Productivity dispersion and sectoral labour shares in Europe

Martina Lawless*[a,b] and Luke Rehill[c]

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Abstract:

The stability of the labour share of income is a fundamental feature of macroeconomic models, with broad implications for the shape of the production function, inequality, and macroeconomic dynamics. However, empirically, this share has been slowly declining in many countries for several decades, though its causes are subject of much debate. This paper analyses the drivers of labour share developments in Europe at a sectoral level. We begin with a simple shift-share analysis which demonstrates that the decline across countries has been primarily driven by changes within industries. We then use aggregated microdata from CompNet to analyse drivers of sector-level labour shares and to decompose their effects into shifts in the sector average or reallocation of resources between firms. Our main findings are that the advance of globalisation and the widening productivity gap between "the best and the rest" have negative implications for the labour share. We also find that most of the changes are due to reallocation within sectors providing support for the "superstar firms" hypothesis. The finding that globalisation has had a negative impact on the labour share is of relevance for policy in the context of the current backlash against globalisation and reinforces the need to ensure benefits of globalisation and productivity are passed on to workers.

1. Introduction

The labour share represents the proportion of national income that is received by workers as compensation, in the form of wages, salaries and the social contributions paid by employers. The stability of this has been a fundamental feature of macroeconomic models for many decades, holding broad implications for the shape of the production function, inequality, and macroeconomic dynamics.

Changes in the labour share over time matter because wages are the main form of income for the majority of households, and therefore capture how well the benefits from the economy's performance are being translated into commensurate improvements in household income. A labour share decline concurrent with economic growth implies that gains made from productivity or globalisation are not being passed on to workers. For policy, a declining trend raises concerns as a fall in the labour share can have a distributional impact. A decrease in the labour share implies a corresponding rise in the capital share of income and since most capital tends to be concentrated amongst a small share of individuals at the top of the income scale, this can contribute to growing inequality. Income and wealth inequality has worsened in advanced countries in recent decades (Wolff, 2010) in line with the declining labour share trend. For these reasons, a declining labour share can also have political consequences if it erodes support for market-oriented economic policies and globalisation.

Until the 1980s, the labour share being relatively fixed over time was accepted as a 'stylized fact' in economic literature (Kaldor, 1961). This was true to the point where most macroeconomic growth models of the time, the most famous being the Solow model (1956), assumed it to hold a constant value. However, since then evidence of a decline in the labour share was found to have occurred from the 1970s until the 2000s (Karabarbounis and Neiman, 2014; Dao et al., 2017). This has provoked extensive research efforts to provide possible explanations and adequate policy response, with trends such as technological advances and greater global value chain participation being the most prominent arguments linked the compression of labour shares (Schwellnus et al., 2018).

The decline has been broad based across regions and economies.[1] Although the pace of this decline has slowed in most countries since 1995, it has still manifested itself in a decoupling between productivity growth and compensation of workers (Schwellnus et al. 2018). In addition to this secular decline, the labour share also possesses a cyclical pattern, occurring due to investment in capital tending to be more volatile in a recession, in contrast to wages which are relatively sticky. This led to the temporary jump in the labour share in the late 2000s, coinciding with the Great Recession, which interrupted the longer-term pattern.

Most of the initial literature tended to focus on the macro- or sectoral determinants of this labour share, with the two leading explanations for the downward trend being the rapid advice of technology and the globalisation of trade. Technological advancement can affect labour shares through a

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[1] It occurred in seven of the eight largest economies of the world, in emerging markets such as China, India and Mexico that have opened up to international trade, and even in Scandinavian countries where levels of labour unionisation has traditionally been strong (Karabarbounis and Neiman, 2014).

reduction in the relative price of investment goods, giving firms incentives to replace labour with capital. Meanwhile, the rise in global integration through trade and participation in global value chains can affect firm structure and organisation by facilitating the offshoring of domestic production activities for the most labour-intensive tasks (Elsby et al., 2013).

More recently, the literature has moved towards looking at what is driving the changes in the labour share at firm-level. In addition to the macro-drivers already mentioned, Autor et al. (2017) pointed to the rise in "superstar firms" as a factor. If changes in the economic environment advantage only the most productive firms in an industry product market concentration will rise and the labour share will fall as the share of resources held by the most productive firms ('superstars') in each sector, those with above-average mark ups and below-average labour shares, grows. In addition, the growth of this concentration was found to be disproportionately apparent in industries experiencing faster technical change.

Mertens (2019) further contributed to the understanding of the mechanisms behind the fall of the labour share by analysing three of these competing explanations. The first two explanations related to increases in market distortions, through either firm's product market power or labour market power, as have been suggested in recent literature (De Loecker and Eeckhout, 2018). This was tested against the alternative explanation that the labour share decline is due to the elasticity of output with respect to labour falling. Applying this to the German manufacturing sector it was found that the majority of the fall in the labour share is due to a concordant fall in the elasticity of labour. The labour share fall is also shown to be equally driven by within and between firm dynamics, in contrast to Autor (2017) who found it is mainly a between-firm phenomena in the US.

Other explanations for the downward trend in the labour share are also possible, such as changes in institutional settings over time. The erosion of labour collective organizations (union density, bargaining coverage) and labour market regulation (employment protection, minimum wage provisions) has been highlighted in a number of papers (e.g. Bental and Demougin (2010), Blanchard and Giavazzi (2003), Stiglitz (2012)). Collectively, the decline of these is suggested to have weakened the bargaining power of workers and thus affected their outcomes in terms of rent-sharing.

In this paper we begin by examining whether the downward trend in the labour share for each country is driven by within-industry declines (declines within individual industries, such as manufacturing) or by changes in the industrial composition (shifts from high-labour-share sectors to low-labour-share sectors). We do this by performing a shift-share analysis using sectoral data for 15 European countries, comparing the actual change in the labour share in each country to a hypothetical scenario where the value of each sector to the economy is held fixed over the period. We find that most of the change in the labour share has been largely due to within-sector changes in the labour share for most countries.

