3. Data and stylised facts

3.1 Data
We have compiled a comprehensive database for nine OECD economies drawing on six publicly available international databases for sectoral data which we augmented by country level data.\(^3\)

We measure the wage share as labour compensation over value added with data obtained from the EU KLEMS database. Labour compensation includes the wage of self-employed workers, imputed based on the assumption that their wage is equal to the average hourly wage of the sector. Different concerns have been raised with regard to this imputation, as it is generally said to overestimate the wage share for sectors of predominantly low skilled workers while it underestimates high skilled sectors’ wage shares. Indeed we find the wage share to exceed 1 in a total of 588 out of 13796 cases (4.26\%) for data at 2 digits and 324 out of 10245 observation (3.16\%) for the 1-digit level.\(^4\) However, wage shares exceeding one are not generally a problem and can naturally arise for mainly two reasons which have nothing to do with overestimations of the imputed wages for self-employed workers: First, if a sector incurs heavy losses and second, if a sector receives significant subsidies (EU KLEMS, 2007). The second case arises because value added in KLEMS is calculated as compensation of employees plus operating surplus plus taxes minus subsidies (on labour and capital), i.e. at basic prices, and therefore can fall short of labour compensation if the subsidies exceed operating surplus and taxes in a particular period.\(^5\) Since data from EU KLEMS is only available until 2009 we extrapolate through splicing. More specifically, we link the wage share from KLEMS with the growth rate of the wage share obtained from the OECD Structural Analysis database (OECD STAN).\(^6\) Both series have a correlation of 0.91. We control for violent swings in the wage share by excluding years where the percentage change

\(^3\) The use of an international database is instructional for making the variables and estimations comparable between countries. See table A3 in the appendix for further information on sector definitions and the skill taxonomy.

\(^4\) This number excludes Agriculture, Fishing and Foresting. These sectors are repeatedly reported to have wage shares bigger than one because of poor data quality and because the imputation for self-employed workers largely overestimates the labour compensation for this low skilled sectors (EU KLEMS growth and productivity, p. 37).

\(^5\) It would be preferable to use value added at factor cost for the calculation of the wage share. Unfortunately, there are no long series on taxes minus subsidies on production in EU KLEMS.

\(^6\) Since self-employed are not included in the measure of labour compensation in OECD STAN we impute their wages by applying the same technique as in EU KLEMS. We exclude observations where the number of self-employed suddenly falls to zero, assuming that it must be related to a measurement error.
in the wage share exceeds 30% in absolute values, which mostly appear in Denmark, Korea, Mexico, the UK and Sweden, but our results are robust to all these cleaning procedures.

In order to see how our results differ if we use the after-tax wage share we had to obtain measures for implicit tax rates on labour income, indicating the share of taxes paid out of wage income. The series are not readily available for many countries and for long periods; therefore we reconstructed the series using the technique proposed by Carey and Tchilinguirian (2000) with data from several sources of the OECD database.

We obtain measures of capital stock from the KLEMS database. Unfortunately only aggregated capital stock data is available at the 2-digit level.\(^7\) We extrapolate capital stock from KLEMS using the growth rate of the same measure from STAN. At the 1-digit level we are able to disaggregate ICT and non-ICT capital. ICT and non-ICT capital is reported as services (measured as an index) rather than stock in the newer versions of KLEMS. We prefer this measure over capital measured as stock because it is available for a more detailed sectoral disaggregation and more recent years in the newer versions of KLEMS. We do, however, use the stock measure for our descriptive statistics because it is impossible to aggregate indices by skill-groups. All measures enter our analysis as a ratio to GDP.

Our globalisation variables are obtained from the OECD. Import data disaggregated for intermediate import and other imports is from OECD STAN Bilateral Trade Database by Industry and End-Use Category. We calculate the ratio of intermediate and other imports to domestic absorption, i.e. value added plus total exports minus total imports.\(^8\)

FDI is taken from the OECD FDI statistics database and measures FDI positions (stocks) as assets minus liabilities of all parent companies to their affiliates. The measure is organised according to the direction of investment of the reporting country and all “positions of direct investors resident [in the reporting country] are shown under outward investment and all […] positions for direct investment enterprises resident in that economy are shown

\(^7\) We refer to our data as ‘at the 2-digit level’ if we use manufacturing sectors at 2-digits. Most service sectors are always used at the 1-digit level.

