



JRC TECHNICAL REPORTS

Employment composition and labour earnings inequality within EU countries

Martínez Turégano, David

2020

This publication is a Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

Contact information

Name: David Martínez Turégano
Address: C/Inca Garcilaso, 3. E-41092 Seville, Spain
Email: david.martinez-turegano@ec.europa.eu
Tel.: +34 954488334

EU Science Hub

<https://ec.europa.eu/jrc>

JRC120255

EUR 30154 EN

PDF ISBN 978-92-76-17516-2 ISSN 1831-9424 doi:10.2760/676883

Luxembourg: Publications Office of the European Union, 2020
© European Union, 2020



The reuse policy of the European Commission is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

All content © European Union 2020.

How to cite this report: Martínez Turégano, D., Employment composition and labour earnings inequality within EU countries, EUR 30154 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-17516-2, doi:10.2760/676883, JRC120255.

Contents

- 1 Introduction4
- 2 Data and methods6
 - 2.1 Data6
 - 2.2 Methods.....8
 - 2.2.1 Effect of employment characteristics8
 - 2.2.2 Inequality measures9
 - 2.2.3 Structural decomposition9
 - 2.2.4 Macroeconomic factors..... 11
- 3 Estimated effect of employment characteristics 13
 - 3.1 Sectoral differences 15
 - 3.2 Observed changes in the composition of employment 16
 - Box 1. The role of macroeconomic factors explaining changes in the shares of sectoral employment 18
- 4 Structural drivers of earnings inequality across EU countries..... 19
 - 4.1 Characterization of inequality trends across EU countries..... 20
 - 4.2 Alternative inequality approaches..... 21
 - Box 2. The role of macroeconomic factors explaining changes in the unemployment rate ... 23
- 5 Concluding remarks 24
- References 26
- Annex..... 28
 - Annex 1. NACE economic sections 28
 - Annex 2. ISCO occupation major groups..... 28

Acknowledgements

This technical report was produced in the context of the JRC multi-year cross-national research project to study different aspects of fairness (<https://ec.europa.eu/jrc/en/research/crosscutting-activities/fairness>).

Author

Martínez Turégano, David

Abstract

This paper presents a novel methodology that combines different datasets to decompose estimated changes in labour earnings inequality into the contributions of a number of employment characteristics. Based on this approach, we provide empirical evidence for recent developments in 18 EU countries starting in 2000. We find that the common upward trend in inequality is related to shifts in the composition of employment within sectors, rather than to sectoral reallocation. In particular, we estimate that the expansion of part-time and fixed-term contracts, as well as the higher share of tertiary educated workers within sectors, have been the main contributors to the rise of earnings inequality. Cross-country differences are exacerbated when taking into account unemployed population due to divergent capacities to create jobs in face of successive economic crises and external competition. In policy terms, a specific concern deals with the possibility that a higher share of flexible contractual arrangements is masking the rise of underemployment. On a broader perspective, we deem that the overall growth and competitiveness strategies are essential within the fairness agenda, while the enhancement of education, social and income-redistribution tools is needed to face economic and technological challenges in the most inclusive way possible.

JEL classification: D31, E24, J21

Keywords: Inequality, Labour Market, Employment Structure, Economic Crisis, Structural Change.

1 Introduction

A myriad of factors have reshaped labour markets around the world in the 21st century. This includes the emergence of China as a dominant economic player – both on the demand and the supply side, the sluggish productivity growth and crises legacies in many developed countries, as well as the cheapening of productive capital fuelling automatisisation in manufacturing activities. These trends are having an impact on the reallocation of employment across countries, sectors and occupations, eventually affecting the income distribution at the global and national level.

In the case of the EU, the loss of competitiveness has been particularly relevant in manufacturing activities, contributing to the decline of both the sectoral weight in total GDP and its participation in global manufacturing value chains. This feature, which has been shared with other developed economies, was mirrored by the emergence of China, a phenomenon having a decisive impact on EU employment in this sector (Breemersch et al. 2017). Around one million jobs serving manufacturing value chains were lost in the EU between 2000 and 2014 due to the declining shares in worldwide markets (Marschinski and Martínez-Turégano 2019).

Nevertheless, sluggish growth, particularly in face of successive economic crises, has been the main driver of limited job creation in the EU and the rise of unemployment in a number of countries in Southern Europe (Martínez-Turégano 2019). A differentiated picture emerges for countries that have joined the EU in the 21st century, which softened the effect of global developments due to structural transformation associated with their integration in EU markets and value chains. Accordingly, inequality developments have been rather heterogeneous across broad-defined regions within the EU (Benczur et al. 2017).

Technological progress has also reshaped the nature of employment within labour markets. In addition to the shift of employment to the service sector supported by stronger productivity gains in primary and manufacturing activities, the price of productive capital has kept on declining relative to other products. This has favoured the mechanization of certain tasks in capital-intensive industries and the substitution of associated employment, but it has also generated an increasing demand for tasks that are complementary to the use of capital. At the same time, demand for non-routine tasks has remained unaltered in other economic activities.

The literature on international economics has extensively documented this phenomenon of factor-biased technological change and job polarization, such as in Acemoglu and Autor (2011), Autor et al. (2003, 2006), Krusell et al. (2000) and Violante (2008). On the empirical side, a number of studies have provided specific evidence for European countries, underlining the role of technological progress, the routinization hypothesis and changes in the occupational structure when explaining the increase of job polarisation; Breemersch et al. (2017), Goos et al. (2009) and OECD (2017) among others. On cross-country differences, De La Rica and Gortazar (2016) and Michaels et al. (2014) show the relevance of ICT adoption, while Lewandowski (2017) finds that in central eastern Europe no job polarization occurred as workforce upskilling to tertiary education aligned well with job upgrading.

All these factors – resilience to global competition, economic crises, technological progress and a shift in skills demand – would have contributed to the observed increase of inequality in developed countries (Alessi et al. 2018, OECD 2011). Among the different dimensions of inequality, we are interested in those changes that are related with the composition of employment and its implications for the distribution of labour earnings. Labour earnings are the main source of income for households and their degree of inequality define to large extent the targets for both redistribution and education policies. The characterization of employment has changed over time due to shifts in the sectoral composition, mainly driven by macroeconomic factors, and in the composition of employment within sectors, which capture changes in labour demand and supply redefining the nature of jobs. Given the strong heterogeneity of labour

earnings by employment characteristics (Foster-McGregor et al. 2013), these changes in the composition of employment have a potential significant impact on inequality.

The contribution of this paper falls also on the empirical side. While it shares the broad view of some studies aforementioned that consider a number of explanatory factors for inequality or polarization, it deviates substantially in many other aspects. First, instead of focusing on job polarization, our interest is to better understand the recent increase of earnings inequality across EU countries. Second, in doing so we develop a novel methodology that decomposes these changes into the contribution of different employment characteristics, including those related to the individual (gender, age and level of education), the firm (sector, size) and their labour relation (occupation, hours and type of contract). Third, this approach abstracts from the evolution of wages and exclusively accounts for structural shifts in the composition of employment. And four, we complement this analysis with an analogous one developed to study the role of macroeconomic factors explaining sectoral and aggregate (un)employment.

We provide empirical evidence for 18 EU countries in different sub-periods between 2000 and 2017, comparing alternative inequality indicators and making use of different data sources. As in Foster-McGregor et al. (2013) we exploit the Eurostat's Structure of Earnings Survey (SES) to estimate the contribution of different employment characteristics to labour earnings, while we then use the employment weights from the Eurostat's Labour Force Survey (LFS) to build time series of earnings inequality. Finally, the complementary analysis on macroeconomic factors is based on the World Input Output Database (WIOD).

In sum, we find that earnings inequality has increased across the board in the EU, being the main contributors the expansion of part-time and fixed-term contracts, as well as the higher share of workers with tertiary education within sectors. While the first factor widened the population group with lower earnings, the second this the same for those more highly remunerated, with the consequence of a higher dispersion (inequality). On the contrary, according to our structural approach, we estimate that shifts in the sectoral composition of employment and in the occupational content played a more heterogeneous and limited role. From a broader perspective, the capacity to create jobs was very divergent between Member States and that had a significant impact on inequality when including also unemployed population.

The remaining part of this paper is organized as follows. Section 2 presents the different data sources and details the methodological approach. Section 3 focuses on the characteristics shaping the average and dispersion of earnings, including recent trends in the composition of employment. Section 4 presents the results from the structural decomposition analysis developed at country level and applied to different inequality indicators. Finally, Section 5 summarizes the main findings and discusses policy implications.

2 Data and methods

The aim of this paper is to identify the main factors driving labour earnings inequality in recent years starting in 2000 within a number of EU countries. For this purpose, we develop a Structural Decomposition Analysis (SDA) that follows along these steps:

- First, we use the Eurostat's Structure of Earnings Survey (SES) to estimate the contribution of different employment characteristics to the average and dispersion of labour earnings across different groups of employees. In addition to the economic sector, we look into variables related to the individual (gender, age and level of education), the firm (size) and their labour relation (occupation, hours and type of contract).
- Second, we build time series of earnings inequality for total employment based on the estimated contribution of characteristics using the SES and the employment weights derived from the Eurostat's Labour Force Survey (LFS). Given methodological breaks, we split the sample into three sub-periods, which also correspond to different economic periods around the Great Recession: 2000-2007, 2008-2010 and 2011-2017.
- Finally, we develop a SDA of changes in earnings inequality differentiating the impact of shifting weights in sectoral employment from those in other employment characteristics. We consider that while the latter are associated with changes in the nature of employment itself, the former would be the outcome of macroeconomic factors (such as demand, competitiveness or technological developments), for which we develop a complementary analysis based on a global framework using the World Input Output Database (WIOD).

Unfortunately, methodological breaks and the lack of continuous earnings data at granular level don't allow analysing changes in the remuneration of characteristics on a yearly basis. Instead, the SDA focuses on shifts in the composition of employment and the impact on aggregate inequality through differences in earnings average and dispersion across population groups.

2.1 Data

The SES provides harmonised data on the relationships between the level of remuneration and characteristics of both employees and employers in EU Member States. In principle, the statistics of the SES refer to large enterprises operating in business activities, although information on public administration and enterprises with less than 10 employees is also available from some countries on a voluntary basis. The 4-yearly SES anonymised microdata sets are available for reference years 2002, 2006, 2010 and 2014.

The base remuneration variable is 'Gross annual earnings in the reference year' (W), which we transform into a full-timer's equivalent (Weq) using the '% share of a full-timer's normal hours' ($\%h$) and the share of the 'Number of weeks to which the gross annual earnings relate' (wk) relative to the total number of weeks in a year:

$$Weq = \frac{W}{\%h \times \frac{wk}{52.14}} \quad (1)$$

Given data availability, we work with the following SES sample:

- Three reference years: 2006, 2010 and 2014.
- 18 countries: Belgium, Bulgaria, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovakia, Spain and the United Kingdom¹.