To bridge the gap from macro to micro changes in the labour share, we then analyse the drivers of these labour share developments within sectors across Europe. We use the 6th vintage of the CompNet database, which contains sectoral level data from 15 European countries aggregated up

from firm-level microdata from various administrative and public sources. This data contains a rich detail on variables ranging from financial to trade and competition. As it is based on firm-level data, the dataset contains the not only the average and median value of each variable, but also the different distribution points allowing for further investigation of the dynamic within sectors.[2]

Our key findings are that increases in industry concentration, a widening productivity gap between the frontier and laggard firms and the increase in global value chain participation are all found to have played a significant role in the movement of the aggregate labour share over time. We further examine the mechanisms of these changes by decomposing the sectoral labour share into within-firm and between-firm components, which can provide insight into how each factor is enabling firms characterised by low-labour shares, potentially "superstar firms", to grow their resources. Here, we find consistent evidence that it is reallocation within sectors that is the main margin by which the labour share is changing.

The rest of the paper is structured as follows; the next section describes the data used and sources and section 3 presents a shift share analysis of overall sectoral labour shares. Section 4 provides an overview of the methodology used in the analysis of the intra-sector drivers of labour shares and the results of the regression analysis are then presented in section 5. Section 6 looks at how these results vary by sector and country, before section 7 concludes.

2. Data

To begin, we use the EU KLEMS database, an industry level panel dataset covering OECD countries from 1995-2015. The KLEMS data derives from an international research collaboration that provides harmonized industry-level information on output, inputs and productivity taken from national statistical agencies and is made comparable across countries using a harmonised framework. To obtain the labour share for each country and sector we use the compensation of employees data and divide by the level of value added (in current prices), while we also analyse the compensation of employees data adjusted for self-employed as a robustness check. We focus on the 15 countries of the EU-15 and 33 2-digit industries within each of these.

To look at the labour share at a micro-level, we make use of the 6th vintage of the CompNet database. CompNet data is sourced from Central Banks and National Institutes and consolidated into a common industry hierarchy (NACE rev. 2). We use the 6th vintage of CompNet, which covers 15 European countries from 1999-2016. This dataset is built up from firm-level data, aggregated up to 2-digit sector level. By being based on firm-level it enables the inclusion of not only the average and median value of each variable, but also the different distribution points and standard deviations calculated using a

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[2] By using micro-aggregated data focusing on firms and their employees, this removes the confounding effects of self-employment on labour share estimates (Adrjan, 2018).

harmonised methodology, allowing for further investigation of the dynamic within sectors.[3] A full description of the data construction and cross-country stylised facts are contained in CompNet (2018a, 2018b and 2018c).

The data contains the mean wage share for each sector-year combination, while we are able to calculate the overall wage share using a combination of this mean and the sum of weights. The difference between the overall wage share and the mean gives us a covariance term capturing the strength of the relationship between the firm size (measured by its share of value-added in the sector) and its wage share. We use all three of this variables are dependent variables in our regression analysis.

For our explanatory variables, we use the sectoral-level Hermann-Herfischal Index (HHI) included in the CompNet database as a proxy for changes in the level of competition. The standard deviation of productivity (both labour productivity and the Solow measure) is taken as our measure of productivity dispersion. As an alternative measure of this, we also measure this as the absolute gap between the 90th percentile and 10th percentile of productivity. Finally, CompNet calculates firm and time specific mark-ups based on different gross output production function specifications by using the framework of De Loecker and Warzynski (2012). We test both the measure based on a Cobb-Douglas production function and another assuming a translog production function.

We complement this dataset by also including Irish firm-level data for the period 2006-2014. This is sourced from the Census of Industrial Production (CIP) and Annual Services Inquiry (ASI) and includes all the key input variables required such as wages, employment, investment, gross output and value added. To give an idea of the coverage of the sample provided, around 5 per cent of the entire population of firms as reported in the population are represented by the combined CIP and ASI sample each year, with these firms accounting for around 40 per cent of employment.

Industry-level relative investment price indices are constructed from the OECD STAN database. Price deflators for gross fixed capital formation are divided by value added price deflators in the corresponding industry. The same reference year (2005) is used for all indices. Since firms in the same industry face similar changes in relative investment prices, the industry-level response of labour shares should at least partly be driven by within-firm developments rather than reallocation effects.

GVC participation is constructed using the OECD Trade in Value-Added (TiVA) database. In line with previous studies, industry-level participation in global value chains is constructed as the sum of backward and forward linkages in vertical specialisation of production. Backward linkages measure the offshoring of intermediate inputs used in exports and are defined as foreign value added

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[3] The reader must be aware that data collection rules and procedures across countries are different, and out of CompNet's control. Hence, despite all efforts made to improve sample comparability across countries (including the use of population weights), some country samples might still suffer from biases. For a more detailed account of raw data characteristics and sample biases, please refer to the Cross-Country Comparability Report (CompNet, 2018b).

embodied in exports. Forward linkages measure trading partners' offshoring of intermediate inputs and are defined as domestic value added used as intermediate inputs in trading partners' exports. For the sample of high-income countries included in this paper, increases in backward and forward linkages are likely to have similar effects on labour shares: offshoring raises specialisation on the most capital-intensive stages of production while trading partners' offshoring raises demand for capital-intensive intermediate goods, with both therefore expected to have a negative correlation with the labour share.

We remove observations which display mean wage shares above 1 or below zero. Sectors coke, real estate or non-market are excluded from the analysis as labour shares in these industries are driven by changes in commodity and asset prices or by imputation choices. Finally, we drop Romania and the years 2015 and 2016 due to a low number of observations. The coverage across countries and time and summary statistics on the variables used are detailed in Tables 1 and 2.

Table 1: Coverage across Countries and Time

	Observations	Years
Belgium	447	2004-2014
Croatia	179	2002-2014
Czech R.	263	2003-2014
Denmark	513	2000-2014
Finland	503	1999-2014
France	337	2004-2014
Hungary	254	1999-2014
Ireland	365	2006-2014
Italy	426	2001-2014
Lithuania	255	2000-2014
Netherlands	531	2000-2014
Portugal	251	2006-2014
Slovenia	163	2005-2014
Spain	135	2009-2014
Sweden	151	2003-2014
Total	4,773	