\(^8\) It would be preferable to differentiate intermediate imports by origin. However, given that a significant part of information on bilateral trade data is withheld for data protection reasons we were not able to meaningfully aggregate this measure by groups of countries. Unfortunately, data for most countries includes re-export and re-imports as most countries do not report these series separately.
under inward investment” (OECD, 2016).\textsuperscript{9} We normalise the measure by the numbers of people engaged in the sector, which we consider to have advantage over other forms of normalization for two reasons: First, since we are interested in the effect of FDI on industrial relations, a normalisation by people engaged in the production process seems reasonable. Second, since FDI is measured as a stock it is preferable to normalise it by another stock variable and not a flow variable like value added or output.

Our measure of migration is the stock of foreign labour by nationality taken from the OECD and we splice it with the growth rate of foreign population for the years for which data is not available (in line with IMF, 2007).\textsuperscript{10} We include it in our estimations as a ratio to total employment of the country.

Finally, for robustness tests we use an aggregate index of economic globalisation supplied by Dreher (2006) and updated in Dreher, et al. (2008) which combines \textit{de facto} data from trade flows, FDI stocks, Portfolio investment, income payments to foreign nationals with \textit{de jure} measure of hidden import barriers, tariff rates, taxes on international trade and capital account restrictions.

Our only measures for labour market institutions available at the sectoral level is union density supplied by Ebbinghaus and Visser (2000) and Visser (2015). Data is only available on a very aggregated level of sectoral classification and not available for each year. Therefore, we interpolated the series between available years and extrapolated data for service sectors using the growth rate of country-level union density. Similarly, we extrapolated manufacturing sectors using the growth rate of the total manufacturing union density or country-level union density when the latter series was not available. Due to the large amount of data created by extra- or interpolation we have reasons to doubt the reliability of this variable, although this is more relevant for earlier years before 1995 which are included only in a limited number of our estimations. However, it is important to note that such interpolation smooths the data and thereby diminishes its ability to capture short-time adjustment in bargaining variables in reaction to certain political or economic events. Nevertheless, we think the results are indicative and important as this paper is the first

\textsuperscript{9} Given the asset/liability principle of the measure negative FDI positions can result “when the loans from the affiliate to its parent exceed the loans and equity capital given by the parent to the affiliate” (FDI Statistics explanatory paper, 2016).

\textsuperscript{10} Since data for foreign labour and population by nationality is not available for the US we use foreign labour and population differentiated by country of birth for the US only.
attempt to analyse the impact of union density on sectoral wage share for several countries. We also check for robustness by using the country level aggregate union density variable supplied by the OECD. Our second measure of bargaining power is adjusted bargaining coverage\textsuperscript{11} measuring the number of employees covered by collective (wage) bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining (Visser, 2015). This variable is only available at the country level.

Furthermore, we account for social government spending defined as social transfers in kind from government to households measuring expenditure by government on market goods and services provided to households such as health care, housing, recreational and cultural services, education and social protection. This measure excludes social transfers in cash (reflecting welfare benefits), which we add to the previous measure for robustness tests, but unfortunately the latter series is available from 1995 only for most countries. We extrapolate our measure using the growth rate of government consumption for early years. The variable is measured as percentage of GDP and obtained from the OECD National Accounts at a Glance database.

Furthermore we include the Gini-coefficient obtained from the “Standardized World Income Inequality Database” (Solt, 2014), and top 1 percent income shares from the “World Wealth and Income Database” Alvaredo, et al. (2015).

Our country-level financialisation variables include interest and dividend payments and income of nonfinancial corporations as a ratio to total resources of nonfinancial corporations obtained from the OECD Non-financial Accounts by Sectors Database which is part of the Annual Accounts statistics. Furthermore we augment our analysis by a variable measuring household debt as percentage of GDP from the Bank of International Settlements Total Credit Statistics.