¹ Despite its leave in January 2020, we keep on referring to the United Kingdom as an EU Member State since that was its condition throughout the sample period.

Our population groups are defined by the combination of eight characteristics, which are available in both the SES and the LFS surveys:

- 'Economic sector', 'Size class category of enterprise', 'Sex', 'Age group category', 'Highest successfully completed level of education', 'Occupation', 'Type of employment contract', 'Full-time or part-time employee'.

In order to build time series of inequality indicators, we combine the earnings data for reference years from the SES and the yearly employment weights from the LFS associated with the corresponding population groups. We assume that, given identical characteristics, self-employed workers – which are included in the LFS but not in the SES – are equally remunerated than employees.

The LFS is a large household sample survey providing harmonised data on labour participation of people aged 15 and over, covering all industries and occupations. Microdata is available on a yearly basis from 1983 onwards depending on the accession date of individual countries. We focus on the sample starting in 2000.

When combining datasets, some categories of different characteristics in the SES are grouped to match data availability in the LFS. Accordingly, categories used for each characteristic are the following:

- Economic sector, based on NACE (*Nomenclature statistique des Activités économiques dans la Communauté Européenne*): 16 individual or combined sections as defined by NACE Revision 1.1 before 2008 and NACE Revision 2 since 2008 (see Annex 1 for details).
- Firm size: small (between 1 and 49 persons employed) or large (50 or more employees).
- Gender: male or female.
- Age: six categories based on year bands (15-19, 20-29, 30-39, 40-49, 50-59 and 60 or more years).
- Education level, based on the International Standard Classification of Education (ISCED): low (up to lower secondary), medium (upper secondary) and high (tertiary).
- Occupation: ten categories based on the 1-digit level major groups as defined by both ISCO-88 and ISCO-08 (International Standard Classification of Occupations) (see Annex 2 for details).
- Type of contract: permanent or fixed-term (i.e. temporary employment).
- Full-time or part-time employee.

There are important methodological breaks affecting both the SES and LFS. In particular, the 2008 revision of NACE and the use of ISCO-08 since 2011². For this reason, we split the sample into three sub-periods, which combine the 2006 SES reference year with 2000-2007 LFS data, the 2010 SES reference year with 2008-2010 LFS data and the 2014 SES reference year with LFS data starting in 2011.

Finally, the complementary analysis we develop for the role of macroeconomic factors mainly relies on the WIOD. The WIOD provides annual world intercountry input-output tables, covering in its most recent release 56 economic activities from 2000 to 2014 for the 28 EU Member States and other 15 individual countries, as well as an aggregate for the rest of the world. These data are complemented by the information in Socio Economic Accounts (SEA) of WIOD, particularly by sectoral employment in our case. Based on WIOD and using value chain analysis we can extract informative drivers of changes in aggregate and sectoral employment by country, differentiating

² In order to ease the reading, we always refer to the nomenclature corresponding to the latest revision.

demand, competitiveness and technological factors. In addition, for an alternative inequality measure that considers the unemployed population we also make use of the annual macro-economic database of the European Commission's (AMECO) for country time series on the labour force and demographic variables.

2.2 Methods

2.2.1 Effect of employment characteristics

The starting point is the definition of population groups by a number of employment characteristics. In addition to their research interest, these characteristics should be available in both the SES and the LFS surveys for practical reasons in order to build the inequality time series. As mentioned before, we work with a sample containing information for eight characteristics and every single group g is then identified as follows by a category for each characteristic:

$$g = \{\text{sector, size, gender, age, education, occupation, contract, hours}\} \quad (2)$$

According to the number of categories in each characteristic defined in the Data subsection, there would be 46,080 different population groups.

We use the 4-yearly SES anonymised microdata sets to compute the average and dispersion of remuneration at the group level based on the full-timer's equivalent of earnings.

We run regressions to estimate the effect of the different categories within each characteristic on the corresponding moment of the distribution (Xeq). In a given country c at time t , the general expression for group g defined by categories j of characteristics h is the following:

$$Xeq_{c,g,t} = \mu_{c,t} + \sum_{h(j) \in g} \gamma_{c,h(j),t} \times d_{h(j)} + \varepsilon_{c,g,t} \quad (3)$$

where

$\mu_{c,t}$ = value for reference group

$\gamma_{c,h(j),t}$ = effect of category j from characteristic h relative to reference group

$d_{h(j)}$ = dummy variable for category j from characteristic h $\begin{cases} = 0 & \text{if } h(j) \notin g \\ = 1 & \text{if } h(j) \in g \end{cases}$

$\varepsilon_{c,g,t}$ = error term

The effects are estimated relative to a reference group. The choice of this reference group has been made both on representativeness concerns and to facilitate interpretation and comparison within and across countries. Namely, our benchmark corresponds to a male person aged 20-29 years with secondary education level, working full-time on an indefinite contract for a large manufacturing company as a technician or associate professional.

We run these regressions for three SES reference years (2006, 2010 and 2014) using as dependent variable two definitions for average, arithmetic and geometric, and three dispersion (inequality) measures, which are explained with detail in the following subsection.

Regressions on group averages can be associated with human capital returns in the vein of the original work by Mincer (1974) and later updates as compiled in Lemieux (2016). In a similar contribution than our analysis, Foster-McGregor et al. (2013) make use of the first three waves of the SES (including 2002 but not 2014) to estimate Mincer regressions for EU countries.

2.2.2 Inequality measures

The choice of a measure for inequality is not unbiased and reflects a certain set of preferences on how income should be distributed. For this reason, we consider alternative indicators based on the weight of certain population groups.

In addition, a number of properties are required for an inequality measure (Anand, 1997):

- Scale independence, which implies that the value of the indicator should stay constant if everyone's income is changed by the same proportion.
- Population size independence, which consists of the indicator remaining constant if the number of people at each income is changed by the same proportion.
- The Pigou-Dalton principle states that the value of the indicator should decrease if there is a transfer from a richer to a poorer individual not resulting in a change of the individual ranking.

Even though it also fulfils the aforementioned properties, we exclude the well-known Gini index from our comparison as it does not share with the others the simplicity for decomposition.

The first indicator is the log variance (LV), which is the variance of the logarithm of income. Contrary to the variance of the income levels, it holds the property of scale independence as described before:

$$LV = \frac{1}{N} \times \sum_i \left[\log \left(\frac{W_i}{\bar{W}} \right) \right]^2 \quad (4)$$

where

N = sample population

W_i = income of individual i

\bar{W} = geometric average

The other two selected indicators are specific cases of the so-called generalized entropy index, a dispersion measure based on information theory, and both use the arithmetic average instead (\bar{W}).

The mean log deviation (MLD) is the average of the log distance from the population mean, giving higher weight to population with lower income:

$$MLD = \frac{1}{N} \times \sum_i \log \left(\frac{\bar{W}}{W_i} \right) \quad (5)$$

The Theil index (TH) is the second specific case of the generalized entropy index, giving more weight in this case to population with higher income:

$$TH = \frac{1}{N} \times \sum_i \left(\frac{W_i}{\bar{W}} \right) \times \log \left(\frac{W_i}{\bar{W}} \right) \quad (6)$$

2.2.3 Structural decomposition

Once we estimate the effect of different characteristics on group averages and dispersion measures using the SES, we build the time series for country inequality indicators using employment weights given by the LFS.

We need to make certain assumptions on the effect of categories missing in the SES that are available in the LFS, such as NACE sections A (agriculture), T (domestic personnel) and U (extraterritorial organization), or occupational ISCO group 0 (armed forces), as well as for categories missing for certain countries in the SES, which mainly affect NACE section O (public administration) and occupational group 6 (skilled agricultural workers).

Additionally, in the case of groups holding either part-time or fixed-term contracts, we need to adjust full-timer's equivalent average earnings to account for actual remuneration. For this purpose, and since we don't have the number of hours or weeks worked available in the LFS, we transform earnings the following way using median values estimated from the SES samples:

$$W_{c,g,t} = Weq_{c,g,t} \times adj_g \quad (7)$$

where

$$adj_g = \begin{cases} 100\% \text{ if full-time permanent contract} \\ 75\% \text{ if full-time fixed-term contract} \\ 50\% \text{ if part-time permanent contract} \\ 37.5\% = 75\% \times 50\% \text{ if part-timer fixed-term contract} \end{cases}$$

The three inequality indicators share the property of linear decomposition and can be expressed as a weighted sum of both the group earnings dispersion and the relative average.

In the case of the log variance:

$$LV_{c,t} = \sum_g \alpha_{c,g,t} \times LV_{c,g,t} + \sum_g \alpha_{c,g,t} \times \left[\log \left(\frac{\bar{W}_{c,g,t}}{\bar{W}_{c,t}} \right) \right]^2 \quad (8)$$

where

$\alpha_{c,g,t}$ = employment share of group g

And analogously for the other two inequality indicators:

$$MLD_{c,t} = \sum_g \alpha_{c,g,t} \times MLD_{c,g,t} + \sum_g \alpha_{c,g,t} \times \log \left(\frac{\bar{W}_{c,t}}{\bar{W}_{c,t}} \right) \quad (9)$$

$$TH_{c,t} = \sum_g \alpha_{c,g,t} \times \left(\frac{\bar{W}_{c,g,t}}{\bar{W}_{c,t}} \right) \times TH_{c,g,t} + \sum_g \alpha_{c,g,t} \times \left(\frac{\bar{W}_{c,g,t}}{\bar{W}_{c,t}} \right) \times \log \left(\frac{\bar{W}_{c,g,t}}{\bar{W}_{c,t}} \right) \quad (10)$$

Based on these specifications, we develop the SDA in two levels, differentiating changes in sectoral employment shares from shifts in the weight of other characteristics within each economic sector.

The idea behind this two-level methodology is to separate macroeconomic factors – likely to affect to a larger extent the sectoral structure of employment in a given country – from other factors more related to the shifting nature of employment itself, such as occupational content or educational skills.

