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Sectoral trends in earnings inequality and employment
International trade, skill-biased technological change, or labour market institutions?

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Abstract

Current studies addressing the rise in inequality confine themselves to country-level developments. This paper delineates trends in earnings inequality and employment at the sectoral level for eight LIS countries between 1985-2005. Earnings inequality mainly manifests itself within rather than between sectors. Yet, there is significant variation in the level of inequality across sectors whilst the differences between countries in intrasectoral inequality are much less pronounced. A general rise in intrasectoral earnings dispersion and a shift from the manufacturing industry towards the financial sector are perceptible. Cross-sectional pooled time-series analyses indicate significant associations between the exposure to import and decreased employment within sectors, whilst no evidence is found for relations between earnings inequality and international trade or skill-biased technological change.

Keywords

Earnings inequality, sectoral approach, globalisation, skill-biased technological change, income inequality

JEL codes

D30; D63; E24; L60

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1. Introduction

A widely observed phenomenon in social sciences is the gradual and widespread increase in income inequality in developed countries (*e.g.*, Brandolini and Smeeding, 2008; 2009; OECD, 2008; 2011a; Autor *et al*., 2013). In general this trend is attributed to widening labour earnings (Kenworthy and Pontusson, 2005; Immervoll and Richardson, 2011; Caminada *et al*., 2012).

Even though much attention has been given to these inequality trends at the country level, much less has been written on developments within countries across different sectors. Questions that remain unanswered are to what extent these higher levels of inequality are a consequence of larger differences in average earnings between industries, or a higher earnings dispersion within industries. Another possible explanation is that there has been loss of employment within certain sectors. Furthermore, it is unclear if these tendencies in earnings and employment took place in all sectors and in all countries, or whether differences between sectors can be observed. Lastly, in case there is heterogeneity across sectors or countries, we do not know what can account for these differences.

This study describes trends in labour earnings inequality and employment at the sectoral level in eight LIS countries between 1985 and 2005 based on a new database (Wang *et al*., 2013). By means of a decomposition we depict that the bulk of earnings inequality at the country level is a consequence of inequality within rather than between sectors. The level of intrasectoral inequality differs significantly across sectors, with agriculture, finance, and wholesale as relatively unequally distributed sectors, and mining and utilities as the most equally distributed sectors. Our calculations denote a rise in sectoral earnings inequality that is widespread across sectors, corresponding to the rise of inequality at the country level. During the period under scrutiny a notable shift from the manufacturing industry towards the financial sectors took place. These sectoral trends do not differ much across countries.

Using cross-sectional pooled time-series analyses we test three possible determinants of these sectoral trends that are often put forward to explain the upsurge in inequality at the country level, namely, international trade, skill-biased technological change, and changes in labour market institutions. As for the first two sets of factors sectoral data are available, we inspect whether sectors more exposed to trade or technological change embody higher earnings inequality or job loss. In this way we allow for heterogeneity across sectors due to imperfect labour mobility, which contributes to the existing knowledge on the effects of international trade and technological change based on country-level information. We do not find positive associations between international trade or technological change and earnings

inequality. Nonetheless, there is robust evidence for a decrease in relative employment in import-competing industries. Lastly, we find a relation between decreased trade union influence at the country level and sectoral earnings inequality.

Empirically, our approach is in between the inequality literature, which generally bases its conclusions on the distribution of household earnings (Mahler *et al*., 1999; Brandolini and Smeeding, 2008; 2009; Checchi and García-Peñalosa, 2008), and the (Mincerian) wage literature which by and large employs individual earnings and generally analyses skill demand or polarisation rather than inequality per se (Acemoglu, 2003a; 2003b; Autor *et al*., 2003; Michaels *et al*., forthcoming). From the inequality literature we take the dependent variable, as our main objective is to analyse how increased earnings inequality at the country level is manifested at the sectoral level. Yet, we base our main findings on individual earnings, which is common in the wage literature, rather than summing and equivalising the earnings at the household level. In this way we can attribute earnings to sectors with less noise, as we do not attribute all household earnings to the sector in which the household head is working regardless if the spouse or other relatives are working in that sector as well.

In the inequality literature our sectoral design is relatively new. The approach allows for heterogeneity between sectors due to imperfect labour mobility. Compared to the existing studies (Mahler *et al*., 1999; OECD, 2011a; Michaels *et al*., forthcoming) who only calculate sectoral information at two moments in time, we seek to contribute to the literature by building a new database on inequality and employment at the sectoral level that contains sectoral data over a longer period. This allows us to conduct cross-section panel regressions, in which we can control for certain unobserved and observed industry-specific and country-specific developments. Second, as opposed to the sectoral studies from the wage literature (OECD, 2011a; Michaels *et al*., forthcoming), we do not only explore earnings but also sectoral employment indicators separately. Compared to Mahler *et al*. (1999), who also use LIS data, we base our findings on individual rather than household earnings, so that we can attribute information to sectors with less noise.

The remainder of the paper is structured as follows. Section 2 gives a description of the dataset and the used indicators. Next, in Section 3, the trends at the country and sectoral level are presented. In Section 4 we expound on three possible explanations for our sectoral trends, which are subsequently analysed in Section 5. Section 6 concludes.

2. Data section

2.1 Income definition, sector standardisation, and sample

To calculate the level of labour earnings inequality at the sectoral level this paper makes use of the *Leiden LIS Sectoral Income Inequality Dataset* (Wang *et al*., 2013).[2] This database is constructed on the basis of the Luxembourg Income Study (LIS) micro data. Appendix 2 provides background information and descriptives for the database, and Appendix 3 gives a full overview of the variables that are included in the dataset.

Elaborating on the approach laid down by Mahler *et al*. (1999) we confine our sample to individuals aged between 25 and 54, which are those people most dependent on earnings as source of income. Since we are interested in labour earnings inequality, we only include income from wages and salaries or self-employment, omitting income from other sources, such as interest and rent, and we do not adjust the wages for taxes or social contributions. We refer to this income definition as earnings for the remainder of this paper. For all calculations we comply with standard LIS top- and bottom coding conventions, with 1 per cent of mean earnings as the bottom, and ten times the median earnings as the top boundary. Even though this procedure reduces the influence of outliers, a disadvantage of this approach is that enrichment at the top is left out of the analysis (Atkinson *et al*., 2011).

We explicitly dissent from the inequality literature convention as for instance Mahler *et al*. (1999) do, to sum and equivalise earnings at the household level. The main problem with summing earnings at the household level is that in that way earnings or employment information from the spouse or other relatives are attributed to the sector in which the household head is working, even though the other household members work in a different sector than the household head. As a sensitivity test, we also show results for household-level earnings and for individual earnings in which we restrict our sample to household heads only.

We standardise the sectoral information by means of the International Standard of Industrial Classification (ISIC) rev. 3.0 at the two and three digit level.[3] Table 1 provides the full set of included sectors. The two-digit level distinguishes between the main nine industries. We use the three-digit level to further break down the manufacturing and transport

[2] This dataset is available at www.hsz.leidenuniv.nl.

[3] Sometimes this required some interpretation or the exclusion of some sectors (mainly manufacturing of transport equipment and recycling); the classification scheme is available as a worksheet in Wang *et al*. (2013). Evidence that the classification scheme is reliable comes from the correlation between the relative employment size of the sectors based on our data and data available from OECD STAN. This correlation is for all countries around 0.93.

and telecommunication sector into 12 subsectors, as in Mahler *et al*. (1999), OECD (2011a), and Michaels *et al*. (forthcoming).[4]

Table 1 Industry classification

Two-digit ISIC sectors	Three-digit ISIC subsectors
1. Agriculture and fishing	(none)
2. Mining and quarrying	(none)
3. Manufacturing	31. Manufacturing of food products, beverages, and tobacco 32. Manufacturing of textiles, textile products, leather, and footwear 33. Manufacturing of wood and products of wood and cork 34. Manufacturing of pulp, paper, paper products, printing, and publishing 35. Manufacturing of chemical, rubber, plastics, and fuel products 36. Manufacturing of other non-metallic mineral products 37. Manufacturing of basic metals and fabricated metal products 38. Manufacturing of machinery and equipment) 39. Manufacturing of transport equipment 30. Other manufacturing (n.e.c. and recycling)
4. Electricity, gas, and water	(none)
5. Construction	(none)
6. Wholesale and retail trade, restaurants and hotels	(none)
7. Transport and telecommunications	71. Transport 72. Telecommunications
8. Finance, insurance, real estate, and business	(none)
9. Community, social, and personal services	(none)

Sectoral information is available for eight OECD countries as listed in Table 2, allowing us to compose an unbalanced panel of five periods of five years each in between around 1985 up to and including around 2005.[5] In total we have 31 waves and 651 observations at the sectoral level.

Table 2 Country sample

Country	Waves
1. Czech Republic	1996, 2004
2. Denmark	1987, 1992, 1995, 2000, 2004
3. Finland	1987, 1991, 1995, 2000, 2004
4. Germany	1984, 1989, 1994, 2000, 2004
5. Ireland	1994-1996, 2004
6. Sweden	1987, 1992, 2000, 2005
7. UK	1986, 1999, 2004
8. US	1986, 1991, 1994, 2000, 2004

Note: We combine the 1994-1996 waves for Ireland where we recalculate the earnings information to 1995 levels using information on inflation from the World Bank (2012).

[4] Unfortunately, no further breakdown in the community services sector is possible with LIS micro data for a sufficient number of country-period observations. The community sector consists of people working in public administration, education, health and social work, and other community and personal service activities.

[5] For Spain in 1995 and 2000 information at the sectoral level is available as well, but the number of surveyed people is too low to calculate levels of inequality at a disaggregated level with sufficient confidence. Belgium is excluded as only data on net earnings are available. For Poland data are available, but not for our indicator for skill-biased technological change, thus we exclude it altogether.

2.2 Earnings inequality at the country level

We make use of two indicators to calculate the earnings inequality. The mean log deviation (MLD) or GE(0) is more sensitive to fluctuations at the bottom end of the distribution, whereas the Gini coefficient is more sensitive to changes across the mean of the distribution (Atkinson, 1970). We start by calculating the earnings inequality based on our earnings definition at the country level for both indicators. We subsequently decompose the MLD into a part within and a part between sectors, as this indicator has the advantage of not leaving a residual. This decomposition is defined as follows[6], with sectors indexed $\{k = 1, \dots, g\}$ weighted by their share of employed individuals v_k, where the sector includes the individuals indexed $\{j = 1, \dots, m\}$ with earnings y_{kj}, weight w_{kj}, and arithmetic mean earnings $\bar{y}$:

$$\text{MLD} = \sum_{k=1}^{g} v_k \sum_{j=1}^{m} \frac{w_{kj}}{\sum_{j=1}^{m} w_{kj}} \log\left(\frac{\overline{y_k}}{y_{kj}}\right) + \sum_{k=1}^{g} v_k \log\left(\frac{\overline{y_k}}{\bar{y}}\right) \tag{1}$$

The first element on the right-hand side of equation (1) denotes inequality within industries, calculated as the sum of the MLD in all separate sectors weighted by the (weighted) number of individuals working in the sector relative to the total (weighted) number of working individuals. The second part summarises the between-sector part, which are the arithmetic mean earnings in sector k as a fraction of the mean earnings of the total population.

2.3 Earnings inequality at the sectoral level

Next, we analyse earnings inequality trends at the sectoral level. To this end we apply the MLD and the Gini index. The MLD at the sectoral level is defined in the following fashion:

$$\text{MLD}_k = \sum_{j=1}^{m} \frac{w_{kj}}{\sum_{j=1}^{m} w_{kj}} \log\left(\frac{\bar{y}_k}{y_{kj}}\right) \tag{2}$$

The Gini coefficient has the advantages of being the most frequently used inequality measure in the literature, and it can be corrected for underestimation bias in case of small sample sizes. Therefore, we use this indicator for the descriptive trends.[7] Using Monte Carlo simulations for

[6] See Kampelmann (2009) for a general discussion on inequality measures, including an appendix with a decomposition of the MLD that can be transposed to ours.

[7] The correlation between the first-order corrected Gini index and the MLD at the sectoral level is 0.88.

different cumulative distributions, Deltas (2003) shows that the Gini index can understate the 'true' inequality level when the sample size is relatively low (roughly from $m < 30$). By multiplying the Gini index by $\frac{m}{m-1}$, which Deltas calls the first order correction, the underestimation bias is significantly reduced.[8] The first order corrected Gini index at the sectoral level then becomes:

$$\text{F. o. c. Gini}_k = \frac{m}{m-1}\left\{\sum_{j=1}^{m}\frac{w_{kj}}{\sum_{j=1}^{m} w_{kj}}\,\frac{2\sum_{j=1}^{m} w_{kj} - w_{kj} + 1}{\bar{y}\sum_{j=1}^{m} w_{kj}}\left(y_{kj} - \bar{y}_k\right)\right\} \tag{3}$$

2.4 Employment measures at the sectoral level

Increased income inequality at country level might be not so much a consequence of widening earnings distribution, but rather of employment loss (Gottschalk and Smeeding, 1997; Atkinson, 2003; Kenworthy and Pontusson, 2005). Even though the LIS database allows for the standardised calculation of sectoral earnings inequality for multiple countries over time (Förster and Vleminckx, 2004; Mahler and Jesuit, 2006), unfortunately, it is not possible to track individual employment shifts over time. This is due to the fact that the LIS database is a time series rather than a panel at the individual level.

Using a number of proxies we try to depict employment effects at the sectoral level in an indirect fashion. First, we use own data based on LIS (Wang *et al*., 2013) and OECD STAN data (2011b) on the relative employment size of sectors to map total labour shifts between sectors. The relative employment size is defined as the number of persons engaged per industry divided by the total number of persons engaged in a country.[9] We show our own data for the descriptives.[10] Second, following Mahler *et al*. (1999), we also calculate the relative median wage, defined as the sectoral median labour earnings divided by the national median labour earnings. The relative median earnings in a sector will increase when job loss mainly occurs at the lower end of the earnings distribution.[11]

[8] As an alternative to the first order correction to correct for small samples, we also conduct the regressions leaving out the sectors with $m < 30$, which does not affect the results.
[9] This indicator is only sensitive to net changes at the extensive rather than intensive margin, as it measures the number of persons engaged rather than the number of working hours.
[10] The correlation between the relative employment size from our data and the OECD STAN data is 0.93.
[11] Both employment indicators that we constructed are amended for the person weight as provided by LIS.

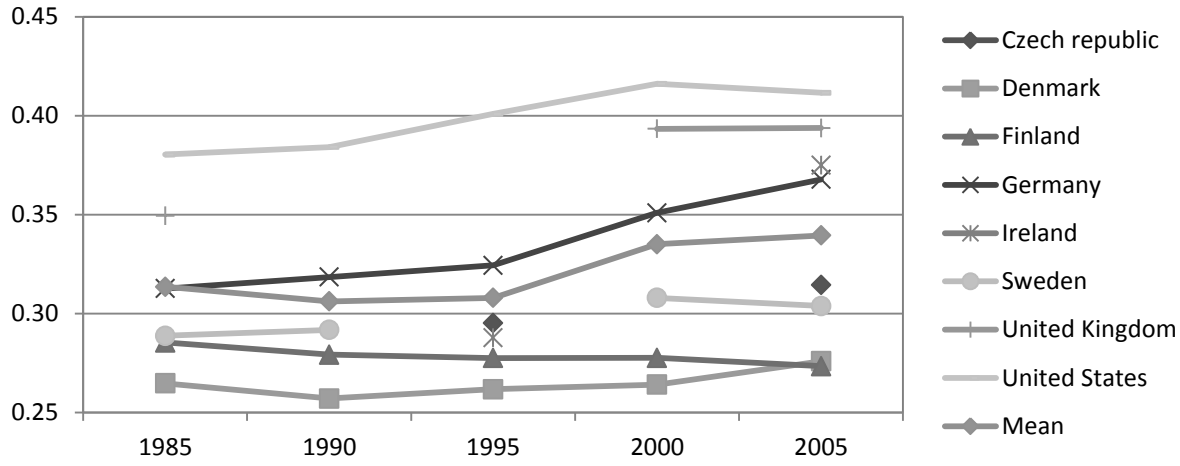
3. Trends in inequality over time, across countries, and across industries

3.1 Trends at the country level

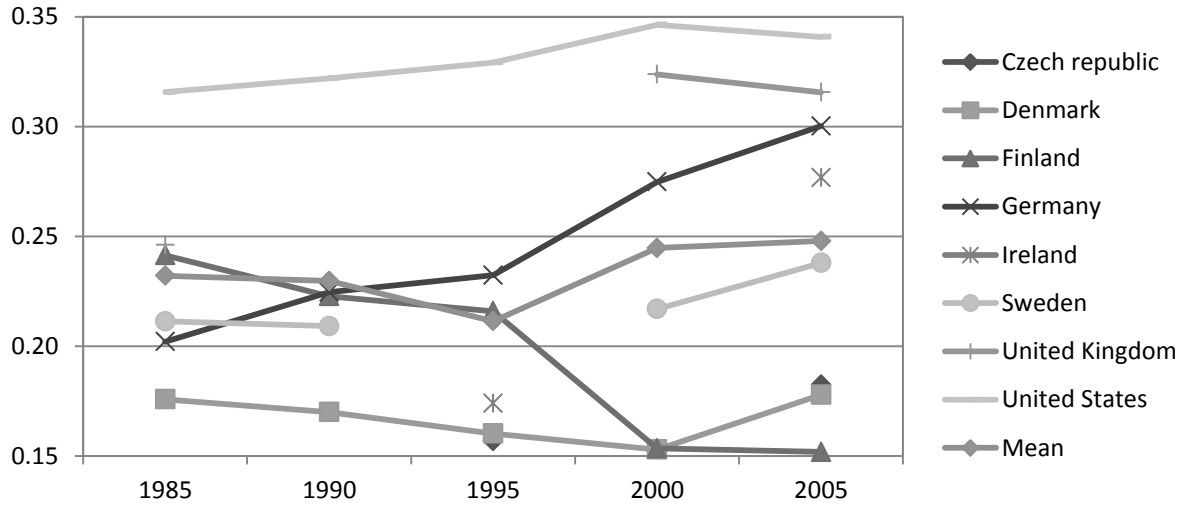
Figure 1 shows the trends in inequality at the country level when all sectors are pooled, using our Leiden LIS Sectoral Income Inequality dataset. The calculations are based on the same sample as used in the regressions, thus, all individuals aged 25-54 with non-zero earnings excluding those not classified in a sector.

Figure 1 Earnings inequality at the country level 1985-2005

1a Gini index



1b Mean log deviation



Source: Leiden LIS Sectoral Income Inequality Dataset

As can be deduced from Figure 1 inequality is the highest in the Anglo-Saxon countries, and considerably lower in the Northern countries. As is widely documented in the literature,

earnings are growing wider apart within countries over time (OECD, 2008; 2011a; Brandolini and Smeeding, 2008; 2009; Immervoll and Richardson, 2011; Caminada *et al*., 2012). The strongest increase took place between 1995 and 2000. In addition, we see a strong upsurge in especially the MLD of Germany; up to around 1990 the earnings inequality was still below average, rising up to a level just below the United Kingdom around 2005. This is likely to be at least partly a consequence of the unification as the LIS waves of 1984 and 1989 are based on West Germany only[12] (see also Fuchs-Schündeln *et al*., 2010).