3.2 Stylised Facts

While the observed decline in the aggregate country-level labour share is a well-documented fact, there is only limited analysis of dynamics in functional income distribution at the

\textsuperscript{11} The variable is adjusted for the possibility that some sectors or occupations are excluded from the right to bargain (removing such groups from the employment count before dividing the number of covered employees by the total number of dependent workers in employment).
sectoral level. We find that the trend observed in the aggregate country level wage share is mirrored at the sectoral level, albeit with important differences between manufacturing and services sectors as well as high (HS) and low skilled (LS) sector groups and across countries as can be seen in Graph 1 below for selected countries.

**Figure 1: wage share in Austria, France, Germany and the UK**

![Graph 1](image-url)

Source: Own calculations; see Section 3.1 for detailed sources. Total excludes “Agriculture, Hunting, Forestry and Fishing” sector.

In Austria we observe one of the steepest declines in the wage share in comparison to other European countries. The wage share in value added of the sector is generally higher in the manufacturing industries than in services until the late 1990s, after which the wage share in manufacturing falls below the wage share in the service sectors. This pattern is unique to Austria – most other countries exhibit a higher wage share in low skilled service industries than in manufacturing as can be seen in France, Germany and the UK – and can well be related to imputed wages of owner entrepreneurs.
Within manufacturing sectors in Austria low skilled sectors maintained the highest share of wages in value added in the economy until the mid-1980s, but also exhibit the sharpest decline amongst all sector groups by 27 percentage-points from 85 percent to 58 percent between 1978 and 2007. Interestingly, this trend is mirrored by the other sectors so that low skill manufacturing never falls below high skilled manufacturing which experienced a reduction of the wage share by 21 percent between 1980 and 2008, a period which was marked by high scale privatisation practises. The wage share in high skilled service sectors declined relatively less in comparison to the rest of the economy, but with a decrease by 14 percentage-points between 1970 and 2007 the reduction in the share of wages in these sectors is still substantial.

During the same time employment composition between sectors (measured as people engaged to include self-employed) changed drastically. The general trend is a decrease in the employment of low skilled sectors while employment in the high skilled sectors increased. In order to isolate the effect of a change in employment on the wage share, we further calculated labour shares for a constant level of employment between its peak and bottom point in Austria. While the change in people engaged accounted for 89% of the decline in the wage share for low skilled manufacturing sectors in Austria, a significant part of the decline remains unexplained. This figure is even more dramatic for the other sectors: change in employment explains only 30% of the decrease in the wage share of low skilled service sectors, while employment in high skilled manufacturing and services increased and even more than doubled for high skill service sectors.

Turning to other countries the wage share in France exhibits the strongest skill bias amongst the four countries. However, although there is a clear decline in the wage share of low skilled service and manufacturing sectors, high skilled services have lost out in comparison to their own position in the 1980s as well. In fact the only sector group characterised by a slightly increasing wage share is high skilled manufacturing.

In Germany the wage share appears to be quite stable until the early 2000s, which marks the implementation of the Hartz reforms – one of the most drastic labour market policy

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12 This is not a true isolation of the employment effect since the level of employment has an impact on the bargaining power of worker and is itself a function of economic activity measure by value added. However, this calculation allows us to see how much of the decline in the wage share is a mere effect of a change in the number of people employed and how much of it is due to changes in bargaining power between employees and workers, which is, among other factors, determined by the level of (un)employment.
packages to be implemented in Germany. Thereafter all sector groups besides high skilled services exhibit a strong decline in the wage share, a trend that is only momentarily changed during the crisis. Indeed, the wage share of high skilled manufacturing industries declined by more than 19 percentage-points between 1993 and 2008, the strongest reduction in all sector groups.