Accordingly, we can detail inequality indicators as follows, starting with the log variance:

$$LV_{c,t} = \sum_s \alpha_{c,s,t} \times \left(\sum_{g(s)} \beta_{c,g(s),t} \times LV_{c,g(s),t} \right) + \sum_s \alpha_{c,s,t} \times \left[\sum_{g(s)} \beta_{c,g(s),t} \times \log \left(\frac{\bar{W}_{c,g(s),t}}{\bar{W}_{c,t}} \right) - \sum_s \alpha_{c,s,t} \times \sum_{g(s)} \beta_{c,g(s),t} \times \log \left(\frac{\bar{W}_{c,g(s),t}}{\bar{W}_{c,t}} \right) \right]^2 \quad (11)$$

where

$\alpha_{c,s,t}$ = employment share of sector s in total economy

$\beta_{c,g(s),t}$ = employment share of group g in sector s

And analogously for the other two inequality indicators:

$$MLD_{c,t} = \sum_s \alpha_{c,s,t} \times \left(\sum_{g(s)} \beta_{c,g(s),t} \times MLD_{c,g(s),t} \right) + \sum_s \alpha_{c,s,t} \times \log \left(\frac{\sum_s \alpha_{c,s,t} \times \sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}}{\sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}} \right) \quad (12)$$

$$TH_{c,t} = \sum_s \alpha_{c,s,t} \times \left(\frac{\sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}}{\sum_s \alpha_{c,s,t} \times \sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}} \right) \times \left(\sum_{g(s)} \beta_{c,g(s),t} \times \frac{\bar{W}_{c,g(s),t}}{\sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}} \times TH_{c,g(s),t} \right) + \sum_s \alpha_{c,s,t} \times \left(\frac{\sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}}{\sum_s \alpha_{c,s,t} \times \sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}} \right) \times \log \left(\frac{\sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}}{\sum_s \alpha_{c,s,t} \times \sum_{g(s)} \beta_{c,g(s),t} \times \bar{W}_{c,g(s),t}} \right) \quad (13)$$

Given methodological breaks, we develop the SDA for three sub-periods: 2000-2007, 2008-2010 and 2011-2017. Each of these sub-periods uses a different SES reference year for earnings data by group of characteristics. Accordingly, only changes in the composition of employment move country inequality indicators within each of the sub-periods. The contributions of these changes are conditioned by differences in group averages and dispersions relative to the corresponding aggregate.

Alternatively, in Section 4 we propose two additional approaches. The first one considers full-timer's equivalent earnings instead of actual ones, so we just have to skip the adjustment made in Equation 7.

The second approach broadens the sample to include unemployed as an additional population group in Equations 11 to 13. Hence, the sectoral shares should be computed over total labour force instead of aggregate employment and can be expressed in terms of the previous definition and the unemployment rate of the country (ur):

$$\hat{\alpha}_{c,s,t} = (1 - ur_{c,t}) \times \alpha_{c,s,t} \quad (14)$$

This approach needs to make some additional assumptions. On the one hand, to avoid extreme values when computing the indicators, we consider that unemployed receive a non-zero remuneration, which we arbitrarily fix as equivalent to a 1-month pay of average annual earnings³. And on the other hand, we consider the group of unemployed to be completely homogeneous and then to have zero earnings dispersion.

2.2.4 Macroeconomic factors

We complement the structural decomposition with an analysis on the role of macroeconomic factors explaining changes in sectoral and aggregate employment using a global input-output framework based on WIOD data.

Studying the global macro-economy with its country and cross-sectoral linkages by using global input output data has become a widely used approach since the pioneering work of Hummels et al. (2001), as well as the value chain perspective following the seminal work by Timmer et al. (2013).

Unfortunately, due to methodological differences between Eurostat's labour datasets and WIOD, we are not able to fully integrate this analysis with the SDA developed in Section 4, although results shown in Box 1 and 2 are in any case of great value for interpreting inequality trends across EU countries in the sample.

The SDA differentiates between the contribution of changes to the sectoral composition of employment from shifts in other employment characteristics within sectors. The first component is then about understanding what makes employment in a particular sector to gain or lose weight in the total economy:

$$\alpha_{c,s,t} = \frac{EMP_{c,s,t}}{EMP_{c,t}} \quad (15)$$

where

$EMP_{c,s,t}$ = employment in sector s of country

$EMP_{c,t}$ = aggregate employment in country c

³ Changing this remuneration to other reasonable values does not qualitatively have an impact on the results.

In the global input-output framework, we can decompose the sectoral employment for a given country c at time t into the product of the employment-output ratio and an expression for the sectoral output:

$$EMP_{c,s,t} = \left(\frac{EMP_{c,s,t}}{Y_{c,s,t}} \right) \times \left[\sum_{d,r} \left(\frac{Y_{c,s,t}(FD_{d,r,t})}{FD_{d,r,t}} \right) \times FD_{d,r,t} \right] \quad (16)$$

where

$Y_{c,s,t}$ = output in sector s

$Y_{c,s,t}(FD_{d,r,t})$ = output in sector s associated with final demand of sector r in country d

The employment-output ratio is inherent to the sector and corresponds to the inverse of apparent labour productivity, reflecting production technologies and overall technological developments. The second term is an expression of sectoral output in which, following the methodology of Marschinski and Martínez-Turégano (2019, 2020), we can differentiate participation of that specific sector in worldwide value chains – a sort of competitiveness indicator – from changes in the volume of those value chains. Each value chain is here represented by the final demand of a product in a particular country, so volume changes are associated then with demand effects, including product and geographical composition effects.

Since the variables of interest are sectoral employment shares, the relevant macroeconomic factors for our analysis are those having a more intense effect in a particular sector relative to the rest of the economy. For instance, *ceteris paribus*, a general-purpose increase of productivity would reduce the amount of labour per unit of output and be detrimental for aggregate employment, but have a neutral impact on sectoral shares.

We also make use of this methodology for the alternative inequality approach proposed in Section 4 that includes unemployed population.

In particular, we are interested in analysing changes of the unemployment rate, which is defined as the share of the labour force that is not employed and can be written as follows for country c and time t :

$$ur_{c,t} = \frac{LF_{c,t} - EMP_{c,t}}{LF_{c,t}} = 1 - \frac{EMP_{c,t}}{LF_{c,t}} = 1 - \frac{EMP_{c,t}/WAP_{c,t}}{LF_{c,t}/WAP_{c,t}} \quad (17)$$

where

$LF_{c,t}$ = labour force

$WAP_{c,t}$ = working age population

Accordingly, we can then decompose shifts in the unemployment rate into the contribution of changes in aggregate employment relative to demographics (EMP/WAP) and in the labour force participation rate (LF/WAP). This way we differentiate between the impact of genuine job creation (destruction) dynamics and other factors that are more related to long-run socio-educational aspects (Fernández and Martínez-Turégano. 2018).

In turn, the contribution of job creation (destruction) dynamics can be further decomposed into the factors shown in Equation 16, considering now the aggregate for the whole economy.

3 Estimated effect of employment characteristics

The first step in the empirical strategy is the estimation of the effect of the different employment characteristics on the average and dispersion of labour earnings. For this purpose, we estimate Equation 3 for the 18 available EU countries and three reference years of the SES (2006, 2010 and 2014) using the population group benchmark defined in subsection 2.2.1. Effects from the different characteristics are then expressed as deviations from the average or dispersion of earnings corresponding to a male person aged 20-29 years with secondary education level, working full-time on an indefinite contract for a large manufacturing company as a technician or associate professional.

On average, the proposed specification accounts for half of the variance for group averages and around a fifth for dispersion measures. Overall, individual characteristics are statistically significant with the same sign for the majority of countries and across the three reference years. A lower significance level is found for the effect of the economic sector and when using dispersion measures as dependent variables.

Table 1 provides selected quantiles for 2014 that are representative of the results obtained for the other two reference years. Namely, the table shows for each indicator the average value for the lowest three deciles, the middle four deciles and the highest three deciles. The colour code illustrates the sign of the marginal effect for the different characteristics relative to the value of the reference group shown in the first row (blue if positive, orange if negative).

A number of results are worth highlighting for the average indicators.

For instance, within the economic sector characteristic, NACE sections B (mining) and K (finance) show the largest average positive coefficients and hence we would expect, other employment characteristics being equal, a higher remuneration relative to C (manufacturing). The opposite is observed for a number of service activities, such as section I (accommodation and food services), P (education), Q (health) or R & S (entertainment and personal services).

An even more heterogeneous picture is observed across occupations, with quite positive earning returns for ISCO groups 1 (managers) and 2 (professionals) relative to the reference group 3 (technicians), in opposition to the rest of the occupations considered. This draws a remuneration frontier between those occupations developing mainly non-routine cognitive tasks versus others in which either manual or routine tasks constitute the bulk of the job description (e.g. group 4, clerical support workers, or group 8, machine operators).

Education and age profiles are also marked according to our estimations, particularly when comparing the remuneration of employees with tertiary education with those with only a basic level, as well as middle-aged workers (over 40) relative to younger ones (below 30). The age profile is however less homogeneous than the education one across countries and a number of EU Member States show a steeper return curve when employees age.

On the other hand, in line with recent literature findings (De La Rica and Gortazar 2016, Foster-McGregor et al. 2016), the so-called *gender gap* is confirmed - with a 10% lower earning for women than men if all other characteristics are held constant - and holds for the three quantile averages.

Regarding the labour relation, we observe a significant negative contribution for those employees with part-time contracts, particularly considering that we are using full-timer's equivalent earnings. Fixed-term contracts relative to permanent ones also show a negative coefficient, but to a much lower extent.

Finally, labour earnings are found to be substantially and robustly lower for employees working for smaller firms (below 50 persons) rather than large ones.

As mentioned before, estimations for the effect of employment characteristics on earning dispersion yield a more limited explanatory power. However, the majority of categories show significant coefficients signalling relevant differences to be taken into account.

In a nutshell, we find a higher degree of earning inequality for employees working in the aggregate of NACE sections L & M & N, which include a number of business services, those with a higher level of education, occupations with a larger content of non-routine cognitive tasks – managerial occupations in particular – and employees with part-time work arrangements. On the contrary, lower dispersion is found to be significant for NACE sections O and P, which are mainly public administration activities, and to a lesser extent for female employees and younger workers (i.e. new entrants in the labour market).

