Labour Share Developments in OECD Countries Over the Past Two Decades

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Abstract – Over the past two decades, real wage growth in many OECD countries has decoupled from labour productivity growth, as labour income shares have declined. This paper analyses the drivers of labour share developments using a combination of industry- and firm-level data. Technological change in the investment goods-producing sector and greater global value chain participation have compressed labour shares, but the effect of technological change has been significantly less pronounced for high-skilled workers. Countries with falling labour shares have witnessed both a decline at the technological frontier and a reallocation of market shares toward "superstar" firms with low labour shares. The decline at the technological frontier mainly reflects the entry of firms with low labour shares into the frontier rather than a decline of labour shares in incumbent frontier firms, suggesting that thus far this process is mainly explained by technological dynamism rather than anti-competitive forces.

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Real wage gains are normally the most direct mechanism through which productivity gains are transmitted to workers. However, over the past two decades, real wage growth in many OECD countries has decoupled from labour productivity growth as the share of labour income in total income has declined. Since wages are typically the main source of market income (total pre-tax income excluding income from government sources) for low- and middle-income households, this decoupling also tends to raise broader measures of income inequality.

This paper analyses labour share developments in OECD countries using a combination of aggregated and disaggregated data. Aggregated data are used to provide descriptive evidence on recent labour share developments, with disaggregated data at the industry- and firm levels providing evidence on the role of technology, global value chain expansion and public policies. The analysis based on disaggregated data further provides insights into the mechanisms underlying aggregate labour share developments, including the roles of substitution of capital for labour (henceforth capital-labour substitution) and firm dynamics.

The contribution of this paper to the existing body of research is threefold. First, the empirical analysis is based on industry-level data, which allows a more credible identification of the policy drivers of labour share developments than existing studies based on country-level data (IMF, 2017; Stockhammer, 2017). Second, the paper analyses the role of skills and routine-task intensity in shaping the response of labour shares to technological change and global value chain expansion and analyses a broad range of potential policy determinants in a unified empirical framework. Third, the paper sheds light on a number of micro mechanisms underlying aggregate labour share developments. In particular, it analyses the extent to which aggregate labour share developments are related to high-productivity firms pulling away from other firms and capturing a larger share of the market ("winner-takes-most" dynamics).

The main findings are as follows:

- For the OECD as a whole, the labour share has declined over the past two decades, but there have been large differences across countries. About half of the covered countries experienced significant declines whereas the others experienced constant or increasing labour shares;

- Technological change and globalisation can explain most of the average contraction of the labour share. Technology-driven declines in relative investment prices and, to a lesser extent, the expansion of global value chains (in which different stages of production are spread across countries or regions) account for about two-thirds of the aggregate labour share decline in the OECD;

- The substitution of capital for labour in response to declines in relative investment prices is particularly pronounced in industries with a predominance of high routine tasks. High shares of high-skilled workers reduce the substitution of capital for labour even in highly routine task-intensive industries;

- Pro-competition product market reforms raise the labour share by reducing producer rents that tend to accrue to capital owners. A number of labour market policies and institutions that strengthen workers' bargaining power, such as higher minimum wages, can reduce the labour share by raising labour costs and triggering the substitution of capital for labour. Higher spending on active labour market policies raises the labour share by preserving labour market attachment and skills of workers who lose their jobs;

- Countries with falling labour shares have witnessed both a decline at the technological frontier and a rise in market shares of capital-intensive "superstar" firms with low labour shares ("winner-takes-most" dynamics). The labour share decline at the technological frontier mainly reflects the entry of capital-intensive firms with low labour shares into the frontier rather than a decline in incumbent frontier firms, suggesting that thus far "winner-takes-most" dynamics are mainly explained by technological dynamism.

The remainder of the paper is structured as follows. The second section describes recent labour share developments across OECD countries, with a particular focus on the use of firm-level data to analyse and discuss the role of "winner-takes-most" dynamics. The third section describes the empirical setup and the empirical results. The fourth section concludes with a number of policy implications.

Recent Labour Share Developments across OECD Countries

Aggregate Labour Share Developments

The labour shares in this section cover the period 1995-2017 and are defined as labour

compensation of salaried and self-employed workers as a share of value added at factor costs in the total economy excluding the primary, housing and non-market industries. They are constructed from industry-level data in the OECD Annual National Accounts Database, complemented with additional data from the archives of the OECD STAN database, OECD Annual Labour Force Statistics and the EU-KLEMS database. Labour compensation is the sum of compensation of salaried workers and the imputed compensation of self-employed workers, with the imputation based on the average compensation of salaried workers in the corresponding industry.[1] Value added at factor costs is defined as value added at basic prices minus taxes net of subsidies on production. Using value added at factor costs in the denominator ensures that labour and capital shares of value added sum to one.[2]

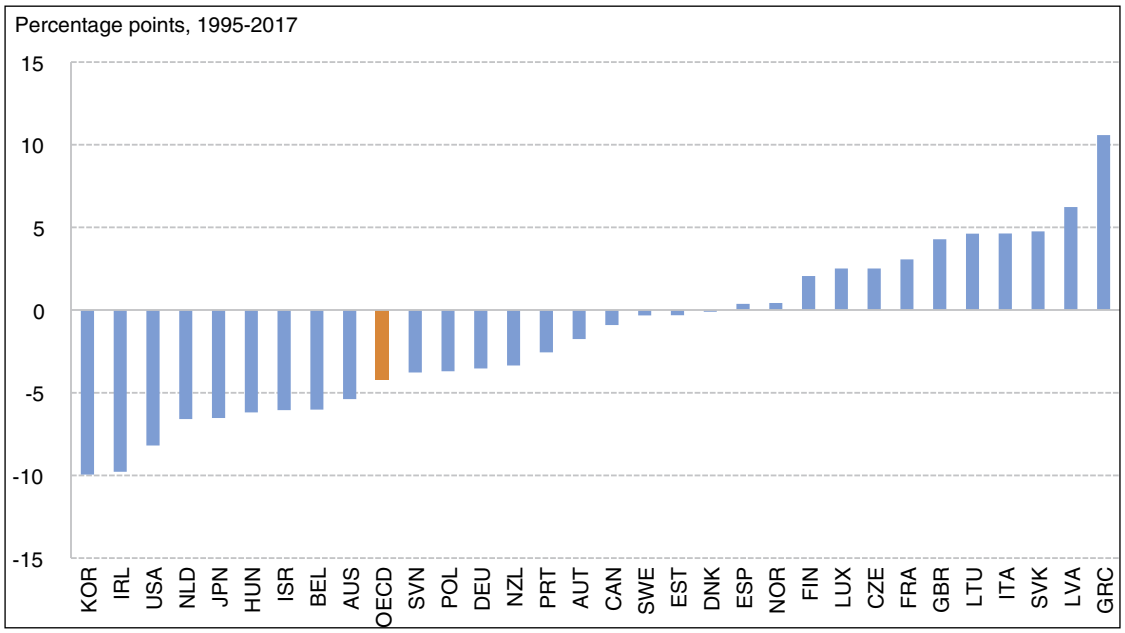
The aggregate OECD labour share has declined significantly over the past two decades, but there have been large differences in labour developments across countries (Figure I). While labour shares declined significantly between 1995 and 2017 for about half of the covered countries (including Germany, Japan and the United States), they remained about constant or increased for the other half (including France, Italy and the United Kingdom).[3]

Declines in labour shares excluding primary, housing and non-market sectors are typically less pronounced than in the total economy (see Table 1). Total-economy labour shares may partly be driven by developments in specific industries for which there are significant conceptual and measurement issues. For instance, total-economy labour shares are partly explained by developments in housing rents, which may in turn be driven by factors other than those driving capital income in the business sector and may have different distributional consequences.