The UK presents a diverse picture in terms of wage share dynamics. While low skilled services experienced a steady reduction in the wage share since the mid-1990s, low skilled manufacturing sectors have increased their wage share in the same period, although they still lost out in relation to their position in the early 1980s. Turning to high skilled sectors, services show the most steady wage share, which experienced a sharp decline by 9 percentage-points between 1984 and 1994 and afterwards stabilised at a lower level. The wage share in high skilled manufacturing is highly volatile and characterised by interchanging periods of increase and decline. However, it is 11 percentage-points lower than its peak in 1981 at 71 percent in 2009, the last year of our sample for the UK, and close to its lowest level of 67 percent in 1996.
The dynamics of the other countries in our sample are similarly diverse as can be seen in Figure 2. The USA and Sweden experienced a steady decline in high and low skilled manufacturing as well as low skilled service wage shares, while high skilled service wage shares appear to be relatively stable – a sector dominated by high wages in the financial sector.

In Italy all sector groups experienced a steady decline since the early 1980s, a trend which has been slightly reversed in the early 2000s for high and low skilled manufacturing and low skilled services but not for high skilled services.

In Spain wage shares look fairly stable over the whole period, but this hides a persistent decline since the early 2000s. One exception is low skilled service industries which experienced a decline of the wage share by 27 percentage-points between 1970 and 2010.
Denmark is the only country where the wage share appears to have been increasing or at least stable in the low and high skilled services and low skilled manufacturing sectors, while high skilled manufacturing workers have lost out in terms of wage share in comparison to their position in the 1980s.

Looking at the crisis year shows some interesting dynamics. Unfortunately, our data quality is worse for those years given that we are employing an unbalanced panel and thereby face the risk of sectors dropping out of our sample at the beginning and end of the time period. Nevertheless we can observe some interesting dynamics. Historically, the wage share tends to rise during recessions as companies hold on to workers and productivity falls more than real wages, then the wage share falls back in a recovery. But during the 2008 recession the labour share did the opposite in some countries: it fell soon after the initial year of the recession, and when the recovery began the aggregate wage share kept falling in most countries. This trend can clearly be observed in the US, Austria, France and Germany. Unfortunately our sectoral data for the UK is limited and ends in 2009, but nevertheless we can observe a decline for manufacturing sectors in the last years of the sample while service sectors exhibit an increase between 2008 and 2009; also the data for the aggregate economy which is available until 2015 confirms these trends.

Summing up, despite the diversity of wage share dynamics across countries and sector groups, there are no sectors which seem to be exempt from the rise in inequality in functional income distribution across countries, an observation which cast doubt on two most commonly used explanations to account for the decrease in the country-level wage share in the mainstream analysis. On the one hand, there is reason to question the argument of skill-biased technological change as the main driver of functional income inequality, since it predicts an increase in the wage share of skilled workers while the wage share of unskilled workers declines. If our sectoral skill disaggregation roughly reflects the share of skilled and unskilled workers we can decisively conclude that this trend is not apparent in the OECD countries. In Austria labour in all sectors of the economy has lost compared to capital. On the other hand, several economists have attributed the decline of the country-level wage share to a change in the sectoral composition of the economy, maintaining that the observed decline is mainly the result of traditionally capital intensive sectors with a low wage share producing an increasing share of overall value added (EC, 2009). Although our observation of an overall decline in the wage share across skill groups does not invalidate this explanation, it nevertheless
provides evidence to the fact that changing industrial composition cannot on its own explain the decline in the aggregate wage share. This confirms previous findings by Karabarbunis and Neiman (2012, 2014) and Rodriguez and Jayadev (2010). Therefore the analysis of the causes of the decline in the wage share remains an important question which can’t be merely attributed to technology driven changes in the sectoral composition of the economy.
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Source: Own calculations; see Section 3.1 for detailed sources. Total excludes “Agriculture, Hunting, Forestry and Fishing” sector.
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Source: Own calculations; see Section 3.1 for detailed sources. Excluding “Agriculture, Hunting, Forestry and Fishing” sector.
Table 1 presents cumulative percentage changes of selected variables for non-overlapping five year periods. Variables accounting for globalisation shows similar pattern across all countries of our sample. Intermediate import penetration increased in all countries in both high and low skilled manufacturing sectors.\textsuperscript{13} The years of the crisis and shortly afterwards are the only exception to the otherwise increasing trend, which resumed latest in 2010 in all countries.\textsuperscript{14} The highest total growth rates were achieved in the 1990s in Sweden and Germany, driven by high skilled manufacturing sectors which in general have a higher level of intermediate imports than low skilled manufacturing sectors. This is not surprising because our sample consists of high-income economies supplying high-skilled goods whose production process was characterised by outsourcing measures which substitute domestic production by imported intermediate goods.