Even though the MLD is characterised by a more erratic course, its trend is by and large comparable to the one shown for the Gini coefficient. A noticeable exception is Finland, where the Gini index shows a gradual descent whilst the MLD drops rather abruptly from 1995 to 2000. It implies that during this period the earnings inequality at the bottom end of the distribution decreased more rapidly than around the middle. Further inspection shows that inequality at the top half of the distribution actually increased as measured by the GE(2), as also found by Cowell and Fiorio (2011), even though they base their analysis on disposable household income from LIS data. This provides an explanation why the Gini index decreases less rapidly than the MLD.

Next, we decompose the MLD into a part within and a part between sectors, as shown in Table 3. Columns 1-3 show the level of earnings inequality at the country level and the fourth one denotes the increase over time. Columns 5-7 summarise the percentage of the MLD at the country level due to inequality within industries.

Table 3 shows that the lion's share of inequality is a result of earnings dispersion within industries, rather than differences in average earnings between industries.[13] On average, within-industry inequality accounted for a larger share of the inequality at the country level over time.

From the decomposition it cannot be inferred that sectoral variation is not important in understanding country-level inequality – it only shows that the variation within sectors is more pronounced than the average wage differences between sectors. In particular, as we show in the next section, there is substantial variation in the levels of inequality across sectors – in fact, this variation is more pronounced than the country-level differences.

[12] The waves 1984 and 1989 for Germany are not included in the regressions as no sectoral information on import or export is available.

[13] Of course, the share of inequality between groups depends on the number of distinguished groups. As an extreme case, the share of between-group inequality becomes 100 per cent when every individual is defined as a separate group. Yet, for our study with a relatively small number of sectors in comparison to the number of households, the results are not that sensitive to the number of sectors that are defined. The share of within-sector inequality for the United States in 2005 increases from 96.0 to 96.8 per cent if we take the manufacturing and transport and telecommunication sector at the aggregated rather than at the disaggregated level.

Table 3 Decomposition of inequality within and between sectors over time

	MLD at country level			Difference	Share of MLD due to within-sector inequality (%)			Difference
	1985	1995	2005	85-05	1985	1995	2005	85-05
Czech Republic	.	0.157	0.182	.	.	93.4%	96.1%	.
Denmark	0.176	0.160	0.178	0.002	95.4%	95.4%	96.5%	1.1%
Finland	0.241	0.216	0.152	-0.090	87.6%	91.8%	93.7%	6.0%
Germany	0.202	0.232	0.300	0.098	95.0%	94.9%	94.1%	-0.9%
Ireland	.	0.174	0.277	.	.	93.8%	93.3%	.
Sweden	0.211	.	0.238	0.027	95.3%	.	96.1%	0.8%
United Kingdom	0.246	.	0.316	0.070	94.5%	.	92.8%	-1.7%
United States	0.316	0.329	0.341	0.025	95.1%	95.3%	96.0%	0.9%
Average	0.232	0.211	0.248	0.022	93.8%	94.1%	94.8%	1.0%

Note: For this calculation we differentiate between 19 industries, namely, all two-digit sectors apart from the manufacturing and transport and telecommunications sectors, for which we utilise the subsectors. The average is the unweighted arithmetic average for the available observations of that period

Source: Leiden LIS Sectoral Income Inequality Dataset

3.2 Trends in inequality within industries

We now turn to the earnings inequality at the sectoral level, which according to our decomposition comprises the main part of country-level earnings dispersion. Here we employ the first order corrected Gini index. We first pool data from all available periods to compare the levels of earnings inequality across industries and countries in Table 4.

Table 4 divulges the importance of the sector in understanding earnings inequality. The average difference between the highest and lowest level of sectoral inequality within countries is as high as the average difference between the most equal and unequal country, Denmark and the United States.[14] As an example, within Sweden, a country with an average level of earnings inequality at the country level within our sample, we can find sectors which have more unequally distributed earnings than in the United States, but also sectors with more evenly dispersed earnings than in Denmark.

The importance of the sector becomes even more noticeable when the sectoral level of inequality is compared to the average level of sectoral inequality at the country level, or the 'country average' in Table 4. From this it becomes evident that in all countries the ranking of sectors in their level of inequality is comparable, or to put it differently, that the country differences are minor compared to the sectoral deviations. Agriculture, wholesale, and the financial sector ubiquitously stand out as sectors with a higher inequality than the country

[14] The countries with the most equally and unequally distributed earnings are Denmark (0.265) and the United States (0.396); their level of inequality differs by 0.134 Gini points. The difference between the sector with the highest and the lowest inequality per country is on average 0.135 first order corrected Gini points, or almost half of the average level of sectoral earnings inequality in the full sample.

average.[15] The opposite holds for mining, utilities, and the manufacturing of metals and transport.

As stated already, there are only few differences between countries in these trends. The earnings dispersion in Ireland within construction and the manufacturing of minerals and machinery is larger than its country mean, whilst in the other countries these sectors have a relatively lower inequality. To a lesser degree this also holds for the transport and telecommunication sector in the UK and the manufacturing of wood in the US.

Table 4 Pooled earnings inequality across sectors and countries

Industry	CZE	DNK	FIN	DEU	IRL	SWE	GBR	USA	Industry average
1. Agriculture	0.292	0.356	0.493	0.353	0.383	0.402	0.381	0.463	0.391
2. Mining	0.216	0.211	0.225	0.191	0.164	0.169	0.293	0.326	0.225
3. Manufacturing	0.299	0.230	0.236	0.292	0.284	0.255	0.316	0.358	0.284
4. Utilities	0.257	0.190	0.219	0.231	0.239	0.202	0.274	0.288	0.237
5. Construction	0.276	0.227	0.263	0.269	0.307	0.221	0.332	0.357	0.282
6. Wholesale	0.362	0.293	0.292	0.393	0.368	0.330	0.420	0.433	0.361
7. Trans. and telecom	0.263	0.223	0.233	0.267	0.245	0.253	0.336	0.317	0.267
8. Finance	0.341	0.298	0.300	0.381	0.360	0.334	0.401	0.425	0.355
9. Community	0.275	0.249	0.257	0.320	0.314	0.289	0.375	0.393	0.309
31. Man. food	0.338	0.228	0.231	0.320	0.263	0.277	0.336	0.359	0.294
32. Man. textile	0.345	0.254	0.284	0.320	0.288	0.259	0.356	0.386	0.312
33. Man. wood	0.268	0.189	0.222	0.246	0.271	0.217	0.297	0.369	0.260
34. Man. paper	0.326	0.228	0.221	0.342	0.277	0.253	0.328	0.343	0.290
35. Man. chemicals	0.306	0.238	0.231	0.265	0.273	0.266	0.299	0.346	0.278
36. Man. minerals	0.272	0.228	0.195	0.293	0.307	0.217	0.262	0.322	0.262
37. Man. metals	0.280	0.196	0.208	0.251	0.220	0.211	0.271	0.319	0.245
38. Man. machinery	0.267	0.223	0.227	0.288	0.299	0.257	0.314	0.345	0.278
39. Man. transport	0.249	0.199	0.172	0.251	0.214	0.218	0.242	0.302	0.231
30. Other man.	0.272	0.225	0.219	0.372	0.306	0.279	0.338	0.385	0.300
71. Transport	0.253	0.236	0.239	0.272	0.253	0.257	0.333	0.336	0.272
72. Telecom	0.294	0.198	0.215	0.244	0.223	0.245	0.340	0.303	0.258
Country average	0.288	0.234	0.247	0.294	0.279	0.258	0.326	0.356	0.285

Note: First order corrected Gini index, full sample, pooled across periods. Industry average: arithmetic average of earnings inequality at the country level per sector. Country average: arithmetic average of earnings inequality at the sectoral level per country

Source: Leiden LIS Sectoral Income Inequality Dataset

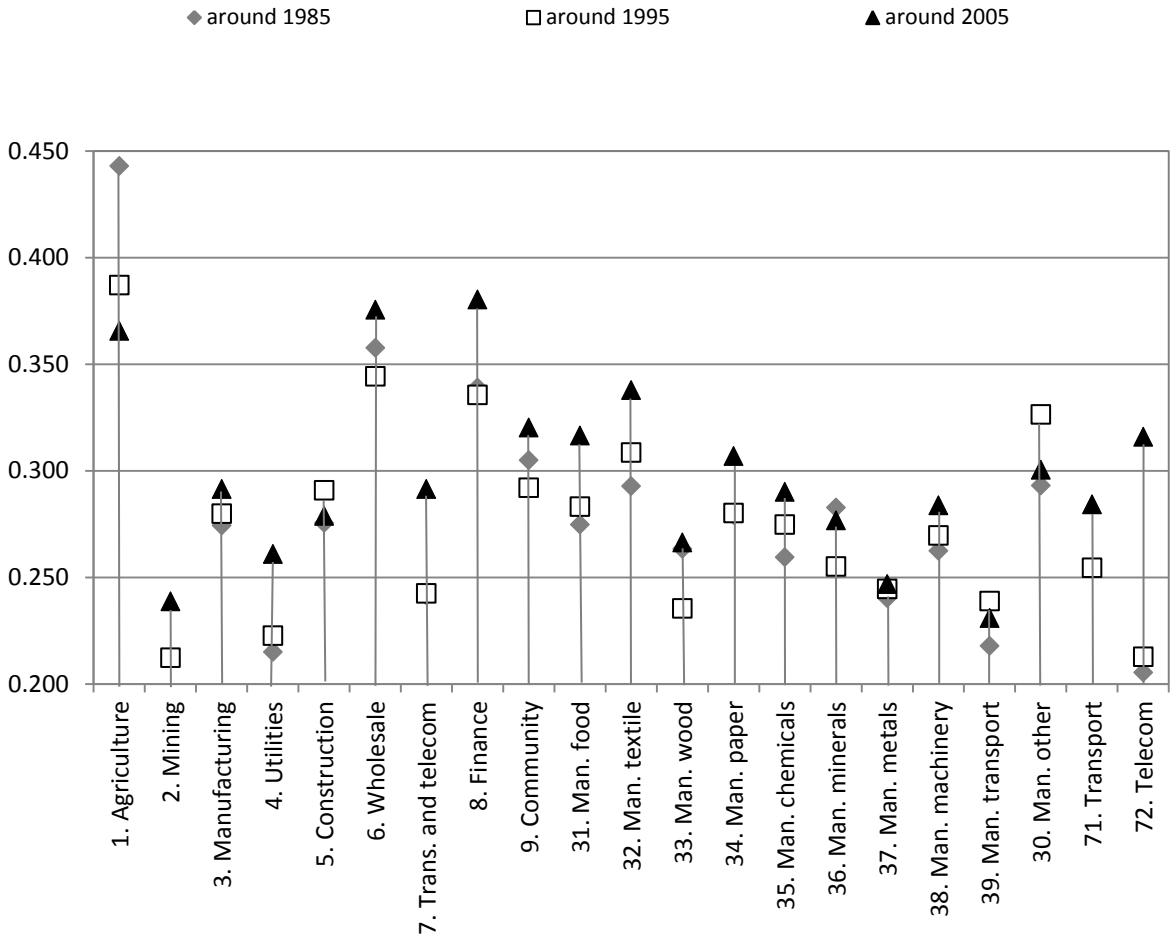
Since the intrasectoral levels of inequality do not differ much across countries, in Figure 2 we pool the sectoral levels for all countries and inspect the developments over time.[16] Mirroring the trend at the country level, sectoral earnings in general have become more dispersed over time. Still, inequality decreased in the agriculture with the highest earnings inequality on

[15] The high level of earnings inequality within agriculture can partly be explained by the use of individual rather than household earnings information. Using household information the level of inequality drops from 40.1 to 35.7, whereas for all other sectors, the inequality based on individual and household information are at par on average. The regression results are not sensitive to the inclusion of agriculture, and wholesale and the financial sector drop out due to data availability for import and export.

[16] The regression results barely change if we restrict the sample to the four countries for which we have data for all periods. The differences in earnings inequality within wholesale between the three first periods decreases, and inequality within manufacturing of minerals in 1985 becomes even higher.

average. Also in the manufacturing of minerals inequality reached its top around 1985. In five sectors, next to the two aforementioned also construction, manufacturing of transport and manufacturing other, earnings were more dispersed in 1985 or 1995 than in 2005.

Figure 2 Trends of sectoral earnings inequality over time



Note: First order corrected Gini index, average for a sector and period across available countries
Source: Leiden LIS Sectoral Income Inequality Dataset

3.3 Trends in sectoral levels of employment

Now we inspect trends for our two sectoral employment indicators. First, we analyse the relative employment size of sectors based on LIS data. Table 5 shows the sectoral observations pooled over time per country.

Table 5 Pooled relative employment size across sectors and countries

Industry	CZE	DNK	FIN	DEU	IRL	SWE	GBR	USA	Industry average
1. Agriculture	0.048	0.022	0.051	0.014	0.035	0.017	0.014	0.015	0.027
2. Mining	0.017	0.001	0.002	0.004	0.003	0.003	0.010	0.007	0.006
3. Manufacturing	0.267	0.179	0.222	0.297	0.160	0.195	0.212	0.175	0.213
4. Utilities	0.020	0.006	0.012	0.011	0.009	0.008	0.011	0.014	0.011
5. Construction	0.079	0.059	0.071	0.077	0.070	0.058	0.065	0.063	0.068
6. Wholesale	0.133	0.141	0.134	0.143	0.155	0.123	0.158	0.201	0.149
7. Trans. and telecom.	0.076	0.071	0.077	0.047	0.082	0.072	0.071	0.066	0.070
8. Finance	0.078	0.118	0.115	0.110	0.141	0.121	0.143	0.136	0.120
9. Community	0.282	0.402	0.315	0.286	0.345	0.405	0.340	0.323	0.337
31. Man. food	0.025	0.031	0.023	0.023	0.039	0.018	0.026	0.016	0.025
32. Man. textile	0.030	0.008	0.014	0.017	0.014	0.005	0.018	0.014	0.015
33. Man. wood	0.013	0.008	0.016	0.004	0.004	0.012	0.005	0.006	0.008
34. Man. paper	0.011	0.019	0.042	0.024	0.011	0.025	0.023	0.021	0.022
35. Man. chemicals	0.029	0.021	0.017	0.041	0.025	0.016	0.028	0.020	0.025
36. Man. minerals	0.014	0.008	0.009	0.007	0.006	0.004	0.008	0.005	0.008
37. Man. metals	0.049	0.013	0.029	0.060	0.013	0.017	0.014	0.017	0.027
38. Man. machinery	0.063	0.058	0.055	0.074	0.037	0.078	0.057	0.046	0.059
39. Man. transport	0.018	0.007	0.009	0.037	0.005	0.029	0.027	0.021	0.019
30. Other man.	0.014	0.013	0.007	0.010	0.006	0.008	0.009	0.009	0.009
71. Transport	0.058	0.051	0.055	0.041	0.054	0.049	0.047	0.040	0.049
72. Telecom	0.018	0.021	0.022	0.016	0.028	0.023	0.024	0.026	0.022
Country average	0.064	0.060	0.062	0.064	0.059	0.061	0.062	0.059	0.061

Note: Relative employment size, full sample, pooled across periods. Industry average: arithmetic average of earnings inequality at the country level per sector. Country average: arithmetic average of earnings inequality at the sectoral level per country

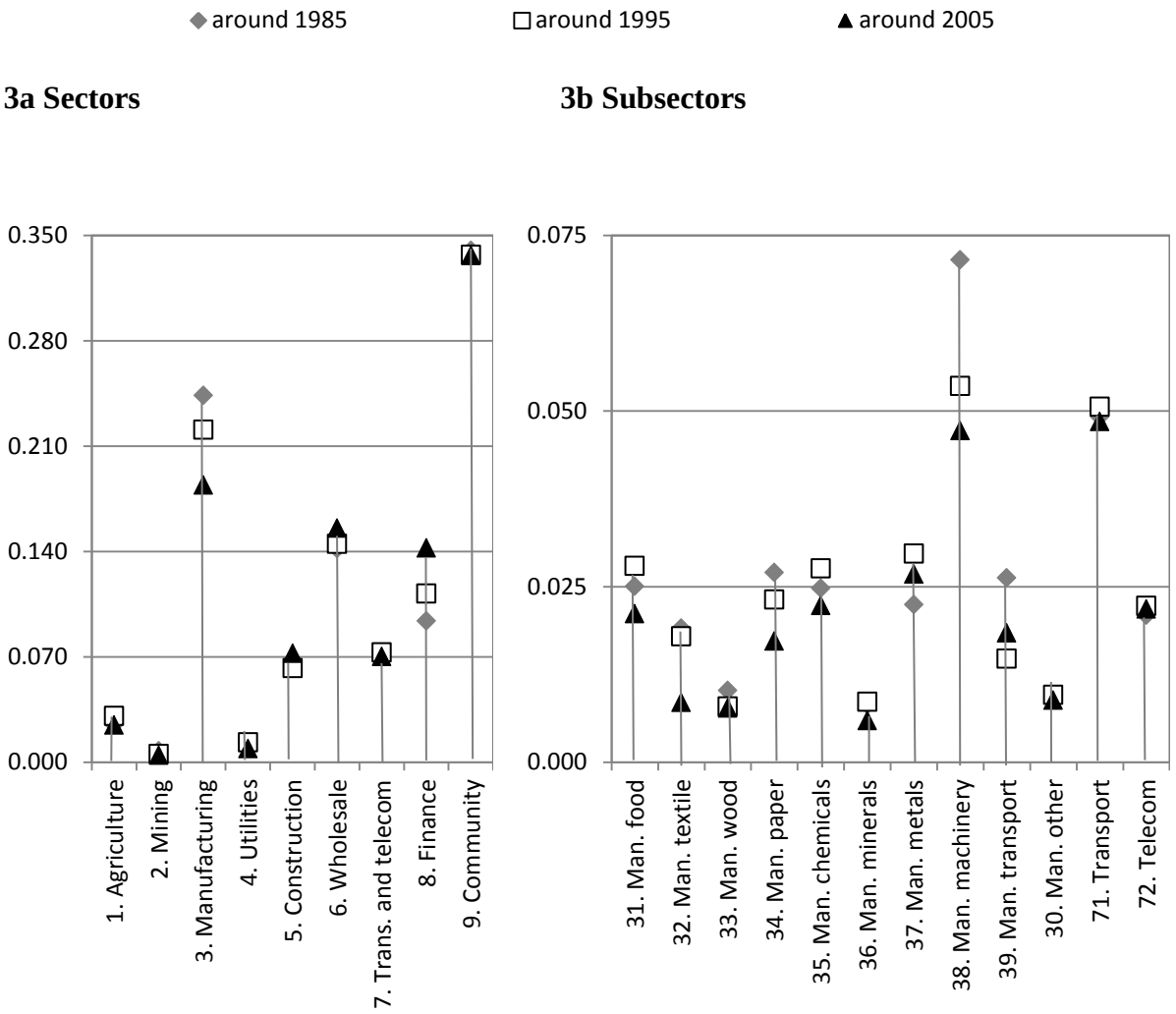
Source: Leiden LIS Sectoral Income Inequality Dataset

For the relative employment size the differences between countries are again small. In Czech Republic still one in three persons is employed in agriculture, mining, or manufacturing, compared to one in four for the other countries. The community sector is relatively large in Finland and Denmark (around 40.0% compared to 33.7% on average). The Anglo-Saxon countries are characterised by a comparatively extensive financial sector (around 14.0% compared to 12.0%). The manufacturing industry, in particular the manufacturing of transport, metal, and chemicals, is relatively large in Germany (29.7% versus 21.3%).

