ia}) = 0 \qquad (5)$$

Thirdly, the transitory component of earnings can be serially correlated, thus v_{it} is assumed to follow an ARMA(p,q) process (McCurdy, 1982):

$$\sum_{j=0}^{p} \rho_j v_{i,t-j} = \sum_{j=0}^{q} \theta_j, \varepsilon_{i,t-j,} \quad \varepsilon_{ij} \sim iid(0, \sigma_\varepsilon^2), \quad v_{i0} \sim (0, \sigma_{0,c}^2), \qquad (6)$$

ε_{it} is assumed to be white noise, the variance $\sigma_{0,c}^2$ measures the volatility of shocks in the first period and σ_ε^2 the volatility of shocks in subsequent years. ρ_j ($\rho_0 = 1$) is the autoregressive parameter measuring shocks' persistence, and θ_j ($\theta_0 = 1$) the moving average parameter, accommodating sharp drops of the lag-j autocovariance compared with the other autocovariances.

1.3. Overview of previous empirical findings

The existing literature on earnings dynamics is predominantly based on US data (see Atkinson, Bourguignon et al. (1992) for a survey). Earlier work focused on fitting statistical models to the earnings process: e.g. Lillard and Willis (1978), Lillard and Weiss (1979), McCurdy (1982). Abowd and Card (1989) fitted models to the autocovariance structure of earnings, however without accounting for changes in the autocovariance structure over time.

Later work, Moffitt and Gottschalk (1995, 1998, 2002) estimated the permanent and transitory components and their evolution over time. Moffitt and Gottschalk (1998), modelling the permanent component as a random walk in age, a serially correlated transitory component, with year weights, found that the increase in the cross-sectional inequality in the U.S. between 1969 and 1991 has been roughly equally composed of increases in the variances of the permanent and transitory earnings, with little change in mobility. Since most of the theoretical explanations for the increase in inequality have been aimed at explaining increases in the variance of the permanent component of earnings (e.g. increases in the price of skills), they found their result surprising and unexpected. Moffitt and Gottschalk (2008), estimating the trend in the transitory variance from 1970 to 2004, found that the transitory variance increased substantially in the 1980's and remained at the same level until 2004, for both less and more educated workers. Moreover, the transitory variance had a strong cyclical component, accounting for 30%-65% of the rise in the overall inequality.

Baker (1997), comparing two competing specifications for the permanent component of earnings - the "profile heterogeneity or the random growth model" and the "random walk model" - showed that despite the increased popularity of the latter, the profile heterogeneity model better represents the data. Baker and Solon (2003), using Canadian data, combined both specifications and found that the growth in earnings inequality reflects both an increase in the long-run inequality and an increase in earnings instability.

The European literature on the dynamic nature of earnings is relatively limited. In UK, Dickens (2000) examined the pattern of individual male wages over time by year-birth cohorts using the data for the period 1975-1995. Using a similar model to Moffitt and Gottschalk (1998), he explained about half of the rise in cross-sectional inequality by the rise in permanent variance.

Ramos (2003) explored the dynamic structure of gross monthly earnings of male full-time employees in the UK for 1991-1999 using a specification similar to Baker and Solon (2003). It concluded that the increase in inequality was due to increased earnings volatility. The relative earnings persistence was found to decline over the lifecycle, implying a lower mobility for younger cohorts. These findings are at odds with previous literature on earnings dynamics both for the UK and the OECD. Unlike previous literature, this study considered also the effect of observed characteristics, finding that human capital and job related characteristics account for nearly all persistent earnings differences.

Kalwij and Alessie (2003) examined the variance-covariance structure of log-wages of British men between 1975 and 2001, using a specification similar with Abowd and Card (1989), Dickens (2000) and Baker and Solon (2003), considering also cohort effects. They showed that the increase in cross-sectional inequality was caused mainly by the increase in transitory differentials and to a lesser extent by permanent differentials, and thus was accompanied by an increase in earnings mobility.

Cappellari (2003) decomposed the autocovariance structure of male earnings in Italy for 1979-1995 using a specification similar with Moffitt and Gottschalk (1995) and Backer (1997). Long-term differentials were found to be the driving factor behind increased inequality. Other evidence on the contribution of the two components has become available in Sweden (Gustavsson, 2004).

Daly and Valletta (2008) compared the evolution of the permanent and transitory yearly earnings inequality for men in Germany, the UK and the US, finding that both components contributed significantly to the overall trend. Doris et al. (2008) decomposed inequality in Ireland without considering the cohort effect. They found decreasing transitory and permanent differentials over the period 1994-2001.

These studies lack the comparative perspective. Our study responds to this limitation, and explores earnings dynamics and the contribution of earnings dynamics to the change in the earnings inequality in a comparative setting at the EU level to bring new insights into the earnings dynamics outcomes of different systems.

2. Data

In order to look at the impact of earnings dynamics on inequality in a comparative setting, we require a consistent comparative panel data. For this we use the European Community Household Panel (ECHP)[v] over the period 1994-2001 for 14 EU countries. Except for Luxembourg and Austria, observed between 1995 and 2001 and, Finland, observed between 1996 and 2001, the other countries are present in all eight waves. Following the tradition of previous studies, the analysis focuses only on men to avoid the selection bias associated with women's earnings.

A special problem with panel data is that of attrition over time, as individuals are lost at successive dates causing the panel to decline in size and raising the problem of representativeness. Several papers examined the extent and the determinants of panel attrition in ECHP and found that they vary between countries and across waves within one country, but these differences do not bias the analysis of income or the ranking of the national results (Behr et al., 2003). Ayala et al. (2006) assessed the effects of panel attrition on income mobility comparisons for some EU countries and found that ECHP attrition is characterized by a certain degree of selectivity, but only affecting some variables and some countries. Moreover, income mobility indicators show certain sensitivity to the weighting system.

We apply the weighting system recommended by Eurostat, namely the "base weights" of the last wave observed for each individual, bounded between 0.25 and 10. The dataset is scaled up to a multiplicative constant[vi] of the base weights of the last year observed for each individual.

Separate identification of age and time effects requires earnings observed at different phases of the life cycle in each year, which is achieved by exploiting the variation in age across birth cohorts. Individuals are tracked in cohorts over time, however limited to four birth cohorts due to the limited number of observations.

Earnings are expressed in real log net[vii] hourly wage[viii] adjusted for CPI of male workers aged 20 to 57, born between 1940 and 1981. Only observations with hourly wage lower than 50 Euros and higher than 1 Euro were considered in the analysis. The resulting sample for each country is an unbalanced panel. The choice of using unbalanced panels for estimating the covariance structure of earnings is motivated by the need to mitigate the potential overestimation of earnings persistence that would arise from balanced panels where the estimation is based only on people that have positive earnings for the entire sample period. Details on mean hourly earnings, variance of ln hourly earnings, inflows and outflows of the sample over time for each country are provided in Table 1. Mean hourly earnings appear to increase in all countries except for Austria where it records a slight decrease. The highest attrition rates from one year to the next are observed in Ireland, Italy, Greece, Spain and Portugal. For more descriptive statistics refer to Sologon and O'Donoghue (2009a) and Sologon (2010).

[Table 1 here]

3. The dynamic autocovariance structure of hourly earnings

To begin with, it is informative to have a description of the dynamic structure of individual ln hourly earnings for all 14 countries. The model used to fit the autocovariance structure of earnings must be consistent with the trends observed in the dynamic autocovariance structure.

Figure 1 displays the overall autocovariance structure of earnings. Overall inequality, measured by the variance of log hourly earnings, decreases over the sample period in most countries (Germany, Denmark, Belgium, France, UK, Ireland, Spain and Austria), and increases in six (Netherlands, Luxembourg, Greece, Italy, Portugal and Finland), with Portugal having the highest inequality in 2001 and Denmark the lowest.

[Figure 1 here]

The overall autocovariance structure of earnings displays both similar and diverging patterns across countries. Common to all countries, the autocovariance of all lags observe, in general, a similar pattern as the variance. They are positive and quite large in magnitude relative to the variances, with the distance between autocovariances at consecutive lags falling at a decreasing rate. The biggest fall is registered by

the lag-1 autocovariance, after which the covariances appear to converge gradually at a positive level. Variances reflect both the permanent and the transitory components of earnings, whereas higher order covariances reflect the permanent component of earnings. Therefore, the evolution of the covariances, at all orders, suggests the presence of a permanent individual component of wages and a transitory component which is serially correlated. Moreover, the sharp decline of the first lag autocovariance is consistent with the presence of a moving average process of first order. Both mean earnings (Table 1) and all lags autocovariances (Figure 1) vary over time, which signals the presence of nonstationarity in the dynamic structure of earnings.

Although not reported here for reasons of brevity, Sologon and O'Donoghue (2009a) and Sologon (2010) find that the autocovariances display different patterns across cohorts in all countries, supporting the hypothesis of cohort heterogeneity with respect to individual earnings dynamics. In most countries, the variance of earnings for all cohorts follows the evolution of the overall variance, however mixed trends across cohorts are observed in a number of countries. The evolution of the variance is not monotonic and the rate of change differs among cohorts. In general, when a change in the variance is recorded, the older the cohort, the steeper the change. Moreover, the younger the cohort is, the lower are the autocovariances. Hence, given that higher order autocovariances capture the permanent component of earnings, it is reasonable to expect that in all countries, for younger cohorts, the transitory variance plays a larger role in the earnings formation than the permanent component compared with older cohorts. For all cohorts, all lags autocovariances show in general a similar pattern as the variance, in line with the overall pattern.

To look at lifecycle effects, it is necessary to remove the time effect that is present in these within cohort autocovariances. The smoothed lifecycle profiles illustrate that, on average, all lags autocovariances increase with age at a decreasing rate, which is consistent with the presence of a permanent component of earnings that rises with age at a diminishing rate, in line with the trends observed by Dickens (2000).