Table 2: Dependent and explanatory variables

|	Observations	Mean	Standard Deviation	Min	Max
Total labour share	4473	0.65	0.227	-5.01	1.00
Mean/Within-industry labour share	4773	0.59	0.198	0.01	1.00
Between-industry labour share	4773	0.06	0.261	-5.75	0.87
Concentration (HHI)	4773	0.05	0.101	0.00	0.98
Lab productivity Sd.Dev.	4773	0.06	0.178	0.00	9.37
Solow residual gap	4738	0.04	0.032	0.00	0.81
Labour productivity gap	4400	0.32	0.489	0.02	9.08
TFP (no markup) gap	3061	0.12	0.291	0.00	6.47
TFP (revenue) gap	3067	0.74	2.21	0.00	36.52
TFP (value added) gap	4330	0.07	0.790	0.00	1.57
Investment prices	4076	1.04	0.208	0.39	3.90
Global value chain part.	3459	0.95	0.608	0.14	4.86
Mark-up: Cobb-Douglas	3405	29.9	729.5	0.03	31391
Mark-up: Translog	3299	22.0	196.3	0.29	6237

3. Shift-Share Analysis

We begin by looking at one very simple explanation for a long-run decline in the labour share which is that it is driven by broad structural changes in the composition of the economy, in particular by reallocation across sectors. Gollin (2002) put forward this argument that a possible explanation for the decline in the labour share is that it is the result of the changing sectoral composition of economic activity. Differences in shares across sectors are expected given that some activities are innately labour-intensive while others, such as manufacturing, are typically more capital intensive. In addition, competitive pressures also differ across sectors so equilibrium mark-ups can vary, which will also impact the long-run labour share. For these reasons, changes in the structure of the economy, whereby low labour share sectors begin to account for greater proportions of aggregate value-added than higher labour share sectors, could explain the decline in total labour share. Lawless and Whelan (2011) tested this theory using data up to 2007 and found that these sectoral composition effects fail to explain the aggregate decline in the labour share. This section updates this analysis and examines

how much, if any, of the change in European labour shares over twenty years is driven by broad reallocation across sectors.

The shift-share analysis is performed on a sample of 15 European countries across 33 two-digit industries (Nace rev. 2) from the EU KLEMS database, decomposing the trend changes in labour shares into their within-industry and between-industry components. This means we can gauge the extent to which structural transformation in economies has impacted on the labour share and allows us to determine which we should focus on within-industry changes or the reallocation mechanisms in the subsequent analysis. Classical trade theory, for example, predicts a shift toward capital-intensive industries in capital-abundant advanced economies (resulting in lower labour shares) and a shift toward labour-intensive industries in labour-abundant emerging market economies (resulting in rising labour shares). A snapshot of the heterogeneity of labour shares across sectors in 2000 and 2015 for the EU-15 is shown in Figure 1 below.

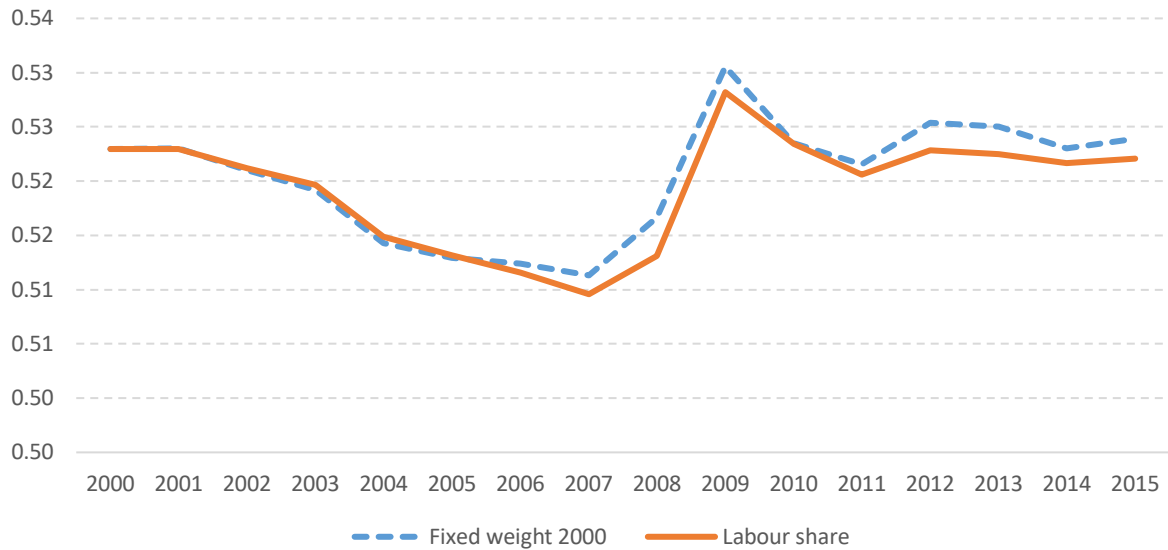## Figure 1: Labour share differences across sectors in EU-15, 2000 vs. 2015
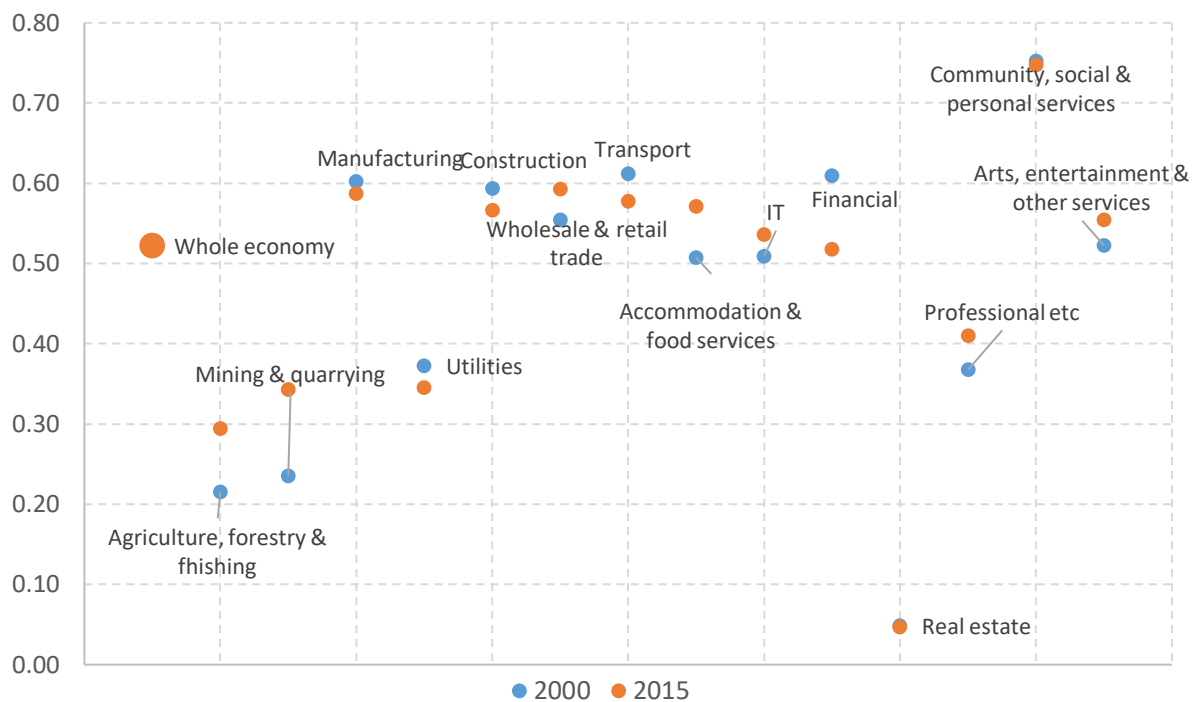
Source: Authors calculations using EU KLEMS