In general, the sectoral employment sizes appear to be relatively stable over time, as shown in Figure 3.[17] Most clearly perceptible is the drift in employment from manufacturing, in particular the manufacturing of machinery, towards the financial sector. We can also discern a minor reduction in employment in agriculture and mining, whereas a small increase is observable in construction and wholesale. There is hardly any fluctuation in the largest sector, the community sector.

[17] For 1985 data are missing for a number of sectors, causing the sum of all relative employment sizes to differ from 1 for this period. The ratios presented in Table 5 are corrected for this overestimation. Restricting the graph to the four countries for which all data are available does not affects the results.

Figure 3 Trends of relative employment size over time



Note: Relative employment size, average for a sector and period across available countries
Source: Leiden LIS Sectoral Income Inequality Dataset

As Table 6 shows, also for the relative median earnings there is more variation across sectors than across countries. Mining, utilities, transport and telecommunications, and finance pay relatively well in all countries. On the contrary, earnings are uniformly low in agriculture, followed by the manufacturing of textile and wholesale. The sectoral median earnings are below its country counterpart for the manufacturing industry in all countries except for Czech Republic and Ireland, whilst only in these two countries the median earnings are relatively high in the community sector. Principally in Finland the relative median earnings are low in agriculture (0.45 to 0.68 on average), whilst earnings are above average for mining in the UK (1.60 to 1.29) and utilities in Ireland (1.72 to 1.33). Within the manufacturing industry the differences between countries are even smaller.

Table 6 Pooled relative median earnings across sectors and countries

Industry	CZE	DNK	FIN	DEU	IRL	SWE	GBR	USA	Industry average
1. Agriculture	0.818	0.745	0.453	0.697	0.623	0.710	0.779	0.603	0.679
2. Mining	1.235	1.283	1.106	1.300	1.029	1.264	1.602	1.481	1.287
3. Manufacturing	0.945	1.047	1.108	1.108	0.969	1.098	1.102	1.125	1.063
4. Utilities	1.159	1.188	1.245	1.295	1.715	1.313	1.309	1.430	1.332
5. Construction	1.079	1.051	1.002	1.018	0.993	1.140	1.118	1.008	1.051
6. Wholesale	0.850	0.962	0.889	0.698	0.755	0.959	0.684	0.754	0.819
7. Trans. and telecom.	1.081	1.058	1.092	1.017	1.133	1.068	1.101	1.281	1.104
8. Finance	1.299	1.161	1.083	1.126	1.107	1.153	1.237	1.094	1.158
9. Community	1.040	0.943	0.968	0.964	1.068	0.899	0.919	0.981	0.973
31. Man. food	0.866	1.045	1.019	0.916	0.936	1.011	0.969	0.945	0.963
32. Man. textile	0.683	0.823	0.733	0.820	0.829	0.888	0.689	0.660	0.766
33. Man. wood	0.860	0.968	0.958	0.933	0.875	1.036	0.991	0.851	0.934
34. Man. paper	1.045	1.208	1.318	1.013	1.083	1.180	1.184	1.093	1.140
35. Man. chemicals	0.986	1.124	1.205	1.190	1.125	1.142	1.239	1.369	1.173
36. Man. minerals	0.925	1.048	1.090	1.116	1.003	1.112	1.045	1.053	1.049
37. Man. metals	1.048	1.018	1.122	1.097	0.979	1.100	1.165	1.118	1.081
38. Man. machinery	0.999	1.046	1.170	1.149	0.972	1.105	1.165	1.275	1.110
39. Man. transport	1.132	1.087	1.132	1.224	1.172	1.188	1.241	1.462	1.205
30. Other man.	0.818	0.922	0.886	0.968	0.783	0.973	0.931	0.863	0.893
71. Transport	1.122	1.092	1.107	1.014	1.050	1.067	1.081	1.170	1.088
72. Telecom	1.000	0.986	1.052	0.990	1.259	1.062	1.124	1.384	1.107
Country average	0.999	1.038	1.035	1.031	1.022	1.070	1.080	1.095	1.046

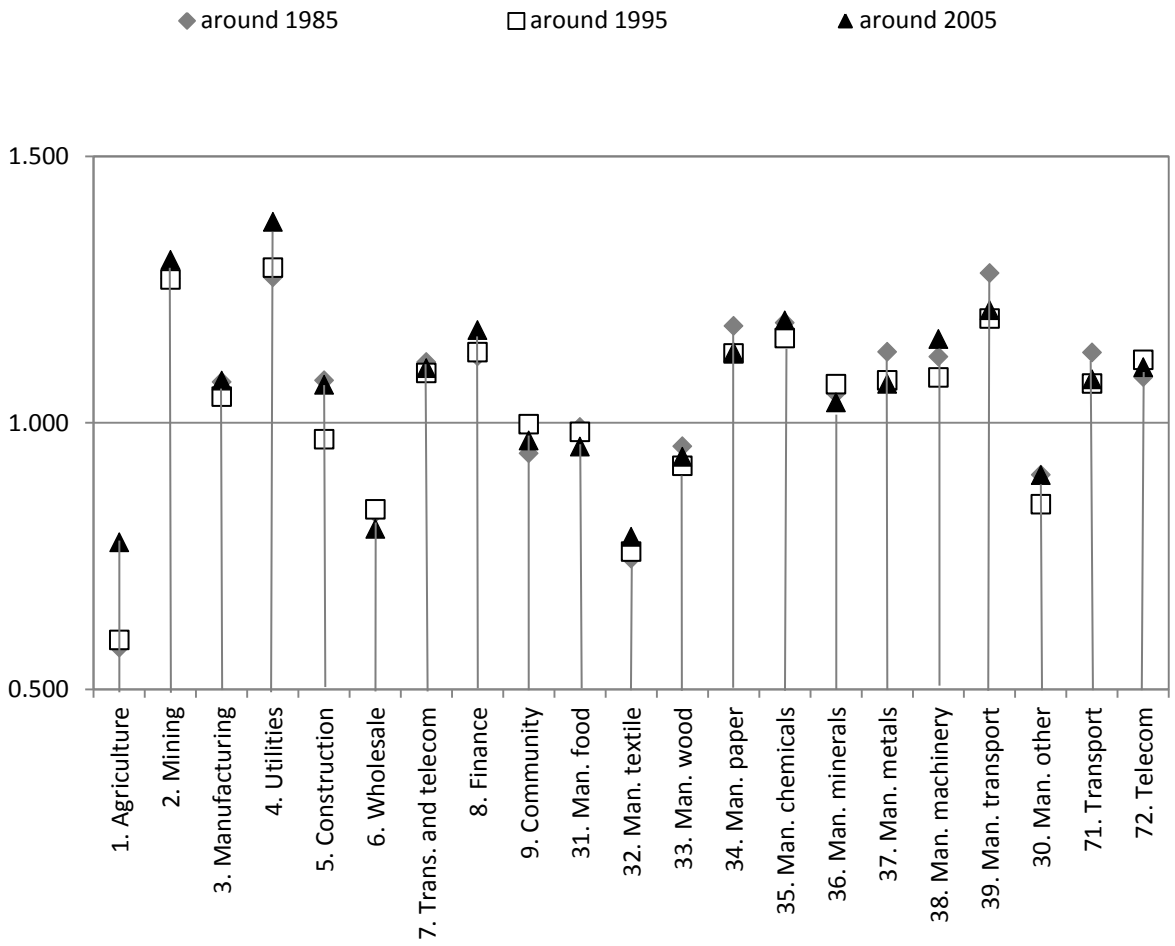
Note: Relative median earnings, full sample, pooled across periods. Industry average: arithmetic average of earnings inequality at the country level per sector. Country average: arithmetic average of earnings inequality at the sectoral level per country

Source: Leiden LIS Sectoral Income Inequality Dataset

There are few fluctuations over time, as shown in Figure 4. [18] The largest change took place in agriculture, where the (low) earnings went up significantly between 1995 and 2005. Apparently, in agriculture individuals at the lower end of the earnings distribution saw an increase in their earnings, as indicated by an increase in relative median earnings combined with a decrease in earnings inequality. Also within the mining and utilities industry, homogeneous sectors with low earnings dispersion and a decreasing employment size, we can see increasing median earnings.

[18] If we only look at the four countries for which all data are available, then the absolute levels hardly change. For the manufacturing of wood the median wage then is the highest around 1985.

Figure 4 Trends of relative median earnings over time



Note: Relative median earnings, average for a sector and period across available countries
Source: Leiden LIS Sectoral Income Inequality Dataset

4. Possible explanations for sectoral levels of inequality and employment

From the previous section we can conclude that the levels of inequality, relative employment size, and median earnings differ substantially across sectors. Here we expound on possible explanations for these sectoral trends derived from the inequality literature. Three possible causes of rising earnings inequality at the country level are most frequently put forward, namely, increased trade or globalisation, skill-biased technological change, and waning labour market institutions.[19]

[19] Another possible determinant are demographic variables, such as the shift in employment towards the care sector resulting from increasing care demand due to ageing. As the community sector is excluded in the regressions, we do not consider this channel. In any case, the relative employment size did not increase in the community sector, thus any employment increase in the care sector should have been accompanied by a decrease in other parts of the community sector, such as general government or education.

4.1 Trade integration

The amount of international trade increased substantially during the last decades, in particular between developed and developing countries (Harrison *et al*., 2011). The Stolper-Samuelson theorem and the factor price equalisation hypothesis predict distributional consequences of these phenomena (Kremer and Maskin, 2006; Davis and Mishra, 2007). For trade between developed and developing countries, where the advanced economies have a relative abundance of highly skilled workers and where in developing countries lowly skilled workers are relatively abundant, trade will induce a higher skill demand in developed countries. Earnings or employment opportunities for lowly skilled labour in developed countries will then be compressed. The factor price equalisation argument predicts that trade equalises factor prices throughout the world, leading to wage cuts for the lowly skilled in developed countries (Freeman, 1995).

Mahler (2004) and Mahler *et al*. (1999) differentiate between effects of import and export on the earnings distribution. Import might impair the wages or employment possibilities of domestic workers by putting them into direct competition with foreign workers. When mainly the lowly skilled jobs are prone to outsourcing to low wage countries, then import has a direct effect on the earnings distribution. For export, the opposite might hold as it could give room for higher earnings or job creation.

The empirical evidence for widening incomes due to trade integration is ambiguous.[20] Generally, country-level studies report largely insignificant effects (OECD, 2011a; Harrison *et al*., 2011; Mahler, 2004). The same holds for the sectoral studies of Mahler *et al*. (1999), OECD (2011a), and Michaels *et al*. (forthcoming).[21] More recent studies, however, do not only incorporate trade flows, but also financial flows (FDI) and outsourcing or trade in intermediates (Hellier and Chusseau, 2013), for which some inequality-enhancing effects are presented (Alderson and Nielsen, 2002; Dreher and Gaston, 2008; Bergh and Nillson, 2010). Unfortunately, only a very limited number of observations are available on sectoral FDI.[22]

[20] International trade could also lead to more inequality by lowering the amount of redistribution, see *e.g.*, Van Vliet (2011) and Winner (2012). Since we inspect earnings rather than disposable income, this channel is left out of the analysis here.

[21] We were able to replicate the findings from Mahler *et al*. (1999), who also employ LIS data, with our own data using their sample of countries and periods and inequality indicators (available upon request).

[22] Our regressions do not provide evidence for inequality-enhancing effects of inward or outward FDI (available upon request).

4.2 Skill-biased technological change

A prevalent theory is that rapid technological innovation complements the highly skilled, whilst it substitutes routine labour by capital (Van Reenen, 2011; see for a formal model that also includes trade (Acemoglu, 2003a). The theory is frequently tested in the wage literature, using skill demand or the skill wage gap as dependent variable. The evidence for skill-biased technological change (SBTC) is relatively robust (Acemoglu, 2003b; Autor *et al*., 2003; 2006; 2013; Goos and Manning, 2007; Goos *et al*., 2009; see for an overview *e.g.*, Hellier and Chusseau, 2013).

Regarding sectoral studies, the OECD (2011a) reports a positive correlation between changes in the hourly skill wage gap per sector and the ICT propensity from EU-KLEMS. Michaels *et al*. (forthcoming) calculate the wage bill for three education groups (high, middle, and low) and find that in industries with the greatest growth in ICT intensity from EU-KLEMS data were also the ones with the strongest growth in wages for the highly educated workers. The lowly educated were largely unaffected by this rise in ICT, whilst demand for middle educated workers fell in industries with the greatest growth in ICT intensity. Trade openness is also associated with this sectoral polarisation, but becomes insignificant in their study when ICT intensity is added to the equation. Mahler *et al*. (1999), who analyse inequality using LIS data, do not inspect technological change.

4.3 Labour market institutions

Another branch of the literature addresses changes in labour market institutions as the main cause of growing earnings dispersion in the developed world. In particular the weaker influence of trade unions and changes in employment protection legislation (EPL) are put forward in the empirical literature (Pontusson *et al*., 2002; Mahler, 2004; Koeniger *et al*., 2007; Checchi and García-Peñalosa, 2008; Oliver, 2008; Dustmann *et al*., 2009; OECD, 2011a; Oesch and Menés, 2011). In general, it can be expected that the more centralised and coordinated the process of wage bargaining is, the more compressed wages are (Lucifora *et al*., 2005). With respect to the effects of EPL on wage inequality, generally two types of arguments are provided in the literature. On the one hand, strict EPL brings employees in a strong bargaining position for employees and therefore to less wage dispersion. However, this will mainly apply to employees with a permanent contract. Therefore, strict EPL can lead to a dual labour market with relatively high degrees of wage earnings inequality between the segments. Thus, the overall effect of EPL is rather ambiguous.

The strictness of EPL is set at the national level, and there is no sectoral information available for the influence of trade unions. Still, the institutions might provide an explanation for fluctuations in earnings inequality in all sectors per country.[23]

5. Empirical analyses of sectoral trends

5.1 A sectoral approach to analysing earnings inequality

Thus far few studies utilise a sectoral approach when inspecting patterns of inequality in multiple countries over time (Mahler *et al*., 1999; OECD, 2011a; Michaels *et al*., forthcoming). Mahler *et al*. (1999) follow the inequality literature, basing their conclusions on household earnings, which has the disadvantage of attributing earnings to sectors in which they were not necessarily earned. OECD (2011a) and Michaels *et al*. (forthcoming) calculate the wage bill shares of different skill groups, which corresponds more to the wage literature where individual earnings are employed.

Our approach is somewhere in between the existing sectoral studies. As our main objective is to analyse how increased earnings inequality at the country level is manifested at the sectoral level, we calculate inequality indicators rather than wage bill shares. Yet, we base our main findings on individual rather than household earnings, so that we can attribute earnings to sectors with less noise, although we use household earnings as a sensitivity test. Compared to the existing studies (Mahler *et al*., 1999; OECD, 2011a; Michaels *et al*., forthcoming) who only calculate sectoral information at two moments in time, we seek to contribute to the literature by building a new database on inequality and employment at the sectoral level that contains sectoral data over a longer period. This allows us to conduct cross-section panel regressions, in which we can control for certain unobserved and observed industry-specific and country-specific developments. We update the analyses of Mahler *et al*. (1999) by including data from the early 1990s to 2005, a period in which trends persisted of rapidly increasing trade and technological change, and waning institutions. Last, we do not only explore earnings but also sectoral employment indicators.

A sectoral design has a number of advantages over a country-level study. Empirically, the number of observations increases and it becomes possible to correct for unobserved industry-specific next to country-specific developments. In addition to this, a sectoral design allows for heterogeneity between sectors. As shown later in this section (see Table 7) there

[23] As a sensitivity test we also run regressions in which we interact the country-level institutions with sectoral information on trade and technological change. The results are fully comparable to the ones shown.

are clear differences in the degree to which sectors are exposed to trade or technological change. These differences in exposure may render variations in effects on earnings or employment per sector if there is imperfect labour mobility between sectors. Evidence for imperfect labour mobility comes from persistent wage differences between sectors that cannot be explained by (observable) composition effects (Krueger and Summers, 1988; Dickens and Katz, 1987). These persistent differences may be a result of labour market frictions, such as search costs in looking for jobs (Mortensen and Pissarides, 1999), job and industry specific human capital (Estevez-Abe *et al*., 2001), or institutions such as employment protection legislation that depress labour mobility (Hellier and Chusseau, 2013). Artuc *et al*. (2008) and Artuc and McLaren (2010) for instance show that it takes around eight years before a wage effect in a liberalising sector of a trade shock spreads out across the economy.

Our sectoral design also has limitations. First, dependencies between industries are not taken into account as sectors are taken as independent units of analysis. In addition, certain confounding factors that might have an effect on both trade or technology and sectoral earnings and employment, are not included in the model, such as product market developments. Therefore, the empirical results should be seen as associations rather than causal evidence.

5.2 The regression model and data

Our database consists of country-industry data, which allows us to exploit variation within countries across industries and over time. Following Bassanini *et al*. (2009), we estimate the following equation using OLS:

$$\text{inequality}_{ijt} = \beta_0 + \beta\ \text{trade}_{ijt} + \gamma\ \text{techn}_{ijt} + \text{instit}_{it}\delta\ + X_{it}\mu + \varphi_i\theta + \varphi_j\theta + \varepsilon_{ijt} \qquad (4)$$

Our main dependent variable is earnings inequality within sector j, country i, and period t. Employment effects are explored using the relative employment size and relative median earnings at the sectoral level as dependent variables.[24]

For two independent variables data are available at the sectoral level. In Section 4 we hypothesised that the degree to which sectors are exposed to international trade and technological progress might explain sectoral inequality and employment patterns. For the trade data ($\beta\ \text{trade}_{ijt}$) we use the OECD STAN database (2011b) where we calculate trade

[24] All dependent variables are multiplied by 100 in the regressions to enhance readability.

values in percentage of sectoral added value from the same year as the LIS waves. We differentiate between import and export. Unfortunately no distinction is possible between trade among developed and trade between developed and developing countries.[25] For our sectoral indicator of technological progress ($\gamma\,\mathrm{techn}_{ijt}$) we follow OECD (2011a) and Michaels *et al*. (forthcoming) and use the share of compensation of ICT capital in total capital compensation from EU-KLEMS (2011), to which we refer to as the ICT propensity or intensity. This indicator should be seen as an imperfect proxy to gauge technological change, as technological change exhibits itself in multiple fashions, many of which are unobservable (Oesch and Menés, 2011; OECD, 2011a). Further, Michaels *et al*. remark that the sectoral EU-KLEMS indicator suffers from measurement error.