A further issue with total-economy labour shares is that they are partly driven by commodity price developments and by imputation choices in the non-market sector. For countries with large

1. Depending on data availability, the imputation is based on hourly labour compensation or on per-capita labour compensation of salaried workers.
2. For Canada and Israel, value added is at basic prices, since data on taxes net of subsidies on production are unavailable. Ireland's labour share is computed over the period 1995-2014 since value added in 2015-2016 is distorted by the relocation of intellectual property assets by multi-national enterprises in 2015 (OECD, 2018).
3. The larger cross-country heterogeneity in terms of changes in labour shares with respect to Karabarbounis & Neiman (2014) likely reflects differences in sampling periods (mid-1990s to 2016 in this paper versus mid-1970s to 2012 in Karabarbounis & Neiman, 2014) and treatment of self-employed workers (imputation of self-employed workers' wages using industry-level wages in this paper versus absence of imputation in Karabarbounis & Neiman, 2014).

Figure I
Changes in the labour share without the primary, housing and non-market industries



Notes: The OECD average is the GDP-weighted average of changes in labour shares over the 31 countries covered by the analysis. Start year is two-year average or 1994-1995 for Australia, Denmark, Finland, France, Japan, Korea, New Zealand, Norway, Sweden and United States; 1995-1996 for Austria, Belgium, Czech Republic, Estonia, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Portugal, Slovak Republic, Slovenia, Spain and United Kingdom; 1997-1998 for Canada; 2000-2001 for Poland. End year is average of 2016-2017 for all countries except for France, Norway, Slovak Republic, Slovenia, Sweden, United Kingdom and United States (2015-2016); Canada, Israel, Japan, Korea and New Zealand (2014-2015); Ireland (2013-2014).
Sources: OECD National Accounts Database, OECD STAN Database, OECD Annual Labour Force Statistics Database and EU KLEMS Database.

agricultural or mining (i.e. primary) sectors, developments in total-economy labour shares are largely driven by developments in commodity prices; when commodity prices increase, aggregate profits rise without commensurate increases in aggregate wages.[4] In Australia, for instance, where the mining sector is large, the non-housing labour share declined by around 7 percentage points over the period 1995-2016, but it declined by only around 3 percentage points when the agriculture, mining and non-market sectors are excluded (Table 1). Moreover, national accounting conventions in the non-market sector may bias developments in labour shares. Value added in the non-market sector is equal to the sum of wage compensation and capital consumption,

4. The decline in the aggregate labour share partly reflects a change in industry composition: as commodity prices increase, the share of the mining sector – for which the labour share is low – in total value added increases.

Table 1
Contributions to changes in total economy labour shares
Percentage points, 1995-2017

	Changes in labour share	Contributions of			
	Total economy	Non-primary business sector	Housing sector	Primary industries	Non-market sector
Australia	-7.1	-3.6	-0.6	-3.5	0.6
Austria	-4.2	-1.2	-1.4	-1.8	0.2
Belgium	-2.2	-4.1	0.9	0.2	0.8
Canada	-2.4	-0.8	0.5	-1.8	-0.3
Czech Republic	1.8	1.8	-0.8	-0.3	1.1
Denmark	0.7	0.0	0.0	0.0	0.7
Estonia	-0.4	-0.1	-1.3	-1.2	2.2
Finland	-2.3	1.3	-2.1	-1.0	-0.5
France	0.2	1.9	-1.1	-1.0	0.5
Germany	-2.6	-2.5	0.2	-0.6	0.2
Greece	6.6	6.0	-1.9	0.5	2.0
Hungary	-5.9	-4.1	-1.0	-1.9	1.1
Ireland	-9.1	-7.2	-0.7	-0.7	-0.5
Israel	-7.2	-3.8	-1.8	-0.2	-1.4
Italy	0.4	3.0	-2.1	-0.3	-0.2
Japan	-5.8	-4.9	-1.1	-0.5	0.7
Korea	-11.5	-7.3	0.0	-3.9	-0.3
Latvia	2.6	4.2	-2.6	-2.4	3.4
Lithuania	3.3	3.0	0.9	-1.0	0.5
Luxembourg	3.6	1.9	1.2	-0.2	0.8
Netherlands	-2.2	-4.5	0.7	0.9	0.6
New Zealand	-1.1	-2.2	-0.3	-0.5	1.9
Norway	-0.9	-0.1	0.5	-1.9	0.6
Poland	-9.6	-2.9	0.7	-7.0	-0.5
Portugal	-5.3	-1.7	-2.3	-0.4	-0.9
Slovak Republic	2.9	3.5	0.4	-1.2	0.2
Slovenia	-11.1	-2.8	0.5	-8.6	-0.1
Spain	-2.9	0.1	-2.7	-0.3	-0.1
Sweden	2.7	-0.2	2.5	-0.2	0.7
United Kingdom	5.9	2.9	0.6	1.1	1.3
United States	-4.7	-5.3	-0.5	-0.1	1.3
OECD (GDP weighted average)	-3.3	-3.0	-0.6	-0.5	0.7
OECD (unweighted average)	-2.2	-1.0	-0.5	-1.3	0.5
G7 (unweighted average)	-1.3	-0.8	-0.5	-0.5	0.5

Notes: See Figure I for sample period and Online complement C2 for analytical details on the statistical decomposition.
Sources: See Figure I.

which artificially implies limited variation over time.[5]

Most of the decline in the business labour share excluding the housing and primary sectors took place before the global crisis of 2008-09 (Figure II). However, labour share developments have been very heterogeneous across countries, with no pre-crisis decline for the country at the third quartile of the distribution of cumulated labour share changes and a large decline for the country at the bottom quartile. Given that this narrowly defined labour share is not affected by house and commodity price developments, the timing of the decline and rebound suggests that the structural factors that drove down the labour share before 2005 weakened thereafter.