The shift-share analysis is carried out by creating a hypothetical scenario where industry value-added shares are held fixed from the first year of the sample, and therefore any changes observed in this hypothetical labour share over the period are due to changes within-industries. An example of the difference between the hypothetical scenario (blue) and the actual labour share (red) over time for the EU-15 is displayed in Figure 2 below. Periods when the blue line lies above the red implies that sectors which hold relatively high labour shares are larger in size compared to the beginning of the period. The results of this exercise across the different countries are then shown in Figure 3 below

which plots the total labour share change on the vertical axis against the within component on the horizontal axis.
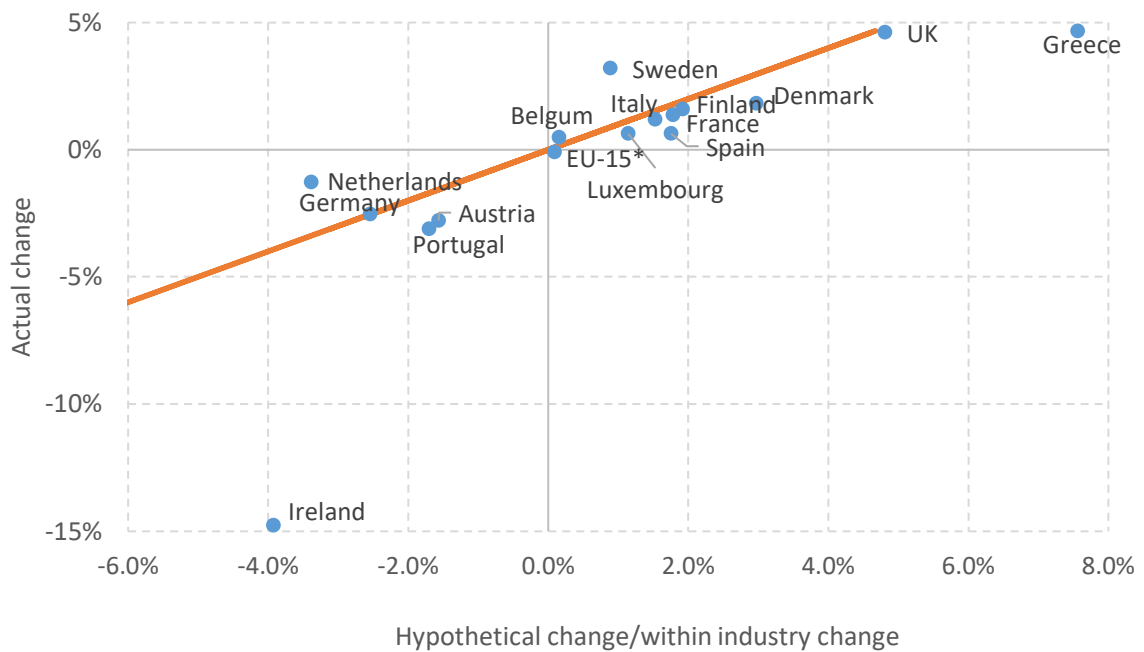
Figure 2: Labour share for EU-15, actual vs. hypothetical scenario

Fixed weight 2000 — — — Labour share

Figure 3: Labour share trends by country, within vs. actual (1995-2015)

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The shift-share analysis suggests that the reallocation of factors across sectors has generally not been a significant driver of labour share trends. Most countries are clustered around the 45-degree line, signifying that the total changes in the labour share are the same as the hypothetical changes, which indicates that changes in labour shares emerge overwhelmingly from trend changes in within-industry labour shares rather than from the reallocation of factors across industries. An important exception is Ireland, with the large GDP distortions in 2015 driving down the actual labour share change.[4]

These findings do not provide much support for the predictions of traditional trade theory and suggest that it would be useful instead to study the drivers of within-industry changes to understand overall trends in labour shares. Therefore, the next part of our empirical analysis turns to exploring aggregated micro-data at country-sector level to analyse potential drivers.

4. Methodology

To think about the potential pathways through which firm and market characteristics can impact the labour share, we begin with the canonical papers on productivity and market power by Hall (1988, 1990) as applied to their analysis of labour share evolution by Autor et al (2017) and Mertens (2019). In this framework, standard firm cost-minimization can be combined with definitions of productivity to generate the following identity:

$$LS = \frac{wL}{Y} = \frac{\alpha}{\mu^{PMP} * \mu^{LMP}} + overhead\ cost$$

By definition, the labour share is the proportion of overall value-added, *Y,* accruing to labour (the product of labour input and wages, *wL*). This can be shown to depend on a range of parameters of the production function and changes in any or all of these could be drivers of the observed decline in the labour share, potentially with different strengths in different countries or sectors. The first important parameter is α which measures the importance or substitution of labour compared to other input factors (capital and intermediates). This could change over time due to technological developments or changes in the relative prices of the inputs. Labour market power, μ^{LMP}, could also impact the degree of rent sharing in sector and countries which may have reduced over time due to a decrease of union density for instance. Product market power, μ^{PMP}, on the other hand would be associated with a lower labour demand if firms are able to make greater profits but not share them with workers. The "superstar firms" hypothesis discussed above could operate either through reducing the importance of labour α if driven by technologial developments and/or by increasing product market power of the dominant firms. While our data may not allow us to precisely disentangle these elements, it is useful to have this framework to link the different factors we examaine with the channels through which they would feed through to changes in the labour share.

In addition to these factors that could impact the share of labour compensation in the value-added of any individual firm, reallocation across firms within a sector towards those with lower labour shares

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[4] See Appendix 1 for more detail on the Irish labour share and 2015 distortions.

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(for any of the reasons discussed above) could also drive changes in labour shares at more aggregated sector levels. Autor et al. (2017) found this reallocation margin to be the main factor explaining changes in the labour share for US sectors and Mertens (2019) also found it to be an important, albeit with a smaller share, factor in his work on German manufacturing. Although our cross-country data is at the sector level rather than at the firm level, the high degree of distributional detail in the CompNet distributed microdata approach allows us to decompose the overall labour share into comparable within firm and between firm margins. As the overall labour share LS_{jt} for sector j at time t comes from an aggregation of all of the firms i in the original microdata, its components can be rearranged to come from the average labour share and weights across firms:

$$LS_{jt} \equiv \frac{\sum w_{it} L_{it}}{\sum VA_{it}} = \sum \left(\frac{VA_{it}}{\sum VA_{it}} * \frac{w_{it} L_{it}}{VA_{it}} \right)$$

This can be further rearranged into the following expression:

$$LS_{jt} = \overline{LS}_{jt} + cov_{jt}(\frac{VA_{it}}{\sum VA_{it}}, \overline{LS}_{jt})$$

Where the first component, the average labour share in the sector $\overline{LS}_{jt}$ represents the within firm element and the second component, $cov_{jt}(\frac{VA_{it}}{\sum VA_{it}}, \overline{LS}_{jt})$, captures the between firm margin. As the CompNet data provides the information necessary to calculate the overall labour share as well a direct measure of the mean labour share within a sector we can use all three elements as dependent variables in our regression analysis.

For the empirical specification, we use the following:

$$LS_{jt} = \beta_0 + \beta_1 HHI_{jt} + \beta_2 Prod_{jt} + \beta_2 X_{jt} + + \mu_c + \gamma_j + \tau_t + \varepsilon_{jt}$$

Where LS_{jt} is the sector level labour share and can be replaced with either of its two components (the within and between measures). As this is estimated by OLS, the coefficients on the explanatory variables in the within and between estimations will sum to the coefficient on the overall labour share. Motivated by the superstar firm hypothesis, our choice of explanatory variables focuses on measures of concentration and productivity dispersion. To mesure concentration we use HHI_{jt} the Herfindahl-Hirschman index in industry j at time t which is computed as follows based on s_{ijt}^2 the market share of each firm i at time t in industry j.

$$HHI_{jt} = \sum_{i}^{N} s_{ijt}^2$$

We use a range of measures for productivity dispersion, as described in the data section. We also explore a range of other factors X_{jt} that may affect the competitive environment of a sector such as participation in global value chains, mark-ups and relative investment prices. We control in all specifications for country, sector and year fixed effects.

5. Analysis of sector labour shares and productivity

In this section, we examine the relationships between the labour share of income at a sectoral level with a range of sector-level characteristics with a focus on measures of within-sector productivity dispersion. Each specification begins with the total labour share in the sector and then decomposes the effects into the within and between components. The coefficients on these latter two components sum to the overall effect giving a direct measure of their relative importance as contributors to variation in the total labour share. As noted above, this decomposition is useful in understanding the extent to which variation in labour shares are associated with developments across all firms (the within component) in a sector relative to how much is coming from reallocation across firms (the between component).

Table 3: Labour Shares, Concentration and Productivity

	Total	Within	Between
Concentration (HHI)	-0.282***	-0.024	-0.258***
	(0.062)	(0.048)	(0.070)
Lab productivity Sd.Dev.	-0.091**	-0.045*	-0.046**
	(0.043)	(0.027)	(0.021)
Constant	0.438***	0.651***	-0.212***
	(0.024)	(0.026)	(0.034)
Observations	4,773	4,773	4,773
R-squared	0.461	0.317	0.285
Year effects	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes
Country effects	Yes	Yes	Yes

Robust standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3 gives our initial estimates of drivers of the labour share, controlling for country, sector and time fixed effects. We begin with a simple indicator of productivity dispersion, using the standard deviation of labour productivity measured at the individual sector level. In the first column, we find that the overall labour share is significantly lower in sectors with higher sales concentration (measured by the HHI) and in sectors with greater dispersion of productivity. These initial results point towards support of the "superstar firm" explanation of Autor et al (2017) for the decline in US labour shares

over time also applying across European countries. Further support for this explanation is found when we look at the balance of the two components. For concentration, the primary contributor to the overall variation in the labour share comes from reallocation across firms within sectors with the size of the between coefficient several times larger (and also more statistically significant) than those on the within component. For productivity dispersion, the effect is split more evenly between reducing the average labour share (within-firm component) and reallocation amongst firms to those with lower labour shares

These baseline results could however be sensitive to the use of labour productivity as the explanatory factor so we next look at a range of different measures of productivity computed at the firm level under the CompNet project.

Table 4: Alternative Productivity Measures				
	Total	Within	Between	Observations
Solow residual gap	-0.721***	-0.008	-0.713**	4,738
	(0.203)	(0.181)	(0.347)	
Labour productivity gap	-0.121***	-0.173***	0.051	4,772
	(0.030)	(0.056)	(0.059)	
TFP (no markup) gap	0.018*	-0.050***	0.068***	3,061
	(0.010)	(0.015)	(0.020)	
TFP (revenue) gap	0.002	-0.003	0.004**	3,067
	(0.001)	(0.002)	(0.002)	
TFP (value added) gap	-0.462***	-0.196***	-0.267***	4,330
	(0.069)	(0.041)	(0.070)	

Reports separate regressions for each productivity measure. Controlling for country, sector and year fixed effects. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4 summarises the results of five alternative measures of productivity within sectors: the Solow residual, labour productivity and three variants on the measurement of total factor productivity based on excluding mark-ups, a revenue approach and a value-added approach. In each case the measure of

dispersion is taken as the gap between the 90th and the 10th percentile.[5] As in the baseline specification, each of the regressions reported controls for country, sector and year fixed effects. Although the coefficients for each productivity measure vary somewhat, the overall picture of a negative relationship between productivity dispersion and the labour share of income holds across most of the measures. Furthermore, the between component remains the key driver for most of the measures apart from when TFP is measured using approaches other than value added (which we would suggest is the more appropriate to use in this context).