Figure 3: Intermediate Import Penetration in selected OECD countries

\begin{figure}
\centering
\includegraphics[width=\textwidth]{fig3}
\caption{Intermediate Import Penetration in selected OECD countries}
\end{figure}

Source: Own calculations; see Section 3.1 for detailed sources. Total excludes “Agriculture, Hunting, Forestry and Fishing” sector.

\textsuperscript{13} We focus on the analysis of manufacturing sectors for intermediate imports because the only service sector for which we have data is Recycling.

\textsuperscript{14} These years are the reason why several countries have a negative growth rate for the last period.
A similar pattern can be observed for outward foreign direct investment (FDI). Here we can see a strong skill bias in the sense that outward FDI per employee increased more for high skilled manufacturing and service sectors than for their low skilled counterparts in Austria, France, Germany and the US while the other countries experienced a rather balanced increase in outward FDI across sectors. The exceptions are always low-skilled service sectors which experience the least amount of outward FDI.

Additionally we analyse the share of migrant workers in the total labour force. This measure has been increasing in most countries with the noticeable exceptions of Sweden, where it has stagnated, and France where it declined. Nevertheless, the share of migrants is very small in all countries, exceed ten percent only for Austria where it reaches 12 and the USA where the data is not comparable because it is measured as foreign-born rather than foreign labour force.

The share of ICT capital in value added is usually applied as a measure of technological change in the literature (Bassanini and Manfredi 2012). We observe a steady increase in the share of ICT capital measures across all sectors and countries. There is a slight bias in favour of high skilled sectors in Austria, the UK and the USA, but the general positive and sometimes even exponential trend is common to all countries.
Figure 4: union density in selected OECD countries

We observe a strong decline in union density for all sector groups in Austria, France, Germany, the UK and the USA, while the decline is more moderate, albeit still visible, in Italy, Denmark and Sweden. Union density stagnated or even increased in Spain between 1980 and 2010, however not exceeding the comparatively low level of 20 percent. Since this can be attributed to a period of recovery after oppressed labour unions after Franco, we regard it as a special case. In most countries union density began to decrease in the 1980s, with the exception of Austria, France and the US where it has been declining throughout the whole sample period. Union density is highest in manufacturing sectors and lowest in low skilled service sectors. However, the latter group is also characterised by the smallest reduction in union density. Comparing countries amongst each other union density measured at the country level decline most strongly in Austria where we observe a reduction by 35

15 Due to data limitations we are not able to differentiate between high and low skilled manufacturing in some countries. In this case only the graph for high skilled manufacturing is displayed.
percentage-points between 1970 and 2011, followed by the UK and Germany where the reduction constitutes 24 and 18 percentage-points respectively.

Adjusted collective bargaining coverage also falls in most countries. The most drastic reductions in bargaining coverage can be observed in the UK, Germany and the US where it declined by 48, 27 and 18 percentage-points between the 1970 and the 2010s.

We observe an increase in social government spending in our sample period in most countries with the exception of Sweden and Denmark where the measure stayed roughly constant. Interestingly, while social government spending increased or stagnated, it’s financing is more relying on workers income as can be observed by the increasing implicit tax rates for labour and consumption for all our sample (Onaran and Bösch, 2014).

Personal inequality measured by the Gini coefficient increased in most countries with regard to its level in the 1980, with France as the only outstanding exception. A similar pattern can be observed for the income share of the top 1 percent, this time Denmark being the exception from the rule of increasing top income shares.