Employment Characteristics		Full-timer's Equivalent Earnings Average (in logs)						Full-timer's Equivalent Earnings Dispersion								
		Arithmetic Average			Geometric Average			Log Variance			Mean Log Deviation			Theil Index		
Characteristic	Category	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
Reference group (value)		9.48	10.02	10.43	9.39	9.96	10.38	0.07	0.12	0.17	0.04	0.06	0.09	0.04	0.07	0.09
Sector	NACE section B	0.07	0.15	0.31	0.10	0.20	0.34	-0.06	-0.02	0.04	-0.03	-0.01	0.01	-0.03	-0.01	0.01
Sector	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sector	D & E	0.00	0.06	0.13	0.03	0.08	0.15	-0.05	-0.02	0.02	-0.03	-0.01	0.01	-0.03	-0.01	0.00
Sector	F	-0.08	-0.01	0.04	-0.07	0.00	0.06	-0.04	-0.01	0.01	-0.02	-0.01	0.00	-0.02	-0.01	0.00
Sector	G	-0.09	-0.04	0.03	-0.09	-0.04	0.04	-0.03	0.00	0.02	-0.01	0.00	0.01	-0.01	0.00	0.01
Sector	HJ	-0.04	0.05	0.11	-0.04	0.05	0.11	-0.02	0.00	0.04	-0.01	0.00	0.02	-0.01	0.00	0.02
Sector	I	-0.20	-0.15	-0.08	-0.20	-0.12	-0.05	-0.05	-0.02	0.02	-0.03	-0.01	0.01	-0.03	-0.01	0.01
Sector	K	0.05	0.19	0.32	0.05	0.20	0.34	-0.03	0.01	0.07	-0.02	0.00	0.03	-0.02	0.00	0.02
Sector	L & M & N	-0.11	-0.03	0.04	-0.13	-0.05	0.03	-0.01	0.02	0.06	0.00	0.01	0.03	0.00	0.01	0.03
Sector	O	-0.19	-0.09	0.00	-0.18	-0.06	0.04	-0.09	-0.04	0.00	-0.04	-0.02	0.00	-0.04	-0.02	0.00
Sector	P	-0.27	-0.17	-0.06	-0.24	-0.16	-0.03	-0.07	-0.03	0.02	-0.04	-0.02	0.01	-0.03	-0.02	0.00
Sector	Q	-0.20	-0.12	-0.02	-0.19	-0.10	0.00	-0.06	-0.02	0.02	-0.03	-0.01	0.01	-0.03	-0.01	0.01
Sector	R & S	-0.19	-0.13	-0.08	-0.20	-0.13	-0.05	-0.05	-0.02	0.05	-0.02	-0.01	0.02	-0.02	-0.01	0.02
Size	<50	-0.30	-0.20	-0.09	-0.30	-0.19	-0.08	-0.02	0.00	0.03	-0.01	0.00	0.02	-0.01	0.00	0.01
Size	50 or more	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gender	Male	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gender	Female	-0.13	-0.10	-0.05	-0.13	-0.09	-0.04	-0.03	-0.02	0.00	-0.02	-0.01	0.00	-0.01	-0.01	0.00
Education	Basic	-0.11	-0.06	-0.03	-0.10	-0.05	-0.01	-0.02	-0.01	0.01	-0.01	0.00	0.00	-0.01	-0.01	0.00
Education	Upper Secondary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	Tertiary	0.09	0.16	0.25	0.10	0.15	0.23	0.00	0.03	0.06	0.00	0.01	0.03	0.00	0.01	0.03
Occupation	ISCO group 1	0.30	0.44	0.55	0.28	0.41	0.54	0.02	0.05	0.08	0.01	0.03	0.04	0.01	0.03	0.04
Occupation	2	0.14	0.18	0.24	0.13	0.17	0.22	0.00	0.01	0.06	0.00	0.01	0.02	0.00	0.01	0.02
Occupation	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Occupation	4	-0.21	-0.15	-0.10	-0.20	-0.14	-0.08	-0.04	-0.02	0.00	-0.02	-0.01	0.00	-0.02	-0.01	0.00
Occupation	5	-0.34	-0.23	-0.16	-0.33	-0.22	-0.15	-0.07	-0.03	0.02	-0.03	-0.02	0.01	-0.03	-0.02	0.00
Occupation	6	-0.41	-0.32	-0.23	-0.36	-0.26	-0.18	-0.07	-0.03	-0.01	-0.03	-0.02	-0.01	-0.04	-0.02	-0.01
Occupation	7	-0.26	-0.21	-0.13	-0.24	-0.19	-0.11	-0.06	-0.03	-0.01	-0.03	-0.02	-0.01	-0.03	-0.02	-0.01
Occupation	8	-0.30	-0.23	-0.12	-0.28	-0.20	-0.09	-0.07	-0.04	-0.01	-0.03	-0.02	-0.01	-0.03	-0.02	-0.01
Occupation	9	-0.46	-0.34	-0.26	-0.45	-0.33	-0.24	-0.07	-0.04	0.02	-0.03	-0.02	0.01	-0.03	-0.02	0.01
Age	15-19	-0.30	-0.04	0.02	-0.29	-0.02	0.04	0.00	0.02	0.04	0.00	0.01	0.02	0.00	0.00	0.01
Age	20-29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Age	30-39	0.05	0.11	0.18	0.04	0.10	0.18	-0.01	0.02	0.04	-0.01	0.01	0.02	-0.01	0.01	0.02
Age	40-49	0.03	0.13	0.26	0.01	0.12	0.26	-0.01	0.02	0.04	0.00	0.01	0.02	0.00	0.01	0.02
Age	50-59	0.00	0.13	0.30	-0.01	0.12	0.29	0.00	0.02	0.03	0.00	0.01	0.02	0.00	0.01	0.02
Age	60 or more	-0.06	0.10	0.32	-0.06	0.09	0.31	0.00	0.02	0.03	0.00	0.01	0.02	0.00	0.01	0.02
Contract	Permanent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Contract	Fixed-term	-0.18	-0.09	0.02	-0.16	-0.07	0.06	-0.04	-0.02	0.03	-0.02	-0.01	0.01	-0.02	-0.01	0.01
Hrs	Full-time	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hrs	Part-time	-0.57	-0.31	-0.06	-0.63	-0.34	-0.06	0.01	0.08	0.21	0.00	0.03	0.09	0.00	0.03	0.07

Table 1: Estimated coefficients for categorical variables of employment characteristics explaining the average and dispersion of full-timer's equivalent earnings relative to the reference group described by a male person aged 20-29 years with secondary education level, working full-time on an indefinite contract for a large manufacturing company as a technician or associate professional. Coefficient averages for the lowest three deciles (Low), the middle four deciles (Mid) and the highest three deciles (High) from regressions for 18 EU countries. Own elaboration based on the SES 2014 reference year.

3.1 Sectoral differences

The results presented in Table 1 evaluated the individual effect of employment characteristics on either the average or the dispersion of labour earnings. We now turn to the comparison across economic sectors, which means aggregating groups with different categories for the other employment characteristics. This aggregation process, which includes adjusting for the actual working time instead of using full-timer's equivalent earnings, generates composition effects that could soften or exacerbate the sectoral effects previously estimated.

Table 2 shows the average and dispersion of sectoral earnings relative to reference NACE section C for 2014 using the LFS employment weights. Again, values correspond to the average for different deciles in the country distribution (i.e. the lowest three, the middle four and the highest three).

Regarding sectoral averages, a number of NACE sections show significantly different earnings than manufacturing once we take into account the composition of sectoral employment by the other characteristics. This would be the case of a higher average remuneration for employees in NACE sections B (mining), D & E (utilities) and K (finance), while the opposite holds for sections A (agriculture), G (trade), I (accommodation and food services), R & S (entertainment and personal services) and T (domestic personnel).

NACE section	Sectoral Earnings Average (in logs)						Sectoral Earnings Dispersion								
	Arithmetic Average			Geometric Average			Log Variance			Mean Log Deviation			Theil Index		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
C(value)	9.23	9.89	10.45	9.12	9.77	10.34	0.17	0.22	0.32	0.09	0.12	0.16	0.10	0.13	0.16
A	-0.96	-0.59	-0.32	-0.93	-0.56	-0.31	-0.05	0.02	0.11	-0.03	0.01	0.04	-0.04	0.00	0.02
B	0.05	0.20	0.44	0.09	0.25	0.49	-0.12	-0.03	0.03	-0.06	-0.02	0.01	-0.05	-0.02	0.01
C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D & E	0.06	0.12	0.23	0.07	0.13	0.23	-0.05	0.02	0.07	-0.02	0.01	0.03	-0.02	0.00	0.03
F	-0.17	-0.09	0.01	-0.14	-0.08	0.03	-0.07	-0.01	0.03	-0.03	-0.01	0.01	-0.03	-0.01	0.01
G	-0.33	-0.14	-0.04	-0.42	-0.16	-0.05	0.00	0.06	0.20	0.00	0.03	0.09	0.00	0.03	0.08
HJ	-0.02	0.09	0.21	-0.04	0.07	0.19	0.01	0.04	0.11	0.00	0.02	0.05	0.00	0.02	0.04
I	-0.61	-0.38	-0.23	-0.70	-0.37	-0.25	-0.04	0.05	0.30	-0.02	0.02	0.14	-0.02	0.02	0.13
K	0.17	0.39	0.62	0.14	0.36	0.62	0.00	0.06	0.18	0.00	0.02	0.07	-0.01	0.02	0.05
L & M & N	-0.14	-0.01	0.09	-0.24	-0.07	0.04	0.08	0.14	0.27	0.04	0.06	0.11	0.03	0.05	0.09
O	-0.15	0.05	0.22	-0.17	0.06	0.23	-0.05	0.01	0.10	-0.03	0.00	0.04	-0.03	-0.01	0.03
P	-0.17	0.00	0.19	-0.22	-0.02	0.17	0.02	0.07	0.21	0.00	0.03	0.08	0.00	0.01	0.05
Q	-0.32	-0.08	0.13	-0.36	-0.08	0.11	-0.01	0.05	0.16	-0.01	0.02	0.07	-0.01	0.01	0.05
R & S	-0.37	-0.23	-0.14	-0.45	-0.26	-0.16	0.03	0.08	0.25	0.01	0.04	0.11	0.01	0.03	0.09
T	-2.39	-0.73	-0.54	-1.02	-0.69	-0.51	-0.10	0.02	0.21	-0.06	0.00	0.10	-0.07	-0.02	0.08
U	-1.63	0.05	0.22	-0.06	0.09	0.25	-0.13	-0.01	0.12	-0.06	-0.01	0.04	-0.06	-0.01	0.03

Table 2: Estimation of sectoral earnings average and dispersion. Values correspond to averages for the lowest three deciles (Low), the middle four deciles (Mid) and the highest three deciles (High) across 18 EU countries and relative to NACE section C. Own elaboration based on the 2014 SES reference year and employment weights from the 2014 LFS.

A number of features are worth highlighting when comparing individual effects shown in Table 1 with aggregate figures in Table 2. On the one hand, individual effects are exacerbated for a few sectors: NACE sections B and K to the upside and sections I and R & S to the downside. And on the other hand, composition effects exert a significant downward effect on sectoral averages in the case of NACE sections F (construction) and G (trade), whereas the opposite happens for sections O (public administration) and P (education). In the case of the latter, which are associated to a large extent with public services, this feature would be explained by the fact that, *ceteris paribus*, employees in these activities are paid less than in the private sector (individual effect) but the employment composition is biased towards more highly remunerated characteristics, such as tertiary education, more senior workers or professional occupations.

Composition effects when aggregating at sectoral level are even much more relevant for the case of earnings dispersion. By intuition, we would expect that the degree of inequality within a more broadly defined group is higher than for a narrower one, as the latter shares more employment

characteristics. This is in fact the main feature we show in Table 2, contrasting with the limited individual effects commented before.

The increase of earnings dispersion relative to the manufacturing sector is particularly significant for NACE sections L & M & N (business services), but it's also a common feature across other service activities except for public administration.

3.2 Observed changes in the composition of employment

So far in this section we have provided static insights related to the effect of different employment characteristics on aggregate and sectoral earnings. Based on the finding that employment characteristics show significant heterogeneous effects on the average and dispersion of labour earnings, we now add the time dimension to assess the most relevant trends related to the composition of employment in EU countries since 2000 and give a first hint on their potential impact on country inequality.