That the estimate of TFP excluding mark-ups gave a different result from our other measures of productivity dispersion leads us on to looking more directly at links between the overall labour share and mark-ups within sectors. Two different approaches to the measurement of mark-ups at the firm level are used (Mark-up: Cobb-Douglas and Mark-up: Translog) as described in Section 2. In both cases, Table 5 shows there is a statistically significant negative relationship found at the level of the overall labour share, the magnitude of which is driven almost entirely by the between component and with the within component actually showing a positive relationship in the first specification.

Table Mark-Up: Labour Shares and Mark-up Dispersion

	Total	Within	Between
Mark-up: Cobb-Douglas	-16.606***	14.264***	-30.870***
	(4.673)	(2.733)	(3.884)
Observations	3,405	3,405	3,405
R-squared	0.540	0.346	0.344
	Total	Within	Between
Mark-up: Translog	-41.085*	-0.279	-40.806
	(22.890)	(12.469)	(29.574)
Observations	3,299	3,299	3,299
R-squared	0.522	0.364	0.340
Year effects	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes
Country effects	Yes	Yes	Yes

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

This pattern may be linked to profitable sectors being able to pay higher wages on average but that at the upper levels of the profitability (or productivity) distribution the sharing of returns with workers becomes weaker. The decomposition of the second measure does not show either margin being statistically significant despite the significant coefficient estimated on the overall relationship. The

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[5] Broadly similar results can be obtained by using the standard deviation as the measure of dispersion.

reasons for the difference across the two measures of mark-ups is unclear, and potentially related to how they capture the firms at the upper end of the distribution, but this is probably an area where more granular data would be necessary to fully disentangle the effects.

Two other factors hypothesised to have an impact on changing labour shares at a country level are looked at in Table 6 using our sector dataset. The first factor is that falling prices of capital goods relative to labour ("Inv. price") may have created an incentive to invest more in technologies that are less labour intensive. We find that there is a statistically significant relationship between this measure of the relative cost of capital and lower shares, again mainly driven by reallocation across firms. Similarly, we find that sectors with higher degrees of global value chain (GVC) integration tend to have lower labour shares. As we are using sector level data, we cannot directly identify to what extent this may be driven by multinational firms operating across countries but again this suggests a useful direction for future work to identify what type of firms the reallocation component is affecting most strongly.

Table 6: Relative Investment Prices and Globalisation

	Total	Within	Between	Total	Within	Between
Inv. price	-0.327***	-0.071***	-0.256***			
	(0.028)	(0.018)	(0.031)			
GVC				-0.032**	0.007	-0.039**
				(0.015)	(0.011)	(0.019)
Constant	0.749***	0.702***	0.047	0.620***	0.632***	-0.011
	(0.037)	(0.033)	(0.048)	(0.026)	(0.022)	(0.031)
Observations	4,076	4,076	4,076	3,459	3,459	3,459
R-squared	0.474	0.336	0.297	0.455	0.317	0.292
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

6. Variation across sectors and countries

While the shift-share analysis discussed earlier provided evidence that the pattern of decline identified in aggregate labour shares appear to be driven mainly by developments within sectors rather than reallocation across sectors, it is still possible that there may be variation in how the strength of the

factors identified in the previous section operate across groups of sectors or across countries. This section therefore splits the sample into a number of subgroups to see if we can find any systematic differences across the groups in how concentration and productivity dispersion are affecting the labour share of value added. We begin by using a very broad split of sectors into basic (mainly primary production), manufacturing and services. We then look in more depth at manufacturing and services by splitting them into technology and knowledge classes based on Eurostat indicators. Finally, we examine variation across the countries in the sample.

Table 7 initially splits the sectors into three broad groups and runs the baseline specification containing sector concentration and productivity dispersion on total labour share as well as on the within and between components. Sector concentration is statistically significantly associated with overall labour share for each of the broad groups with the coefficient size being remarkably similar for both manufacturing and services but somewhat lower for basic production sectors. Looking within the components sees a reasonably even split in the contributions of within and between components for basic sectors, with neither being statistically significant; athis may be related to the relatively small number of observations for this group. For both manufacturing and services, we find that the majority of the overall effect is accounted for by the between firm margin. In services, this accounts for almost all of the overall effect while in manufacturing about three-quarters of the total effect comes from the between measure.

When we look at productivity dispersion, the variation in the size of the effects across the sector groups is more substantial but the broad pattern identified in the baseline specification of a negative relationship coming mainly through the between firm reallocation margin mainly holds. Basic production sectors and manufacturing both have similar overall estimates of the negative relationship between the labour share and productivity dispersion. The components are quite different, however, with most of the relationship in basic sectors coming from changes in the within firm labour share, whereas in manufacturing the within firm margin accounts for only around one-third of the total coefficient with the reminder related to between firm reallocation. The magnitude of the relationship between labour share and productivity dispersion is quite a bit lower for services – potentially related to their greater labour intensity – but the split into within and between components of approximately one-third within to two-thirds between is strikingly similar to that in manufacturing.

Table 7: Variation across Broad Sector Groups

		Concentration (HHI)		Productivity dispersion		Obs
Basic	Total	-0.187**	(0.074)	-0.996***	(0.213)	454
Basic	Within	-0.142	(0.100)	-0.488	(0.368)	454
Basic	Between	-0.044	(0.095)	-0.508**	(0.247)	454
Manufacturing	Total	-0.588***	(0.076)	-0.110*	(0.058)	1,964
Manufacturing	Within	-0.286***	(0.054)	-0.046	(0.032)	1,964
Manufacturing	Between	-0.302***	(0.090)	-0.064**	(0.028)	1,964
Services	Total	-0.375***	(0.082)	-0.365**	(0.147)	2,355
Services	Within	-0.032	(0.050)	-0.127*	(0.069)	2,355
Services	Between	-0.342***	(0.088)	-0.238***	(0.089)	2,355

Reports separate regressions for each group. Controlling for country, 2-digit sector and year fixed effects. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

We next look more deeply into the broad manufacturing and services divisions by further splitting the two according to Eurostat classifications of technology level (Eurostat 2016). Manufacturing sectors are divided into four groups: high technology, medium-high, medium-low and low technology. Table 8 shows a strong negative association between concentration and labour shares in the high-technology group, coming predominantly from the reallocation margin. Productivity dispersion, on the other hand, is not found to have any statistically significant effect for this subgroup. For the two medium technology subgroups we find the opposite pattern from that of the highest technology group with the main statistically significant relationship found to be between productivity dispersion and labour shares. In both cases the effect comes primarily from the between margin so reallocation across firms plays a strong role. There is some effect operating through the within firm margin in the medium-high technology group but this is not observed in the medium-low group where only the between margin is significant. For the low technology sectors, we again see concentration as a significant driver along with productivity dispersion. These results suggest that the hypothesis of increased importance of superstar firms dominating production is not limited (or even strongest) in high technology sectors but is a more widespread phenomenon within sectors at almost all technology levels.

Table 8: Variation across Technology Class in Manufacturing

		Concentration (HHI)		Productivity dispersion		Obs.
High	Total	-0.742***	(0.248)	-0.022	(0.018)	181
High	Within	-0.330	(0.239)	-0.013	(0.019)	181
High	Between	-0.412*	(0.241)	-0.009	(0.013)	181
Med-high	Total	0.023	(0.103)	-1.025***	(0.244)	487
Med-high	Within	-0.177	(0.109)	-0.375***	(0.088)	487
Med-high	Between	0.200	(0.169)	-0.650***	(0.224)	487
Med-low	Total	-1.340	(0.948)	-2.256**	(0.939)	590
Med-low	Within	0.159	(0.201)	0.101	(0.339)	590
Med-low	Between	-1.499	(1.002)	-2.357**	(0.921)	590
Low	Total	-0.680***	(0.164)	-1.463***	(0.455)	684
Low	Within	-0.340***	(0.101)	-0.824***	(0.292)	684
Low	Between	-0.340**	(0.147)	-0.639	(0.408)	684

Reports separate regressions for each group. Controlling for country, 2-digit sector and year fixed effects. Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

We make a similar division of services sectors into knowledge intensive sectors and less knowledge intensive sectors as categorised by Eurostat (2016). As with manufacturing we find in Table 9 that overall lower labour shares are associated with greater productivity dispersion in both groups although the magnitude of the effect is considerably larger for the less knowledge intensive sectors. Likewise, in both groups, the majority of the productivity effect operates through the between margin. Concentration is associated with lower labour shares particularly in knowledge intensive sectors, although decomposing the balance of the components is not statistically significant. For both manufacturing and services, we therefore find that the strongest link between greater concentration and lower labour shares is in the higher technology sectors but that the effect of productivity dispersion is more broad based across almost all sector types.

Table 9: Variation across Knowledge Class in Services

		Concentration (HHI)		Productivity dispersion		Obs.
Knowledge intensive	Total	-0.409***	(0.131)	-0.188***	(0.073)	804
Knowledge intensive	Within	-0.116	(0.124)	-0.062	(0.053)	804
Knowledge intensive	Between	-0.294	(0.182)	-0.127***	(0.039)	804
Less knowledge intensive	Total	0.018	(0.104)	-2.151***	(0.161)	937
Less knowledge intensive	Within	-0.189*	(0.113)	-0.755***	(0.128)	937
Less knowledge intensive	Between	0.207	(0.177)	-1.396***	(0.151)	937

Reports separate regressions for each group. Controlling for country, 2-digit sector and year fixed effects. Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Our final split of the data is to look across countries in Table 10. Although not all individual country specifications show statistically significant results, the broad pattern of coefficients is in line with our pooled estimations. In seven of the fifteen countries, concentration is statistically significantly associated with lower labour shares and in eleven of the fifteen, productivity dispersion is significantly negatively related to the labour share. One striking exception to the pattern is a strong positive relationship between concentration and labour share in France – a possible explanation for this could be if worker bargaining power or unionisation levels are high in more concentrated sectors but we do not have enough data at a sector level to investigate if this is the case. It is a useful demonstration however that sector concentration does not necessarily have to reduce the worker share of value-added despite that being the more common pattern when all the data is pooled.

	Concentration (HHI)			Productivity dispersion		
	Total	Within	Between	Total	Within	Between
Belgium	-0.254**	-0.061	-0.193	-0.056***	0.023	-0.079***
Croatia	-0.151	-0.098	-0.053	-1.800***	-1.297*	-0.503
Czech R.	-7.659***	-2.213	-5.446*	-0.120**	-0.082	-0.037
Denmark	0.636*	-0.047	0.683*	-0.137	-0.124	-0.013
Finland	-0.667	-0.845	0.178	-1.144***	0.162	-1.306***
France	10.082***	-3.969	14.051***	-0.228	0.288	-0.517
Hungary	-2.504***	-0.184	-2.320***	-9.954***	-0.386	-9.568**
Ireland	-0.108	-0.263**	0.155	-0.008	0.025***	-0.033***
Italy	-7.140***	-1.889	-5.251**	-4.891***	-1.524	-3.367**
Lithuania	-0.947**	2.022***	-2.969***	-0.405	-3.333***	2.929
Netherlands	-1.729**	-1.124	-0.605	-1.389***	-0.149	-1.240**
Portugal	-0.153	0.615	-0.768	-6.534***	-0.021	-6.513***
Slovenia	-0.812	0.398	-1.210	-0.588**	-0.562	-0.026
Spain	-0.536**	0.788	-1.324*	-4.285***	-1.922**	-2.363
Sweden	-0.568	-1.075***	0.506	-2.787***	-1.442***	-1.345

Reports separate regressions for each country. Controlling for 2-digit sector and year fixed effects.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Conclusions

This paper uses aggregated microdata from across Europe to analyse the factors most associated with changes in the labour share of income and to decompose the extent to which these have operated through average firm-level changes within sectors or through a reallocation of resources between firms in a sector towards large firms characterised by lower labour shares.

The labour share of national income has been steadily declining in countries across the world for many years with the causes still under debate. This paper first demonstrates that this decline across countries has been driven by changes within industries by constructing a shift-share analysis with a counterfactual labour share based on unchanged sector composition. This approach shows that very

little of the overall decline is associated with structural change across sectors and we must therefore look within sectors to identify the key drivers.

While some work has been done on more disaggregated data (Autor et al, 2017; Mertens, 2019), these have been restricted to individual countries. The benefit of the use of the CompNet aggregated microdata data is that we can look at development across countries while also having distributional details that would rarely be present in standard sectoral data. This allows us to investigate how concentration and productivity dispersion in particular are affecting the labour share. Furthermore, this data allows us to decompose the effects into those operating on the average labour share within a sector and those reallocating resources between firms, a key factor to investigating the strength of the "superstar firms" hypothesis which has become the focal point of recent research in this area.