The timing of the decline and the rebound of the labour share is consistent with evidence suggesting that the pace of expansion of global value chains associated with China's integration into the world trading system slowed in the wake of the global crisis of 2008-2009 (Ferrantino & Taglioni, 2014). Alternative explanations could be the slowing pace of IT-related technological change or the reduced scope for regulatory reforms, especially in network industries, which appear to be two major drivers of labour share declines (Karabarbounis & Naimen, 2014; Azamat *et al*., 2012). The post-2005 rebound in the labour share may partly also reflect business cycle conditions, with limited downward adjustment of wages and employment during and in the wake of the global economic crisis.

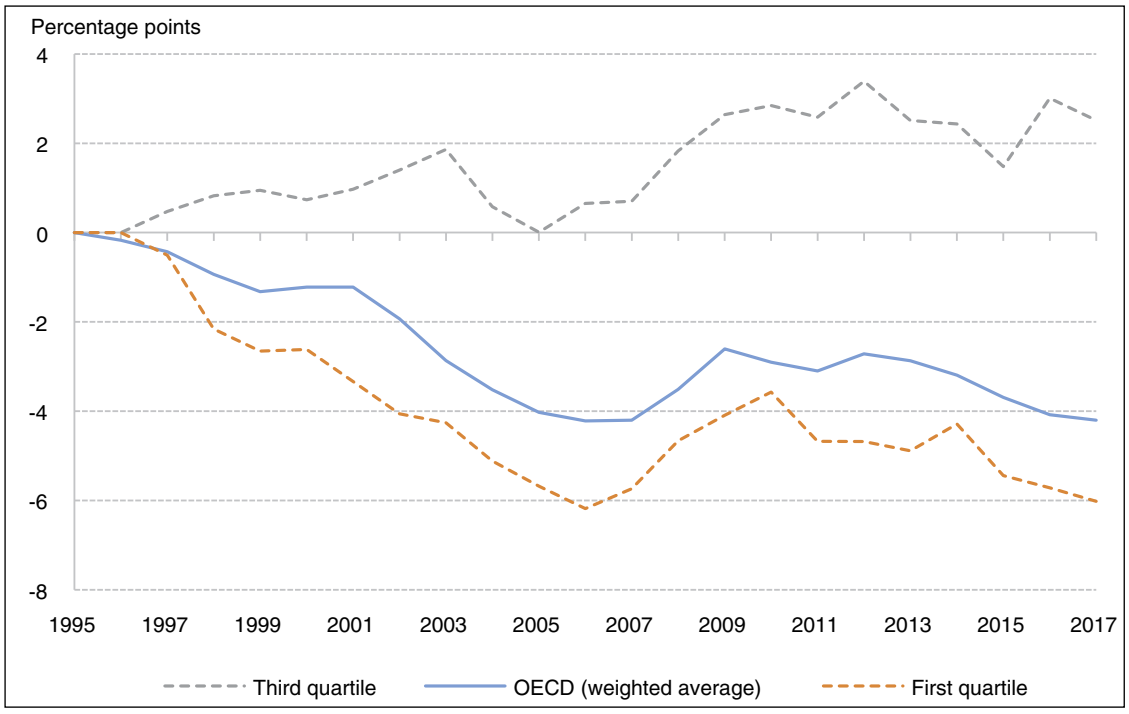
Descriptive Evidence on the Micro Mechanisms Underlying Aggregate Labour Share Developments

Firm-level data based on the ORBIS dataset allow analysing whether labour share developments over the period 2001-2015 are consistent with "winner-takes-most" dynamics.[6] In order to

5. The finance sector is included in the analysis. Excluding the finance sector would only have a marginal effect on labour share developments for most countries, the exception being Australia and Luxembourg for which the exclusion of the finance sector would make the change in the labour share 2-3 percentage points more positive over the period and Hungary for which it would make it 2 percentage points more negative.

6. The ORBIS firm-level dataset is available for a broad range of OECD countries and contains information from firms' income statements and balance sheets, including information on revenues, value added, employment and compensation. Coverage of firms is uneven across countries, with data for some countries covering a large fraction of firms, such as for Finland, Italy, Portugal, Sweden and Spain, but only a small fraction in others, such as the United States (only listed firms) and the first half of the 2000s for Germany. The main characteristics of leading and other firms are described in Online complements Table C1-II. Link to the Online complements at the end of the article.

Figure II
Cumulated change in OECD labour share



Notes: See Figure I. Excluding primary, housing and non-market industries.
Sources: See Figure I.

limit the influence of erratic or implausible firm behaviour, the dataset is cleaned by removing extreme outliers using the procedure described in Andrews *et al*. (2016). For the purpose of the labour share analysis in this paper, the dataset is additionally cleaned by removing observations with extreme values for labour shares. The resulting database covers firms in the non-primary and non-financial business sector of 15 OECD countries and closely tracks developments in labour share dynamics in the national accounts.[7]

In countries that experienced declines in labour shares over the period 2001-2015, wages in technologically leading firms decoupled from productivity but closely tracked productivity in the remaining firms (Figure III). This implies that in these countries labour shares within the group of leading firms declined while they remained constant in the remaining firms, which is consistent with "winner-takes-most" dynamics.[8] The best firms in these countries diverged from the remaining firms in terms of both productivity and wages, but wage divergence was much less pronounced than productivity divergence.[9] Given that technologically leading firms account for approximately 25% of aggregate value added of the firms in these countries, developments in leading firms contributed significantly to the decline in the labour share.