For this purpose, Table 3 shows the change of the share of characteristics in total employment for the three available sub-periods as explained in Section 2: 2000-2007, 2008-2010 and 2011-2017. Again, values correspond to the average for different deciles in the country distribution (i.e. the lowest three, the middle four and the highest three).

There are a number of interesting features that shape recent trends in employment composition.

From the sectoral perspective, there has been a significant shift from non-service activities to the service sector (see Box 1 for a complementary analysis on the role of macroeconomic factors explaining these changes). Among those sectors reducing their employment shares, the largest contributions are accounted by the decline of agriculture (NACE section A) – more acute in countries becoming EU Member States during the sample, manufacturing (C) – starting already in the pre-crisis period, and construction (F) – particularly intense in some countries following the Great Recession. Within service activities, there has been a steady increase of the employment share, particularly in business services (L & M & N), health (Q) and entertainment and personal services (R & S), and to a lower extent in transport and ICT services (H & J), accommodation and food services (I), and domestic personnel (T). Also public administration (O) and education (P) show a net positive change over the period, mainly concentrated around the Great Recession – a time when fiscal policies were expansionary across the EU and private employment declined. On the contrary, the share of employment in trade (G) and finance (K) show a declining trend.

The occupational content has also undergone significant changes over the sample. On a steady basis, we observe an increase of the share of professionals (ISCO group 2) and, to lower extent, technicians (group 3). The opposite has been recorded for skilled agricultural workers (group 6), craft and related trade workers (group 7) and elementary occupations (group 9), all of which correspond to occupational groups for which either manual or routine tasks prevail. The latter has also been observed in the most recent sub-period for clerical support workers (group 4) and services and sales workers (group 5), in contrast with previous increases.

Regarding characteristics associated with individuals, we find a persistent and extensive increase of the share of females and workers with tertiary education; in the latter the case not only to the detriment of basic profiles but also to labour force with upper secondary education. In addition, we observe a progressive aging of staff, shown by the decline of the below-40 year bands and the increase for those aged 50 or more.

On the other hand, the characterization of labour relations has moved on average to a higher share of part-time and fixed-term contracts, a trend intensified during the successive economic crises affecting the EU.

Finally, the weight of employment in larger firms have shown a pro-cyclical pattern, increasing in the pre-crisis period, showing a strong decline around the Great Recession and growing again in recent years.

In sum, there have been a number of changes affecting the composition of employment, which, given the heterogeneity of average and dispersion earnings across characteristics previously shown, have the potential to generate structural changes in the degree of inequality across EU Member States. That is precisely the purpose of the SDA developed in Section 4.

Employment Characteristics		Change of the Share of Characteristics in Total Employment (percentage points)								
		2000-2007			2008-2010			2011-2017		
Characteristic	Category	Low	Md	High	Low	Md	High	Low	Md	High
Sector	NACE section A	-6.65	-1.59	-0.32	-0.58	0.11	0.56	-3.34	-0.39	0.23
Sector	B	-0.47	-0.12	0.06	-0.07	-0.01	0.11	-0.23	-0.04	0.02
Sector	C	-3.08	-1.99	0.43	-2.31	-1.41	-0.92	-1.13	0.00	1.01
Sector	D & E	-0.64	-0.18	0.07	-0.10	0.03	0.18	-0.20	-0.03	0.16
Sector	F	-0.55	1.19	4.77	-2.83	-0.59	0.10	-1.61	-0.57	0.34
Sector	G	-0.96	0.18	2.14	-0.49	-0.04	0.72	-1.33	-0.36	0.72
Sector	HJ	-0.89	0.06	0.65	-0.24	0.12	0.40	-0.31	0.14	1.12
Sector	I	0.02	0.40	0.68	-0.13	0.12	0.35	-0.17	0.14	0.75
Sector	K	-0.22	-0.03	0.40	-0.20	-0.03	0.14	-0.31	-0.12	0.19
Sector	L & M & N	0.92	1.64	2.27	-0.19	0.34	1.35	0.38	1.02	1.83
Sector	O	-0.70	-0.09	0.56	-0.26	0.26	1.21	-0.70	-0.06	0.87
Sector	P	-1.03	-0.20	0.69	-0.08	0.46	1.09	-0.78	0.10	0.61
Sector	Q	-0.92	0.72	1.63	0.38	0.81	1.23	-0.30	0.50	1.34
Sector	R & S	-0.11	0.37	0.62	-0.14	0.11	0.36	-0.08	0.26	0.51
Sector	T	-0.08	0.08	0.32	-0.14	0.01	0.23	-0.50	0.02	0.31
Sector	U	-0.02	0.00	0.06	-0.03	0.00	0.06	-0.02	0.00	0.06
Size	<50	-4.28	-0.93	4.64	-0.09	1.20	2.90	-4.06	-1.85	0.60
Size	50 or more	-4.64	0.93	4.28	-2.90	-1.20	0.09	-0.60	1.85	4.06
Gender	Male	-2.85	-0.51	1.52	-2.04	-0.84	-0.06	-1.46	-0.52	0.81
Gender	Female	-1.52	0.51	2.85	0.06	0.84	2.04	-0.81	0.52	1.46
Education	Basic	-9.29	-4.86	-1.74	-2.92	-1.55	-0.66	-6.95	-2.32	0.59
Education	Upper Secondary	-1.37	1.51	4.97	-1.80	-0.49	0.61	-3.74	-1.15	2.02
Education	Tertiary	0.97	3.89	6.14	1.09	2.09	3.63	1.35	3.72	6.45
Occupation	ISCO group 0	-0.30	0.01	0.52	-0.07	0.05	0.12	-0.19	-0.05	0.12
Occupation	1	-1.65	0.13	1.14	-0.60	-0.01	0.61	-1.27	-0.27	0.91
Occupation	2	-0.37	1.20	2.80	0.05	0.87	2.10	-0.38	1.18	4.04
Occupation	3	-1.12	0.72	2.25	-0.93	0.19	1.16	-1.50	0.19	2.10
Occupation	4	-1.82	-0.29	0.39	-0.59	0.12	0.66	-1.17	-0.19	0.72
Occupation	5	0.10	0.92	2.75	0.25	0.58	1.29	-1.03	-0.07	1.43
Occupation	6	-6.33	-1.00	0.12	-0.48	0.07	0.44	-2.84	-0.40	0.15
Occupation	7	-2.20	-0.94	0.84	-2.92	-1.14	-0.57	-1.98	-0.67	0.65
Occupation	8	-0.87	0.47	2.04	-0.83	-0.31	0.01	-0.72	0.02	1.02
Occupation	9	-1.79	-0.38	2.58	-0.61	-0.07	0.51	-1.04	-0.18	1.45
Age	15-19	-1.02	-0.37	0.24	-0.73	-0.32	0.01	-0.37	-0.02	0.27
Age	20-29	-4.40	-2.40	-0.28	-2.02	-1.16	-0.39	-2.53	-1.56	-0.80
Age	30-39	-5.33	-2.87	2.17	-1.59	-0.36	0.71	-4.01	-1.62	0.18
Age	40-49	-3.58	-0.17	3.26	-0.86	0.47	1.31	-3.81	-1.02	1.83
Age	50-59	1.93	3.97	5.68	0.19	1.21	2.04	-1.34	1.62	3.93
Age	60 or more	-1.27	1.35	3.13	-0.18	0.60	1.11	0.86	3.58	4.78
Contract	Permanent	-4.46	-0.11	2.68	-1.53	-0.26	0.79	-1.70	-0.62	1.25
Contract	Fixed-term	-2.68	0.11	4.46	-0.79	0.26	1.53	-1.25	0.62	1.70
Hours	Full-time	-3.93	-0.77	1.81	-2.40	-1.07	-0.39	-2.23	-0.43	1.59
Hours	Part-time	-1.81	0.77	3.93	0.39	1.07	2.40	-1.59	0.43	2.23

Table 3: Change of the share of characteristics in total employment in percentage points over three sub-periods. Values correspond to averages for the lowest three deciles (Low), the middle four deciles (Mid) and the highest three deciles (High) across 18 EU countries. Own elaboration based on the yearly LFS anonymised microdata sets between 2000 and 2017.

Box 1. The role of macroeconomic factors explaining changes in the shares of sectoral employment

The declining share of agriculture (NACE section A) and manufacturing (C) sectors is driven for the majority of countries by shifts in demand patterns as well as technological progress reducing employment requirements per unit of output (Table 4).

In contrast, changes in competitiveness show a more heterogeneous picture. In the general context of the EU losing global market shares against external competitors, China in particular (Marschinski and Martínez-Turégano 2019, 2020), the reallocation of manufacturing activity within EU value chains softened this negative impact in those countries that joined the EU throughout the sample period.

Within the service sector, those more market-oriented activities have recorded the largest gains in employment shares. This is particularly the case of business services (L & M & N), for which the main contributor has been lower gains in labour productivity relative to the rest of the economy (or labour hoarding practices⁴), as well as their increasing weight in the input structure throughout different value chains.

Among those activities traditionally associated with public services, the relative increase in employment requirements is the main driving factor for public administration (O) and education (P). In contrast, the change in demand patterns – likely conditioned by the ageing process of EU population – plays the larger role explaining the increasing weight of employment in the health sector (Q).

On a country basis, labour productivity changes constitute the main contributing factor in 13 out of 18 countries. In particular, it explains half or more of sectoral employment shifts in Germany, Hungary and the three Baltic states. In turn, demand factors are the main driving force in France and the Netherlands, being also quite significant in Portugal and Bulgaria. On the other hand, changes of the participation in value chains dominates in Belgium, Finland and Romania, while they contribute also substantially in the Czech Republic and Slovakia.