To test the waning labour market institutions hypothesis, we add a vector of institutional variables at the country level ($\mathrm{instit}_{it}\delta$).[26] We take a measure of overall EPL from OECD data (2009). Visser (2011) provides us with data on union coverage, defined as the proportion of employees covered by wage bargaining agreements, and the level of wage coordination, where a higher number indicates a more centralised level of wage bargaining.[27] The vector $X_{it}\mu$ contains two common control variables measured at the country level, namely, the unemployment rate and real GDP per capita divided by 100, from the OECD National Accounts (2012). The relationship between GDP per capita and inequality is strongly contested in both causal directions (see *e.g.*, Thewissen, 2012) but it corrects for effects from possible differences in economic development between countries. Inclusion of the country-level unemployment rate can be seen as a rough control for labour market efficiency differences between countries.

We also implicitly control for unobserved industry-specific developments by including interactions of sector dummies and the trend ($\varphi_j\theta$), such as for the fact that industries might be exposed to different demand dynamics in their product markets. The set ($\varphi_i\theta$) includes interaction terms of the country dummies and the trend, to control for unobserved effects that

[25] This is a common problem in the current literature (Bensidoun *et al*., 2011). As the largest increases in trade during the last two decades came from trade between developed and developing countries, in particular, from trade with China and India (OECD, 2011a), we conduct sensitivity tests in which we only incorporate the periods from 1995 onwards, which does not affect the main results, see Section 5.6.

[26] As a sensitivity test, we also generate interactions between the country-level labour market variables and the sectoral indicators for import, export, and technological progress. These interactions do not reach significance, see section 5.6

[27] The variable WCoord from Visser (2011) is divided into: 5 = economy-wide bargaining, 4 = mixed industry- and economy-wide bargaining, 3 = industry-level bargaining with no (standard) pattern setting, 2 = mixed industry- and firm-level bargaining, 1 = fragmented or no bargaining.

have comparable effects on earnings within different industries at the country level.[28] Standard errors are clustered at the country level to allow for general forms of heteroskedasticity and autocorrelation within countries.

5.3 Descriptive statistics for the independent variables

Table 7 shows that the amount of import and export has increased in every sector. The largest increase took place in the manufacturing of textile and manufacturing of transport; in mining import rose significantly while exports remained stable. The amount of international trade barely rose in the utility sector. As is evident from the table, for international trade data are only available for agriculture, mining, utilities, and manufacturing and its subsectors.

Table 7 Trends in international trade and technological change at the sectoral level

	Import (% sectoral value added)			Export (% sectoral value added)			Share of ICT in total capital compensation (%)		
	1985	1995	2005	1985	1995	2005	1985	1995	2005
1 Agriculture	21.15[a]	33.15	47.85	22.57[a]	21.43	25.81	0.19	0.02	0.03
2 Mining	285.94[a]	223.97	459.81	46.72[a]	35.01	49.97	0.03	0.05	0.11
3 Manufacturing	91.63	114.36	144.40	88.25	132.12	167.30	0.10	0.09	0.12
4 Utilities	3.13[a]	2.23	3.79	1.06[a]	1.30	5.47	0.04	0.05	0.05
5 Construction	.	.	.	.	.	.	0.06	0.28	0.12
6 Wholesale	.	.	.	.	.	.	0.19	0.16	0.18
7 Transport and telecommunications	.	.	.	.	.	.	0.23	0.20	0.26
8 Finance	.	.	.	.	.	.	0.09	0.10	0.12
9 Community	.	.	.	.	.	.	0.14	0.16	0.18
31 Man. food	50.75	57.56	81.07	59.80	100.24	83.18	0.07	0.07	0.09
32 Man. textile	208.18	249.14	503.79	95.18	161.39	264.39	0.07	0.07	0.13
33 Man. wood	65.16	73.67	83.37	72.08	86.08	81.69	0.08	0.06	0.07
34 Man. paper	31.15	58.10	54.91	64.57	87.59	83.03	0.14	0.13	0.16
35 Man. chemicals	130.61	135.74	166.18	96.18	131.70	188.81	0.06	0.06	0.09
36 Man. minerals	41.20	44.93	65.52	30.37	55.16	63.09	0.09	0.07	0.07
37 Man. metals	87.43	111.04	123.94	72.77	95.02	111.63	0.07	0.08	0.13
38 Man. machinery	124.23	177.30	209.20	109.38	181.77	239.74	0.16	0.14	0.17
39 Man. transport	174.15	269.00	424.87	120.47	171.65	245.23	0.26	0.13	0.20
30 Other man.	75.77	87.87	132.52	66.65	95.82	110.70	0.09	0.12	0.26
71 Transport	.	.	.	.	.	.	0.13	0.14	0.15
72 Telecommunications	.	.	.	.	.	.	0.30	0.29	0.40
Average	99.32	117.00	178.66	67.57	96.88	122.86	0.12	0.12	0.15

Note: Import and export are expressed in % of sectoral value added, pooled for countries for which data are available.
[a] Data from 1990. The average is the unweighted arithmetic average for the available observations of that period.
Source: Import and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS.

The ICT propensity rose over time as well, but not uniformly across all sectors. The starkest increases took place in other manufacturing, telecommunications, and mining. The ICT propensity decreased significantly in agriculture, which is fully due to high values in

[28] As a sensitivity test we also exclude these sets of interaction terms. These results, prone to unobserved heterogeneity, change the results to some extent, see Section 5.6.

Germany around 1985.[29] Minor reductions occurred in the manufacturing of wood, minerals, and transport. As can also be seen in Table 7, for a number of sectors no data on international trade are available. Of particular importance are the community sector, which can be expected to be relatively sheltered against international trade, and the financial sector, in which the relative employment size grew relatively fast.[30]

Table 8 summarises the country-level data for the incorporated set of institutions per country. On average the union coverage rate decreased and EPL became less strict. Finland and Sweden are the only countries in which the union coverage rate increased over time. In the UK and Ireland EPL became more strict, but only marginally so. There is not much fluctuation in the level of wage coordination within countries over time. In Sweden wage coordination became more decentralised whereas it became more centralised in Denmark.[31]

Table 8 Trends in institutions at the country level

Country	Union coverage rate (%)			Level of wage coordination			EPL		
	1985	1995	2005	1985	1995	2005	1985	1995	2005
Czech Republic	.	60.0	43.5	.	2	2	.	1.90	1.90
Denmark	83.0	84.0	83.0	3	3	4	2.40	1.50	1.50
Finland	77.0	82.2	90.0	4	3	4	2.33	2.16	2.02
Germany	78.0	72.0	64.3	4	4	4	3.17	3.09	2.12
Ireland	.	60.0	54.6	.	5	5	.	0.93	1.11
Sweden	85.0	94.0[a]	94.0	4	3[a]	3	3.49	2.24[a]	2.24
UK	64.0	36.1	34.7	1	1	1	0.60	0.60	0.75
US	19.9	17.4	13.8	1	1	1	0.21	0.21	0.21
Average	65.9	63.2	59.7	2.8	2.8	3.0	1.88	1.58	1.48

Note: [a] Data from around 2000. The average is the unweighted arithmetic average for the available observations of that period.
Source: Union coverage and level of wage coordination from Visser (2011), EPL from OECD EPL

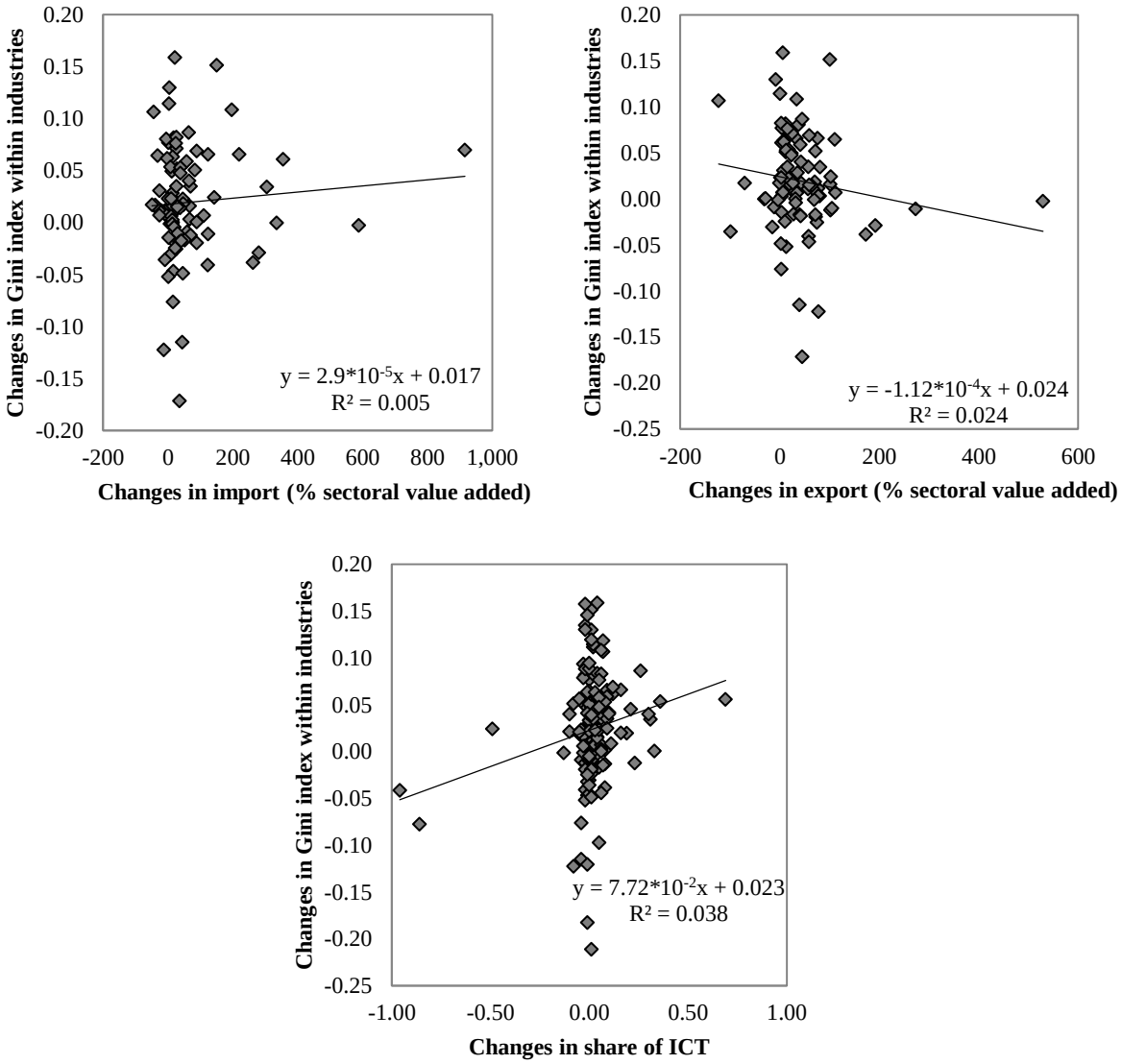
5.4 Within-industry inequality

We start with simple scatterplots for the sectoral data to examine the correlation between changes in the first order corrected Gini coefficient and sectoral levels of import, export, and the share of ICT. There is a weak positive relation between changes in import and the first order corrected Gini index, as can be seen from Figure 5. For export the relationship is marginally stronger and negative. These two signs correspond to Mahler's (2004) predictions.

[29] These extreme values for Germany drop out in the regressions as no data on export and import are available for 1985 and 1990.
[30] In Section 5.6 we make an explicit comparison between the community and the manufacturing industry for our three dependent variables. In addition, we impute zero's for international trade in the community sector and run the regressions. Both analyses fully correspond to our presented findings.
[31] In 1991 the Swedish Federation of Employers withdrew from the tripartite negotiations, so that the central collective wage negotiations came to a halt (Lindvall and Sebring, 2005). In Denmark Anthonsen *et al.* (2010) describe a revival of corporatism during the 1980s and 1990s.

There is a somewhat stronger positive association for changes in the share of ICT, which is in line with the SBTC hypothesis.

Figure 5 OLS associations for import, export, ICT, and sectoral earnings inequality



Note: Changes in first order corrected Gini index. Differences between 1985 and 2005 for sectoral observations, except for Czech Republic, Ireland, and Germany for import (between 1995 and 2005), and Sweden (between 2000 and 2005)

Source: First order corrected Gini index from the Leiden LIS Sectoral Income Inequality Dataset, import from OECD STAN, share of ICT in total capital compensation from EU-KLEMS

As shown in Table 9 no evidence is found for the hypothesis that international trade leads to higher earnings inequality at the sectoral level. The only borderline significant result is the negative association between export and the first order corrected Gini index, which suggests that sectors more exposed to export actually have a more compressed earnings structure.

The sectoral ICT propensity is insignificant in all regressions, thus, we do not find evidence for the SBTC hypothesis. The union coverage rate is consistently significant, however, and its sign corresponds to our hypothesis that a weaker trade union position goes hand-in-hand with a more dispersed earnings distribution. The level of wage coordination is significant only for the Gini index regressions, whereas EPL becomes significant in the regressions with the MLD as the dependent variable. Finally, the unemployment rate at country level has a negative association with sectoral inequality. A possible explanation for this is that when the unemployment rate is rampant, people with earnings at the lower end of the distribution are most prone to job loss resulting in lower earnings inequality. Another reason is that starters with relatively low earnings postpone entry into the labour market (*e.g.*, Elsby *et al*., 2010).

Table 9 Panel data regressions for earnings inequality within sectors

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002		-0.000	
	(0.319)		(0.797)	
Export		-0.008*		-0.009
		(0.077)		(0.202)
Share of ICT	1.068	0.359	0.903	0.544
	(0.553)	(0.869)	(0.737)	(0.848)
Country level data				
Union coverage	-0.134***	-0.134***	-0.257***	-0.254***
rate	(0.001)	(0.001)	(0.004)	(0.003)
Level of wage	-1.884***	-1.784***	-1.391	-1.288
coordination	(0.001)	(0.002)	(0.126)	(0.156)
EPL	0.897	0.912	3.478**	3.447***
	(0.376)	(0.343)	(0.012)	(0.009)
Unemployment	-0.410***	-0.392***	-0.235*	-0.218*
rate	(0.000)	(0.001)	(0.071)	(0.097)
Real GDP per	-0.026**	-0.027**	-0.044	-0.045
capita/100	(0.045)	(0.035)	(0.124)	(0.122)
Constant	44.054***	44.071***	38.350***	38.261***
	(0.000)	(0.000)	(0.001)	(0.001)
*N*T*I*	334	334	334	334
Adjusted R^2	0.627	0.629	0.407	0.409

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index and MLD from the Leiden LIS Sectoral Income Inequality Dataset, import and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

5.5 Employment effects

It might be that increased income inequality at country level is not so much a consequence of widening earnings distribution, but rather of employment loss at the bottom end of the earnings distribution (Gottschalk and Smeeding, 1997; Atkinson, 2003). As explained earlier, unfortunately the LIS database is a time series rather than a panel at the individual level. This makes it impossible to directly track employment shifts, such as transfers to less exposed sectors or to unemployment.

There are two indirect measures at our disposal to map employment effects. First, we can use data on the relative employment size of a sector. If our independent variables are associated with job loss, we should expect a decrease in the relative employment size of the sector. Second, if this job loss mainly occurred for people at the lower end of the earnings distribution, we should expect higher relative median earnings in sectors that were more exposed to trade or that were more skill-intensive (see also Mahler *et al*., 1999, who coin this inequality between sectors).

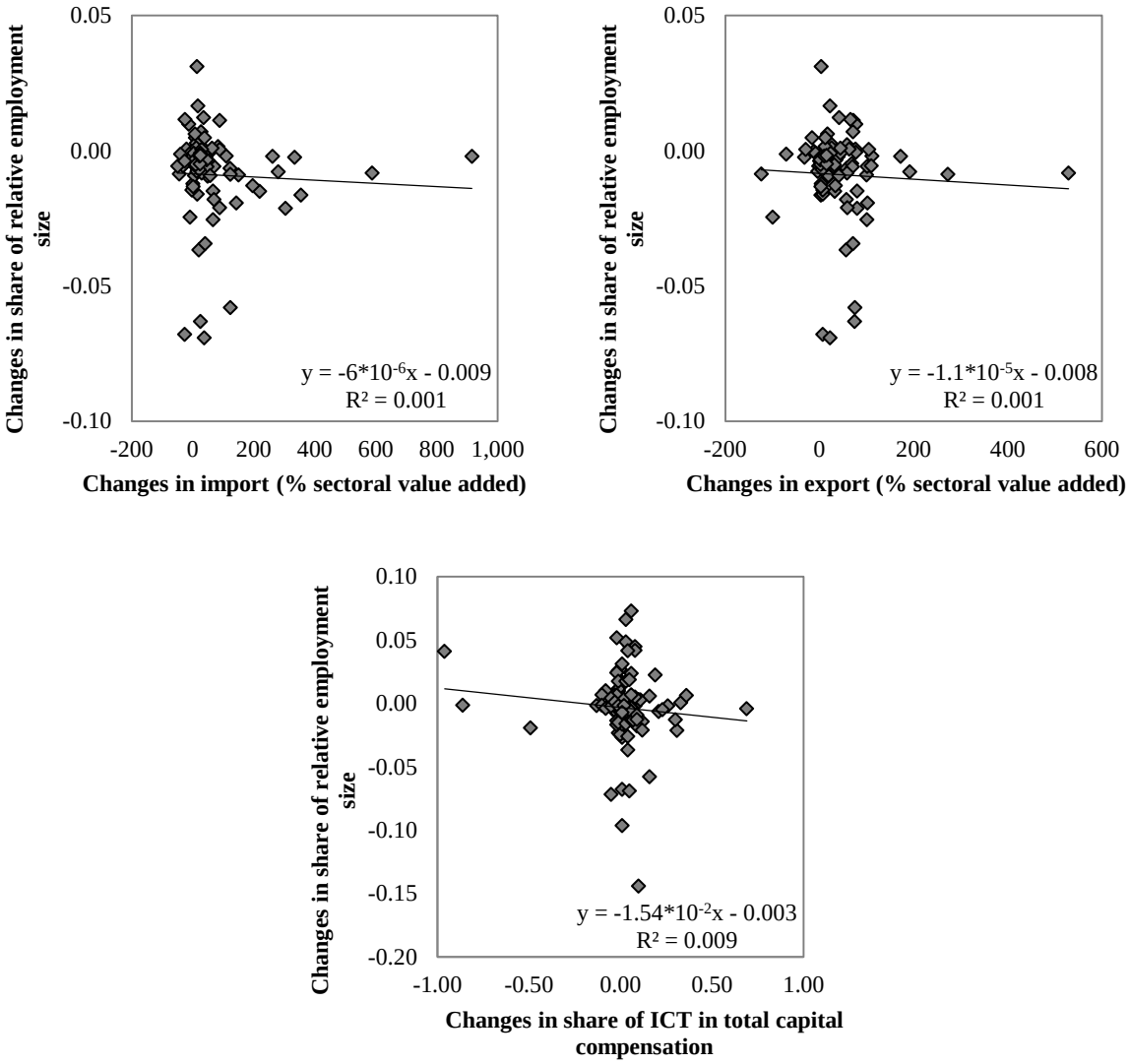
For the relative employment size we use our own LIS and the OECD STAN data, defined as the number of persons engaged per industry divided by the total number of persons engaged. This indicator only tells us something about the extensive margin; cuts in working hours are not incorporated. The indicators from the two data sources are highly correlated (0.96). For the relative median earnings we divide the sectoral median earnings by its country-level counterpart of the same period.

As both employment indicators are expressed in percentages relative to the national level, the institutional and control variables at the country level lose their interpretation. As the sectoral terms are expressed in ratios, they average out to around 100 at the country level. The country-level variables are therefore left out of the regressions, although the results are not affected by their inclusion.[32]

Figure 6 shows a weak negative association between changes in import, export, and the ICT propensity on the one hand, and the relative employment size on the other. Yet, the explanatory power is limited as evident from the low R^2 value.

[32] The coefficients for the country-level indicators are still estimated as for some sectors data are missing, so that the problem of perfect collinearity does not arise.

Figure 6 OLS associations for import, export, ICT, and relative employment size



Note: Changes in relative employment size. Differences between 1985 and 2005 for sectoral observations, except for Czech Republic, Ireland, and Germany for import (between 1995 and 2005), and Sweden (between 2000 and 2005)
Source: Relative employment size from the Leiden LIS Sectoral Income Inequality Dataset, import from OECD STAN, share of ICT in total capital compensation from EU-KLEMS

We can see from the results in Table 10 that import is significantly associated with the relative employment size of industries. We can infer from this that the relative number of jobs has decreased in sectors more exposed to import. This is in line with the hypothesis that trade leads to job loss in import-competing sectors. From the results we can conclude that for a given sector, an increase in import of 1 percentage point of the sectoral value added is on average associated with an in between 0.001 and 0.002 percentage point lower relative employment size in a period, holding constant the control variables.

The results provide no evidence for job creation in sectors with a large export fraction. For the ICT propensity we only find one borderline significant result; the positive direction is

not in agreement with the SBTC job loss hypothesis. The fact that we find a decline in employment in import-competing industries combined with no significant association with technological progress is in line with the industrial findings from Autor *et al*. (2013) for the US.

Table 10 Panel data regressions for the relative employment size

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002***		-0.001***	
	(0.007)		(0.005)	
Export		0.001		-0.001
		(0.232)		(0.673)
Share of ICT	0.686*	0.386	0.434	0.125
	(0.097)	(0.377)	(0.207)	(0.730)
Constant	2.660***	2.611***	2.215***	2.224***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	334	334	339	339
Adjusted R^2	0.627	0.609	0.672	0.655

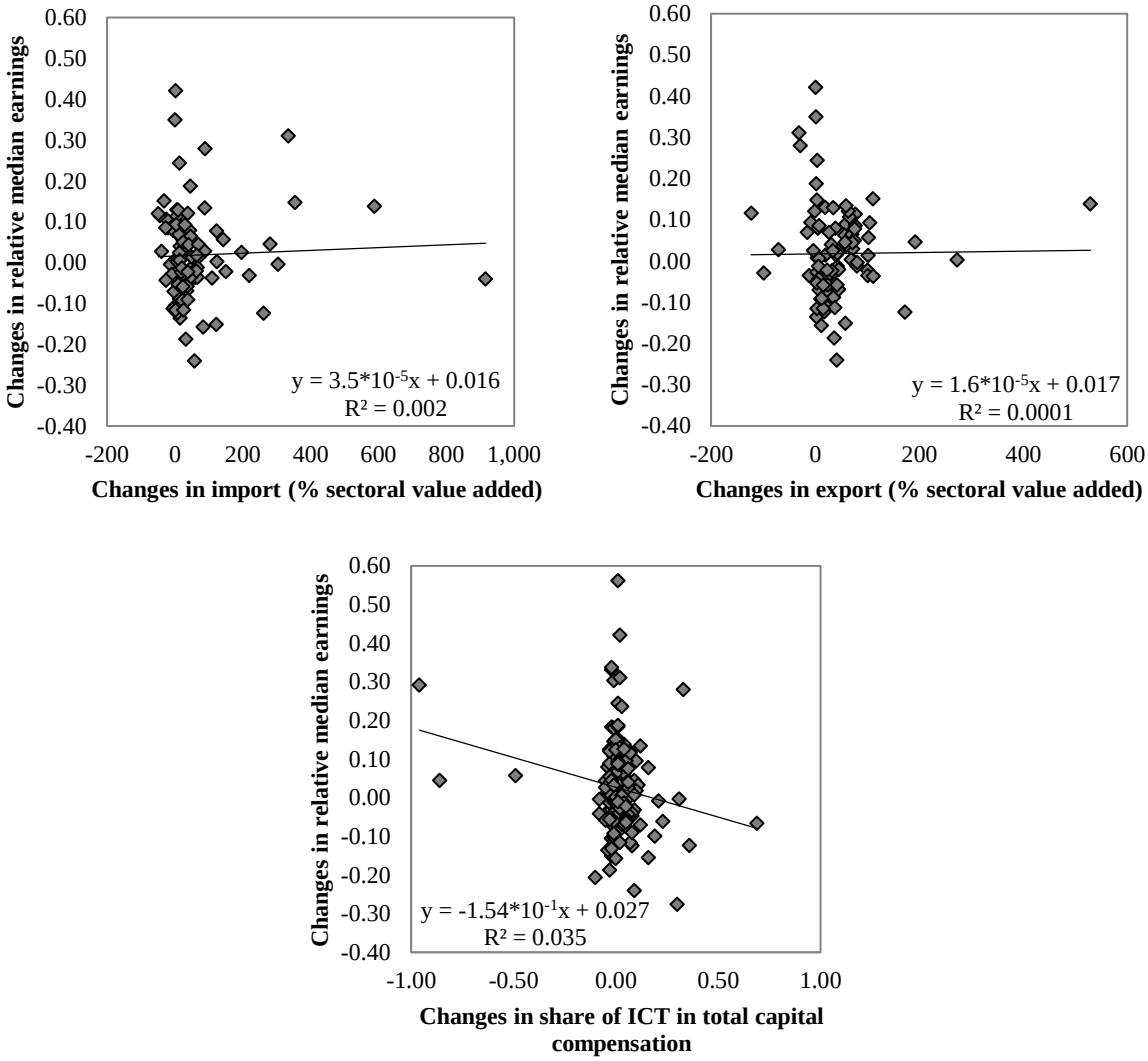
Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: Relative employment size from OECD STAN and Leiden LIS Sectoral Income Inequality Dataset, import and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS

Yet, the relative employment size does not necessarily tell us something about job loss for lowly skilled; it simply captures all relative job movements. Therefore, we also use the sectoral median earnings relative to the national median earnings. In case that low wage jobs for lowly skilled have disappeared we should expect higher relative median earnings in sectors that became more exposed to international trade or more skill intensive.

Figure 7 shows that the OLS associations are generally weak. Changes in both import and export have a marginal positive association with changes in the relative median earnings. This positive sign corresponds to the hypothesis that trade leads to job loss at the lower end of the distribution, resulting in higher relative median earnings. For the ICT propensity a somewhat stronger negative association is reported.

Figure 7 OLS associations for import, export, ICT, and relative median earnings



Note: Differences between 1985 and 2005 for sectoral observations, except for Czech Republic, Ireland, and Germany for import (between 1995 and 2005), and Sweden (between 2000 and 2005)
Source: Relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, import from OECD STAN, share of ICT in total capital compensation from EU-KLEMS

The regressions presented in Table 11 actually show a negative association between import and the relative median earnings which is significant at the 10 per cent level. This finding indicates that the diminution of employment found in the former regressions is not associated with concomitant job loss for the lowly skilled, although the evidence is not particularly strong here. All things considered, we find that sectors more exposed to import are characterised by a lower number of jobs, potentially lower median earnings, but not a more dispersed earnings distribution. An explanation for this is that job loss in import-competing sectors is not only tailored to the low end of the earnings distribution, but rather that the whole distribution shifts down as a result of increased international competition. Other

explanations are feasible as well though, and in addition, the evidence for lower relative median earnings is weak. For export and ICT intensity no significant associations are reported.

Table 11 Panel data regressions for the relative median earnings

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.016*	
	(0.054)	
Export		0.014
		(0.516)
Share of ICT	3.596	0.485
	(0.713)	(0.962)
Constant	103.335***	102.721***
	(0.000)	(0.000)
*N*T*I*	334	334
Adjusted R^2	0.660	0.650

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: Relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, import and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS

5.6 Sensitivity tests

We perform a battery of additional tests to examine the sensitivity of our findings, results of which are placed in Appendix 1. First, we test whether the reported results are sensitive to the selected sample. We exclude the industries in which the number of included individuals in the LIS data is below 30, causing the number of observations to decrease from 334 to 316. This does not affect the results, see Table A1.1. Second, we test for the possibility that trade only had an effect from around 1995 onwards, when the trade between developed and developing countries mainly increased (OECD, 2011a). As can be seen in Table A1.2, this alters the regressions with sectoral earnings inequality as the dependent variable somewhat; export becomes insignificant and so does the union coverage rate for the MLD, whereas the level of wage coordination and EPL become significant in all regressions.

In our original results the community sector was excluded as no data for international trade are available. If we compare trends in earnings inequality and employment in the community and manufacturing sector per country, then we find that earnings inequality is actually higher and more rapidly rising in the sheltered community sector, which again does not suggest inequality-enhancing effects of international trade (see Table 12a). Yet, we can see that the relative employment size decreased more quickly in the manufacturing industry

combined with increasing relative median earnings (Tables 12b and 12c). This hints to possible employment effects of international trade.

Table 12 Comparing the manufacturing and the community sector

12a First order corrected Gini index

Country	Manufacturing						Community					
	1985	1990	1995	2000	2005	Change	1985	1990	1995	2000	2005	Change
1. Czech Rep.	.	.	0.305	.	0.293	-0.012	.	.	0.266	.	0.285	0.019
2. Denmark	0.235	0.225	0.230	0.222	0.238	0.003	0.254	0.259	0.239	0.237	0.254	-0.001
3. Finland	0.232	0.239	0.222	0.246	0.243	0.011	0.262	0.262	0.255	0.258	0.249	-0.013
4. Germany	0.295	0.279	0.290	0.294	0.305	0.010	0.295	0.304	0.321	0.327	0.354	0.059
5. Ireland	.	.	0.269	.	0.300	0.031	.	.	0.273	.	0.356	0.084
6. Sweden	0.266	0.251	.	0.254	0.249	-0.017	0.282	0.293	.	0.288	0.295	0.013
7. UK	0.286	.	.	0.337	0.326	0.040	0.363	.	.	0.389	0.372	0.009
8. US	0.331	0.340	0.363	0.377	0.378	0.048	0.372	0.388	0.399	0.409	0.397	0.025
Average	0.274	0.267	0.280	0.288	0.291	0.014	0.305	0.301	0.292	0.318	0.320	0.024

12b Relative employment size

Country	Manufacturing						Community					
	1985	1990	1995	2000	2005	Change	1985	1990	1995	2000	2005	Change
1. Czech Rep.	.	.	0.270	.	0.264	-0.006	.	.	0.317	.	0.246	-0.072
2. Denmark	0.180	0.185	0.189	0.179	0.165	-0.015	0.422	0.438	0.377	0.372	0.399	-0.023
3. Finland	0.243	0.219	0.224	0.220	0.206	-0.037	0.284	0.312	0.342	0.307	0.328	0.045
4. Germany	0.351	0.364	0.263	0.255	0.254	-0.097	0.270	0.253	0.298	0.294	0.312	0.041
5. Ireland	.	.	0.194	.	0.126	-0.068	.	.	0.358	.	0.332	-0.026
6. Sweden	0.215	0.190	.	0.194	0.181	-0.034	0.406	0.419	.	0.388	0.406	-0.001
7. UK	0.291	.	.	0.197	0.147	-0.144	0.350	.	.	0.318	0.353	0.003
8. US	0.201	0.196	0.186	0.161	0.131	-0.069	0.331	0.312	0.331	0.321	0.319	-0.013
Average	0.247	0.231	0.221	0.201	0.184	-0.059	0.344	0.347	0.337	0.333	0.337	-0.006

12c Relative median earnings

Country	Manufacturing						Community					
	1985	1990	1995	2000	2005	Change	1985	1990	1995	2000	2005	Change
1. Czech Rep.	.	.	0.938	.	0.951	0.013	.	.	1.018	.	1.062	0.044
2. Denmark	1.061	1.052	1.042	1.031	1.049	-0.012	0.914	0.930	0.960	0.959	0.950	0.036
3. Finland	1.066	1.059	1.143	1.146	1.129	0.062	0.993	1.010	0.966	0.926	0.946	-0.048
4. Germany	1.046	1.053	1.129	1.143	1.167	0.121	0.991	0.969	0.966	0.969	0.922	-0.068
5. Ireland	.	.	0.926	.	1.011	0.085	.	.	1.093	.	1.043	-0.050
6. Sweden	1.075	1.079	.	1.118	1.119	0.044	0.888	0.914	.	0.890	0.902	0.014
7. UK	1.088	.	.	1.110	1.106	0.018	0.908	.	.	0.907	0.941	0.033
8. US	1.123	1.152	1.116	1.133	1.100	-0.023	0.963	0.991	0.983	1.000	0.970	0.007
Average	1.077	1.079	1.049	1.114	1.079	0.039	0.943	0.963	0.998	0.942	0.967	-0.004

Note: The average is the unweighted arithmetic average for the available observations of that period
Source: Leiden LIS Sectoral Income Inequality Dataset

Comparable results are obtained if we assume that no trade took place in the community sector by replacing the zeros for missing values and redoing the estimations, see Table A1.3 (the *N* increases to 363). Compared to the original regression results, the only difference is that export becomes insignificant for the first order corrected Gini index.

Next, we test more generally whether the reported results are robust to the exclusion of sectors. The general picture is again confirmed; import remains significantly associated with

the relative employment size, as can be seen from Figure A1.1. The coefficient becomes twice as strong (-0.003 for both LIS and OECD data) when the mining sector is excluded. The significant association between the union coverage rate and earnings inequality is also robust to the exclusion of sectors, see Figure A1.2. The significant associations between export and the first order corrected Gini coefficient and between import and relative median earnings disappear frequently (results not shown).

Subsequently, the fact that we do not find many significant results might be due to the conservative nature of our empirical specification. By including interactions of country dummies and the time trend, or sector dummies and the time trend, we remove patterns over time in sectors and countries from the data which reduces the variation. Therefore we also estimate the models without the dummies, see Tables A1.4-A1.6. This comes at a high price though, as it makes the results more susceptible to unobserved heterogeneity bias. There are still no signs of inequality-enhancing effects of international trade. Without the country and time trend interactions the institutions become significant in all four inequality regressions. There are some signs of a significant positive association between export and the relative employment size, entailing that export could lead to job creation, when the sector and time trend interactions are removed. The initially found negative significant association between import and the relative median earnings disappears regularly.

One way to cope with the fact that we do not have sectoral information for the labour market institution variables is to calculate interactions between the sectoral indicators (import, export, and technological change) and the three labour market institutions (EPL, level of wage coordination, and the union coverage rate). In this way we test whether the effects of international trade or technological change on earnings inequality at the sectoral level are mitigated through the country-level labour market institutions. None of the interaction variables in the regressions with earnings inequality as the dependent variable reach significance, both with and without the original institution and sectoral variables included. The results for the regressions including all interactions are shown in Table A1.7.

It could be that parts of the changes in earnings or employment are caused by people shifting from unemployment to part-time unemployment or from part-time to fulltime jobs. Especially spouses and other relatives are prone to make these labour shifts. We recalculate all indicators for household heads only[33] and redo the regressions, see Table A1.8; correlations with the original indicators are above 0.94 for the sectoral earnings inequality and

[33] These indicators are also included in the database.

employment size, and 0.85 for the relative median earnings. There are still no signs of inequality-enhancing effects of international trade, while EPL becomes significantly positive for the first order corrected Gini index. The association between the relative sectoral size and import remains firm, whereas the significance between import and the relative median earnings disappears.

Last, we explore possible consequences of the fact that we base our estimations on individual rather than household earnings, as Mahler *et al*. (1999) did. Employing household earnings introduces noise into the dataset as earnings are attributed to sectors in which they were not necessarily made. However, if labour supply decisions are made at the household level and when earnings are shared between household members, it might be preferable to base the regressions on household data.[34] The correlations between the individual and household data indicators are high for the relative employment size (above 0.93), but lower for the inequality indicators (0.82 for the first order corrected Gini index and 0.67 for the MLD) and the relative median earnings (0.68). As can be seen from Table A1.9, we still do not find evidence for inequality-enhancing effects from international trade, whilst the level of wage coordination becomes comfortably significant for all regressions. The most salient finding is the robustly significant positive association between the ICT propensity and within-sector inequality. Thus, based on household level data we do find evidence for SBTC. The employment regressions correspond to the ones based on individual data, except the consistently insignificant association between trade and relative median earnings that was already apparent from the other sensitivity tests.

6. Conclusions

This paper describes trends in sectoral labour earnings inequality and employment using a new database containing information for eight countries between 1985 and 2005. In addition, using cross-sectional pooled time-series we scrutinise possible explanations for variations in sectoral inequality and employment.

Our decomposition divulges that earnings inequality at the country level is by and large a consequence of dispersion within sectors rather than large differences in mean earnings between sectors. This share of within-sector inequality has increased further over time. Having said that, the level of sectoral earnings inequality within countries fluctuates as much as the level of earnings inequality between countries. The ranking of sectors in their

[34] These indicators are also included in the database.

level of inequality is comparable across countries, indicating that the sectoral dimension is important for understanding earnings inequality at the country level. Agriculture, wholesale, and the financial sector ubiquitously stand out as the sectors with the most unequally distributed earnings, whereas mining, utilities, and the manufacturing of metals and transport are characterised by low levels of earnings dispersion in all countries.

Mirroring the developments at the country level, earnings inequality has increased in the lion's share of sectors, although the rise differs per sector. In the sector with the highest level of inequality, agriculture, there is in fact a trend towards equalisation over time. The mining and utilities industries comprise a relatively homogeneous workforce as they are characterised by a relatively even earnings distribution, combined with relatively high median earnings. The median earnings are relatively low in the traditionally labour-intensive industries, namely, agriculture, wholesale, and the manufacturing of textile, although median earnings are rising fast in the agricultural sector. It thus seems that in agriculture individuals at the lower end of the earnings distribution saw an increase in their earnings, as indicated by an increase in relative median earnings combined with a decrease in earnings inequality. Our comparison of the relative employment sizes of industries over time imparts a notable employment shift from the manufacturing industry towards the financial sector. For all these trends the differences across countries are limited.

By means of cross-sectional pooled time-series we do not find evidence for associations between trade and earnings inequality, in line with other sectoral studies (Mahler *et al*., 1999; OECD, 2011a; Michaels *et al*., forthcoming). Yet, the reported results denote that the employment size has decreased in sectors that are more exposed to import. No further evidence is found that this job loss has occurred at the bottom end of the earnings distribution. In addition, the union coverage rate at the country level is found to be negatively associated with sectoral earnings inequality, which corresponds to the hypothesis that waning trade union power is an explanation for rising inequality (*e.g.*, Koeniger *et al*., 2007). These results are robust to a set of sensitivity analyses. Further inspection using sectoral data on union coverage rates could provide more insight into how trade unions' influence works its way into sectoral earnings differences.

The regression results are not in line with the predictions from the SBTC hypothesis, as we do not find significant associations between the sectoral ICT intensity and any of the dependent variables. In particular from the wage literature there is empirical support the SBTC hypothesis. A first reason for this difference is imperfect measurement; sectoral proxies for technological change are not abundantly available and they suffer from measurement

error. The deviation from Michaels *et al*. (forthcoming) might arise from the fact that these scholars examine polarisation in skill demand, rather than earnings inequality, and that they only use two periods over time. It therefore might be interesting to further analyse in what way polarisation seeps through to inequality at the sectoral level.

The conducted regressions do not provide causal evidence. Other confounding factors, in particular in product markets, can be expected to affect both the earnings and employment, as well as the trade and technology. In addition, individual labour market transitions cannot be tracked directly by means of the used database. Still, the analyses instigate a sectoral approach in understanding inequality, in which heterogeneity between sectors is accounted for.

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Appendix 1. Sensitivity tests

Table A1.1 Without sectors with number of individuals below 30

A1.1a Earnings inequality: Without sectors with number of individuals below 30

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.004		-0.005	
	(0.116)		(0.207)	
Export		-0.009**		-0.009
		(0.026)		(0.168)
Share of ICT	0.840	-0.283	1.554	0.283
	(0.593)	(0.884)	(0.570)	(0.929)
Country level data				
Union coverage	-0.133***	-0.132***	-0.249***	-0.249***
rate	(0.000)	(0.000)	(0.003)	(0.003)
Level of wage	-1.586**	-1.653***	-0.938	-1.024
coordination	(0.011)	(0.010)	(0.310)	(0.282)
EPL	1.005	1.095	3.462***	3.567***
	(0.298)	(0.249)	(0.003)	(0.002)
Unemployment	-0.302**	-0.296**	-0.096	-0.090
rate	(0.025)	(0.025)	(0.514)	(0.548)
Real GDP per	-0.023	-0.024	-0.038	-0.038
capita/100	(0.162)	(0.146)	(0.218)	(0.218)
Constant	42.171***	42.309***	35.179***	35.355***
	(0.000)	(0.000)	(0.003)	(0.003)
*N*T*I*	316	316	316	316
Adjusted R^2	0.628	0.629	0.402	0.402

A1.1b Relative employment size: Without sectors with number of individuals below 30

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.003***		-0.003***	
	(0.006)		(0.005)	
Export		0.001		-0.001
		(0.295)		(0.649)
Share of ICT	0.987**	0.370	0.647	-0.054
	(0.029)	(0.373)	(0.139)	(0.893)
Constant	2.854***	2.732***	2.290***	2.263***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	316	316	307	307
Adjusted R^2	0.636	0.604	0.673	0.646

A1.1c Relative median earnings: Without sectors with number of individuals below 30

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.025*	
	(0.095)	
Export		0.016
		(0.460)
Share of ICT	6.410	1.839
	(0.597)	(0.882)
Constant	103.501***	102.240***
	(0.000)	(0.000)
*N*T*I*	316	316
Adjusted R^2	0.681	0.672

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.2 After and including 1995

A1.2a Earnings inequality: After and including 1995

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.003		-0.000	
	(0.265)		(0.790)	
Export		-0.008		-0.006
		(0.117)		(0.289)
Share of ICT	1.907	0.913	1.545	1.211
	(0.260)	(0.690)	(0.597)	(0.708)
Country level data				
Union coverage	-0.152***	-0.152***	-0.188	-0.186
rate	(0.006)	(0.004)	(0.113)	(0.100)
Level of wage	-1.749**	-1.668**	-2.379*	-2.326*
coordination	(0.027)	(0.029)	(0.087)	(0.091)
EPL	2.005*	1.949*	3.553**	3.472**
	(0.071)	(0.071)	(0.033)	(0.029)
Unemployment	-0.414***	-0.395***	0.012	0.022
rate	(0.002)	(0.004)	(0.938)	(0.888)
Real GDP per	-0.030	-0.030*	-0.019	-0.020
capita/100	(0.109)	(0.092)	(0.527)	(0.490)
Constant	43.326***	43.480***	29.877**	30.052**
	(0.000)	(0.000)	(0.012)	(0.011)
*N*T*I*	260	260	260	260
Adjusted R^2	0.643	0.643	0.459	0.460

A1.2b Relative employment size: After and including 1995

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.001***		-0.001**	
	(0.009)		(0.013)	
Export		0.000		-0.001
		(0.893)		(0.322)
Share of ICT	0.140	-0.269	0.255	-0.128
	(0.736)	(0.626)	(0.503)	(0.792)
Constant	2.636***	2.671***	2.179***	2.257***
	(0.000)	(0.000)	(0.009)	(0.005)
*N*T*I*	260	260	260	260
Adjusted R^2	0.695	0.671	0.711	0.695

A1.2c Relative median earnings: After and including 1995

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.016**	
	(0.041)	
Export		0.008
		(0.679)
Share of ICT	1.436	-2.870
	(0.854)	(0.773)
Constant	98.803***	98.899***
	(0.000)	(0.000)
*N*T*I*	260	260
Adjusted R^2	0.714	0.700

Note: OLS with country*period and sector*period fixed effects, full sample, 1995-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.3

A1.3a Earnings inequality: Including the community sector

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002		-0.000	
	(0.336)		(0.992)	
Export		-0.007		-0.006
		(0.119)		(0.377)
Share of ICT	0.541	-0.084	-0.363	-0.550
	(0.770)	(0.969)	(0.901)	(0.853)
Country level data				
Union coverage	-0.125***	-0.125***	-0.243***	-0.240***
rate	(0.002)	(0.001)	(0.002)	(0.001)
Level of wage	-1.851***	-1.772***	-1.480	-1.416
coordination	(0.001)	(0.001)	(0.110)	(0.128)
EPL	0.774	0.784	3.109***	3.078***
	(0.447)	(0.422)	(0.006)	(0.004)
Unemployment	-0.380***	-0.366***	-0.208*	-0.198
rate	(0.000)	(0.001)	(0.086)	(0.105)
Real GDP per	-0.021*	-0.022**	-0.037	-0.037
capita/100	(0.056)	(0.045)	(0.131)	(0.133)
Constant	43.050***	43.102***	37.420***	37.372***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	363	363	363	363
Adjusted R^2	0.640	0.641	0.424	0.425

A1.3b Relative employment size: Including the community sector

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002**		-0.001**	
	(0.012)		(0.014)	
Export		-0.003		-0.001
		(0.112)		(0.600)
Share of ICT	1.450	0.919	1.316	0.961
	(0.131)	(0.185)	(0.155)	(0.247)
Constant	5.664***	5.765***	4.157***	4.198***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	363	363	366	366
Adjusted R^2	0.873	0.872	0.870	0.870

A1.3c Relative median earnings: Including the community sector

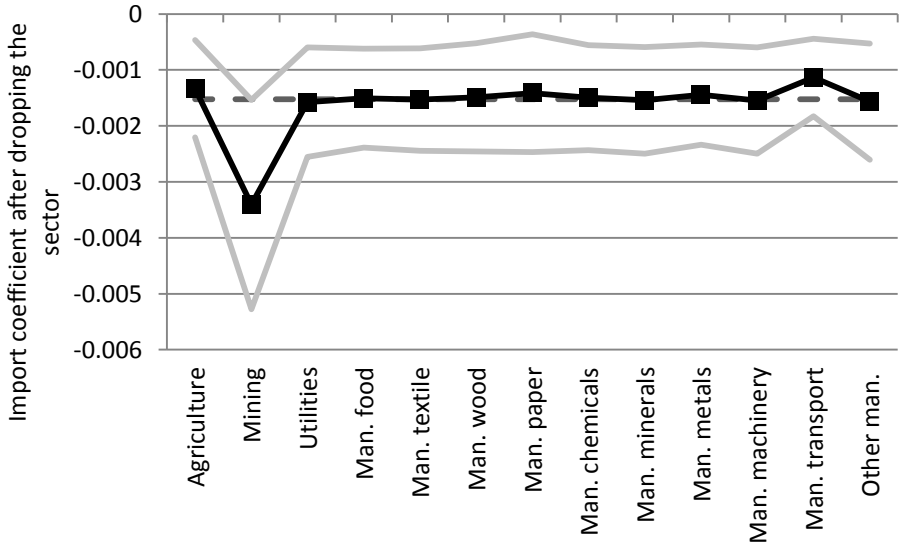
	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.016**	
	(0.050)	
Export		0.011
		(0.595)
Share of ICT	3.889	0.891
	(0.679)	(0.926)
Constant	102.591***	102.130***
	(0.000)	(0.000)
*N*T*I*	363	363
Adjusted R^2	0.657	0.647

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

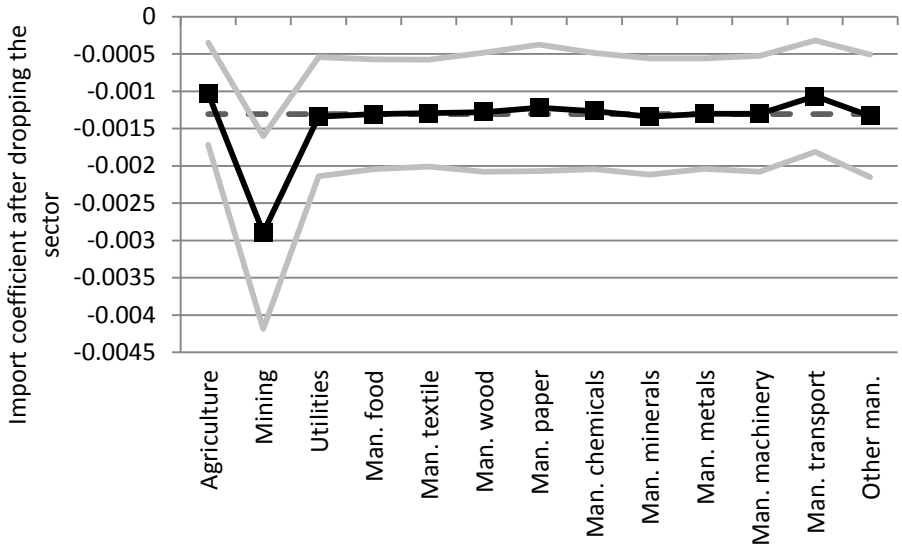
Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Figure A1.1 Excluding sectors for import and the relative employment size

A1.1a Import and relative employment size LIS data (Table 10 column 1)



A1.1b Import and relative employment size OECD data (Table 10 column 3)

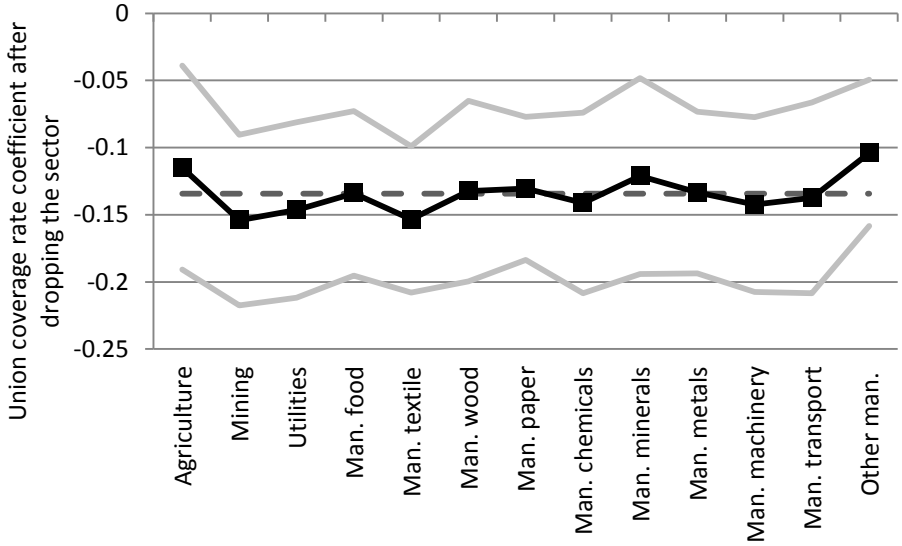


Note: Regression: See Table 10. Dashed line: coefficient of import (% sectoral value added) in when all sectors are included. Black marked line: coefficient of import when the below-mentioned sector is excluded. Grey lines: 95 per cent confidence intervals

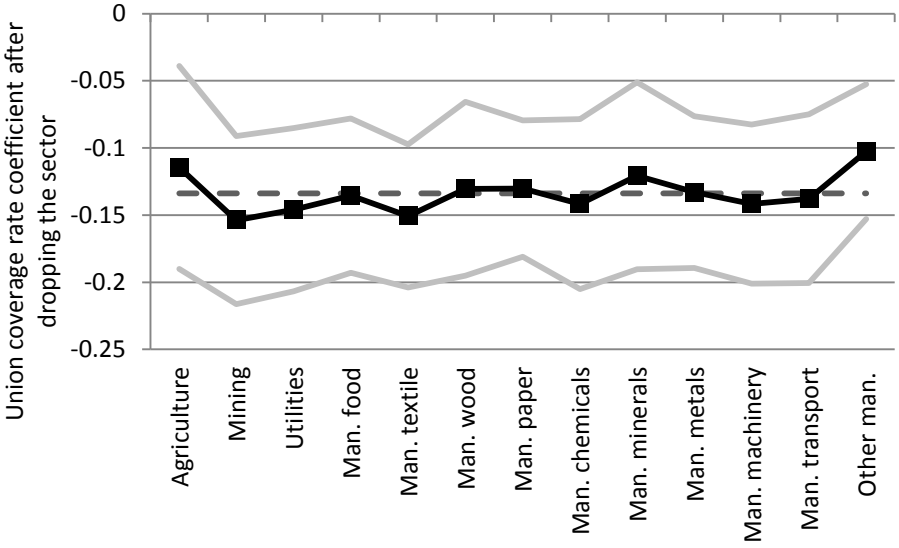
Source: See Table 10, relative employment size from the Leiden LIS Sectoral Income Inequality Dataset and OECD STAN, import from OECD STAN

Figure A1.2 Earnings inequality: Excluding sectors for the union coverage rate

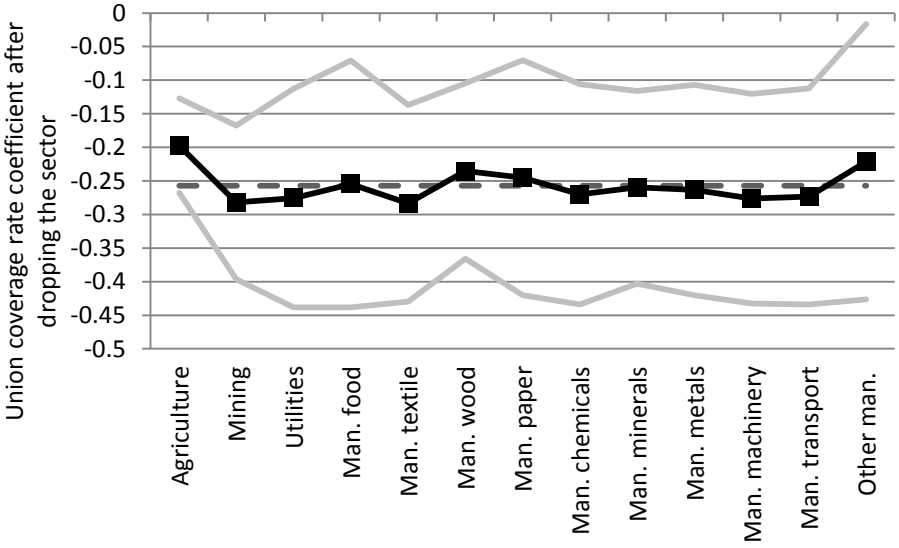
A1.2a First order corrected Gini index and import (Table 9 column 1)



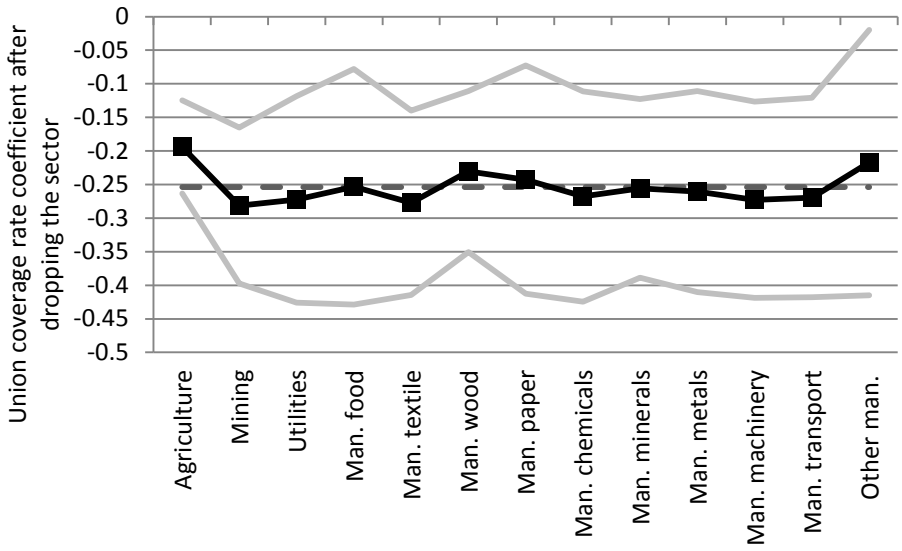
A1.2b First order corrected Gini index and export (Table 9 column 2)



A1.2c Mean log deviation and import (Table 9 column 3)



A1.2d Mean log deviation and export (Table 9 column 4)



Note: Regression: See Table 9. Dashed line: coefficient of the union coverage rate when all sectors are included. Black marked line: coefficient of the union coverage rate when the below-mentioned sector is excluded. Grey lines: 95 per cent confidence intervals

Source: See Table 9. Mean log deviation from the Leiden LIS Sectoral Income Inequality Dataset, union coverage rate from Visser (2011), import, and export from OECD STAN

Table A1.4 Without sector * time trend interactions

A1.4a Earnings inequality: Without sector * time trend interactions

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.003**		-0.004***	
	(0.016)		(0.007)	
Export		-0.004		-0.013
		(0.549)		(0.270)
Share of ICT	-1.662	-2.337	-5.441	-5.067
	(0.627)	(0.519)	(0.396)	(0.404)
Country level data				
Union coverage	-0.130***	-0.133***	-0.250***	-0.250***
rate	(0.001)	(0.001)	(0.003)	(0.002)
Level of wage	-1.929***	-1.860***	-1.523*	-1.329
coordination	(0.000)	(0.001)	(0.063)	(0.117)
EPL	0.927	0.975	3.552***	3.531***
	(0.296)	(0.279)	(0.006)	(0.005)
Unemployment	-0.416***	-0.404***	-0.259**	-0.227*
rate	(0.000)	(0.000)	(0.032)	(0.064)
Real GDP per	-0.026**	-0.026**	-0.045	-0.046
capita/100	(0.033)	(0.028)	(0.124)	(0.122)
Constant	44.070***	44.114***	38.875***	38.705***
	(0.000)	(0.000)	(0.001)	(0.001)
*N*T*I*	334	334	334	334
Adjusted R^2	0.385	0.379	0.121	0.126

A1.4b Relative employment size: Without sector * time trend interactions

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002***		-0.002***	
	(0.005)		(0.000)	
Export		0.005**		0.002*
		(0.022)		(0.088)
Share of ICT	1.758	0.595	0.919	0.029
	(0.158)	(0.546)	(0.211)	(0.966)
Constant	2.636***	2.498***	2.189***	2.122***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	334	334	339	339
Adjusted R^2	0.082	0.115	0.114	0.082

A1.4c Relative median earnings: Without sector * time trend interactions

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.003	
	(0.640)	
Export		-0.006
		(0.788)
Share of ICT	11.131	10.789
	(0.545)	(0.532)
Constant	101.814***	102.037***
	(0.000)	(0.000)
*N*T*I*	334	334
Adjusted R^2	0.002	0.002

Note: OLS with country*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.5 Without country * time trend interactions

A1.5a Earnings inequality: Without country * time trend interactions

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002		-0.001	
	(0.308)		(0.492)	
Export		-0.012**		-0.012*
		(0.010)		(0.050)
Share of ICT	1.839	0.919	2.402	1.676
	(0.236)	(0.630)	(0.344)	(0.548)
Country level data				
Union coverage	-0.166***	-0.155***	-0.137***	-0.123***
rate	(0.000)	(0.000)	(0.000)	(0.000)
Level of wage	-0.433***	-0.367***	-0.954**	-0.865**
coordination	(0.005)	(0.004)	(0.024)	(0.044)
EPL	1.373*	1.192*	2.098***	1.877***
	(0.065)	(0.088)	(0.002)	(0.004)
Unemployment	-0.015	-0.051	0.156*	0.117
rate	(0.869)	(0.544)	(0.073)	(0.139)
Real GDP per	0.014**	0.010**	0.034***	0.030**
capita/100	(0.015)	(0.034)	(0.008)	(0.016)
Constant	31.632***	32.444***	15.460***	16.283***
	(0.000)	(0.000)	(0.001)	(0.001)
*N*T*I*	334	334	334	334
Adjusted R^2	0.616	0.623	0.406	0.410

A1.5b Relative employment size: Without country * time trend interactions

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.001**		-0.001	
	(0.037)		(0.148)	
Export		0.002		0.002
		(0.201)		(0.283)
Share of ICT	0.071	-0.063	-0.256	-0.320
	(0.896)	(0.903)	(0.729)	(0.609)
Constant	2.620***	2.563***	2.183***	2.113***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	334	334	339	339
Adjusted R^2	0.575	0.568	0.579	0.580

A1.5c Relative median earnings: Without country * time trend interactions

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.019**	
	(0.037)	
Export		-0.012
		(0.532)
Share of ICT	12.238	8.325
	(0.297)	(0.474)
Constant	102.788***	103.080***
	(0.000)	(0.000)
*N*T*I*	334	334
Adjusted R^2	0.647	0.631

Note: OLS with sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.6 Without country * time trend and sector * time trend interactions

A1.6a Earnings inequality: Without country * time trend and sector * time trend interactions

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.003**		-0.004***	
	(0.018)		(0.002)	
Export		-0.005		-0.014
		(0.399)		(0.177)
Share of ICT	-1.099	-1.576	-3.885	-3.645
	(0.725)	(0.615)	(0.487)	(0.500)
Country level data				
Union coverage	-0.161***	-0.160***	-0.125***	-0.115***
rate	(0.000)	(0.000)	(0.001)	(0.000)
Level of wage	-0.467**	-0.472***	-1.054***	-0.955**
coordination	(0.028)	(0.004)	(0.008)	(0.028)
EPL	1.569**	1.563**	2.044***	1.919***
	(0.022)	(0.030)	(0.008)	(0.005)
Unemployment	-0.013	-0.025	0.138	0.102
rate	(0.899)	(0.808)	(0.100)	(0.241)
Real GDP per	0.021***	0.020***	0.034***	0.032***
capita/100	(0.003)	(0.004)	(0.002)	(0.004)
Constant	31.250***	31.652***	15.010***	16.068***
	(0.000)	(0.000)	(0.001)	(0.001)
*N*T*I*	334	334	334	334
Adjusted R^2	0.377	0.374	0.128	0.135

A1.6b Relative employment size: Without country * time trend and sector * time trend interactions

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.001***		-0.001**	
	(0.008)		(0.015)	
Export		0.004**		0.003
		(0.034)		(0.114)
Share of ICT	1.103	0.199	0.258	-0.484
	(0.301)	(0.822)	(0.724)	(0.500)
Constant	2.012***	1.532***	1.903***	1.548***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	334	334	339	339
Adjusted R^2	0.027	0.050	0.027	0.023

A1.6c Relative median earnings: Without country * time trend and sector * time trend interactions

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.005	
	(0.507)	
Export		-0.015
		(0.396)
Share of ICT	18.288	18.313
	(0.314)	(0.271)
Constant	104.380***	105.146***
	(0.000)	(0.000)
*N*T*I*	334	334
Adjusted R^2	0.004	0.006

Note: OLS, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.7 Earnings inequality: Including all labour market institution interactions

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	0.006		0.019	
	(0.651)		(0.213)	
Export		0.001		0.016
		(0.946)		(0.548)
Share of ICT	1.442	-3.835	-0.121	-5.220
Interactions	(0.856)	(0.424)	(0.993)	(0.608)
EPL*import	-0.007*		-0.009	
	(0.057)		(0.170)	
UCR*import	0.000		0.000	
	(0.266)		(0.712)	
Coordination	-0.002		-0.002	
*import	(0.358)		(0.332)	
EPL*export		0.002		0.005
		(0.653)		(0.625)
UCR*export		-0.000*		-0.001*
		(0.090)		(0.052)
Coordination		0.004		0.006
* export		(0.179)		(0.210)
EPL*ICT	17.011	13.036	24.254	18.789
	(0.126)	(0.182)	(0.176)	(0.198)
UCR*ICT	-0.324	-0.141	-0.364	-0.177
	(0.136)	(0.347)	(0.269)	(0.377)
Coordination	-2.242	-3.031	-5.405	-5.074
* ICT	(0.470)	(0.357)	(0.238)	(0.261)
Country level data				
Union coverage	-0.111***	-0.094***	-0.233**	-0.197**
rate	(0.000)	(0.000)	(0.010)	(0.019)
Level of wage	-1.586***	-2.161***	-0.918	-1.876
coordination	(0.007)	(0.001)	(0.436)	(0.106)
EPL	-0.337	-0.338	1.692	1.561
	(0.413)	(0.466)	(0.406)	(0.442)
Unemployment	-0.395***	-0.439***	-0.253*	-0.320**
rate	(0.000)	(0.001)	(0.070)	(0.034)
Real GDP per	-0.020*	-0.028*	-0.039	-0.050
capita/100	(0.053)	(0.064)	(0.182)	(0.127)
Constant	42.527***	45.003***	37.554***	40.600***
	(0.000)	(0.000)	(0.001)	(0.001)
*N*T*I*	334	334	334	334
Adjusted R^2	0.630	0.633	0.404	0.409

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index and MLD from the Leiden LIS Sectoral Income Inequality Dataset, import and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.8 Only household heads r.t. all individuals

A1.8a Earnings inequality: Only household heads r.t. all individuals

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.005***		-0.003*	
	(0.005)		(0.052)	
Export		-0.008		-0.008
		(0.177)		(0.315)
Share of ICT	3.870	2.570	3.676	2.762
	(0.223)	(0.425)	(0.192)	(0.347)
Country level data				
Union coverage	-0.170***	-0.174***	-0.243*	-0.244*
rate	(0.002)	(0.002)	(0.060)	(0.059)
Level of wage	-1.650**	-1.544**	-0.809	-0.705
coordination	(0.011)	(0.023)	(0.527)	(0.595)
EPL	1.729**	1.814**	4.232*	4.270*
	(0.046)	(0.037)	(0.069)	(0.068)
Unemployment	-0.409***	-0.389***	-0.166	-0.148
rate	(0.001)	(0.002)	(0.429)	(0.498)
Real GDP per	-0.033*	-0.034*	-0.052	-0.053
capita/100	(0.081)	(0.075)	(0.247)	(0.244)
Constant	42.712***	42.888***	32.297**	32.366**
	(0.000)	(0.000)	(0.035)	(0.035)
*N*T*I*	334	334	334	334
Adjusted R^2	0.541	0.535	0.356	0.356

A1.8b Relative employment size: Only household heads r.t. all individuals

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.000***		-0.001***	
	(0.004)		(0.005)	
Export		0.000		-0.001
		(0.205)		(0.673)
Share of ICT	0.010	0.006	0.434	0.125
	(0.134)	(0.300)	(0.207)	(0.730)
Constant	0.032***	0.031***	2.215***	2.224***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	334	334	339	339
Adjusted R^2	0.609	0.594	0.672	0.655

A1.8c Relative median earnings: Only household heads r.t. all individuals

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.000	
	(0.133)	
Export		0.000
		(0.822)
Share of ICT	0.035	0.006
	(0.729)	(0.953)
Constant	0.944***	0.941***
	(0.000)	(0.000)
*N*T*I*	334	334
Adjusted R^2	0.489	0.480

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Table A1.9 Household r.t. individual earnings

A1.9a Earnings inequality: Household r.t. individual earnings

	First order corrected Gini index		Mean log deviation	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.003*		-0.003	
	(0.067)		(0.143)	
Export		-0.003		-0.002
		(0.628)		(0.764)
Share of ICT	5.341***	4.633**	5.534**	4.829**
	(0.006)	(0.014)	(0.037)	(0.043)
Country level data				
Union coverage	-0.114***	-0.117***	-0.085**	-0.089**
rate	(0.000)	(0.000)	(0.021)	(0.020)
Level of wage	-1.820***	-1.782***	-2.382***	-2.354***
coordination	(0.002)	(0.001)	(0.006)	(0.005)
EPL	2.016**	2.077**	1.788	1.856
	(0.047)	(0.047)	(0.131)	(0.130)
Unemployment	0.031	0.038	0.099	0.105
rate	(0.679)	(0.559)	(0.566)	(0.524)
Real GDP per	-0.030***	-0.031***	-0.030	-0.031
capita/100	(0.002)	(0.002)	(0.164)	(0.157)
Constant	38.808***	38.941***	26.237***	26.387***
	(0.000)	(0.000)	(0.004)	(0.004)
*N*T*I*	334	334	334	334
Adjusted R^2	0.615	0.610	0.574	0.570

A1.9b Relative employment size: Household r.t. individual earnings

	LIS data		OECD data	
Sectoral data	(1)	(2)	(3)	(4)
Import	-0.002***		-0.001***	
	(0.005)		(0.005)	
Export		0.001		-0.001
		(0.646)		(0.673)
Share of ICT	0.791	0.422	0.434	0.125
	(0.158)	(0.429)	(0.207)	(0.730)
Constant	3.250***	3.214***	2.215***	2.224***
	(0.000)	(0.000)	(0.000)	(0.000)
*N*T*I*	334	334	339	339
Adjusted R^2	0.551	0.535	0.672	0.655

A1.9c Relative median earnings: Household r.t. individual earnings

	Relative median earnings	
Sectoral data	(1)	(2)
Import	-0.000	
	(0.127)	
Export		0.000
		(0.975)
Share of ICT	-0.080	-0.106
	(0.487)	(0.389)
Constant	0.985***	0.984***
	(0.000)	(0.000)
*N*T*I*	334	334
Adjusted R^2	0.556	0.545

Note: OLS with country*period and sector*period fixed effects, full sample, 1985-2005, clustered standard errors. Significance levels are noted by *** (1 per cent), ** (5 per cent), or * (10 per cent)

Source: First order corrected Gini index, MLD, relative employment size and relative median earnings from the Leiden LIS Sectoral Income Inequality Dataset, relative employment size, import, and export from OECD STAN, share of ICT in total capital compensation from EU-KLEMS, union coverage and level of wage coordination from Visser (2011), all other data from OECD

Appendix 2. Documentation Leiden LIS sectoral income inequality dataset

LEIDEN LIS SECTORAL INCOME INEQUALITY DATASET

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Version 1, June 2013

A2.1 Introduction

The Leiden LIS Sectoral Income Inequality Dataset contains information on multiple indicators of earnings inequality and employment within 9 sectors and 12 subsectors for 12 developed countries and 49 LIS waves between 1969 and 2005. We provide additional information of earnings and employment at the country level. This dataset draws upon data from the Luxembourg Income Study (LIS) micro dataset, which is a time series of household survey data containing information on earnings and employment, standardised across countries. The Leiden LIS Sectoral Income Inequality Dataset allows researchers and public policy analysts to compare sectoral earnings inequality and employment levels across developed countries over the last three decades, based on a standardised classification of sectors across countries and periods. The data can be linked to other sectoral databases, for instance to the OECD Structural Analysis (STAN) database. The database extends the work of Mahler, Jesuit, and Roscoe (1999) who calculate sectoral earnings inequality in 10 countries around the years 1985 and 1990. The full list of variable definitions can be found in Appendix 3.

A2.2 Calculating sectoral earnings inequality and employment

Labour earnings and sample definition

We calculate annual earnings both at the household and individual level. We follow the earnings and sample definitions of Mahler *et al*. (1999), that is, we only include income from wages and salaries or self-employment. Income from other sources, such as interest and rent,

is excluded. Also excluded are public benefits and income taxes. For all calculations we apply standard LIS top- and bottom coding conventions, with 1 per cent of (for household inequality: equivalised) mean earnings as our bottom, and ten times the median (for household inequality: non-equivalised) earnings as our top boundary.

We restrict our sample to 'prime age workers', people aged between 25 and 54 with nonzero earnings following Mahler *et al*. (1999). This is the part of the population that is for its income most dependent on earnings from labour. In addition, this group probably has the strongest labour market attachment as their earnings are less affected by retirement and schooling decisions (Atkinson *et al*., 1995; Mahler *et al*., 1999). Based on this sample, we calculate the earnings inequality using household earnings (following Mahler *et al*., 1999) and using individual earnings for multiple sample definitions.

For the calculations based on household earnings, we correct for differences in household size using the square root equivalence scale. We apply household weights as standard in LIS.[35] We follow Mahler *et al*. (1999) by defining households as working in a particular sector if the household head is working in this sector.[36]

Yet, a problem with using household earnings is that the members of a household might work in different sectors, so that earnings are attributed to sectors in which they were not necessarily made. Therefore, we also calculate inequality based on individual earnings. We use the personal weights[37] and we distinguish between three groups of individuals where we again only include people aged between 25 and 54 with nonzero earnings:

1. Household heads;
2. Household heads and spouses;
3. All individuals.

Here, we attribute the individual earnings to the sector in which the specific individual is working.[38]

We also show the absolute and relative number of households and individuals classified in a sector, both weighted and unweighted, and their weighted absolute and median earnings. The LIS weightings are used to transpose the sample indicators to the population level. In this case, the population is the total number of households or individuals with the age and earnings restriction.

[35] HWEIGHT in LIS.
[36] D16 in LIS.
[37] PPOPWGT in LIS.
[38] IND1_C in LIS.

Contrary to Mahler *et al*. (1999), we do not include sectoral information for disposable income and the amount of redistribution, as taxes and transfers are set at the national level so that these regulations do not differ between sectors.

Sectoral classification and country sample

We standardise the classification of sectors based on the International Standard of Industrial Classification (ISIC) rev. 3.0 at the two digit level. The manufacturing and transport and telecommunication sector are further broken down using the ISIC 3.0 three digit level, as can be seen in Table A2.1.

Table A2.1 Sectoral definitions based on the ISIC 3.0 codes

No.	Sector	ISIC rev. 3.0 code
1	Agriculture, hunting, forestry and fishing	C01T05
2	Mining and quarrying	C10T14
3	Manufacturing	C15T37
31	Food products, beverages and tobacco	C15T16
32	Textiles, textile products, leather and footwear	C17T19
33	Wood and products of wood and cork	C20
34	Pulp, paper, paper products, printing and publishing	C21T22
35	Chemical, rubber, plastics and fuel products	C23T25
36	Other non-metallic mineral products	C26
37	Basic metals and fabricated metal products	C27T28
38	Machinery and equipment	C29T33
39	Transport equipment	C34T35
30	Manufacturing n.e.c. and recycling	C36T37
4	Electricity, gas and water supply	C40T41
5	Construction	C45
6	Wholesale and retail trade – restaurants and hotels	C50T55
7	Transport and telecommunications	C60T64
71	Transport and storage	C60T63
72	Post and telecommunications	C64
8	Finance, insurance, real estate and business services	C65T74
9	Community, social and personal services	C75T99

In the LIS database multiple sectoral definitions are used across countries and waves, such as ISIC 2.0, or NAICS for the US. To consistently classify industries, we recompute all classification schemes to the ISIC 3.0 definitions. In general this did not require much interpretation, although sometimes some sectors needed to be excluded (mainly when no distinction was made between C34T35 Manufacturing of transport equipment and C36T37 Manufacturing n.e.c. and recycling). Seven classification dummies are included. The classification scheme is included as a separate worksheet in the dataset.

As displayed in Table A2.2, for twelve developed countries data at the sectoral level are available. Contrary to Mahler *et al*. (1999), we include Austria, Belgium, Czech Republic, Ireland, Poland, and Spain. Yet, we leave out Australia, Canada, Italy, and the Netherlands for which the data does not have enough detail to calculate inequality for a sufficient number of sectors – only when certain sectors are combined data are available.

The three waves in italics in Table A2.2, the 2000 waves for Belgium, Ireland, and Spain, are based on net earnings. The calculations for Germany in 1984 and 1989 are based on West-Germany. For Ireland, three consecutive waves with only few observations, 1994-1996, have been combined (with YEAR=1994-1996) where earnings information has been recalculated to 1995 levels using information on inflation from the World Bank. Due to the higher number of surveyed people, we recommend to use this combined observation for 1994-1996 instead of the observations for the separate years. The inclusion of Spain, and to a lesser extent Belgium, requires caution as the number of surveyed people is low, leading to possibly inaccurate inequality estimations.

Table A2.2 Country and wave sample

Country	Available waves
Austria	2004
Belgium	1995, *2000*
Czech Republic	1996, 2004
Denmark	1987, 1992, 1995, 2000, 2004
Finland	1987, 1991, 1995, 2000, 2004
Germany	1984, 1989, 1994, 2000, 2004
Ireland	1994, 1995, 1996, 1994-1996, *2000*, 2004
Poland	1986, 1992, 1995, 1999, 2004
Spain	1995, *2000*
Sweden	1981, 1987, 1992, 2000, 2005
UK	1969, 1979, 1986, 1999, 2004
US	1979, 1986, 1991, 1994, 1997, 2000, 2004

For a number of variables information is missing for Austria, Belgium, Poland, Spain, the waves with net earnings, the individual waves 1994-1996 for Ireland, Sweden 1981, UK 1969 and 1979, and the US 1979 and 1997. Thus, for these variables a total of 31 waves and 639 observations are available.

One possible application of this dataset is to use the data in panel data analysis. The waves can be included in an unbalanced panel dataset of five year periods, for instance from around 1985 to around 2005. This leads to the exclusion of the UK 1969 and 1979, Sweden 1981, and the US 1979 and 1997, and the three individual years 1994, 1995, and 1996 for Ireland.

A2.3 Codebook and descriptives

Now we show definitions and descriptives of our main variables. In the summary statistics we exclude the individual waves 1994, 1995, and 1996 for Ireland, but we do use the combination 1994-1996. Thus, in the descriptives a maximum of 47 waves are included.

Country-level data based on household information

The dataset contains a number of indicators at the country level based on household information. The first two columns in Table A2.3 show the sum of unweighted (SUM) and weighted (SUMW) number of individuals within included households in the calculations at the sectoral level in the respective wave. Next, GINIC shows the level of equivalised earnings inequality as measured by the Gini indicator, pooled for all households part of our sectoral sample. P50C gives us the weighted median household earnings. Its summary statistics are not shown here as the indicator is expressed in national currency and current prices, making it not internationally comparable.

Table A2.3 Country-level indicators based on household information

Variable name	SUM	SUMW	GINIC
Mean	10,574	30,751,966	0.320
Standard dev.	11,136	53,294,823	0.049
Minimum	497	4,606	0.249
Maximum	39,944	176,450,466	0.455
No. waves	47	31	47

Thus, the average country-wave observation Gini is 0.320 based on household information.

Country-level data based on individual information

The following country-level indicators are included in the database constructed on the basis of individual information. Table A2.4 shows the sum of the unweighted number of individuals using the three groups of individuals (SUMALL for all individuals, SUMHS for household heads and spouses, and SUMH for household heads only). Table A2.5 shows the same information but then for the weighted frequencies.

Table A2.4 Unweighted individual frequencies at the country level

Variable name	SUMALL	SUMHS	SUMH
Mean	18,013	16,495	10,353
Standard dev.	24,201	20,649	13,842
Minimum	743	511	363
Maximum	124,760	109,999	72,308
No. waves	44	44	44

Table A2.5 Weighted individual frequencies at the country level

Variable name	SUMWALL	SUMWHS	SUMWH
Mean	20,338,100	18,132,199	11,958,302
Standard dev.	28,467,058	24,668,276	16,126,149
Minimum	1,140,132	943,437	569,594
Maximum	89,010,701	76,499,922	49,259,582
No. waves	31	31	31

Next, Table A2.6 summarises the level of inequality for the sample based on all individuals, using a number of indicators. We report the Gini (GINIALLC), the mean log deviation (GE0ALLC), the Theil index (GE1ALLC), and the Atkinson index with inequality aversion parameter $\varepsilon = 0.5$ (AT05ALLC). The dataset also contains information on the median individual earnings for the three sample definitions (P50ALLC, P50HSC, and P50HC), for which summary statistics are not shown here as they are expressed in national currency and current prices.

Table A2.6 Individual earnings inequality at the country level

Variable name	GINIALLC	GE0ALLC	GE1ALLC	AT05ALLC
Mean	0.322	0.234	0.193	0.098
Standard dev.	0.050	0.063	0.059	0.027
Minimum	0.257	0.152	0.125	0.066
Maximum	0.416	0.346	0.328	0.152
No. waves	31	31	31	31

Sectoral data based on household information

Now we move to sectoral data based on household information. In Table A2.7 we show descriptives for the unweighted and weighted number of households per sector (FREQ and WFREQ respectively). Next, RELFREQ shows the weighted relative employment size of a sector, defined as the number of households classified in a sector divided by the total number of households (WFREQ/SUMW * 100%). The relative employment size maps sectoral employment shifts relative to the total labour market per country, sector, and over time. As an example, the average sector contains 665 households.

Table A2.7 Frequencies and relative employment size based on household information

Variable name	FREQ	WFREQ	RELFREQ
Mean	665	1,924,483	6.413
Standard dev.	1,354	5,608,224	7.562
Minimum	2	22	0.139
Maximum	13,115	50,300,000	40.373
No. observ.	960	639	639

Next, Table A2.8 summarises descriptives for sectoral earnings inequality for multiple indicators based on equivalised household information. We report the Gini (GINI), the P90/P10 ratio (P90P10), the mean log deviation (GE0), the Theil index (GE1), and the Atkinson index with inequality aversion parameter $\varepsilon = 0.5$ (AT05). The Gini coefficient is to a certain extent sensitive to the sample size for which the Gini is calculated. For the Gini bootstrapped standard errors with 250 repeats are calculated (BSSE250) to provide a confidence interval of the level of inequality.

Deltas (2003) shows this for different cumulative distributions, using Monte Carlo simulations. When the sample size becomes lower, the Gini starts to underestimate the 'true' inequality level. Deltas calculates that by multiplying the Gini by N / (N – 1), which he calls the first order correction, the underestimation bias is significantly reduced. As for some industries, in particular mining and wood manufacturing, the number of people interviewed is often low, we include his first order procedure by calculating GINIFOC as the GINI * FREQ / (FREQ – 1). We use the unweighted frequencies here as the bias arises from the number of people interviewed (the sample).

Last, we show the relative median wage (BETWEEN), a measure of inequality between rather than within industries, calculated as the sectoral median wage divided by its counterpart at the national level (P50/P50C). Again, summary statistics for the P50 are not shown here as the indicator is expressed in national currency and current prices, so that it is not internationally comparable.

Table A2.8 Earnings inequality based on household information

Variable name	GINI	GINIFOC	BSSE250	P90P10	GE0	GE1	AT05	BETWEEN
Mean	0.289	0.294	0.022	4.918	0.175	0.153	0.076	1.087
Standard dev.	0.062	0.069	0.019	12.813	0.099	0.099	0.036	0.192
Minimum	0.095	0.119	0.002	1.813	0.027	0.027	0.013	0.091
Maximum	0.608	1.216	0.304	360.243	1.514	0.858	0.457	1.980
No. observ.	960	960	960	960	960	960	960	960

Sectoral data based on individual information

The first three columns of Table A2.9 summarise the unweighted number of persons classified in a sector for the three groups of individuals. Columns 4-6 provide the same information for the weighted number of persons.

Table A2.9 Frequencies based on individual information

Variable name	FREQALL	FREQHS	FREQH	WFREQALL	WFREQHS	WFREQH
Mean	1,078	988	637	1,245,758	1,113,643	755,462
Standard dev.	3,031	2,738	1,669	3,321,328	2,917,900	1,832,553
Minimum	4	2	1	1201	1,201	974
Maximum	42,064	37,096	24,418	28,600,000	25,300,000	15,100,000
No. observ.	900	900	900	639	639	639

Table A2.10 describes the weighted relative employment size of a sector, defined as the number of individuals classified in a sector divided by the total number of individuals for the three groups of individuals.

Table A2.10 Relative employment size based on individual information

Variable name	RELFREQALL	RELFREQHS	RELFREQH
Mean	0.062	0.062	0.064
Standard dev.	0.084	0.085	0.078
Minimum	0.001	0.001	0.001
Maximum	0.438	0.440	0.386
No. observ.	639	639	639

Next, we show in Table A2.11 the Gini for the three groups of individuals, both the 'normal' one and the first-order corrected version, which decreases bias due to small sample size.

Table A2.11 Gini based on individual information

Variable name	GINIALL	GINIHS	GINIH	GINIALLFOC	GINIHSFOC	GINIHFOC
Mean	0.281	0.280	0.263	0.282	0.284	0.268
Standard dev.	0.075	0.076	0.075	0.076	0.078	0.078
Minimum	0.078	0.078	0.078	0.083	0.083	0.082
Maximum	0.597	0.601	0.594	0.654	0.845	0.750
No. observ.	900	900	899	900	900	899

Table A2.12 provides information on the mean log deviation (MLD) or GE(0) and the weighted relative median wage for the three groups of individuals. These are again calculated by dividing the sectoral median wage by its counterpart at the country level. Again, summary statistics for the sectoral median wage themselves are not shown here because they are

expressed in national currency and current prices and therefore not internationally comparable.

Table A2.12 MLD and relative median wage based on individual earnings

Variable name	GE0ALL	GE0HS	GE0H	BETWEENALL	BETWEENHS	BETWEENH
Mean	0.185	0.184	0.165	1.050	1.048	1.017
Standard dev.	0.112	0.115	0.114	0.194	0.195	0.185
Minimum	0.010	0.010	0.010	0.159	0.151	0.145
Maximum	1.099	1.143	1.130	1.925	1.844	2.767
No. observ.	638	638	638	639	639	639

A2.4 Comparison to Mahler *et al*. (1999)

Comparing to Mahler et al. (1999), we extend the dataset of sectoral earnings inequality in three ways as can be seen in Table A2.13. Firstly, we calculate earnings inequality for 12 countries and between 1969 and 2005, while Mahler et al. (1999) provide data for 10 countries and between 1984 and 1992. Secondly, we include more inequality measures. Mahler *et al*. only calculate the P90/P10 whilst we also include the Gini, the Atkinson index (ε =0.5), the mean log deviation (GE(0)), and the Theil index (GE(1)) for household earnings. Next to calculations based on household information, we calculate the GE(0) and Gini using individual information, which allows us to more carefully attribute earnings to sectors. In addition, we follow the first order correction to reduce the underestimation bias by low sample size.

Table A2.13 Comparison to Mahler *et al*. (1999)

	Mahler *et al*.	**Leiden LIS Sectoral Income Inequality Dataset**
Launched	1999	June 2013
Last update	1999	June 2013
No. of countries	10	12
Countries	Australia, Canada, Denmark, Finland, Germany, Italy, the Netherlands, Sweden, UK, and US	Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Ireland, Poland, Spain, Sweden, UK, and US
LIS waves	II and III	I, II, III, IV, V, and VI and 0 for UK
Time series	1984-1992	1969-2005
Total no. of included LIS waves	18	49
ISIC scheme	ISIC 2.0	ISIC 3.0
Income unit	Equivalised household earnings	- Equivalised household earnings - Individual income using three individual definitions
Earnings definition	- income from wages and salaries or self-employment - disposable income - redistribution	- income from wages and salaries or self-employment
Within sector earnings inequality indicators	For household earnings: - P90/P10 For individual earnings: None	For household earnings: - Gini - Gini with first order correction (Deltas, 2003) - Atkinson index (ε =0.5) - P90/P10 - Mean log deviation (GE(0)) - Theil index (GE(1)) For individual earnings: - Gini - Gini with first order correction (Deltas, 2003) - Mean log deviation (GE(0))
Between sector inequality	- Sectoral median earnings / country median earnings	- Sectoral median earnings / country median earnings - Sectoral employment size / country employment size

Appendix 3. Full variable list of the Leiden LIS Sectoral Income Inequality Dataset version 1

Variable name	Definition
Identifiers	
COU	Country abbreviation
CNTRY	Country code
YEAR	LIS survey year
PERIOD	Period number {1, …6} (for panel data analysis, with six periods of each around five years between 1980-2005)
INDUS	Sectoral code based on ISIC rev. 3.0
CLASSIFICATION	Full sectoral name based on ISIC rev. 3.0
Industry classification scheme	
ISIC 3	Dummy for ISIC 3.0 (ISIC 3=1 if the LIS micro data (variable D16) of that wave is classified based on ISIC 3.0)
ISIC 2	Dummy for ISIC 2.0 (ISIC 2=1 if the LIS micro data (variable D16) of that wave is classified based on ISIC 2.0)
SIC	Dummy for SIC (SIC=1 if the LIS micro data (variable D16) of that wave is classified based on SIC)
OLD NAICS	Dummy for old NAICS classification (OLD NAICS=1 if the LIS micro data (variable D16) of that wave is classified based on an older version of NAICS classification)
NEW NAICS	Dummy for new NAICS classification (NEW NAICS=1 if the LIS micro data (variable D16) of that wave is classified based on the new version of NAICS classification)
Other	Dummy for other classification schemes (OTHER=1 if the LIS micro data (variable D16) of that wave is classified based on none of the aforementioned classification schemes
NET EARN	Dummy indicating waves for which net earnings are used
WGD	Dummy for West Germany (WGD=1 for Germany 1989, 1994)
Country level data based on household information	
SUM	Total number of individuals within households with household head aged 25-54 with nonzero household earnings classified in a sector
SUMW	Total weighted number of individuals within households with household head aged 25-54 with nonzero household earnings classified in a sector
GINIC	Gini for households with household head aged 25-54 with nonzero household earnings classified in a sector
P50C	Weighted median household earnings with household head aged 25-54 with nonzero household earnings classified in a sector in national currency, current prices
Country level data based on individual information	
SUMALL	Total number of all individuals aged 25-54 with nonzero earnings classified in a sector
SUMHS	Total number of household heads and spouses aged 25-54 with nonzero earnings classified in a sector
SUMH	Total number of household heads aged 25-54 with nonzero earnings classified in a sector
SUMWALL	Total weighted number of individuals aged 25-54 with nonzero earnings classified in a sector
SUMWHS	Total weighted number of household heads and spouses aged 25-54 with nonzero earnings classified in a sector
SUMWH	Total weighted number of household heads aged 25-54 with nonzero earnings classified in a sector
GINIALLC	Gini for all individuals aged 25-54 with nonzero earnings classified in a sector
GE0ALLC	Mean log deviation for all individuals aged 25-54 with nonzero earnings classified in a sector
GE1ALLC	Theil index for all individuals aged 25-54 with nonzero earnings classified in a sector
AT05ALLC	Atkinson's index (0.5) for all individuals aged 25-54 with nonzero earnings classified in a sector
P50ALLC	Weighted median earnings for all individuals aged 25-54 with nonzero earnings classified in a sector in national currency, current prices
P50HSC	Weighted median earnings for household heads and spouses aged 25-54 with nonzero earnings classified in a sector in national currency, current prices
P50HC	Weighted median earnings for household heads aged 25-54 with nonzero earnings classified in a

	sector in national currency, current prices
Sectoral data based on household information	
FREQ	Number of households with household head aged 25-54 with nonzero earnings
WFREQ	Weighted number of households with household head aged 25-54 with nonzero earnings
RELFREQ	Weighted relative sectoral employment size: WFREQ / SUMW * 100%
GINI	Sectoral Gini (without first order correction) of households with household head 25-54 with nonzero household earnings
GINIFOC	Sectoral Gini first order corrected based on Deltas (2003): FREQ / (FREQ – 1) * GINI, of households with household head 25-54 with nonzero household earnings
BSSE250	Bootstrapped standard errors of the sectoral Gini (without first order correction) with 250 repeats
P90P10	Sectoral P90/P10 ratio of households with household head 25-54 with nonzero household earnings
GE0	Sectoral mean log deviation of households with household head 25-54 with nonzero household earnings
GE1	Sectoral Theil index of households with household head 25-54 with nonzero household earnings
AT05	Sectoral Atkinson index with parameter $\varepsilon = 0.5$ of households with household head 25-54 with nonzero household earnings
P50	Weighted sectoral median earnings with household head aged 25-54 with nonzero household earnings, national currency, current prices
BETWEEN	Weighted relative sectoral median wage or inequality between sectors: P50 / P50C
Sectoral data based on individual information	
FREQALL	Number of all individuals aged 25-54 with nonzero earnings
FREQHS	Number of household heads and spouses aged 25-54 with nonzero earnings
FREQH	Number of household heads aged 25-54 with nonzero earnings
WFREQALL	Weighted number of all individuals aged 25-54 with nonzero earnings
WFREQHS	Weighted number of household heads and spouses aged 25-54 with nonzero earnings
WFREQH	Weighted number of household heads aged 25-54 with nonzero earnings
RELFREQALL	Weighted relative sectoral employment size, all individuals: WFREQALL / SUMWALL * 100%
RELFREQHS	Weighted relative sectoral employment size, household heads and spouses: WFREQHS / SUMWHS * 100%
RELFREQH	Weighted relative sectoral employment size, household heads: WFREQH / SUMWH * 100%
GINIALL	Sectoral Gini (without first order correction) forall individuals aged 25-54 with nonzero earnings
GINIHS	Sectoral Gini (without first order correction) for household heads and spouses aged 25-54 with nonzero earnings
GINIH	Sectoral Gini (without first order correction) for household heads aged 25-54 with nonzero earnings
GINIALLFOC	Sectoral Gini first order corrected based on Deltas (2003): FREQALL / (FREQALL – 1) * GINIALL, all individuals aged 25-54 with nonzero earnings
GINIHSFOC	Sectoral Gini first order corrected based on Deltas (2003): FREQHS / (FREQHS – 1) * GINIHS, household heads and spouses aged 25-54 with nonzero earnings
GINIHFOC	Sectoral Gini first order corrected based on Deltas (2003): FREQH / (FREQH – 1) * GINIH, household heads aged 25-54 with nonzero earnings
GE0ALL	Sectoral mean log deviation for all individuals aged 25-54 with nonzero earnings
GE0HS	Sectoral mean log deviation for household heads and spouses aged 25-54 with nonzero earnings
GE0H	Sectoral mean log deviation for household heads aged 25-54 with nonzero earnings
P50ALL	Weighted median individual earnings for all individuals aged 25-54 with nonzero earnings, national currency, current prices
P50HS	Weighted median individual earnings for household heads and spouses aged 25-54 with nonzero earnings, national currency, current prices
P50H	Weighted median individual earnings for household heads aged 25-54 with nonzero earnings, national currency, current prices
BETWEENALL	Weighted relative sectoral median wage or inequality between sectors, all individuals: P50ALL / P50ALLC
BETWEENHS	Weighted relative sectoral median wage or inequality between sectors, household heads and spouses: P50HS / P50HSC
BETWEENH	Weighted relative sectoral median wage or inequality between sectors, household heads: P50H / P50HC