Across a wide range of countries and sectoral groups, we find consistent evidence that the decline in the labour share across Europe is significantly associated with greater concentration and dispersion of productivity within sectors. In addition, these effects mainly operate through the channel of reallocation between firms, thus providing support for the superstar firm hypothesis. Other factors that appear important are involvement in global value chains, investment prices and mark-ups.

It is clear that the labour share is not the fixed parameter assumed in many early macro-economic models. This matters from a policy perspective because wages are the main form of income for households so a fall in the labour share suggests gains made from productivity or globalisation are not being passed on to workers. Trends in the labour share can also have a distributional impact, potentially exacerbating inequality. For these reasons, a declining labour share can also have political consequences if it erodes support for market-oriented economic policies, or for globalisation more broadly. To effectively counterbalance this requires an understanding of the drivers of the decline in the labour share in the first instance. This paper provides the first cross-country evidence on how the labour share decline is associated with trends in productivity dispersion and increased firm concentration and globalisation, all of which all of which point to fruitful avenues of further research to disentangle the directions of causation and potential trade-offs with technological progress and innovation.

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Appendix 1: Irish Labour Share and GDP Measurement Issues

According to standard aggregates, the share of national income going to wages in Ireland has fallen consistently in recent decades and European Commission data show that the wage bill expressed as a fraction of GDP in Ireland is the lowest in the European Union.

However, the decline in the labour income share of value added is clearly overstated by the significant growth of the multinational sector since the 1980's and, more recently, by distortions arising in parts of the multinational sector which artificially inflate (non-labour) activity in Ireland, most notably with the exceptional growth rate recorded in 2015.

Department of Finance (2018) showed that using modified GNI as the numerator, which excludes much of the statistical distortions arising from globalisation, enables a more meaningful analysis of trends in the labour income share over time. Figure A1 below shows the labour share of time with GDP, GNI and GNI* as the numerators. All demonstrate a negative trend over time, in line with the global decline. The GNI* measure has a much higher level however, and does not display the level shift in 2015. In fact, the GNI* based labour share is much more in line with the EU average, as illustrated in Figure A2.
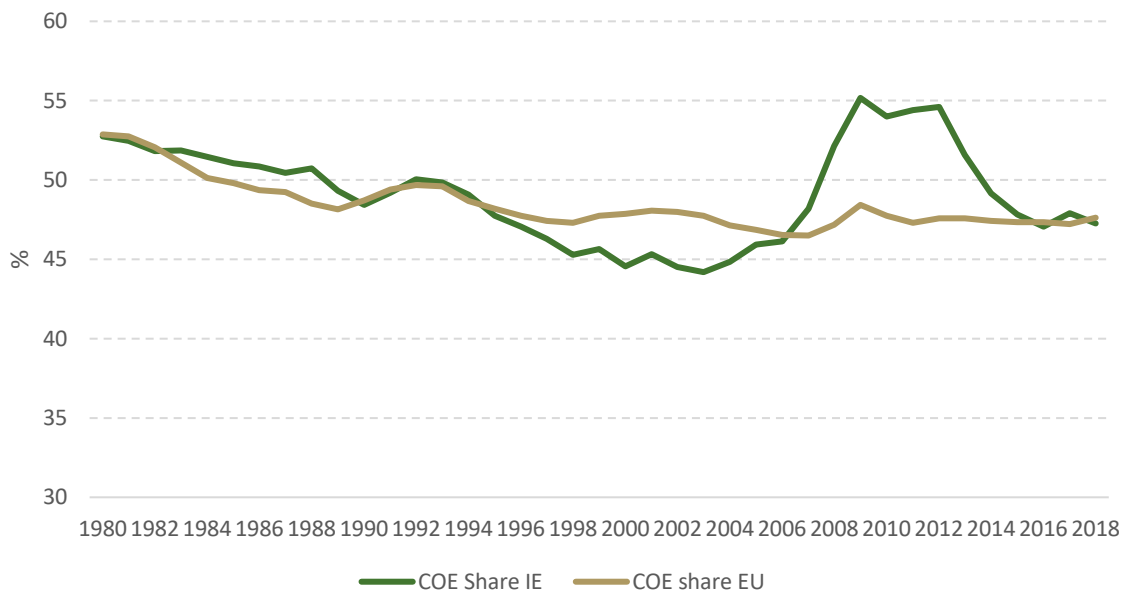
Figure A1: Irelands labour share in GDP, GNI and GNI* terms
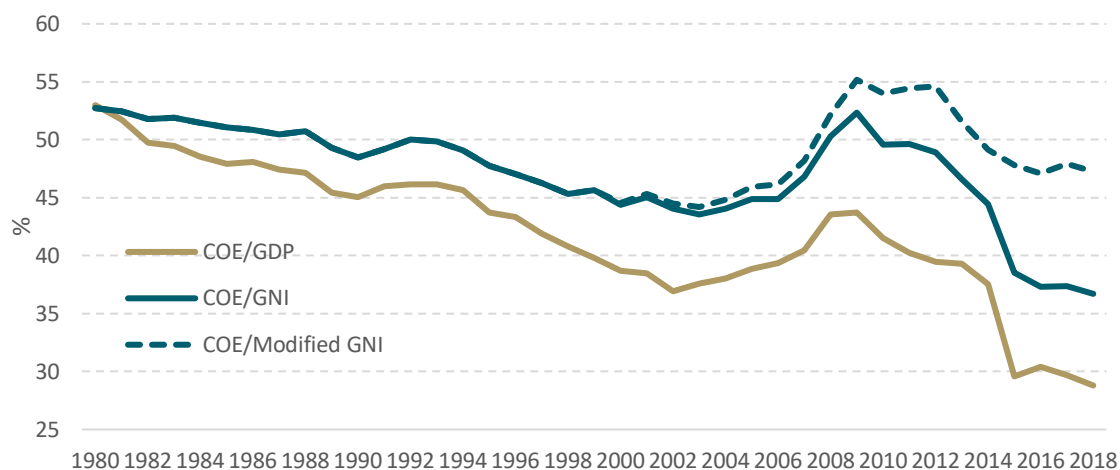
Source: CSO, Department of Finance

Note: COE is the compensation of employees

Figure A2: Irelands GNI* - based labour share vs. EU labour share

Source: Department of Finance, CSO, AMECO

Note: COE is the compensation of employees