Country	Change in the employment sectoral share between 2000 and 2014, contributing factor by NACE individual or combined sections (percentage points)																																						
	A		B		C		D&E		F		G		H&J		I		K		L&M&N		O		P		Q		R&S		T		U								
	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.	Prodd.	Demand	VC Part.									
Belgium	0	0	0	0	0	0	-1	0	-3	0	0	0	-1	0	0	1	-1	-1	0	1	-1	0	0	0	-1	0	0	0	0	0	0	0	0						
Bulgaria	16	-7	-5	0	0	0	-5	-2	4	0	0	0	-2	2	1	-1	3	2	-2	1	1	-1	3	-1	-1	0	0	0	0	0	0	0	0	0					
Czech Republic	0	0	-1	0	0	0	-6	-1	6	0	0	0	1	-1	-1	-4	2	2	0	1	-1	3	-1	-1	0	0	0	0	0	0	0	0	0	0	0				
Germany	0	0	0	0	0	0	-2	1	-1	0	0	0	0	-1	0	0	-1	0	0	-1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0				
Estonia	-2	-1	0	-1	0	0	-7	-2	5	0	0	0	1	1	0	1	1	-2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0				
Spain	-1	-1	1	0	0	0	-3	-1	-2	0	0	0	-1	-3	-2	-2	0	3	0	1	0	3	-1	0	0	0	0	0	0	0	0	0	0	0	0	0			
Finland	-1	0	-1	0	0	0	-1	0	-4	0	0	0	2	-2	1	-2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
France	0	-1	0	0	0	0	-1	-1	-2	0	0	0	1	-1	0	1	0	1	0	1	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Hungary	-3	-1	0	0	0	0	-6	-1	4	0	0	0	1	0	0	1	1	-1	-1	0	1	1	0	-1	1	0	0	0	0	0	0	0	0	0	0	0	0		
Italy	-1	-1	1	0	0	0	-2	-1	-2	0	0	0	2	-2	0	0	0	0	0	0	0	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0		
Lithuania	-5	-1	-3	0	0	0	-7	-1	4	-1	0	0	0	-1	-1	2	2	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Latvia	-8	-2	1	-1	0	0	1	-3	-1	0	0	0	1	1	0	-4	4	2	2	0	-1	0	1	0	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	
Netherlands	-1	0	0	0	0	0	-1	-1	-1	0	0	0	0	-1	0	-1	-1	0	0	0	0	1	1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Poland	-3	-3	-3	1	0	0	-1	-9	0	10	1	0	0	-1	1	0	4	-2	-1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Portugal	-2	-1	1	0	0	0	-4	-1	0	0	0	0	2	-5	-2	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Romania	-6	1	-10	0	0	-1	-1	-1	1	1	0	0	-2	3	2	-2	2	7	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Slovakia	-3	0	0	0	0	0	-10	-3	8	0	-1	-1	2	0	-1	3	4	-3	2	0	-2	-2	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
United Kingdom	0	0	0	0	0	0	-3	-1	-2	0	0	0	0	-1	0	-1	-1	1	0	0	0	1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Deales																																							
Low	-5	-3	-4	0	0	-1	-7	-2	-3	0	0	0	-1	-2	-1	-2	-1	-1	-1	0	-1	-1	-1	-1	-1	0	0	-1	-1	0	0	-1	0	0	0	0	0		
Mid	-1	-1	0	0	0	0	-3	-1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
High	1	0	1	0	0	0	-1	0	6	0	0	0	2	1	1	2	3	3	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4: Decomposition of the change in sectoral shares between 2000 and 2014, by economic activity, country and contributing factor (Prodd. = labour productivity; VC Part. = value chain participation), in percentage points. Own elaboration based on WIOD.

⁴ OECD (2012).

4 Structural drivers of earnings inequality across EU countries

The Structural Decomposition Analysis (SDA) described in Section 2 is based on the estimated effect of employment characteristics on earnings and the observed changes in the composition of employment over time. These two elements were discussed in detail, but individually, in the previous section.

Now we bring together these two elements and provide a comprehensive picture on how earnings inequality has evolved across EU countries between 2000 and 2017, including the estimated contribution of the main drivers.

It's important to keep in mind that the analysis hereby presented is only based on changes of inequality due to composition effects and not driven by divergent trends in the remuneration of characteristics, which we remind is constant within each of the three sub-periods.

Having said that, we develop the SDA in two levels, differentiating the impact of changes in sectoral employment shares – associated with macroeconomic factors – from shifts in the weight of other characteristics within each economic sector – assumed to be more related to the shifting nature of employment itself.

Before we turn into the driving factors, we start having look at the change of our three inequality indicators over the different sub-periods. Table 5 shows the average annual change for the 18 EU countries in our sample⁵. The colour code indicates increases of inequality in red and decreases in green. In addition, the three bottom files contain the average values for the lowest three deciles in the country distribution, the middle four and the highest three.

Change of Earnings Inequality (% average annual change)												
Country	2000-2007			2008-2010			2011-2017			2000-2017		
	LV	MLD	TH	LV	MLD	TH	LV	MLD	TH	LV	MLD	TH
Belgium	0.68	0.59	0.46	0.69	0.58	0.41	0.18	0.08	-0.04	0.48	0.38	0.25
Bulgaria	-0.79	-0.31	0.15	0.14	0.39	0.57	0.57	0.34	0.17	-0.12	0.04	0.21
Czech Republic	-0.16	-0.15	-0.13	0.19	-0.03	-0.26	1.50	1.26	1.02	0.55	0.43	0.32
Germany	0.43	0.49	0.50	0.30	0.43	0.59	0.32	0.28	0.20	0.37	0.39	0.39
Estonia	0.58	0.40	0.27	1.61	0.90	0.15	1.09	1.08	1.04	0.92	0.74	0.56
Spain	0.06	-0.01	-0.03	2.17	1.56	0.85	0.55	0.56	0.52	0.54	0.43	0.30
Finland	0.62	0.55	0.50	2.50	2.19	1.85	-0.01	-0.29	-0.61	0.62	0.43	0.23
France	1.17	1.09	0.99	0.67	0.60	0.51	0.67	0.62	0.57	0.90	0.84	0.76
Hungary	0.71	0.64	0.55	1.63	1.57	1.46	-0.47	-0.30	-0.17	0.36	0.39	0.38
Italy	-0.57	-0.66	-0.72	0.66	0.56	0.45	1.39	1.20	0.97	0.38	0.25	0.11
Lithuania	1.11	0.87	0.76	3.34	2.64	2.02	-0.47	-0.52	-0.54	0.77	0.55	0.41
Latvia	-2.30	-1.82	-1.30	3.90	3.43	3.13	-0.03	0.08	0.17	-0.57	-0.36	-0.12
Netherlands	0.65	0.78	0.88	2.58	2.44	2.19	-0.08	-0.20	-0.26	0.61	0.61	0.60
Poland	0.34	0.27	0.27	-0.22	0.12	0.44	0.18	0.13	0.08	0.20	0.19	0.22
Portugal	1.01	0.86	0.68	0.58	0.36	0.17	0.83	0.44	0.09	0.88	0.62	0.38
Romania	-0.98	-1.91	-2.29	1.13	1.21	1.21	-1.96	-2.07	-1.99	-1.09	-1.56	-1.70
Slovakia	0.25	0.23	0.22	4.40	3.13	2.06	1.32	1.03	0.74	1.23	0.94	0.67
United Kingdom	-0.15	-0.14	-0.06	1.22	1.28	1.20	-0.13	-0.08	-0.04	0.04	0.07	0.12
<i>Deciles</i>												
Low	-0.81	-0.82	-0.74	0.28	0.31	0.23	-0.52	-0.57	-0.59	-0.19	-0.22	-0.19
Mid	0.35	0.30	0.29	1.21	1.03	0.85	0.30	0.23	0.14	0.49	0.41	0.31
High	0.89	0.80	0.72	3.13	2.55	2.10	1.13	0.95	0.80	0.89	0.71	0.56

Table 5: Change of estimated earnings inequality across 18 EU Member States using three indicators: Log Variance (LV), Mean Log Deviation (MLD) and Theil Index (TH). Annual percentage change over available years in the three sub-periods and the whole period. Own elaboration based on SES and LFS anonymised microdata sets.

⁵ An increase of 1% in the inequality indicators is more or less equivalent to a rise of 0.2 percentage points in the unemployment rate (or one percentage point in five years' time).

The first thing to notice is the strong correlation between the three inequality indicators, implying that conclusions at this aggregate level will not be in principle conditioned by the subjective criteria behind the choice of measurement.

Second, the vast majority of EU countries show a distribution of earnings becoming more uneven since 2000, recording in each case two or three sub-periods in which the different inequality indicators increase.

Third, the 2008-2010 appears as the sub-period in which this phenomenon was more intense and more extensively shared across Member States.

And finally, at country level, Slovakia, France and Estonia show the largest increase of earnings equality considering the weighted average over the whole period (2000-2017), whereas Romania and Latvia are the only ones recording an overall decrease of earnings inequality.

4.1 Characterization of inequality trends across EU countries

The properties of the inequality indicators, as discussed in Section 2, allow an easy decomposition of changes into the contribution of the different employment characteristics.

Table 6 summarizes the SDA for the 18 EU countries in the sample and the three inequality indicators. Cells contain the weighted average contribution of the different characteristics throughout the three sub-periods.

Overall, we observe that changes in the share of certain characteristics have moved inequality in the same direction across the majority of EU Member States. This is particularly the case of the working time arrangement. The increasing share of part-time workers have pushed up earnings inequality not only because this population group works less time but also receives lower remuneration on a full-timer’s equivalent basis as shown in Section 3. On a country basis, the largest contribution has been recorded in Finland and Lithuania, followed by Estonia, Spain, Italy and Portugal.

Although to a lesser extent, the growing weight of fixed-term contracts operated the same way as the increase of part-time workers. In this case, France, Poland and Portugal are the countries showing the largest upward contributions to inequality.

Country	Sectoral Shares			Sectoral Composition																								
	LV	MD	TH	Gender			Age			Occupation			Education			Part-/Full-time			Contract			Firm Size						
				LV	MD	TH	LV	MD	TH	LV	MD	TH	LV	MD	TH	LV	MD	TH	LV	MD	TH	LV	MD	TH				
Belgium	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	
Bulgaria	0.0	0.0	0.3	0.0	0.0	-0.1	0.0	0.0	-0.1	-0.3	-0.3	0.0	0.2	0.2	0.1	-0.1	-0.1	-0.2	0.0	0.0	-0.1	0.2	0.2	0.3	0.2	0.2	0.3	
Czech Republic	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.1	0.0	-0.2	-0.3	-0.1	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Germany	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.2	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Estonia	0.1	-0.1	0.1	0.0	0.0	-0.1	0.0	0.1	-0.1	0.4	0.3	0.7	0.0	0.0	-0.1	0.5	0.4	0.2	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	
Spain	-0.2	-0.2	-0.1	0.0	0.0	0.0	0.1	0.0	0.0	-0.2	-0.2	-0.3	0.0	0.0	0.0	0.4	0.3	0.3	0.0	0.0	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Finland	0.0	0.0	-0.1	0.0	0.0	-0.1	0.0	0.0	-0.1	0.1	0.0	0.3	0.0	-0.1	-0.2	0.6	0.5	0.5	-0.1	0.0	-0.1	0.0	0.1	0.0	0.0	0.1	0.0	
France	-0.1	-0.1	0.0	0.0	0.0	-0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.3	0.3	0.2	0.1	0.1	0.1	0.0	0.0	0.0	
Hungary	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	-0.2	-0.3	-0.3	0.3	0.3	0.4	-0.2	-0.1	-0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Italy	0.2	0.2	0.2	-0.1	-0.1	-0.2	0.0	0.0	0.0	-0.6	-0.7	-0.7	0.2	0.2	0.2	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Lithuania	-0.1	-0.1	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.1	0.1	-0.1	1.2	0.7	0.6	-0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	
Latvia	-0.3	-0.3	-0.3	0.0	0.0	0.0	0.1	0.2	0.2	-0.2	-0.2	-0.1	0.1	0.2	0.3	-0.2	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Netherlands	0.1	0.2	0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
Poland	-0.2	-0.3	-0.4	0.1	0.1	0.0	0.1	0.1	0.0	-0.1	-0.1	-0.1	0.3	0.2	0.3	-0.2	-0.1	-0.1	0.2	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	
Portugal	0.0	-0.1	-0.9	0.0	0.0	-0.1	0.1	0.0	0.0	-0.2	-0.1	0.2	0.3	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	
Romania	-0.9	-1.5	-1.5	0.0	0.0	0.0	0.0	0.1	0.0	-0.2	-0.2	-0.2	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	-0.1	0.0	
Slovakia	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.2	0.4	-0.2	-0.3	-1.7	0.5	0.5	1.5	0.3	0.3	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.3	
United Kingdom	0.3	0.3	0.3	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Deales</i>																												
Low	-0.3	-0.4	-0.5	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.3	-0.3	-0.6	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Md	0.0	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	-0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0
High	0.2	0.1	0.3	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.2	0.3	0.3	0.5	0.5	0.4	0.4	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.2

Table 6: Estimated contribution of changes in the employment composition to changes in earnings inequality, 2000-2017 annual average in percentage points, by country, employment characteristic and inequality indicator. Own elaboration based on SES and LFS anonymised microdata sets.