4. Econometric specification and Estimation method of covariance structures

In order to estimate parameters which describe the dynamics of earnings, we fit a parsimonious model to the autocovariance structure of earnings for each country. In order to differentiate lifecycle effects from secular changes in earnings inequality, earnings differentials are explored by cohort. The empirical specification of earnings follows the structure:

$$Y_{ict} = \overline{Y_{ct}} + r_{ict}, \quad t = 1,...,T_i, \; i = 1,...,N_c \qquad (7),$$

where Y_{ict} is the natural logarithm of real hourly earnings of the *i*-th individual, from the ***c***-th cohort in the *t*-th year, $\overline{Y_{ct}}$ is the year-cohort specific mean and r_{ict} is the individual-specific deviation from the year-cohort specific mean.[ix] r_{ict} are assumed to be independently distributed across individuals, but autocorrelated over time. This study approaches the problem of choosing a longitudinal process for the demeaned earnings, r_{ict}, in a similar manner with time series, following McCurdy (1981, 1982).

The graphical inspection of the autocovariance structure of earnings in section 3, suggests the following features of the data:

(i) the elements of the autocovariance structure decrease with the lag at a decreasing rate

(ii) they converge gradually at a positive level;

(iii) the lag-1 autocovariance drops to a larger extent compared with higher order autocovariances, which decline more gradually;

(iv) the autocovariances and mean earnings vary over the sample period, so they cannot be assumed to be stationary over sample period;

(v) the autocovariances vary with age controlling for the period effect, hence they cannot be assumed to be stationary over the life cycle;

(vi) the variance-covariance structure appears to be cohort specific.

Our model incorporates these features. Feature (i) suggests the presence of an AR(1) process, but feature (iii) calls for a more complex ARMA (1, 1) process. Feature (ii) is captured by the presence of the permanent component. Feature (iv) is accommodated by incorporating period specific parameters, allowing the two components of earnings to vary over time. Feature (v) is captured by modelling the permanent individual component as a random walk and/or random growth in age. Cohort heterogeneity (vi) is incorporated by parameters that allow the permanent and transitory components to vary between cohorts and by allowing for heterogenous initial variances.

To avoid choosing a model specification that is inconsistent with the data, we start with a broad class of models for r_{ict} and employ preliminary data analysis procedures to choose among competing specifications. The following general specification encompasses the relevant aspects of earnings dynamics considered above.

$$Y_{ict} - \overline{Y_{ct}} = r_{ict} = \gamma_{1c}\lambda_{1t}[\mu_i + \varphi_i age_{it} + u_{iat}] + \gamma_{2c}\lambda_{2t}v_{it} \tag{8}$$

$$\mu_i \sim iid(0, \sigma_\mu^2), \qquad \varphi_i \sim iid(0, \sigma_\varphi^2), \qquad E(\mu_i, \varphi_i) = \sigma_{\mu\varphi}$$

$$u_{iat} = u_{i,a-1,t-1} + \pi_{ia}, \quad \pi_{ia} \sim iid(0, \sigma_\pi^2), \quad E(u_{i,a-1,t-1}, \pi_{ia}) = 0 \tag{9}$$

$$v_{it} = \rho v_{i,t-1} + \varepsilon_{it} + \theta\varepsilon_{i,t-1}, \varepsilon_{it} \sim iid(0, \sigma_\varepsilon^2), \quad v_{i0} \sim (0, \sigma_{0,c}^2) \tag{10}$$

Based on equation (8), earnings are decomposed into a permanent component $\gamma_{1c}\lambda_{1t}[\mu_i + \varphi_i age_{it} + u_{iat}]$ and a transitory component $\gamma_{2c}\lambda_{2t}v_{it}$. The component $\mu_i + \varphi_i age_{it}$ models the

individual age-profile heterogeneity. The parameterization of the permanent component includes a random growth ($\mu_i + \varphi_i age_{it}$) and a random walk in age (9). The variance of the first period shock (assumed to be at age 20[x]) is estimated together with the σ_μ^2 and is considered part of the unobserved heterogeneity. The transitory component follows an ARMA(1,1) process (equation (10))[xi].

The non-stationary pattern of earnings is captured by time specific loading factors on both components, $\lambda_{kt,\ k=1,2;\ t=0,7}$, normalized to 1 in the first wave for identification[xii]. Cohort heterogeneity is accommodated by cohort specific loading factors on both components, $\gamma_{jc},\ j=1,2$ normalized to 1 for the oldest cohort for identification.

When working with ARMA(p,q) processes in the context of panel data, McCurdy (1981, 1982), and Anderson and Hsiao (1982) underlined the need for a treatment of initial conditions[xiii]. The autoregressive process induces a recursive structure in the moments: the variance-covariance in year *t* depends on the transitory variance-covariance in year *t-1*. Tracking the recursion back to the first sample year for each cohort raises the question of what the initial transitory variance should be for each cohort. Earlier literature restricted the initial transitory variance to be equal across cohorts. In line with the recent literature, our model acknowledges earnings volatility varies across cohorts and therefore such a strong assumption is untenable. Following McCurdy (1981, 1982), the cohort initial transitory variances are treated as 4 additional parameters to be estimated.

Earnings differentials within each cohort is characterised by modelling the covariance structure of earnings: $VarCov(Y_{ict}) = E(r_{ict}, r_{ict-s}),\ s = 0,...,T_c - t_{0c}$ [xiv]. The parameters that are estimated are: $\gamma_{1c}, \lambda_{1t}, \sigma_\mu^2, \sigma_\varphi^2, \text{cov}(\mu_i \varphi_i), \sigma_\pi^2, \gamma_{2c}, \lambda_{2t}, \rho, \theta, \sigma_\varepsilon^2, \sigma_{0,c}^2,\ c = 1,...4.$ For refreshing the meaning of each parameter, please refer to Section 1.2.

The parameters of the models are fit to the covariance structure for each cohort using equally weighted minimum distance methods of estimation. The methodology is similar with Cappellari (2003), Baker and Solon (2003), Ramos (2003), Kalwij and Alessie (2003), Dickens (2000), Baker (1997), Abowd and Card (1989), adapted to unbalanced panels. For a complete technical description of the estimation model, please refer to Sologon and O'Donoghue (2009a) and Sologon (2010).

The aggregation to obtain the overall inequality from the within-cohort inequalities for each country follows the Shorrocks sub-group inequality decomposition (Shorrocks 1984; Chakravarty 2001):

$$I = \sum_{k=1}^{4} (n_k/n) I_k + \sum_{k=1}^{4} (n_k/n)(\mu_k - \mu)^2,\ I_k = PV_k + TV_k \qquad (11)$$

where n_k, PV_k, TV_k, μ_k stand for the population size, permanent variance, transitory variance and mean of ln hourly earnings of the cohort *k*, and *n*, μ stand for the whole population. The first term accounts for the

aggregated within-cohort inequality and the second for the between-cohort inequality. The aggregated within-inequality is formed from the overall permanent inequality and the overall transitory inequality.

$$Aggregated\ Within\ I = \sum_{k=1}^{4}(n_k/n)PV_k + \sum_{k=1}^{4}(n_k/n)TV_k \qquad (12)$$

5. Results of Covariance Structure Estimation

The general specification of the error component model outlined in Section 4, encompassing all relevant aspects of earnings dynamics, is fit to the elements of the covariance matrix of each country, for all cohorts pooled together[xv]. Similar to Dickens (2000), all variances are restricted to be positive by estimating the variance equal to the exponent of the parameter. The reported variance estimates are the exponent of the parameter.

5.1. Estimation results I: Time and Cohort Shifters[PI+AR(1)]

As a starting point, we specify the models for the different countries in the same way to assure the comparability of the parameter estimates across countries. Table 2 reports the estimation results of our common model. The data for some countries cannot support a random growth or a random walk for modelling the permanent component, or a moving average process for modelling the transitory components. Consequently, the general specification that could be fit in all countries has a permanent component following the canonical model, a transitory component following an AR(1) process with heterogenous initial variances, and time and cohort shifters on both components.

[Table 2 here]

Permanent component

The highest persistent dispersion is found in Portugal, Spain, France, Germany and Ireland, and the lowest in Denmark and Finland. The time-specific loading factors for the permanent component indicate that, overall, the returns to skills increased over the sample period in all countries, except Austria, Germany, Denmark, Belgium, and Spain. The estimates of the cohort-specific shifters for the permanent earnings suggest an increase in persistent disparities over the lifecycle in all countries. These trends confirm the expectation that permanent earnings differentials play a much larger role in the formation of earnings differentials of older cohorts compared with younger ones, which experience higher earnings volatility due to temporary contracts.

Transitory component

The variance of initial conditions, which represents the accumulation of shocks up to the starting year of the panel for each cohort, is smaller than the variance of subsequent shocks in all countries, except

Luxembourg, UK (oldest three cohorts), Ireland and Finland. Overall, the variance of initial conditions increases over the lifecycle in most countries except Germany, Netherlands, Greece, Spain, and Austria. The pattern, however, is not monotonic across cohorts.

The magnitude of the autoregressive parameter varies between countries. A large autoregressive parameter, suggesting persistent shocks, is recorded in Austria, Portugal, and Greece, where between 13.4% and 4.4% of a shock is still present after 8 years. A small autoregressive parameter suggesting that shocks die out quickly is recorded in Luxembourg, Spain, Finland, France, where between 0.001% and 0.06% of a shock is still present after 8 years.

The time-specific loading factors show that, overall, the role of the transitory variance decreased over the sample period in all countries, except Luxembourg and Finland. The magnitude of the time loading factors for the transitory component is lower than for the permanent one in most countries, except Luxembourg, where the values are similar. The estimates of the cohort-specific shifters for the transitory earnings indicate that, in general, earnings volatility is higher for younger cohorts, confirming the pattern observed in the dynamic description of the autocovariance structure of earnings, where autocovariances were found to be lower for younger cohorts. This is expected, given the more frequent job changes and less stable earnings of younger workers.

5.2. Estimation results II: Time and Cohort Shifters[RG+AR(1)]

We also specified a second more complex common model, where the permanent component follows a random growth. This model, however, could be fit only in 8 countries (Germany, Denmark, Netherlands, UK, Ireland, Greece, Spain, and Finland), whereas for the rest the SE of some of the parameters for the random growth could not be estimated as the variances are estimated to be close to zero. Table 3 reports the estimation results.

[Table 3 here]

Permanent component

The highest dispersions in the time-invariant individual specific attributes determining wage differentials are observed in Germany, Spain and Netherlands. The estimated random slope variance implies that hourly earnings growth for an individual located one standard deviation above the mean in the distribution of φ is the largest in Germany, where it is with 4.89%[xvi] faster than the cohort mean, followed by Netherlands and Ireland with 1.41%, Greece, UK, Finland, Denmark (between 1.21% - 0.92%), and Spain (0.59%). All these countries have a negative covariance between the time-invariant individual specific effect and the individual-specific slope of the age-earning profile, implying a negative

association between initial and lifecycle heterogeneity. Therefore, earnings mobility is present within the distribution of permanent earnings over the sample period, in agreement with previous studies.

The introduction of the random growth specification influences most of the other parameters. The overall trend of the time shifters for the permanent component is reversed in most countries, except Denmark and Finland. Thus controlling for the lifecycle variation, the returns to skills appear to increase in Germany, Spain and Finland, and to decrease in rest. The trend reversal indicates the sensitivity of the parameters estimates to the model specification. Excluding the random growth specification results in its effect being picked up by other parameters in the model. The estimates of the cohort-specific shifters indicate an increase in permanent inequality over the life cycle in Germany, Netherlands, and Spain, a decrease in the rest, a slightly different picture compared with the previous specification. The decrease over the lifecycle may be due to younger cohorts having more heterogeneous skills or experiencing larger permanent shocks even without a larger dispersion of skills. This could be the case if the labour market has become tougher over time.

Transitory variance

The introduction of the random growth had a smaller impact on the parameters in the transitory component. The variance of initial shocks is smaller than the variance of subsequent shocks in all countries, except UK (oldest three cohorts), Ireland and Finland (the middle cohorts). Overall, the variance of initial conditions increases over the lifecycle in most countries except Germany, Netherlands Ireland, and Spain[xvii].

Moderately persistent shocks are recorded in Denmark, Greece and UK, where between 0.79% and 0.17% of a shock is still present after 8 years. Shocks that die out quickly are recorded in Spain, Finland and Ireland where between only 0.001% and 0.01% of a shock is still present after 8 years.

The time-specific loading factors show that, overall, the role of the transitory variance decreased over the sample period in all countries, except Ireland. The magnitude of the time loading factors for the transitory component is lower than for the permanent one in most countries, except Ireland, where the values are similar. The estimates of the cohort-specific shifters for the transitory earnings also indicate, in general, a higher earnings volatility for younger cohorts compared with older cohorts.

6. Inequality Decomposition into Permanent and Transitory Inequality using Country-Specific Error Components Models

We now try to understand how the changes in permanent and transitory inequality impact on inequality, by using error component models to decompose within-cohort inequality into its permanent and transitory components. Unlike the previous section where we used common models for all countries,

in this section, in order to explain as much as possible of the earnings error structure and to be more consistent with the data in each country we use the models that best fit the data in each country.

In choosing the best country-specific model we follow a general to specific strategy, by imposing additional restrictions on the general model (8)-(10). Table 4 reports the parameters of the best fitting models. The estimation of the general model which incorporates both the random growth and the random walk specifications in the permanent component had identification problems in all countries. The ARMA process was found in three countries and homogenous initial conditions in four. In all countries, the models incorporating both time and cohort shifters performed the best. The tests for alternative models are included in Sologon and O'Donoghue (2009a) and Sologon (2010).

[Table 4 here]

In Germany, Netherlands, UK, Ireland, and Finland, the permanent component follows a random growth in age and the transitory component an AR(1) process with heterogeneous initial variances. Similarly in Denmark, except the permanent component follows a random walk in age. In Italy, Greece and Spain, the permanent component follows a random growth in age, and the transitory component an ARMA(1,1) process, with heterogeneous initial variances except in Spain. For the rest, the persistent dispersion follows the canonical model, and the transitory component an AR(1) process, with heterogenous initial variances except in Portugal and Austria.[xviii]

Inequality Decomposition and the Welfare Implications

We now use these parameters to decompose within-cohort earnings inequality into permanent and transitory inequality. Given that labour market changes affect people differently at different lifecycle stages, that young people are exposed to a larger extent to temporary contracts, more frequent promotions and more earnings volatility compared with older workers where promotion and changes are less frequent, the inequality decomposition is conducted by cohorts.[xix] The within-cohort inequalities together with the between-cohorts inequality are used to obtain the aggregate overall inequality components following the Shorrocks sub-group inequality decomposition (Shorrocks 1984; Chakravarty 2001). As a last step we assess the absolute and relative contribution of the aggregated permanent and transitory inequality to the evolution of the aggregated within-cohort inequality, as main drivers behind the evolution of overall inequality.

A fairly common age effect could be identified across all countries: both in relative and absolute terms, individual earnings within-inequality contains a highly permanent component for the oldest three cohorts and a highly transitory component for the youngest cohort. This is consistent with the evidence of lifecycle earnings divergence showing that earnings volatility is higher at younger ages.[xx]

The trends in the aggregated overall inequality, within and between-cohort inequality, both in levels and relative shares of the overall inequality are displayed in Table 5.[xxi] We report only the actual overall inequality as the predicted overall inequality is almost identical with the actual inequality. Portugal and Denmark record the highest and the lowest overall inequality both in the 1st and last wave observed.[xxii]

[Table 5 here]

The other countries shift their ranks over time. Overall inequality increases significantly in Finland, Greece, Italy, Luxembourg, Netherlands and Portugal, stagnates in France, and decreases significantly in the other seven countries. Common across countries, the aggregated within-cohort inequality dominates the structure of the overall inequality, being the main driver behind the evolution of overall inequality over the sample period.[xxiii] One exception is France, where the decrease in the within inequality was counteracted by an increase of the same magnitude in the between-cohort inequality, preserving the overall inequality between 1994 and 2001.

Only in Greece and France did the share of the between-cohort differentials grow. In nine of the countries, the incidence of the between-cohort differences have reduced, signalling either narrowing education differentials or changing returns. For example, Cholezas and Tsakloglou (2008) find narrowing educational differentials for Finland (between mid 80s and late 90s), Italy (between late 80s and early 2000s), UK (early 1990s and early 2000s) and increasing educational differentials for France between early 1990s and early 2000s. For Greece, Tsakloglou and Cholezas (2005) find increasing returns to education in the 1990s.

The largest drop in the share of the between-cohort differentials is recorded in Ireland (22% to 9%). This trend is consistent with the narrowing of the gap in the age-earning profiles, mostly likely due to a large increase in the returns to skills and the skills of the young generation. Also the increase in immigration might play a role (Barret, Fitzgerald, and Nolan. 2000).

So far we have shown that the trend in overall inequality was determined mainly by the aggregated within-cohort inequality. Next we show the impact of earnings dynamics on the aggregated within-cohort inequality. Table 6 reveals the evolution of the aggregated within-cohort inequality, its permanent and transitory components, both in levels and relative shares. The exacerbation of the within-cohort inequality – the main driver of the increase in overall inequality - is the result of increasing permanent differentials in Finland, Greece, Italy and Luxembourg, and of increasing transitory differentials in Netherlands and Portugal. The increase in inequality is accompanied by an increase in the share of the permanent inequality, except in Netherlands and Portugal, where the opposite holds. The decrease in the aggregated within-cohort inequality reflects a decrease in both components in Austria and UK, a decrease in permanent inequality in Belgium, Germany, Denmark and Spain, and a decrease in transitory inequality in France and Ireland[xxiv]. Austria, France, UK and Ireland experience an increase in the share of

permanent inequality, whereas the other four countries experience the opposite. The relative structure of the within-cohort inequality of each cohort follows in general the overall trends, except the oldest cohort in Belgium, the youngest threes cohorts in Germany, the second youngest cohort in Denmark and the youngest cohort in UK and Finland, which reveal the differential impact across cohorts of the labour market changes. (Table A.1)

The most dramatic within-cohort inequality structural changes over the sample period are recorded in Denmark, Netherlands and Belgium, where transitory inequality becomes dominant with a share of 62%, 57% and 55%; Finland, Greece, where the permanent component becomes dominant accounting for 63% and 61% of the overall within-inequality. For the rest, the structure is maintained, with slight alterations: in Luxembourg, Ireland, Italy, France and the UK the permanent component enhances its dominance reaching a share of 76%, 70%, 66%, 65%, and 62%; in Germany, Portugal and Spain the incidence of the permanent inequality decreases, remaining dominant with an incidence of 67%, 61% and 56%; in Austria, the share of the permanent increases to 50%. [xxv]

Welfare implications

Most important are the welfare implications of these trends. Identifying the dominant component which has driven the change in earnings inequality allows us to gauge the implications of the trends in cross-sectional inequality for lifetime earnings inequality. The growth of overall inequality reflects an increase in lifetime earnings inequality accompanied by a decrease in the year-to-year mobility, thus both a worsening earnings position of the chronically poor and a decreased opportunity for the chronically poor to improve their earnings position in a lifetime perspective in Greece, Finland, Italy and Luxembourg. In the Netherlands and Portugal, the growth in inequality reflects an increase in earnings instability: thus the chronically poor have not gotten poorer and the chronically rich have not gotten richer, but there has been an increase in the year-to-year earnings mobility. The findings for the Netherlands and Portugal may support the "offsetting mobility" argument: lifetime inequality may decrease despite the increase in the cross-sectional inequality provided that there has been a sufficiently large increase in mobility.

The decrease in overall inequality reflects a decrease in lifetime earnings inequality, accompanied by an increase in year-to-year-mobility in Denmark, Belgium, Germany and Spain, signalling both a bettering earnings position of the chronically poor and an increased opportunity for the chronically poor to improve their earnings position in a lifetime perspective. In France and Ireland, the stagnation / decrease in overall inequality reflects a decrease in earnings instability and a stagnation in lifetime inequality, accompanied by a decrease in the year-to year mobility: thus the relative earnings position of the chronically poor has not changed, but they recorded a decrease in their opportunity to improve their

earnings position long-term. In Austria and UK, both lifetime inequality and earnings instability decreased, and were accompanied by a decrease in the year-to-year mobility, signalling a bettering earnings position of the chronically poor, but a decrease in their opportunity to improve their earnings position in a lifetime perspective.

Potential Contextual Explanations

What has caused the differential trends in long-run inequality and instability across the 14 EU countries is an important subject for continuing research. In the 1980s - early 1990s, in the U.S. the increase in persistent in inequality has been attributed to increasing returns to education due to the skill-biased technological change which increased the relative demand for high-skill labour (Katz and Autor, 2000, Acemoglu 2002). In Canada, which experienced an increase in persistent inequality despite little change in the return to education, the explanation was attributed to a dramatic increase in the supply of college-educated labour which offset the wage impact of the increased relative demand for educated labour (Baker and Solon, 2003). The triggers of earnings instability are still puzzling. Some argue that the weakening of the labour market institutions, increased labour market instability, increased competitiveness, a rise in the temporary workforce which increases earnings exposure to shocks, a period of skill-biased technological change, globalization, and immigration can increase earnings instability (Moffitt and Gottschalk, 2002; Katz and Autor, 1999; Rodrik, 1997).

The 14EU countries under study belong to the same economic area and face similar economic challenges. However, they have different institutional arrangements, thus they respond differently to these challenges. In the context of the European economic reality of the early 1990sw, when the single market was implemented (1992) and the single currency was being prepared (Maastricht criteria adopted in 1993) (Palier, B. 2010), Europe witnessed important labour market policy and institutional changes aimed to increase labour market flexibility. These reforms, which have been shifting Europe from labour shedding to employment-friendly reforms, are expected to be part of the story behind the re-shaping of the structure of earnings inequality across Europe.

The dominant increase in persistent inequalities, both in levels and shares of the overall inequality, observed in Greece, Finland, Italy and Luxembourg may signal an increase in skills differentials. Given the high country heterogeneity in their institutional characteristics and the organizational basis of trade unions, this outcome may be the result of country-specific factors. For example, in Luxembourg, these trends cannot be due to the labour market institutions, as they remained roughly unchanged. The dominant increase in persistent differentials most likely is the result of the dramatic labour market structural changes: starting with the late 1970s and intensifying after early 1990s, Luxembourg evolved from an industrial economy to one dominated by the tertiary sector which relies heavily on the cross-

border work force. This transition increased the skill differentials and the returns to skills on the Luxembourgish labour market, enhancing persistent differentials (see also Sologon 2010, Chapter 7).

In Greece, the weakening of labour in the face of the changing economic circumstances of the 1990s – technological change, the opening up of the Greek economy to foreign competition which led to the closure of numerous of industrial enterprises, the extensive privatization and the reduced capacity of the state to intervene, rising unemployment – coupled with declining union density led to the erosion of union strength at the enterprise level (Zambarloukou, S. 2006). These trends are consistent with the dominant increase in persistent earnings differentials. Moreover, Tsakloglou and Cholezas (2005) find that education appears to be a crucial factor shaping the overall distribution of income in Greece. Thus the weakening of the labour market institution in the face of the economic changes has the expected effect of increasing returns to skills, thus persistent differentials. The Italian and Greek cases share many similarities, which may explain the similar outcome.

We find a surprising difference in the evolution of two inequality components between the Scandinavian countries – Finland and Denmark – despite their similarities in the labour market institutional setting. Finland records a dominant increase in persistent differentials. A potential explanation may be the "welfare migration" in the context of the free migration regime characterizing the EU-15. The generosity of the welfare state was found to adversely affect the skill composition of migration: while low-skilled individual are attracted to a generous welfare state, high-skilled individuals are deterred by it as they are net contributors to the tax-benefit schemes (Cohen, A. and Razin, A. 2009). Denmark, on the other hand, records a dominant decrease in persistent differentials despite being exposed to a similar "welfare migration". The difference in outcomes may be due to the "Flexicurity" approach, which is more developed in Denmark.[xxvi] Thus Denmark, may have dealt with the skill structure of migration in a more efficient way by integrating the immigrants into the labour market through developed active labour market policies, boosting their human capital and reducing persistent differentials.

Besides Denmark, other countries which have gone down the "Flexicurity" route – which represents a mix of flexibility (a high degree of job mobility thanks to low employment protection legislation), social security (a generous system of unemployment benefits) and active labour market programmes (OECD, 2004) - are Belgium and Netherlands. These countries recorded a decrease in persistent differentials, both in levels and shares of the within-cohort inequality. This mix, however, may have resulted in increased earnings volatility, especially for younger workers, which is captured by the increase in transitory inequality.

In Netherlands, unlike Denmark and Belgium, the increase in transitory inequality dominated. The difference between these countries may steam from the difference in the "Flexicurity" approach: the Dutch model is based on part-time job flexibility and relatively good social security. The Danish model

combines hiring and firing flexibility with relatively generous social security between jobs, a high individual social protection, developed active labour market policies (ALMPs) and flexible labour markets. Moreover, based on the OECD data, Netherlands developed their ALMPs to a larger extent compared with Denmark and Belgium, reaching in 2001 a level twice the Danish one and 4 times the Belgian one. Additionally, the unions are much stronger in Belgium and Denmark, which may have increased the earnings stability of the reintegrated workers, thus the more moderate increase in earnings instability compared with the Netherlands.

In Spain and Portugal, the decrease in persistent inequality accompanied by an increase in the transitory inequality could be related to problems with the youth labour market characterized by short-term contracts and high unemployment. There is also the impact of migration, expected to increase earnings instability.

In Germany, in the 1990s, the dual effect of global competition and the cost of the unification increased the pressure on the existing system to change. While changes towards a greater market orientation are recorded, the main features of the system have not been altered (Palier, B. 2010, Zambarloukou, S. 2006). The resistance to change is mirrored also by the quite stagnant structure of the earnings inequality. The decrease in persistent differentials accompanied by the increase in earnings instability may be due in part to early retirement observed during this period, which is still one of the most popular instruments in social, labour market, collective bargaining, and human resources policies (Tros, 2004). The changing structure of the labour market due to early retirement is reflected in our sample: the employment share of the individuals born in the oldest cohort drops by 50% over the sample period. Permanent variance increases slightly for the oldest cohort, however, due to its decreasing share in the working population, its contribution to the overall permanent variance drops dramatically, thus causing the drop in the overall permanent variance. Moreover, older workers (especially white collars) enjoy high seniority wages and their early retirement may amplify these trends. Early retirement may increase earnings instability by increasing the share of young workers, which face higher earnings volatility.

In France, in the early 1990s, in the face of the new economic challenges, governments started developing active labour market policies and "make work pay" strategies to reduce the unemployment trap for socially excluded people (Palier, B. 2010). However, these changes had a reduced impact on the inequality structure[xxvii]. The same holds for Austria.

The trends in deregulation and decentralization of industrial relations and cutbacks in social spending have left no EU country unaffected. However, changes have gone the furthest in the liberal market economies, e.g. the UK[xxviii] (Zambarloukou, S. 2006). In the context of these institutional changes, coupled with the economic booming over the period, the labour markets grew substantially particularly in

the middle of the distribution over the period, resulting in a slight decrease in persistent inequality and a dominant decrease in earnings volatility. Similarly, in Ireland, during the Celtic Tiger, labour markets grew substantially particularly in the middle of the distribution over the period. The booming economy reduced earnings instability substantially, whereas persistent differentials remained unchanged probably due to the highly centralized nature of the wage bargaining.

Among the 14 EU countries under study, earnings mobility increased only in Denmark, Belgium, Spain, Netherlands and Portugal. Different triggering factors are expected to be at work. In Denmark, Belgium and the Netherlands, the "Flexicurity" route may potentially explain the increase in earnings mobility. In Germany, the increase in mobility may be the outcome of early retirement, which increases the relative share of the young generations in the labour market which face higher earnings instability. Thus, not a real increase in mobility. In Spain and Portugal, the increase mobility may be linked with the increased incidence of short-term contracts as measures to tackle the high unemployment of the youth labour market.

7. Concluding Remarks

The economic reality of the 1990s in Europe, when the single market was implemented (1992) and the single currency was being prepared (Maastricht criteria adopted in 1993), increased the pressure on the European labour markets to change. Thus since the early 1990s, Europe has been moving towards more flexible labour markets, from labour shedding to employment-friendly reforms, which influenced the distribution of earnings across Europe.

Our study belongs to the strand of literature which explores earnings dynamics in order to understand the driving factors behind the evolution of cross-sectional earnings inequality across Europe. Relying on a consistent cross-national comparative data set – ECHP -, we explore the extent to which changes in cross-sectional earnings inequality in 14 EU countries over the period 1994 and 2001 reflect lifetime earnings becoming more unequal or the receipt of earnings becoming more unstable. Foremost, our study responds to the stringent need of exploring earnings dynamics and the contribution of earnings dynamics to the change in the earnings inequality in a comparative setting at the EU level. The common feature that emerges across all 14 EU countries is that the main factor behind the change in earnings inequality is the change in the "within-cohort" inequality. Thus the main drivers of the within-cohort inequalities are the main drivers of the overall inequality.

The pace of the labour market reforms was different across the EU and led to a continuous departure from the traditional welfare regimes (Palier, B. 2010, Dew-Becker and Gordon, 2008; OECD, 2004). Thus our trial of classifying our findings by any type of welfare regime has proved to be a futile task. Country heterogeneity has increased greatly and it is reflected also in the earnings dynamics outcomes.

The growth in overall inequality reflects an increase in lifetime earnings inequality accompanied by a decrease in the year-to-year mobility, thus both a worsening earnings position of the chronically poor and a decreased opportunity for the chronically poor to improve their earnings position in a lifetime perspective in Greece, Finland, Italy and Luxembourg. In the Netherlands and Portugal, the growth in inequality reflects an increase in earnings instability: thus the chronically poor have not gotten poorer and the chronically rich have not gotten richer, but there has been an increase in the year-to-year earnings mobility. The findings for the Netherlands and Portugal may support the "offsetting mobility" argument: lifetime inequality may decrease despite the increase in the cross-sectional inequality provided that there has been a sufficiently large increase in mobility.

The decrease in overall inequality reflects a decrease in lifetime earnings inequality, accompanied by an increase in year-to-year-mobility in Denmark, Belgium, Germany and Spain, signalling both a bettering earnings position of the chronically poor and an increased opportunity for the chronically poor to improve their earnings position in a lifetime perspective. In France and Ireland, the stagnation / decrease in overall inequality reflects a decrease in earnings instability and a stagnation in lifetime inequality, accompanied by a decrease in the year-to year mobility: thus the relative earnings position of the chronically poor has not changed, but they recorded a decrease in their opportunity to improve their earnings position long-term. In Austria and UK, both lifetime inequality and earnings instability decreased, and were accompanied by a decrease in the year-to-year mobility, signalling a bettering earnings position of the chronically poor, but a decrease in their opportunity to improve their earnings position in a lifetime perspective.

Country heterogeneity with respect to the institutional setting signals that mobility trends may have different underlying factors, depending on the national context. In Denmark, Belgium and the Netherlands, the "Flexicurity" route may be one of the explanations behind the increased earnings mobility. In Germany, the increase in mobility may result from early retirement, which increases the relative share of the young generations in the labour market, which face higher earnings instability. In Spain and Portugal, the increase in mobility may be linked with the increase in the incidence of short-term contracts as measures to tackle the high unemployment of the youth labour market.

Following these changes, in 2001, earnings persistency is the highest in Portugal, around 6 times the lowest persistent dispersion - Denmark. Earnings instability is the highest in Portugal, more than twice the lowest earnings instability - Italy, Finland, and Denmark. Earnings mobility (captured by the share of the transitory inequality) is the highest in Denmark with a level close to three times the lowest mobility – Luxembourg. The outstanding performance of the labour market in Denmark may be due to its approach to "Flexicurity"– a mix of flexibility (a high degree of job mobility thanks to the low employment protection legislation), social security (a generous system of unemployment benefits) and developed

active labour market programmes (OECD, 2004). This mix appears to trigger a small lifetime inequality and a low earnings instability, assuring at the same time a high opportunity for low wage individuals to improve their position in the distribution of lifetime earnings.

What has caused the differentials trends in long-run inequality and instability across the 14 EU countries is an important subject for continuing research. Moreover, the situation will certainly change with the impact of the current global economic crisis on the European labour markets. Thus future research should explore the role of labour market policy and institutional factors and their interactions with the macroeconomic shocks in shaping the pattern of permanent and transitory inequality, a topic much neglected by the existing literature.

Table 1. Summary Statistics

		1994	1995	1996	1997	1998	1999	2000	2001
Germany	Mean	9.43	9.49	9.61	9.52	9.57	9.48	9.60	9.72
	Var(Ln Earnings)	0.176	0.183	0.174	0.169	0.165	0.182	0.177	0.170
	($\%_{t-1}$ |$Wage_t$ >0)		66.99	67.37	66.2	63.01	64.84	64.86	64.39
Denmark	Mean	10.89	11.40	11.58	11.61	11.86	11.85	12.02	12.08
	Var(Ln Earnings)	0.091	0.077	0.084	0.080	0.070	0.080	0.079	0.069
	($\%_{t-1}$ |$Wage_t$ >0)		68.74	66.59	69.43	66.23	67.41	69.6	71.6
Netherlands	Mean	9.69	9.56	9.59	9.70	10.02	9.88	10.04	9.91
	Var(Ln Earnings)	0.119	0.126	0.140	0.125	0.114	0.106	0.114	0.152
	($\%_{t-1}$ |$Wage_t$ >0)		69.07	71.37	68.68	67.52	67.24	68.56	69.59
Belgium	Mean	8.48	8.82	8.71	8.75	8.81	8.83	8.92	9.10
	Var(Ln Earnings)	0.121	0.097	0.101	0.105	0.096	0.101	0.092	0.103
	($\%_{t-1}$ |$Wage_t$ >0)		63.43	63.65	64.38	63.88	64.28	65.15	64.38
Luxembourg	Mean		16.18	15.81	16.73	17.39	17.15	17.22	17.10
	Var(Ln Earnings)		0.214	0.230	0.225	0.213	0.240	0.249	0.233
	($\%_{t-1}$ |$Wage_t$ >0)			64.75	69.48	69.33	69.81	68.71	70.39
France[xxix]	Mean	10.23	9.92	9.87	10.05	10.33	10.60	10.55	10.87
	Var(Ln Earnings)	0.233	0.223	0.216	0.230	0.241	0.242	0.236	0.231
	($\%_{t-1}$ |$Wage_t$ >0)		62.47	64.76	62	52.08	54.24	55.54	60.8
UK	Mean	8.16	8.11	8.22	8.34	8.68	9.01	9.21	9.68
	Var(Ln Earnings)	0.189	0.188	0.177	0.174	0.174	0.167	0.172	0.171
	($\%_{t-1}$ |$Wage_t$ >0)		64.59	66.31	67.06	67.04	67.36	68.33	68.58
Ireland	Mean	9.30	9.54	9.76	10.02	10.43	10.84	11.69	12.44
	Var(Ln Earnings)	0.249	0.237	0.226	0.213	0.206	0.179	0.167	0.164
	($\%_{t-1}$ |$Wage_t$ >0)		49.99	50.04	52.41	53.13	54.1	51.63	54.65
Italy	Mean	7.16	6.91	6.96	7.05	7.29	7.37	7.28	7.32
	Var(Ln Earnings)	0.118	0.109	0.117	0.114	0.125	0.122	0.122	0.123
	($\%_{t-1}$ |$Wage_t$ >0)		51.58	51.19	47.18	47.34	46.87	48.73	48.86
Greece	Mean	4.95	5.03	5.23	5.59	5.63	5.85	5.70	5.77
	Var(Ln Earnings)	0.179	0.184	0.176	0.197	0.199	0.221	0.215	0.205
	($\%_{t-1}$ |$Wage_t$ >0)		45.83	45.69	44.98	42.09	43.52	46.06	49.72
Spain	Mean	6.83	6.95	7.09	6.89	7.18	7.37	7.45	7.42
	Var(Ln Earnings)	0.243	0.252	0.241	0.252	0.250	0.217	0.208	0.205
	($\%_{t-1}$ |$Wage_t$ >0)		47.6	48.29	48.49	48.63	52.13	52.12	56.06
Portugal	Mean	9.08	8.33	8.37	8.49	8.55	8.55	8.54	9.08
	Var(Ln Earnings)	0.250	0.270	0.258	0.260	0.262	0.241	0.258	0.266
	($\%_{t-1}$ |$Wage_t$ >0)		57.84	57.5	57.32	56.98	59.12	60.83	62.16
Austria	Mean		9.08	8.33	8.37	8.49	8.55	8.55	8.54
	Var(Ln Earnings)		0.137	0.117	0.111	0.096	0.097	0.095	0.101
	($\%_{t-1}$ |$Wage_t$ >0)			67.96	68.2	67.49	67.2	66.51	68.21
Finland	Mean			7.89	8.01	8.41	8.45	8.66	8.86
	Var(Ln Earnings)			0.100	0.110	0.095	0.107	0.095	0.110
	($\%_{t-1}$ |$Wage_t$ >0)				55.95	57.2	59.29	53.83	64.16

Note: Mean refers to mean positive hourly earnings expressed in Euro. Var(Ln Earnings) refers to the variance of ln hourly earnings. ($\%_{t-1}$ | $Wage_t$ >0) is the share of individuals present in the sample in year $t-1$ which record positive earnings in year t

Table 2. Common EU14 Error-Components Model for Log Real Hourly Earnings: Time and Cohort Shifters[PI+AR(1)]

	Ge	Dk	Nl	Be	Fr	Lu	UK	Ir	It	Gr	Sp	Pt	At	Fi
Permanent														
Exp() = σ^2_{μ}	0.146**	0.052**	0.073**	0.07**	0.165**	0.107**	0.104**	0.137**	0.083**	0.109**	0.185**	0.233**	0.095**	0.048**
$\lambda_{1,\ 1995}$	0.988**	1.014**	1.006**	0.942**	1.051**		1.035**	1.035**	0.989**	1.030**	1.046**	1.013**		
$\lambda_{1,\ 1996}$	0.994**	0.999**	1.033**	1.004**	1.106**	1.022**	0.988**	1.012**	1.029**	1.067**	1.032**	1.088**	0.908**	
$\lambda_{1,\ 1997}$	0.976**	0.919**	1.031**	0.922**	1.134**	1.181**	1.050**	1.095**	1.010**	1.174**	1.060**	1.078**	0.928**	1.171**
$\lambda_{1,\ 1998}$	0.957**	0.926**	1.126**	0.892**	1.130**	1.249**	1.054**	1.069**	1.125**	1.081**	1.089**	1.087**	0.856**	1.198**
$\lambda_{1,\ 1999}$	1.012**	0.831**	1.048**	0.785**	1.126**	1.320**	1.050**	1.036**	1.152**	1.156**	1.071**	1.056**	0.773**	1.197**
$\lambda_{1,\ 2000}$	1.048**	0.802**	1.046**	0.925**	1.058**	1.342**	0.986**	0.996**	1.139**	1.011**	1.018**	1.165**	0.802**	1.183**
$\lambda_{1,\ 2001}$	0.949**	0.826**	1.112**	0.921**	1.084**	1.298**	1.050**	1.006**	1.147**	1.090**	1.000**	1.152**	0.811**	1.306**
$\gamma_{1,51\text{-}60}$	0.986**	0.925**	0.882**	1.013**	0.859**	0.956**	1.017**	0.978**	0.918**	0.886**	0.986**	0.938**	0.903**	0.926**
$\gamma_{1,61\text{-}70}$	0.746**	0.775**	0.71**	0.778**	0.78**	0.94**	0.94**	0.86**	0.706**	0.606**	0.782**	0.786**	0.843**	0.841**
$\gamma_{1,71\text{-}80}$	0.36**	0.551**	0.501**	0.143**	0.5**	0.593**	0.64**	0.62**	0.542**	0.5**	0.458**	0.332**	0.427**	0.687**
Transitory														
Exp()=σ^2_{ε}	0.146	0.214**	0.068**	0.244**	0.797	0.019**	0.05**	0.043**	0.289**	0.235**	0.138**	0.106**	0.89**	0.031**
Exp()=$\sigma^2_{0,40\text{-}50}$	0.021**	0.033**	0.023**	0.064**	0.064**	0.075**	0.094**	0.091**	0.035**	0.077**	0.044**	0.087**	0.054**	0.062**
Exp()=$\sigma^2_{0,51\text{-}60}$	0.078**	0.021**	0.024**	0.036**	0.036**	0.106**	0.073**	0.059**	0.033**	0.036**	0.071**	0.079**	0.058**	0.054**
Exp()=$\sigma^2_{0,61\text{-}70}$	0.038**	0.029**	0.022**	0.039**	0.039**	0.067**	0.05**	0.061**	0.041**	0.067**	0.072**	0.033**	0.068**	0.054**
Exp()=$\sigma^2_{0,71\text{-}80}$	0.111**	0.026**	0.044**	0.035**	0.035**	0.023**	0.034**	0.072**	0.029**	0.08**	0.05**	0.032**	0.099**	0.056**
ρ	0.574**	0.539**	0.342**	0.628**	0.399**	0.239**	0.48**	0.341**	0.397**	0.677**	0.263**	0.719**	0.778**	0.275**
$\lambda_{2,\ 1995}$	0.290**	0.274**	0.685**	0.294**	0.252**		0.921**	0.915**	0.299**	0.503**	0.590**	0.730**		
$\lambda_{2,\ 1996}$	0.221**	0.264**	0.680**	0.240**	0.170**	1.977**	0.923**	0.931**	0.319**	0.385**	0.540**	0.483**	0.240**	
$\lambda_{2,\ 1997}$	0.193**	0.265**	0.664**	0.268**	0.196**	1.440**	0.816**	0.761**	0.285**	0.314**	0.560**	0.542**	0.171**	1.197**
$\lambda_{2,\ 1998}$	0.214**	0.231**	0.442**	0.278**	0.237**	1.082**	0.801**	0.857**	0.296**	0.388**	0.583**	0.580**	0.140**	0.963**
$\lambda_{2,\ 1999}$	0.232**	0.310**	0.514**	0.337**	0.228**	1.242**	0.804**	0.848**	0.264**	0.399**	0.515**	0.562**	0.172**	1.213**
$\lambda_{2,\ 2000}$	0.186**	0.302**	0.604**	0.270**	0.243**	1.364**	0.954**	0.879**	0.277**	0.453**	0.581**	0.551**	0.166**	1.040**
$\lambda_{2,\ 2001}$	0.248**	0.273**	0.754**	0.326**	0.235**	1.400**	0.890**	0.911**	0.287**	0.423**	0.608**	0.625**	0.166**	1.018**
$\gamma_{2,51\text{-}60}$	0.808**	1.17**	1.072**	1.056**	0.938**	0.857**	0.932**	1.055**	1.014**	1.033**	0.965**	0.747**	0.819**	0.875**
$\gamma_{2,61\text{-}70}$	0.862**	1.236**	1.132**	1.000**	1.047**	1.045**	1.072**	1.213**	1.076**	1.156**	0.991**	0.995**	0.854**	0.914**
$\gamma_{2,71\text{-}80}$	1.199**	1.889**	1.717**	1.357**	1.512**	1.432**	1.236**	1.228**	1.342**	0.981**	1.3**	1.18**	1.071**	1.21**
SSR	0.0171	0.0069	0.01039	0.0047	0.024	0.0222	0.0072	0.0324	0.0023	0.0186	0.0105	0.0274	0.005	0.0049
χ^2	3333.33	5825.66	2671.51	17769.4	1756.36	1632.23	2782.61	2125.02	1908.16	4631.35	1946.30	15350.7	2382.06	1044.33
LogL	446.426	511.817	482.313	540.040	421.969	318.475	508.905	400.507	591.862	440.531	481.594	412.423	402.525	290.562

Note: The SEs are available upon request from the authors. ** indicates p value of < 0.05 and * indicates a p value of < 0.1.

Table 3. Common EU14 Error-Components Models for Log Real Hourly Earnings: Time and Cohort Shifters[RG+AR(1)]

	Ge	Dk	Nl	UK	Ir	Gr	Sp	Fi
Permanent								
$Exp()=\sigma^2_{\mu}$	7.261**	0.06**	0.191**	0.047**	0.056**	0.074**	0.464	0.062**
$Exp()=\sigma^2_{\varphi}$	0.0024**	0.0001**	0.0002**	0.0001**	0.0002**	0.0001**	0.0000**	0.0001**
$Cov(\mu,\varphi)$	-0.131**	-0.002**	-0.005**	-0.002**	-0.003**	-0.003**	-0.004	-0.002**
$\lambda_{1,\ 1995}$	1.073**	0.960**	0.974**	0.992**	0.978**	1.026**	1.051**	
$\lambda_{1,\ 1996}$	1.150**	0.907**	0.975**	0.907**	0.923**	1.008**	1.047**	
$\lambda_{1,\ 1997}$	1.203**	0.795**	0.933**	0.923**	0.960**	1.056**	1.086**	1.127**
$\lambda_{1,\ 1998}$	1.272**	0.773**	0.988**	0.894**	0.914**	1.039**	1.124**	1.078**
$\lambda_{1,\ 1999}$	1.408**	0.669**	0.896**	0.857**	0.856**	1.081**	1.116**	1.017**
$\lambda_{1,\ 2000}$	1.516**	0.627**	0.875**	0.780**	0.793**	0.946**	1.071**	0.955**
$\lambda_{1,\ 2001}$	1.474**	0.630**	0.910**	0.798**	0.777**	0.944**	1.060**	1.030**
$\gamma_{1,51\text{-}60}$	0.44**	1.374**	1.275**	1.413**	1.359**	1.324**	0.888**	1.382**
$\gamma_{1,61\text{-}70}$	0.203**	1.962**	1.317**	2.046**	2.013**	1.936**	0.637**	2.44**
$\gamma_{1,71\text{-}80}$	0.086**	1.651**	0.789**	2.451**	2.981**	3.853**	0.344**	2.979**
Transitory								
$Exp()=\sigma^2_{\varepsilon}$	0.258**	0.502	0.126**	0.07**	0.029**	0.171**	0.177**	0.056**
$Exp()=\sigma^2_{0}$							0.053**	
$Exp()=\sigma^2_{0,40\text{-}50}$	0.004**	0.029**	0.023**	0.076**	0.071**	0.078**		0.055**
$Exp()=\sigma^2_{0,51\text{-}60}$	0.056**	0.023**	0.027**	0.079**	0.069**	0.062**		0.059**
$Exp()=\sigma^2_{0,61\text{-}70}$	0.042**	0.032**	0.011**	0.075**	0.094**	0.102**		0.071**
$Exp()=\sigma^2_{0,71\text{-}80}$	0.083**	0.025**	0.041**	0.031**	0.08**	0.07**		0.046**
ρ	0.358**	0.546**	0.329**	0.451**	0.291**	0.466**	0.264**	0.29**
$\lambda_{2,\ 1995}$	0.453**	0.182**	0.494**	0.821**	1.227**	0.645**	0.513**	
$\lambda_{2,\ 1996}$	0.380**	0.175**	0.484**	0.814**	1.279**	0.563**	0.468**	
$\lambda_{2,\ 1997}$	0.348**	0.178**	0.484**	0.718**	1.043**	0.492**	0.486**	0.885**
$\lambda_{2,\ 1998}$	0.351**	0.157**	0.329**	0.703**	1.092**	0.485**	0.508**	0.707**
$\lambda_{2,\ 1999}$	0.389**	0.210**	0.388**	0.714**	1.060**	0.482**	0.444**	0.930**
$\lambda_{2,\ 2000}$	0.292**	0.204**	0.454**	0.848**	1.082**	0.574**	0.500**	0.819**
$\lambda_{2,\ 2001}$	0.396**	0.184**	0.563**	0.798**	1.109**	0.533	0.524**	0.794**
$\gamma_{2,51\text{-}60}$	0.955**	1.11**	1.046**	0.895**	0.989**	0.936**	1.007**	0.861**
$\gamma_{2,61\text{-}70}$	0.964**	1.155**	1.118**	0.994**	1.099**	1.014**	1.038**	0.871**
$\gamma_{2,71\text{-}80}$	1.383**	1.837**	1.728**	1.19**	1.153**	0.941**	1.314**	1.207**
SSR	0.014	0.007	0.01	0.006	0.027	0.015	0.011	0.004
χ^2	2473.7	5872.5	2492.8	2597.3	2116.2	3945.7	2032.930	945.1
LogL	459.3	514.1	486	520.5	412.8	457.2	478.547	300.6

Note: The SEs are available upon request from the authors. ** indicates p value of < 0.05 and * indicates a p value of < 0.1.

Table 4. Country-Specific Error-Components Models – Best Fit[1,2,3]

	Dk RW+AR1	It RG+ARMA(1,1)	Greece RG+ARMA(1,1)	Spain RG+ARMA(1,1) $\sigma^2_0 = \sigma^2_{0,cohort}$	Portugal PI+AR1, $\sigma^2_0 = \sigma^2_{0,cohort}$	Austria PI+AR1, $\sigma^2_0 = \sigma^2_{0,cohort}$
Permanent						
Exp()=σ^2_μ	0.008**	0.033**	0.078**	0.294**	0.256**	0.081
Exp()=σ^2_φ		0.0001**	0.0002**	0.0002**		
Cov(μ,φ)		-0.001**	-0.003**	-0.006**		
Exp()=σ^2_π	0.0001**					
$\lambda_{1,\ 1995}$	0.971**	0.953**	1.020**	1.010**	0.977**	
$\lambda_{1,\ 1996}$	0.924**	0.955**	0.997**	0.973**	1.041**	1.011
$\lambda_{1,\ 1997}$	0.819**	0.909**	1.039**	0.972**	1.018**	1.057
$\lambda_{1,\ 1998}$	0.807**	0.987**	1.010**	0.976**	1.019**	0.984
$\lambda_{1,\ 1999}$	0.705**	0.998**	1.061**	0.959**	0.987**	0.908
$\lambda_{1,\ 2000}$	0.658**	0.970**	0.924**	0.898**	1.092**	0.940
$\lambda_{1,\ 2001}$	0.666**	0.948**	0.927**	0.867**	1.076**	0.942
$\gamma_{1,51\text{-}60}$	1.269**	1.227**	1.326**	1.162**	0.934**	0.892
$\gamma_{1,61\text{-}70}$	1.646**	1.386**	1.937**	0.988**	0.769**	0.835
$\gamma_{1,71\text{-}80}$	1.478**	1.561**	3.927**	0.475**	0.314**	0.459
Transitory						
Exp()=σ^2_ε	0.260**	0.058**	0.118**	0.099**	0.258**	0.483
Exp()=σ^2_0				0.052**	0.043**	0.075
Exp()=$\sigma^2_{0,40\text{-}50}$	0.031**	0.031**	0.079**			
Exp()=$\sigma^2_{0,51\text{-}60}$	0.022**	0.042**	0.057**			
Exp()=$\sigma^2_{0,61\text{-}70}$	0.033**	0.052**	0.101**			
Exp()=$\sigma^2_{0,71\text{-}80}$	0.027**	0.028**	0.070**			
ρ	0.546**	0.644**	0.600**	0.849**	0.778**	0.701
θ		-0.251**	-0.149**	-0.364**		
$\lambda_{2,\ 1995}$	0.259**	0.769**	0.799**	0.907**	0.506**	
$\lambda_{2,\ 1996}$	0.248**	0.824**	0.699**	0.815**	0.312**	0.293
$\lambda_{2,\ 1997}$	0.250**	0.730**	0.617**	0.842**	0.354**	0.209
$\lambda_{2,\ 1998}$	0.219**	0.754**	0.627**	0.887**	0.372**	0.172
$\lambda_{2,\ 1999}$	0.292**	0.652**	0.611**	0.760**	0.355**	0.227
$\lambda_{2,\ 2000}$	0.284**	0.666**	0.720**	0.821**	0.348**	0.220
$\lambda_{2,\ 2001}$	0.257**	0.700**	0.666**	0.856**	0.392**	0.225
$\gamma_{2,51\text{-}60}$	1.131**	0.989**	0.961**	1.004**	0.780**	0.841
$\gamma_{2,61\text{-}70}$	1.160**	1.032**	1.019**	1.051**	1.010**	0.899
$\gamma_{2,71\text{-}80}$	1.822**	1.330**	0.944**	1.330**	1.107**	1.198
SSR	0.007	0.002	0.015	0.009	0.029	0.005
χ^2	5710.016	1576.228	3824.450	1984.959	3737.507	2229.285
LogL	513.261	611.787	458.005	489.848	408.950	399.618

Note:
1. GE, NL, UK, IR, FI: Best Fit is reported in - Table 3: RG+AR1; BE, FR, LU: Best Fit is reported in Table 2: PI+AR1
2. The SEs are available upon request from the authors.
3. ** indicates p value of < 0.05 and * indicates a p value of < 0.1.

Table 5. Evolution of the overall inequality and its components – within and between-cohort inequality between the 1st and last wave

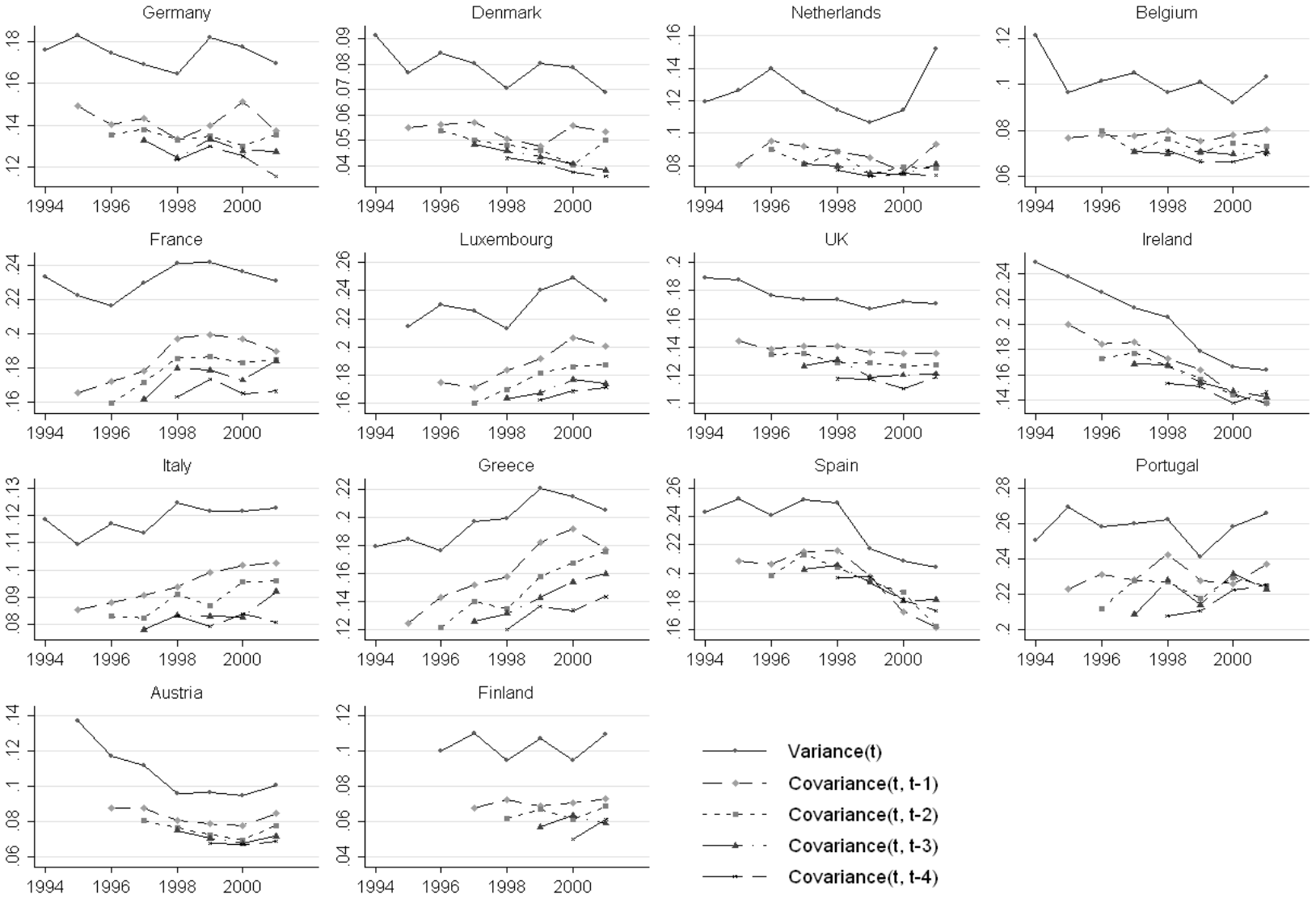
Country		Overall Inequality			Within-Cohort Inequality		Between Inequality	
		1st Wave	2001		1st Wave	2001	1st Wave	2001
AUT	Level	0.137	0.101	Level	0.127	0.092	0.012	0.007
	Boot. SE	0.002	0.002	% of Overall Inequality			9%	8%
BEL	Level	0.121	0.103	Level	0.104	0.091	0.017	0.014
	Boot. SE	0.001	0.001	% of Overall Inequality			14%	14%
DEU	Level	0.176	0.170	Level	0.155	0.154	0.022	0.017
	Boot. SE	0.002	0.002	% of Overall Inequality			12%	10%
DNK	Level	0.091	0.069	Level	0.080	0.064	0.011	0.005
	Boot. SE	0.001	0.001	% of Overall Inequality			12%	7%
ESP	Level	0.243	0.205	Level	0.211	0.181	0.033	0.023
	Boot. SE	0.002	0.002	% of Overall Inequality			13%	11%
FRA	Level	0.233	0.231	Level	0.208	0.189	0.025	0.040
	Boot. SE	0.003	0.003	% of Overall Inequality			11%	17%
GBR	Level	0.189	0.171	Level	0.168	0.155	0.022	0.019
	Boot. SE	0.002	0.002	% of Overall Inequality			11%	11%
IRL	Level	0.249	0.164	Level	0.196	0.150	0.055	0.015
	Boot. SE	0.003	0.004	% of Overall Inequality			22%	9%
FIN	Level	0.100	0.110	Level	0.092	0.098	0.008	0.008
	Boot. SE	0.002	0.002	% of Overall Inequality			8%	7%
GR	Level	0.179	0.205	Level	0.144	0.160	0.034	0.049
	Boot. SE	0.002	0.002	% of Overall Inequality			19%	23%
ITA	Level	0.118	0.123	Level	0.103	0.105	0.018	0.018
	Boot. SE	0.001	0.001	% of Overall Inequality			15%	15%
LUX	Level	0.214	0.233	Level	0.170	0.189	0.045	0.040
	Boot. SE	0.003	0.003	% of Overall Inequality			21%	17%
NLD	Level	0.119	0.152	Level	0.084	0.124	0.035	0.029
	Boot. SE	0.002	0.002	% of Overall Inequality			29%	19%
PRT	Level	0.250	0.266	Level	0.220	0.251	0.029	0.017
	Boot. SE	0.003	0.004	% of Overall Inequality			12%	6%

Note:
Bootstrap SE – based on 1000 iterations
Overall Inequality is the actual inequality, which is almost identical with the predicted overall inequality.

Table 6. Evolution of the aggregate within-cohort inequality and its components – permanent and transitory inequality between the 1st and last wave

Country		Overall Within Inequality			Permanent Inequality		Transitory Inequality	
		1st Wave	2001		1st Wave	2001	1st Wave	2001
AUT	Level	0.127	0.092	Level	0.060	0.046	0.067	0.046
				% of Within Inequality	47%	50%	53%	50%
BEL	Level	0.104	0.091	Level	0.057	0.041	0.047	0.050
				% of Within Inequality	55%	45%	45%	55%
DEU	Level	0.155	0.154	Level	0.116	0.103	0.039	0.051
				% of Within Inequality	75%	67%	25%	33%
DNK	Level	0.080	0.064	Level	0.041	0.025	0.039	0.040
				% of Within Inequality	51%	38%	49%	62%
ESP	Level	0.211	0.181	Level	0.155	0.102	0.056	0.079
				% of Within Inequality	73%	56%	27%	44%
FRA	Level	0.208	0.189	Level	0.123	0.123	0.085	0.066
				% of Within Inequality	59%	65%	41%	35%
GBR	Level	0.168	0.155	Level	0.099	0.097	0.069	0.058
				% of Within Inequality	59%	62%	41%	38%
IRL	Level	0.196	0.150	Level	0.105	0.105	0.091	0.045
				% of Within Inequality	54%	70%	46%	30%
FIN	Level	0.092	0.098	Level	0.040	0.062	0.052	0.036
				% of Within Inequality	43%	63%	57%	37%
GR	Level	0.144	0.160	Level	0.066	0.097	0.078	0.063
				% of Within Inequality	46%	61%	54%	39%
ITA	Level	0.103	0.105	Level	0.059	0.069	0.044	0.036
				% of Within Inequality	58%	66%	42%	34%
LUX	Level	0.170	0.189	Level	0.096	0.144	0.074	0.045
				% of Within Inequality	56%	76%	44%	24%
NLD	Level	0.084	0.124	Level	0.058	0.053	0.027	0.071
				% of Within Inequality	69%	43%	31%	57%
PRT	Level	0.220	0.251	Level	0.181	0.153	0.040	0.098
				% of Within Inequality	82%	61%	18%	39%

Figure 1. Overall Autocovariance Structure of Hourly Earnings: 1994-2001



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Annex

Table A.1. Share of the permanent variance in the overall in equality in the 1st wave and last wave by cohorts

	Cohort 1940-1950		Cohort 1951-1960		Cohort 1961-1970		Cohort 1971-1980	
	1st Wave	2001	1st Wave	2001	1st Wave	2001	1st Wave	2001
AUT	51.90	60.33	54.84	63.11	48.26	56.80	13.68	18.26
BEL	52.18	58.12	64.28	56.09	51.85	45.65	2.17	1.51
DEU	97.32	78.68	73.29	74.59	64.76	66.76	11.02	28.35
DNK	63.32	56.50	60.95	49.18	40.65	42.50	16.50	10.51
ESP	78.60	73.42	78.21	73.11	68.41	58.31	25.73	16.74
FRA	61.40	78.83	60.27	75.73	65.33	67.37	15.89	28.92
IRL	68.06	76.74	65.78	78.86	42.18	73.05	32.82	54.15
UK	60.51	64.31	63.33	72.66	52.92	67.41	52.42	37.01
FIN	49.23	65.98	47.81	71.61	34.38	70.61	34.26	33.40
GR	57.67	66.95	58.43	67.92	21.78	56.81	38.36	44.81
ITA	73.26	77.44	61.20	76.48	38.41	64.81	32.28	35.70
LUX	58.72	82.37	55.57	85.31	56.32	79.08	44.95	44.51
NLD	76.24	66.61	65.38	61.03	77.96	42.94	18.38	11.35
PRT	85.69	75.14	89.57	81.26	77.63	63.67	32.50	19.56

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Notes

[i] Katz and Autor (1999) define earnings mobility as the rate at which individuals shift positions in the earnings distribution.
[ii] Inequality in earnings measured over a long period of time, such as lifetime earnings
[iii] This structure is equivalent to a random coefficient model where the intercept and the coefficient on age in model (4) are randomly distributed across individuals. Therefore, because earnings evolve along an individual specific age profile, a good prediction of future earnings requires additional information besides the current earnings.
[iv] As argued by Baker (1997), the intuition for this model is not obvious, but the high persistency of the unit root model might result from low rates of depreciation of human capital investments or labour market conditions through implicit contacts.
[v] The European Community Household Panel provided by Eurostat via the Department of Applied Economics at the Université Libre de Bruxelles.
[vi] The multiplicative constant equals e.g. p*(Population above age 16/Sample Population). The ratio p varies across countries so that sensible samples are obtained. It ranges between 0.001-0.01.
[vii] Except France, for which gross amounts are observed.
[viii] Hourly wage= Current net monthly wage*(4.33*Hours per week).
[ix] The demeaned earnings r_{ict} adjusts for year, age and cohort effects in a less restrictive way than the preliminary regressions typically used, which assume that age and cohort effects within any year can be approximated by a polynomial in age.(Baker and Solon, 2003)
[x] Age 20 is the lowest age observed in our dataset.
[xi] Measurement error is also captured by the transitory component.
[xii] 1994 refers to t=0
[xiii] See McCurdy(1982, page 92/93)
[xiv] T_c and t_{0c} represent the total number of years and the first year observed for each cohort.
[xv] i.e. 144 auto-covariances for countries observed over 8 waves, 122 for those with 7 waves and 84 for those with 6 waves.
[xvi] $4.89=100*\sqrt{\sigma^2_{\varphi}}$
[xvii] Spain was estimated with homoskedastic initial conditions.
[xviii] The predicted variance resulting from these models follows closely the evolution of the actual variance, confirming the fit of the country-models.
[xix] The decomposition by cohort identifies how inequality and its components are affected by the labour market changes at different lifecycle stages. There is a fundamental conceptual under-identification of time, life-cycle, and cohort effects due to the exact multicollinearity of time, age, and birth year. Our decompositions control for cohort effects, but the age and period effects are confounded. Since our scope is to decompose within-cohort inequality into the two components, the lifecycle effect is considered part of the permanent component, and thus its specific identification is disregarded.
[xx] These results are similar to those found by Dickens (2000) and Ramos (1999, 2003) for UK, Cervini and Ramos (2006) for Spain and Capellari (2003) for Italy.
[xxi] The evolution of the overall PV and overall TV depend both on the evolution of the share for each cohort in the overall population and on the predicted PV and TV for each cohort.

[xxii] This ranking is consistent with Cholezas and Tsakloglou (2008).
[xxiii] Consistent with Cholezas and Tsakloglou (2008).
[xxiv] France and Ireland are the only countries where persistent inequality stagnates.
[xxv] These trends correspond in general with national analyses. Daly and Valletta's (2008) findings for Germany (1994-1999) and the UK (1994-1997) are consistent with oursxxv, as are results for Ireland (Doris et al.'s, 2008) and Italy (Capellari 2003). Overall within-cohort inequality in Spain (1994-2000) is similar to Cervini and Ramos (2006) although component trends differ. Regarding the incidence of the persistent inequality, for UK and Germany, Daly and Valetta (2008) report values close to our overall estimates. For Spain, Cervini and Ramos (2006) found a higher average persistency. For Ireland, Doris et al. (2008) reported an average permanent share of 71%.
[xxvi] Based on OECD data, active labour market policies developed extensively in Denmark between 1994 and 2001, whereas in Finland they decreased, reaching a level 3 times lower than the one in Denmark in 2001.
[xxvii] Another explanation may be the earnings variable used for France, which reports the gross values.
[xxviii] In the UK, the low institutionalization of the non-market forces has facilitated the unilateral action of employers and government in introducing further decentralization and deregulation of industrial relations and working conditions. Moreover, the collective bargaining dropped at the enterprise level, and bargaining coverage has fallen sharply. Welfare benefits decreased and the industrial relations are increasingly determined by market mechanisms (Zambarloukou, S. 2006).
[xxix] Gross Amounts

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