Changes in the employment composition by educational level also contributed to the rise of inequality across the board. This was mainly the result of the increasing weight of workers with tertiary education, which show the highest remuneration return and a higher degree of inequality compared with other education levels. The majority of countries in which the contribution was higher correspond to EU Member States with starting low shares for tertiary-education workforce, such as the Czech Republic, Hungary, Poland, Portugal or Slovakia.

Moderate contributions to the upside has also been found for two other employment characteristics. On the one hand, the aging process has been pushing up inequality in a number of countries, and, in general, to a larger extent in those that joined the EU throughout the sample period. This is the case of Latvia and Slovakia. An on the other hand, shifts in the employment weight by firm size contributed as well as to the rise of earnings inequality, being Bulgaria the country with the largest values.

On the gender composition, contributions have been neutral across the board, except for a marginal downward effect in Italy and the Netherlands – two of the countries with lower starting female employment shares.

Finally, we turn attention to two of the characteristics identified as the usual suspects driving earnings inequality, namely changes in the sectoral and occupational shares. According to our analysis, these two factors don't confirm overall their expected contribution and show in fact a very mixed picture across EU Member States.

In the case of sectoral shares, we observe that shifts in the weight of economic activities reduced inequality in a number of countries that joined the EU throughout the sample period, Romania in particular, followed by Latvia and Poland. Structural change in Eastern Europe implied the reallocation of jobs from agriculture to services, shifting then employment weight from low remunerated activities to others closer to the country average.

The impact was much more moderate across EU15 Member States, having a slight upward contribution in Italy, the Netherlands and the UK, and the opposite in Spain and Portugal. While for all these countries the shift of employment away from industrial sectors pushed up overall inequality due to a more uneven earnings distribution in service activities – business services in particular, the difference in the net effect stems from the impact generated through relative wages.

Regarding occupational shares, the majority of countries record downward contributions to inequality indicators, particularly in the case of Italy. Only Estonia and, to a lesser extent, Finland, show significant upward effects. Existing divergences across countries seem to be associated with the relative increase of workers in occupations where cognitive and non-routine tasks prevail, namely managers, professionals and technicians, which correspond to those that are better paid and show a more uneven earnings distribution.

4.2 Alternative inequality approaches

We complement the analysis on earnings inequality in this section by providing two additional alternative approaches. The first one considers full-timer's equivalent earnings, focusing then on the hourly remuneration of characteristics, while the second one broadens the sample to include unemployed as a population group.

As explained in Section 2, the latter approach needs to make some additional assumptions. Namely, we consider that unemployed are homogenous- i.e. group dispersion is zero – and receive a remuneration equal to one month of average annual earnings. We introduce this group into the three inequality indicators considering the unemployment rate as its population share.

Table 7 compares the results for the three approaches, the one previously summarized in Table 5 and the two additional ones proposed in this subsection. The values correspond to the average annual change over the three sub-periods between 2000 and 2017 for the three inequality indicators across the EU countries in the sample.

When using full-timer's equivalent rather than actual earnings, we observe a softer rise of inequality with respect to the reference approach. This is the expected result of a general increase in part-time and fixed-term contracts throughout the sample, given that, as explained in Section 2, we are assuming that the annual remuneration is respectively 50% lower than full-time arrangements and 25% lower than permanent contracts. On a country basis, the largest contrast is observed for Italy, followed by Germany and Spain, all of which now show almost flat inequality indicators over the sample period.

The comparison with the approach including unemployed population yields more discrepancies compared with our reference approach, as well as a higher degree of dispersion across countries. For instance, while Spain and Portugal show a significant larger rise of inequality when accounting for the sharp increase in their unemployment rates, the sign is on the contrary reversed for Germany and most Eastern European countries, which simultaneously show sustained employment growth and a more uneven distribution for those holding a job (see Box 2 for a complementary analysis on the role of macroeconomic factors explaining changes in unemployment rates).

Change of Earnings Inequality between 2000 and 2017 (% average annual change)									
Country	Actual Earnings			Full-timer's Equivalent Earnings			Actual Earnings including Unemployment		
	LV	MLD	TH	LV	MLD	TH	LV	MLD	TH
Belgium	0.48	0.38	0.25	0.39	0.24	0.07	0.34	0.30	0.23
Bulgaria	-0.12	0.04	0.21	-0.10	0.07	0.24	-2.62	-2.07	-1.37
Czech Republic	0.55	0.43	0.32	0.36	0.28	0.19	-2.63	-1.87	-1.13
Germany	0.37	0.39	0.39	0.14	0.16	0.17	-0.89	-0.52	-0.29
Estonia	0.92	0.74	0.56	0.67	0.54	0.42	-1.05	-1.01	-0.86
Spain	0.54	0.43	0.30	0.20	0.16	0.12	1.55	1.39	1.10
Finland	0.62	0.43	0.23	0.30	0.14	-0.01	-0.19	-0.17	-0.16
France	0.90	0.84	0.76	0.70	0.66	0.61	0.59	0.56	0.53
Hungary	0.36	0.39	0.38	0.30	0.31	0.30	-1.04	-0.73	-0.35
Italy	0.38	0.25	0.11	0.03	-0.09	-0.20	0.61	0.48	0.33
Lithuania	0.77	0.55	0.41	0.68	0.50	0.40	-0.95	-0.94	-0.82
Latvia	-0.57	-0.36	-0.12	-0.38	-0.20	-0.01	-0.43	-0.43	-0.37
Netherlands	0.61	0.61	0.60	0.67	0.61	0.54	0.60	0.46	0.41
Poland	0.20	0.19	0.22	0.21	0.16	0.14	-2.92	-2.10	-1.36
Portugal	0.88	0.62	0.38	0.89	0.66	0.42	2.08	1.48	0.96
Romania	-1.09	-1.56	-1.70	-0.94	-1.44	-1.62	-1.20	-1.30	-1.37
Slovakia	1.23	0.94	0.67	0.71	0.58	0.44	-2.45	-2.12	-1.53
United Kingdom	0.04	0.07	0.12	0.07	0.08	0.10	-0.31	-0.19	-0.07
<i>Deciles</i>									
Low	-0.19	-0.22	-0.19	-0.19	-0.23	-0.27	-2.13	-1.73	-1.26
Md	0.49	0.41	0.31	0.32	0.24	0.20	-0.58	-0.47	-0.34
High	0.89	0.71	0.56	0.71	0.59	0.47	0.94	0.77	0.58

Table 7: Change of earnings inequality across 18 EU Member States under different approaches and using three indicators: Log Variance (LV), Mean Log Deviation (MLD) and Theil Index (TH). Annual percentage change over the three sub-periods between 2000 and 2017. Own elaboration based on SES and LFS anonymised microdata sets and AMECO.

Box 2. The role of macroeconomic factors explaining changes in the unemployment rate

Participation rates and labour productivity have increased in most EU countries, adding pressure to labour markets for sustained employment growth. However, the capacity to create jobs has been very divergent between Member States conditional on their resilience to the successive economic crises and global competition (Table 8).

For instance, Portugal and Spain suffered more intensively the successive economic crises, taking a heavy toll on the labour market. On the contrary, Germany was both successful in holding a strong service-led demand growth and in gaining participation in global value chains, contributing to the sharp decline of the unemployment rate over the sample period.

On the other hand, the integration process of those countries that joined the EU throughout the sample period had a structural downward impact on the unemployment rate, benefiting, as mentioned in Box 1, from the reallocation of manufacturing activity within EU value chains.

Country	Change of the Unemployment Rate between 2000 and 2014, average annual contribution in percentage points					
	Total (1. + 2.)	1. Labour Market Participation	2. Job Creation / Destruction (2a. + 2b. + 2c.)	Job Creation / Destruction: Macroeconomic Developments		
				2a. Labour Productivity	2b. Demand	2c. Value Chain Participation
Belgium	0.11	0.28	-0.17	0.61	-0.91	0.14
Bulgaria	-0.36	1.02	-1.37	1.55	-1.63	-1.29
Czech Republic	-0.19	0.23	-0.42	2.08	-1.37	-1.13
Germany	-0.21	0.58	-0.79	0.47	-1.00	-0.26
Estonia	-0.51	0.37	-0.88	2.62	-2.23	-1.28
Spain	0.90	0.81	0.09	0.73	-0.55	-0.08
Finland	-0.08	0.42	-0.50	0.72	-1.50	0.28
France	0.12	0.17	-0.05	0.80	-1.13	0.29
Hungary	0.10	0.60	-0.50	1.82	-1.40	-0.92
Italy	0.19	0.41	-0.22	-0.56	0.09	0.25
Lithuania	-0.41	-0.02	-0.39	2.58	-2.42	-0.55
Latvia	-0.25	0.70	-0.95	2.24	-2.53	-0.66
Netherlands	0.26	0.52	-0.26	0.64	-1.07	0.17
Poland	-0.51	-0.11	-0.40	1.99	-1.31	-1.08
Portugal	0.64	0.09	0.55	0.43	0.41	-0.29
Romania	-0.06	-0.57	0.52	4.07	-3.13	-0.42
Slovakia	-0.41	0.04	-0.45	1.89	-1.37	-0.97
United Kingdom	0.05	0.21	-0.16	1.25	-1.32	-0.09
<i>Deciles</i>						
Low	-0.40	-0.06	-0.83	0.39	-2.23	-1.11
Mid	-0.06	0.33	-0.35	1.34	-1.31	-0.40
High	0.37	0.70	0.13	2.59	-0.51	0.17

Table 8: Decomposition of the change in unemployment rate between 2000 and 2014, by sub-period, country and contributing factor, annual average in percentage points. Own elaboration based on WIOD and AMECO.

5 Concluding remarks

The aim of this paper was to provide a structural perspective of the evolution of inequality within labour markets of EU countries over the last two decades (2000-2017). In doing so, we make use of complementary datasets to analyse a number of alternative indicators and approaches, quantifying the contribution of changes in different employment characteristics.

We first estimate the effect of employment characteristics on the average and dispersion of earnings using different reference years from the Eurostat's Structure of Earnings Survey (SES). We then use these estimations to build inequality time series for three sub-periods based on employment annual weights from the Eurostat's Labour Force Survey (LFS). We finally develop a structural decomposition analysis differentiating the impact of shifting weights in sectoral employment from those in other employment characteristics. Complementarily, the role of macroeconomic factors is assessed within a global framework using the World Input Output Database (WIOD). There are a number of methodological challenges that remain and call for some caution, although we still think that both the approach and the results are of great value for interpreting recent inequality trends in Europe.

In general terms, we observe that earnings inequality has increased across the board, being this phenomenon particularly intense during the years around the Great Recession. We estimate that the main contributors to this rise are related to the expansion of part-time and fixed-term contracts, as well as to the higher share of tertiary educated workers; the ageing process and a shift to bigger companies also played a role, although to a lesser extent. On the contrary, we found that changes in the occupational content within sectors had an overall downward effect on inequality, while shifts in the sectoral composition of employment presented a rather heterogeneous picture. In both cases, the increasing share of more uneven characteristics – occupations with a larger content of non-routine cognitive tasks and employment in service activities – was partially or fully compensated by changes in income shares and relative earnings reducing aggregate inequality.

Macroeconomic factors played a differentiated role in a number of aspects. First, the shift of employment from non-service activities to service sectors was fuelled by changes in demand patterns and relative productivity. Second, the reallocation of manufacturing activity within EU value chains softened this negative impact in those countries that joined the EU throughout the sample period, supporting structural change and job creation. And third, the generalized increase of participation rates added pressure to labour markets, but the capacity to create jobs was very divergent between Member States conditional on their resilience to the successive economic crises and external competition. This had a significant impact on inequality when considering also unemployed population as illustrated by the comparison of Southern EU countries with Germany.

From the policy perspective, we deem that the use of alternative indicators and approaches to measure inequality, as well as the attempt to decompose recent changes into informative drivers, help to fine-tune the institutional response to more uneven income distributions. This is of course not limited to the contents exposed in this paper, but requires to complement them with other dimensions, including, in particular, more granular information on the evolution of earnings by employment characteristics. As observed for the United States, relative human capital returns can substantially change over time and have a significant impact on inequality (Autor 2014).

Based on our findings, there are some policy readings we would like to underline. First, given its prevalent role in the recent rise of inequality in EU countries, it's critical to understand the factors behind the expansion of part-time and fixed-term contracts, trying to disentangle whether they correspond to underemployment (i.e. a person working less time than desired) or

to convenient working arrangements helping certain population groups to participate in the labour market (e.g. parents looking for work-life balance). Unfortunately, recent evidence for developed countries seems to lean towards the underemployment hypothesis (MacDonald 2019). Second, we have shown that the capacity to create jobs is critical when considering a broad approach of inequality, hence implying that overall growth and competitiveness strategies need to be at the top of priorities in the fairness agenda. And third, there a number of concomitant trends increasing inequality that come with the course of time, such as the improvement of education levels or the ageing of workers. In this sense, a lifelong learning and skills agenda, as well as adequate social and redistribution policies, are needed to ensure that job opportunities are accessible in the most inclusive way possible.

References

- Acemoglu, D. and Autor, D. H. (2011), 'Skills, tasks and technologies: Implications for employment and earnings', *Handbook of labor economics*, Vol. 4, pp. 1043-1171.
- Alessi, L., Benczur, P., Campolongo, F., Cariboni, J., Manca, A. R., Menyhart, B., and Pagano, A. (2018). 'The resilience of EU Member States to the financial and economic crisis. What are the characteristics of resilient behaviour?', JRC Science for Policy Report EUR 29221 EN.
- Anand S. (1997), 'The measurement of income inequality', in: S. Subramanian (ed) *Measurement of inequality and poverty*, Oxford University Press, pp. 81-105.
- Autor, D. H. (2014), 'Skills, education, and the rise of earnings inequality among the "other 99 percent"'. *Science* 344, no. 6186, pp. 843-851.
- Autor, D. H., Levy, F. and Murnane, R. J. (2003), 'The skill content of recent technological change: An empirical exploration', *The Quarterly journal of economics*, vol. 118, no 4, pp. 1279-1333.
- Autor, D. H., Katz, L. F. and Kearney, M. S. (2006), 'The polarization of the US labor market', *American economic review*, vol. 96, no 2, pp. 189-194.
- Benczur, P., Cseres-Gergely, Z., and Harasztosi, P. (2017), 'EU-wide income inequality in the era of the Great Recession', JRC Technical Report.
- Breemersch, K., Damijan, J. P. and Konings, J. (2017), 'Labour market polarization in advanced countries: Impact of global value chains, technology, import competition from China and labour market institutions', *OECD Social, Employment and migration working papers*, no. 197.
- De La Rica, S. and Gortazar, L. (2016), 'Differences in job de-Routinization in OECD countries: Evidence from PIAAC', *IZA discussion paper*, no. 9736.
- Fernández, C., and Martínez-Turégano, D. (2018), 'Labour market participation rate in the euro area: performance and outlook, a long-term view', *Bank of Spain, Economic Bulletin*, 1.
- Foster-McGregor, N., Leitner, S., Leitner, S., Pöschl, J., and Stehrer, R. (2016), 'Study on various aspects of earnings distribution using micro-data from the European Structure of Earnings Survey', *WIIW report commissioned by the European Union*.
- Goos, M., Manning, A. and Salomons, A. (2009), 'Job polarization in Europe', *American economic review*, vol. 99, no 2, pp. 58-63.
- Hummels, D., Ishii, J., and Yi, K. M. (2001), 'The nature and growth of vertical specialization in world trade', *Journal of international Economics*, 54(1), 75-96.
- Krusell, P., Ohanian, L. E., Ríos-Rull, J. V. and Violante, G. L. (2000), 'Capital-skill complementarity and inequality: A macroeconomic analysis', *Econometrica*, vol. 68, no 5, pp. 1029-1053.
- Lemieux, T. (2006), 'The "Mincer equation" thirty years after schooling, experience, and earnings', In *Jacob Mincer a pioneer of modern labor economics*, pp. 127-145.
- Lewandowski, P. (2017), 'The changing nature of jobs in Central and Eastern Europe', *IZA World of Labor*.
- Marschinski, R. and Martínez-Turégano, D. (2019), 'Reassessing the Decline of EU Manufacturing: A Global Value Chain Analysis', *JRC Technical Paper EUR 29999 EN*.
- Marschinski, R. and Martínez-Turégano, D. (2020), 'The EU's shrinking share in global manufacturing: a value chain decomposition analysis'. *National Institute Economic Review*, 252, forthcoming.

- Martínez-Turégano., D. (2019), 'EU employment from 2000 to 2014: factors behind (uneven) sectoral and regional dynamics', JRC Science for Policy Brief.
- MacDonald, D. (2019), 'Under-employment: A crisis hangover, or something more?', OECD Social, Employment and Migration Working Papers, no. 234.
- Michaels, G., Natraj, A. and Van Reenen, J. (2014), 'Has ICT polarized skill demand? Evidence from eleven countries over twenty-five years', *Review of Economics and Statistics*, vol. 96, no 1, pp. 60-77.
- Mincer, J. (1974), 'Schooling, Experience, and Earnings', *Human Behavior and Social Institutions*, no. 2.
- OECD (2011). 'Divided we stand: Why inequality keeps rising'.
- OECD (2012), 'What Makes Labour Markets Resilient During Recessions?', *OECD Employment Outlook*, 2, pp. 53-107.
- OECD (2017), 'How technology and globalisation are transforming the labour market', *OECD employment outlook*, chapter 3, pp. 81-124.
- Timmer, M. P., Los, B., Stehrer, R., and De Vries, G. J. (2013), 'Fragmentation, incomes and jobs: an analysis of European competitiveness', *Economic policy*, 28(76), pp. 613-661.
- Violante, G. L. (2008), 'Skill-biased technical change', *The new Palgrave dictionary of economics*, 2.

Annex

Annex 1. NACE economic sections

Section Rev. 2	Section Rev. 1.1
A Agriculture, forestry and fishing	A Agriculture, hunting and forestry
B Mining and quarrying	B Fishing
C Manufacturing	C Mining and quarrying
D Electricity, gas, steam and air conditioning supply	D Manufacturing
E Water supply, sewerage, waste management and remediation activities	E Electricity, gas and water supply
F Construction	F Construction
G Wholesale and retail trade; repair of motor vehicles and motorcycles	G Wholesale and retail trade: repair of motor vehicles, motorcycles and personal and household goods
H Transportation and storage	I Transport, storage and communications
J Information and communication	H Hotels and restaurants
I Accommodation and food service activities	J Financial intermediation
K Financial and insurance activities	K Real estate, renting and business activities
L Real estate activities	L Public administration and defence; compulsory social security
M Professional, scientific and technical activities	M Education
N Administrative and support service activities	N Health and social work
O Public administration and defence; compulsory social security	O Other community, social and personal services activities
P Education	P Activities of private households as employers and undifferentiated production activities of private households
Q Human health and social work activities	Q Extraterritorial organisations and bodies
R Arts, entertainment and recreation	
S Other service activities	
T Activities of households as employers; undifferentiated goods- and servicesproducing activities of households for own use	
U Activities of extraterritorial organisations and bodies	

Annex 2. ISCO occupation major groups

Major Group ISCO 2008	ISCO 1988
0 Armed Forces Occupations	Armed Forces
1 Managers	Legislators, Senior Officials and Managers
2 Professionals	Professionals
3 Technicians and Associate Professionals	Technicians and Associate Professionals
4 Clerical Support Workers	Clerks
5 Services and Sales Workers	Service Workers and Shop and Market Sales Workers
6 Skilled Agricultural, Forestry and Fishery Workers	Skilled Agricultural and Fishery Workers
7 Craft and Related Trades Workers	Craft and Related Trades Workers
8 Plant and Machine Operators and Assemblers	Plant and Machine Operators and Assemblers
9 Elementary Occupations	Elementary Occupations

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by electronic mail via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications from EU Bookshop at: <https://publications.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

The European Commission's science and knowledge service

Joint Research Centre

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub

ec.europa.eu/jrc



@EU_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub