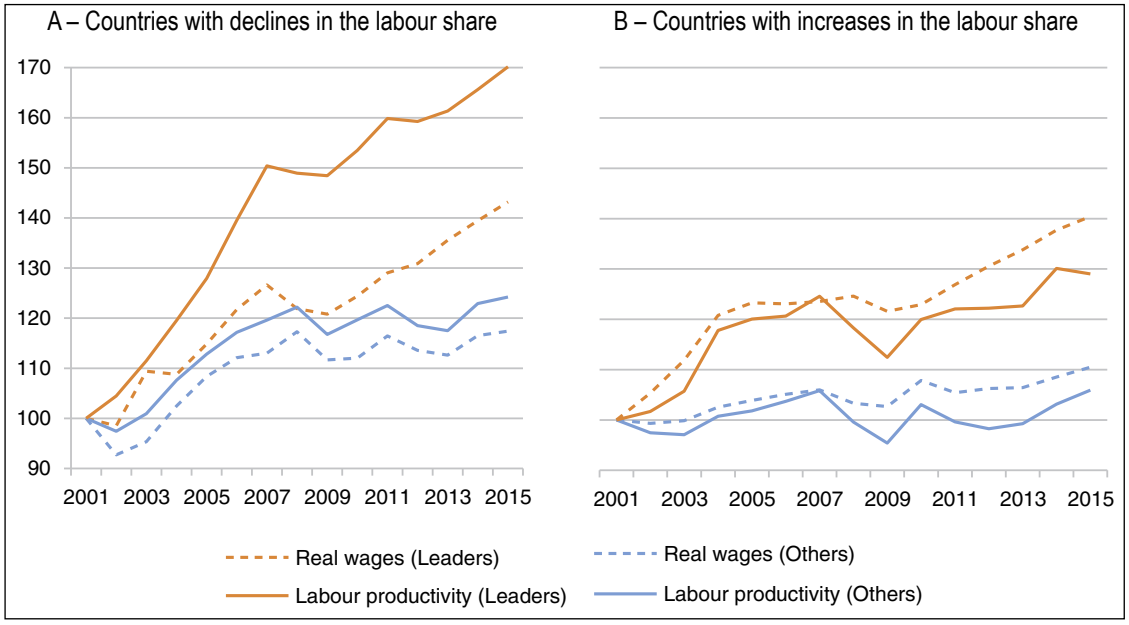
In countries that did not experience declines in labour shares, real wage growth outpaced labour productivity growth in both leading firms and the remaining firms. Productivity and wages in leading firms diverged from those of the remaining firms, but labour shares were broadly constant before the crisis of 2008-09 and increased in both groups thereafter. This suggests that in countries with increases in labour shares over the period 2001-2015 "winner-takes-most" dynamics were less pronounced. One possible explanation could be that there was less technological dynamism in countries with increases in labour shares, which is consistent with the fact that productivity growth of the leading firms in these countries was similar to that of the non-leading firms in countries that experienced labour share declines.

7. The covered countries are Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Korea, Netherlands, Spain, Sweden, United Kingdom and United States.

8. Leaders are defined as the top 5% of firms in terms of labour productivity within each country group in each industry and year, implying that the composition of firms at the technological frontier is allowed to vary over time.

9. The decoupling of wages from productivity in leading firms does not appear to reflect an increase in stock option compensation. Stock option compensation is typically found to be particularly prevalent in finance and ICT services (Elsby et al.*, 2013). The role of increasing stock option compensation can be assessed by removing the finance and ICT industries from the analysis in Figure III. Since the figure remains qualitatively and quantitatively unchanged, increasing non-cash compensation is unlikely to be the main driver of decoupling of wages from productivity in leading firms in countries with declining labour shares (Schwellnus* et al.*, 2018).*

Figure III
Average wages and productivity in the best firms and the rest, 2001=100



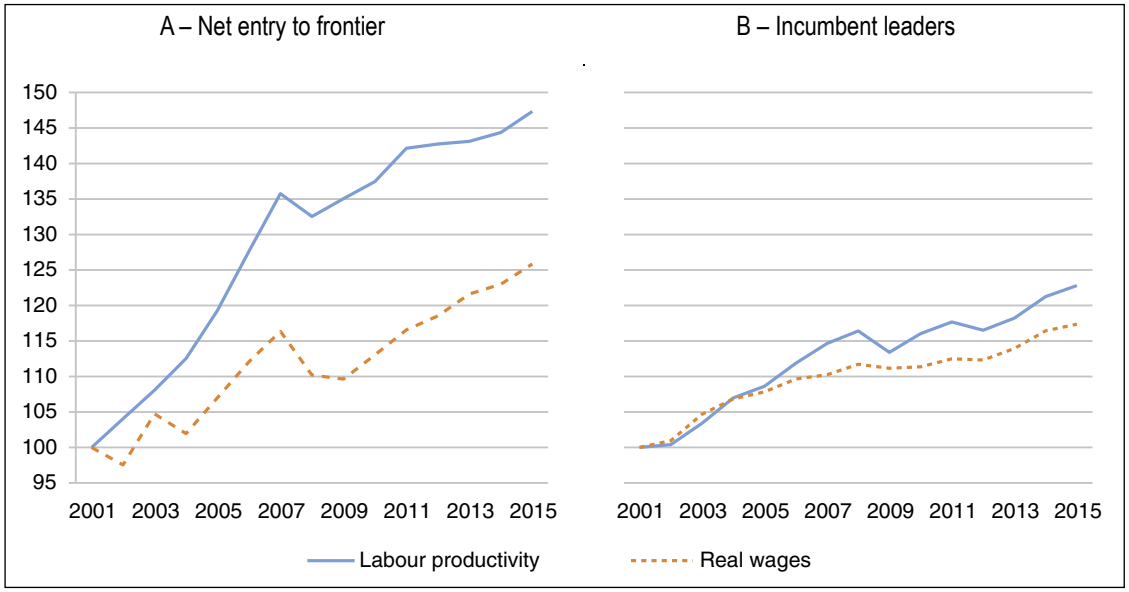
Notes: Labour productivity and real wages are computed as the unweighted mean across firms of real value added per worker and real labour compensation per worker. Leaders are defined as the top 5% of firms in terms of labour productivity within each country group in each industry and year. The countries with a decline in the labour share excluding the primary, housing, financial and non-market industries over the period 2001-2015 are: Belgium, Denmark, Germany, Ireland, Korea, Netherlands, Sweden, United Kingdom and United States (see Online complements, Table C1-I). The countries with an increase are: Austria, Estonia, Finland, France, Italy and Spain.
Sources: OECD calculations based on OECD-ORBIS.

The decoupling of wages from productivity in technologically leading firms is overwhelmingly explained by the entry of low-labour share firms and the exit of high-labour share firms from the technological frontier (Figure IV). The decoupling of wages from productivity in leading firms can be decomposed into contributions from firms staying at the technological frontier ("incumbents") and firms entering and exiting it ("net entry"). While productivity and wages remained closely linked in incumbent technological leaders, net entry into the frontier drove a large wedge between wage and productivity growth. This implies that labour shares were significantly lower for firms entering the technological frontier than for those exiting it. This result suggests that the decline of labour shares at the technological frontier was not driven by increasing markups or capital intensity in firms remaining at the technological frontier but rather by the entry of new firms with higher markups or higher capital intensity into the technological frontier.[10]

Overall, even though superstar firm dynamics do not appear to be a global phenomenon, the firm-level analysis suggests that in a number of countries such dynamics have contributed to labour share declines. In the group of countries, experiencing declines in labour shares, not only has there been a decline in labour shares within the group of technologically leading firms but the evidence also suggests that there has been a reallocation of market shares toward these firms (Schwellnus *et al.*, 2018). The fact that firms entering the frontier are generally smaller (in terms of employment) and younger than those remaining at the frontier and exiting it suggests that the decline in frontier firms' labour share cannot be explained by large monopolistic firms limiting entry into the market.[11] Moreover, the decline in frontier firms' labour share reflects net entry of firms with low shares into this group rather than the decline of labour shares of incumbent frontier firms, which is another indication that the decline in the labour share may thus far mainly reflect technological change rather than barriers to entry.

10. Capital intensity in firms entering the technological frontier was about twice that of exiting firms (see Online complements Table C1-III).
11. The share of firms employing less than 100 workers and have been in existence no more than 5 years is 14% for entrants into the technological frontier, whereas it is 7-8% for firms staying at the frontier or exiting it (see Online complements Table C1-IV).

Figure IV
Net entry fully explains the decoupling of wages from productivity in leading firms



Notes: Contributions to labour productivity and real wage growth at the frontier, countries with declines in labour shares. Contributions to real wage growth and labour productivity growth are based on the decomposition $\Delta X = \left[s_2^{stay} X_2^{stay} - s_1^{stay} X_1^{stay} \right] + \left[s_2^{entry} X_2^{entry} - s_1^{exit} X_1^{exit} \right] = \left[s_1^{stay} \Delta X^{stay} \right] + \left[s_1^{exit} \left(X_2^{entry} - X_1^{exit} \right) \right] + \varepsilon$, where X denotes the logarithm of labour productivity or real wages; s denotes the share of each group of firms in the total number of leading firms; superscripts denote groups of firms; and subscripts denote the period (Baily *et al.*, 1992). The way in which the frontier is constructed implies $\varepsilon = 0$ (Online complement C1) so that the first term in squared brackets in the second equality can be interpreted as the contribution of incumbents to growth of labour productivity and wages at the frontier (Panel B) and the second term the contribution of net entry (Panel A). The countries with a decline in the labour share excluding the primary, housing, financial and non-market industries over the period 2001-2015 are: Belgium, Denmark, Germany, Ireland, Korea, Netherlands, Sweden, United Kingdom and United States (Online complement, Table C1-I).
Sources: OECD calculations based on OECD-ORBIS.

Empirical Analysis

Capital-augmenting technological change or technology-driven declines in equipment prices may reduce the labour share by raising capital intensity. If factor prices are determined competitively, the labour share declines with capital intensity so long as the elasticity of substitution between capital and labour is above unity. Most estimates of the elasticity of substitution are based on within-country time series variation of factor shares and factor prices. These estimates generally imply an elasticity of substitution below one (Chirinko, 2008). By contrast, Karabarbounis & Neiman (2014) use cross-country and cross-industry variation in labour shares and relative investment prices to obtain an elasticity of substitution in the range of 1.2-1.5. According to their estimations, large declines in equipment prices across a broad range of high-income and emerging economies explain around 50% of the global decline of the labour share.

Globalisation in the form of increased trade integration may have similar effects on the labour share as increases in capital intensity (Acemoglu & Autor, 2010). For instance, offshoring of the most labour-intensive stages of production or increased import competition may lead to worker displacement and an increase in capital intensity. If the aggregate elasticity of substitution between capital and labour is above unity, this would reduce the labour share. The cross-country evidence in Harrison (2005) and the cross-industry evidence for the United States in Elsby *et al*. (2013) are consistent with this hypothesis. In a cross-country, cross-industry study IMF (2017) find that increased participation in global value chains has reduced the labour share in low-income countries but that there is no effect in high-income countries.

Setup

The empirical analysis focuses on capital-augmenting technological change as measured by changes in relative investment prices and offshoring as measured by global value chain expansion. It is conducted at the industry-level over the period 1995-2011 on twenty OECD countries for which the dependent and all explanatory variables can be constructed.[12] Adopting an industry-level approach to the modelling of labour shares is both conceptually and econometrically appealing. From a conceptual standpoint, the fact that changes in aggregate labour shares overwhelmingly reflect developments within industries rather than cross-industry reallocation justifies modelling industry-level labour shares to explain aggregate developments.[13] From an econometric standpoint, the industry-level approach has the advantage that country- and industry-specific trends can be controlled for through an appropriate fixed effects structure.

The econometric models focus on medium-term changes in labour shares. For this purpose, the data is split into three periods of approximately five years (1995-2000, 2000-2005 and 2005-2011). The analysis of medium-term changes rather than long-term changes over the entire period permits a more precise estimation of the effects of structural and policy drivers of labour shares while allowing labour shares sufficient time to adjust given that the elasticity of substitution between labour and capital is likely to be higher in the medium term than in the short term. Depending on the specification, business-cycle effects are controlled for by including country-period fixed effects or changes in output gap as explanatory variables.

The first hypothesis tested by the empirical model is that a decline in the relative investment price reduces the labour share, with the reduction being larger in industries using a larger share of routine labour. Declines in relative prices of capital goods lead to the substitution of capital for routine labour, which reduces the overall labour share under the assumption of an elasticity of substitution between capital and routine labour above unity (Karabarbounis & Neiman, 2014). The model also tests whether the negative effect of a given relative investment price decline on the labour share is larger in industries with large shares of routine labour, which would be the case under the assumption that the elasticity of substitution with capital is higher for routine than for non-routine (IMF, 2017; Schwellnus *et al*., 2018).

The second hypothesis tested by the empirical model is that offshoring reduces the labour share. On the one hand, the decline in the cost of offshoring leads to the substitution of imported intermediate goods for domestic routine labour

12. The countries included in the econometric analysis are Australia, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, the Netherlands, Norway, Slovak Republic, Spain, Sweden, the United Kingdom and the United States.

13. At the level of industry disaggregation used in this paper, labour share developments within industries explain around 80% of aggregate labour share developments (Schwellnus et al.*, 2018), which is broadly in line with previous studies (Bassanini & Manfredi, 2012; Karabarbounis & Neiman, 2014; IMF, 2017). Given that reallocation across industries explains only a small fraction of aggregate labour share developments, weighting industries with shares in aggregate value added in the regression analysis allows making direct statements on aggregate effects.*

and thereby to a reduction in the domestic wage bill as a share of gross output. On the other hand, offshoring of previously domestically produced output leads to a reduction in domestic value added as a share of gross output. In addition to these within-firm effects, offshoring may also reallocate production across firms with different labour shares. The theoretical ambiguity of the effect of offshoring is consistent with conflicting results on the impact of offshoring on the labour share in the empirical literature. While a number of studies find a negative impact (Elsby *et al.*, 2013; IMF, 2017), other studies find that the negative impact on the wage bill is smaller in magnitude than the impact on value added so that the labour share increases in response to offshoring (Autor *et al.*, 2019).[14]

The estimated baseline empirical specification is as follows:

$$\Delta LS_{ijt} = \beta_1 \Delta P_{ijt}^{Inv} + \beta_2 \Delta T_{ijt} + \beta_3 \left(RTI_{ij}^{0} \times \Delta P_{ijt}^{Inv} \right) + \beta_4 \left(RTI_{ij}^{0} \times \Delta T_{ijt} \right) + \beta_4 X_{ijt} + \alpha_{it} + \alpha_{jt} + \varepsilon_{ijt} \quad (1)$$

where subscripts i, j and t denote, respectively, countries, industries and periods; ΔLS_{ijt} denotes the medium-term (5- or 6-year) change in the labour share; RTI_{ij}^{0} denotes initial routine task intensity; ΔP_{ijt}^{Inv} denotes the medium-term change in the relative investment price; ΔT_{ijt} denotes the medium-term change in participation in global value chains; X_{ijt} denotes control variables that vary at the country-industry-period level, including the initial routine task intensity RTI_{ij}^{0}; α_{it} and α_{jt} denote country-by-period and industry-by-period fixed effects. Given that the model is estimated in differences, the fixed effects pick up country-period and industry-period specific trends.[15] A drawback of the fixed effects structure in equation (1) is that it does not permit the explicit identification of business cycle effects since changes in the output gap are perfectly collinear with the country-period fixed effects. Some of the results reported below therefore replace the country-period fixed effects by country fixed effects while including medium-term differences in the output gap.

The baseline empirical specification can be augmented by a difference-in-differences setup in the spirit of Rajan & Zingales (1998) to analyse the role of public policies. This approach uses within-country labour share differences across industries to econometrically identify the effects of public policy reforms. More specifically, it assumes that the response of labour shares to a given policy reform is greater in industries that are more exposed to this policy reform. This introduces an exogenous source of cross-industry variation in the policy shock which helps identifying the policy effect on labour shares. The advantage of using cross-industry data to identify the effect of public policies is that it allows to control for unobserved country-specific trends, which could bias the results in a simple cross-country setup. The disadvantage is that it does not allow to explain cross-country heterogeneity in labour share developments, as cross-country differences in public policy and institutional developments are captured by the country-period fixed effects.

The empirical specification takes the following generic form:

$$\Delta LS_{ijt} = \beta_1 \left(Exp_j^k \times \Delta Pol_{it}^k \right) + \beta_2 \Delta P_{ijt}^{Inv} + \beta_3 \Delta T_{ijt} + \beta_4 X_{ijt} + \alpha_{it} + \alpha_{jt} + \varepsilon_{ijt} \quad (2)$$

where Exp_j^k denotes the industry exposure variable relevant for public policy k; ΔPol_{it}^k denotes the medium-term change in policy k; and the remaining notation is as in equation (1) above. The choice of exposure variables for each policy variable is reported in the Online complements, Table C2-I.

Data

The industry-level labour share data are based on the same data sources, imputation methods and industry coverage as in the second section. Industry-level relative investment price indices are constructed as the ratio of price deflators for gross fixed capital formation to value added price deflators by industry in the OECD Annual National Accounts database with additional data from the EU-KLEMS database and the archives of the OECD STAN database.[16]

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 embodied in exports. Forward linkages measure trading partners' offshoring of

14. Offshoring is measured by participation in global value chains, which is defined as the sum of the share of foreign value added in gross exports (backward participation) and the share of exports consisting of intermediate inputs used by trading partners for the production of their exports to third countries (forward participation).

15. Identification in this specification is obtained through the acceleration or deceleration of labour shares and the explanatory variables over and above country- and industry-specific trends.

16. The same reference year (2000) is used for all indices.

intermediate inputs and are defined as domestic value added used as intermediate inputs in trading partners' exports.[17] 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. The data are sourced from the OECD TiVA database, the OECD Annual Accounts database and EU-KLEMS database.

The industry-level routine intensity index is based on the occupation-level routine intensity index of Marcolin *et al*. (2016) and the industry-level skill indicators are constructed from the OECD Survey of Adult skills (PIAAC). The occupation-level routine intensity index provides a measure of the routine content of occupations, based on data from PIAAC. The routine intensity index measures the degree of independence and freedom in planning and organising the tasks to be performed on the job. The occupation-level index is translated into an industry-level index by constructing the weighted average of the occupation-based index by industry, with the occupational weights by industry obtained from the European Labour Force Survey (1995-2015).[18] PIAAC also allows constructing industry-level skill indicators in three areas: literacy, numeracy and problem-solving in technology-rich environments.[19]

Results

The Role of Technological Change, Globalisation and Skills

According to the baseline specification in Equation (1), declines in relative investment prices and increases in GVC participation reduce the labour share.[20] Both in a modified baseline specification that allows estimating the effect of the business cycle on labour shares (Table 2, Columns 1) and in the baseline specification (Column 2), the estimated semi-elasticity of the labour share to the relative investment price is 0.19, which suggests that on average across industries a decline in relative investment prices of 10 percent reduces the labour share by approximately 1.9 percentage point. The estimated semi-elasticity of the labour share to GVC participation is around -0.1, which suggests that an increase of backward and forward linkages of 10 percentage points of value added reduces the labour share by 1 percentage point.

The baseline results are consistent with macro-level evidence that the labour share is counter-cyclical. The coefficient on changes in the output gap – i.e. the difference in business cycle conditions in the initial year and the final year of each 5-year period – is negative and statistically significant at the 1% level, with the estimated semi-elasticity suggesting that a 1 percentage point increase in the output gap (observed GDP growth exceeding potential GDP growth by 1 percentage point) reduces the labour share by 0.5 percentage point. Replacing country-period fixed effects by changes in the output gap neither qualitatively nor quantitatively changes the results on relative investment prices, global value chain participation and the interactions with routine-task intensity (Schwellnus *et al*., 2018).

The baseline specification further suggests that a decline in relative investment prices reduces the labour share by more in industries with high initial routine intensity (Table 2, Column 3). To test for heterogeneous effects of changes in the relative investment price across high- and low-routine industries, the change in the relative investment price is interacted with an indicator variable that takes a value of 1 if initial routine intensity is higher than in the median industry. The estimated semi-elasticity is 0.11 for low-routine industries whereas it is around 0.22 for high-routine industries, with the difference being statistically significant.[21] By contrast, there is no such heterogeneity across low- and

17. Backward and forward linkages are normalised by industry-level value added to account for the overall trade openness of the industry. To avoid spurious correlations with the denominator of the labour share 5-year changes in global value chain participation are defined as follows: $\Delta GVCP_{ijt} = \Delta ln\left(\frac{FWP_{ijt} + BWP_{ijt}}{EXGR_{ijt}}\right) \times \frac{EXGR_{ijt_0}}{VA_{ijt_0}}$, *where* FWP_{ijt} *and* BWP_{ijt} *are forward and backward linkages in in country* i, *industry* j *and year* t*;* $EXGR_{ijt_0}$ *and* VA_{ijt_0} *are respectively gross exports and value added; and* t_0 *is the initial year of each five-period in the empirical analysis.*

18. For Australia, Japan, Korea and the United States, the simple average of the occupational weights across all European countries is used.

19. The share of high-skilled workers at the industry level is defined as the share of adults in each skill area achieving the two highest PIAAC competency levels for numeracy and literacy, and the highest competency level for problem solving. Data for problem solving exclude France, Italy and Spain since they did not participate in the assessment of problem solving in technology-rich environments. For these countries, the simple average across all countries is used.

20. All results reported below are robust to including industries' initial labour shares to control for unobserved industry characteristics (Schwellnus et al.*, 2018).*

21. The coefficient on the change in the relative investment price in Column 3 (0.11) denotes the semi-elasticity for low-routine industries. The sum of this coefficient and the estimated coefficient on the relative investment price interacted with the indicator of high routine intensity (0.22) denotes the semi-elasticity for high-routine industries.

Table 2
Baseline specification

	(1)	(2)	(3)	(4)
Dependent variable	Change in business labour share excluding primary, coke and housing industries			
Change in relative investment price	0.19*** (0.03)	0.18*** (0.03)	0.11*** (0.04)	0.18*** (0.03)
Change in GVC participation	-0.10** (0.04)	-0.11** (0.04)	-0.11** (0.04)	-0.09* (0.04)
High routine intensity×Change in relative investment price			0.11** (0.05)	
High routine intensity×Change in GVC participation				-0.04 (0.05)
Change in output gap	-0.47*** (0.11)			
High routine intensity	Yes	Yes	Yes	Yes
Industry×Period fixed effects	Yes	Yes	Yes	Yes
Country×Period fixed effects	No	Yes	Yes	Yes
Country fixed effects	Yes	No	No	No
Observations	959	968	968	968
Number of countries	20	20	20	20
Number of industries	19	19	19	19
Adjusted R^2	0.26	0.28	0.30	0.28

Notes: Selected OECD countries, 1995-2011. The dummy for high-routine intensity is set to 1 when the share of high routine employment in an industry is above the median across countries and industries. Changes denote 5-year differences. Weighted OLS, with the share of industry-level value added in total value as weights. Standard errors are clustered at the country level. *, **, *** denote statistical significance at the 10%, 5% and 1% levels.
Sources: OECD National Accounts Database, OECD TiVA Database, Marcolin *et al.* (2016), European Labour Force Survey, OECD Economic Outlook Database N° 99.

high-routine intensive industries for the estimated semi-elasticity of the labour share to increased GVC participation (Table 2, Column 4).[22]

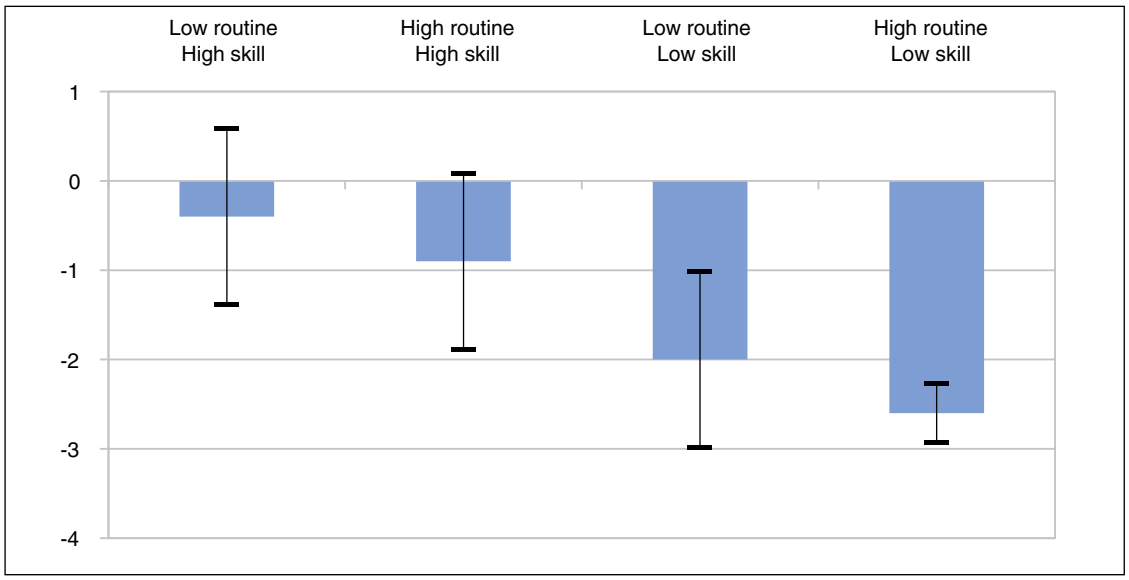
Even at a given level of routine task intensity, labour share declines in response to relative investment price declines are lower in countries and industries with a high share of high-skilled workers (Figure V). One explanation could be that high-skilled labour is more complementary to capital than low-skilled labour, implying lower capital-labour substitution in response to declines in relative investment prices (Krusell *et al.*, 2000).

Taking the estimated elasticities of the baseline model at face value, the observable variables included in the model can account for a significant part of the aggregate labour share decline in the covered OECD countries over the sample period (see Online complements, Figure C2-I). The observed average decline in the relative investment price across countries and industries over the sample period was around 19% and the average increase in GVC participation around 6 percentage points. Assuming that the elasticities estimated at the industry level are similar to those at the aggregate level, over the period 1995-2016 the baseline results suggest that investment price declines reduced the labour share by around 3.5 percentage points and increased GVC participation by around 0.6 percentage point.[23] Over the same period, business cycle effects reduced the labour share by around 0.2 percentage point as the average output gap increased by 0.4 percentage point. The contribution of changes in the relative investment price, global value chain participation and business cycle conditions to the observed change in the labour share was around 4 percentage points, about 90% of the observed decline in the labourshare.

Firm-level analysis can shed light on the micro-level mechanisms underlying the estimated industry-level effects. In particular, firm-level analysis can help understand the extent to which relative investment prices and global value chain participation affect industry-level labour shares primarily through changes in labour shares within firms or through changing firm composition. Since firms in the same industry face similar changes in relative investment prices,

22. This result is robust to restricting the sample to high-income countries.
23. Industry-level elasticities can plausibly be assumed to be similar to aggregate elasticities because within-industry labour share developments explain aggregate developments (Schwellnus et al.*, 2018) and the regression analysis weighs industries by shares in value added.*

Figure V
Change in the labour share in response to a 10% decrease in the relative investment price, percentage points



Notes: 90% confidence interval. Based on the industry-level results for numeracy skills reported in Schwellnus *et al.* (2018).
Sources: Schwellnus *et al.* (2018)

the industry-level response of labour shares should at least partly be driven by within-firm developments rather than reallocation effects. The results suggest that the effect of changes in relative investment prices partly operates through within-firm changes, with larger effects in highly productive firms and smaller effects in firms that are more dependent on external finance (Appendix). Highly productive firms may be better able to adopt new technologies embodied in capital goods if adoption requires complementary know how and firms with better access to external finance may be better able to raise investment in response to a decline in relative investment prices. By contrast, the firm-level analysis finds no evidence that global value chain expansion affects labour shares within firms, suggesting that the industry-level effect mainly reflects a shift in firm composition to firms with lower labour shares.

The Role of Public Policies and Institutions

The estimated effects of public policies and institutions are presented in Table 3. The main results can be summarised as follows[24]:

- Pro-competition product market reforms raise the labour share (Column 1, Row 1).[25] The impact of pro-competition product market reforms on the labour share is a priori ambiguous: while reductions in product market rents tend to raise the labour share, reductions in regulatory barriers to investment tend to induce capital-labour substitution. The empirical results suggest that the upward effect on the labour share of pro-competition product market reforms through a reduction in markups appears to outweigh the downward effect through capital-labour substitution. Assuming that the effect of pro-competition product market reforms is negligible in the least exposed industry, the average country-level effect can be approximated as the value-added weighted average in the remaining industries.[26] According to this approximation, lowering the indicator of product market regulation by one standard deviation of the cross-country distribution in 2013 (which corresponds to lowering it from the level in Germany to the level in the United Kingdom) would increase the labour share by around 0.8 percentage point;

24. Results are robust to the exclusion of the benchmark country from the sample, i.e. United Kingdom for regressions including the share of low-wage workers as the industry exposure variable and United States for the other regressions.

25. Since the indicator of product market regulation is available only for the years 1998, 2003, 2008, 2013, the specifications including this indicator are estimated over the following five-year periods: 1998-2003, 2003-2008 and 2008-2013.

26. The average country-level effects in this section are computed as follows: $\beta_1 \sum_j \omega_j \left(Exp_j^k - Exp_{min}^k \right) \Delta Pol_t^k$, *where subscripts* j *and* k *denote, respectively, industries and policies;* β_1 *is the estimated coefficient on* $\left(Exp_j^k \times \Delta Pol_{it}^k \right)$ *in equation (2);* ω_j *denotes the cross-country average value added share of industry* j *over the period 1995-2011;* Exp_{min}^k *denotes the exposure value of the least exposed industry;* ΔPol_t^k *denotes the change in policy* k.

- Reducing employment protection for regular workers raises the labour share (Column 2, Row 2). Employment protection legislation can affect the labour share by influencing the cost of labour relative to capital and by changing workers' bargaining position. Empirically, reducing employment protection appears to affect the labour share primarily through the reduction in the relative price of labour and the consequent substitution of labour for capital rather than the weakening of workers' bargaining position. This is consistent with results in Cette *et al*. (2016) suggesting that in OECD economies the strengthening of employment protection results in capital-labour substitution.[27] Using the previous approximation suggests that lowering the indicator of employment protection by one standard deviation of the cross-country distribution in 2011 (which corresponds to lowering it from the level in Austria to the level in Australia) would increase the labour share by around 4 percentage points;

- An increase in active labour market spending raises the labour share (Column 3, Row 3).[28] The results suggest that these policies can be effective in offsetting technology- or globalisation-related capital-labour substitution by preserving workers' labour market attachment and skills. Using the same approximation as above suggests that increasing active labour market spending by one standard deviation of the cross-country distribution in 2011 (which corresponds to raising it from the level in the United States to the level in Norway) would increase the labour share by around 4 percentage points;

- On average, across countries, increases in minimum wages reduce the labour share (Columns 4, Row 4). Increases in minimum wages may strengthen workers' bargaining position, but over the 5-6 year horizon considered in this paper the upward effect on the labour share through higher wages appears to be more than offset by capital-labour substitution. Using the aforementioned approximation suggests that increasing the minimum wage (relative to the median wage) by one standard deviation of the cross-country distribution in 2011 (which corresponds raising it from the level in Australia to the level in France) would lower the labour share by around 1 percentage point.

- By contrast, the coverage and centralisation of collective bargaining, the tax wedge (the share of income taxes and social security contributions in total labour costs) and corporate taxes do not appear to affect the labour share (see Online complements, Table C2-II). The insignificance of collective bargaining suggests that capital-labour substitution and changes in rent sharing in response to collective bargaining reforms broadly offset each other. The insignificance of the tax wedge may reflect the fact that in the medium run social security contributions are partly shifted to workers (Bozio *et al*., 2017), which would imply that reducing the tax wedge raises wages net of social security taxes with only little effect on the overall cost of labour.

The main concern with the difference-in-differences approach adopted above is that the effects of different policies are analysed one by one. For instance, reforms of employment protection and product market regulation are correlated and may both have larger effects in industries with large firm turnover, which makes it difficult to attribute the estimated effects to one policy or the other. To address this issue, the baseline specification is augmented with the interaction between the preferred exposure variable and another policy.[29] The results on the effects of product market regulation, employment protection, minimum wages and active labour market policies are broadly robust to augmenting the baseline model with the interaction between the preferred exposure variable and another policy (Table 3). For instance, the coefficient on the interaction of firm turnover with changes in product market regulation remains statistically significant and around 0.3 when interactions of firm turnover with changes in other policies are included in the regression model (Column 1). In the case of employment protection and active labour market spending, the estimated coefficient from the baseline model remains fairly stable but loses statistical significance in some specifications.

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27. Ciminelli et al.*(2018) find that loosening employment protection for regular workers reduces the labour share, but their results are not directly comparable with the ones in this paper. First, their indicator of employment protection is based on a "narrative approach" which classifies over 100 legislative and regulatory actions related to employment protection into one of the three following categories: non-reform years, liberalisation reform years and tightening reform years. Second, their estimations do not systematically control for changes in investment prices or trade openness. Third, their empirical analysis is conducted on a slightly broader country and period sample.*

28. The measure of active labour market spending in this paper includes spending on training and employment subsidies. Public spending on public employment services is found to have a statistically insignificant effect on the labour share.

29. Simultaneously including all interaction terms raises issues of multicollinearity.

Table 3
The effect of public policies on the labour share

	(1)	(2)	(3)	(4)
Controlling for:	Change in PMR×EXPO: Firm turnover	Change in EPL×EXPO: Worker reallocation	Change in ALMP×EXPO: Low-skilled workers	Change in minimum wage×EXPO: Low-wage workers
(1) Change in PMR×EXPO	**-0.31**** **(0.13)**	-0.25* (0.12)	1.01*	-0.08** (0.03)
(2) Change in EPL×EXPO	-0.20* (0.11)	**-0.24*** **(0.13)**	1.09* (0.61)	-0.08** (0.04)
(3) Change in ALMP×EXPO	-0.25* (0.12)	-0.22 (0.13)	**1.10*** **(0.61)**	-0.08** (0.03)
(4) Change in minimum wage×EXPO	-0.21 (0.15)	-0.18 (0.11)	1.03* (0.51)	**-0.08**** **(0.03)**
(5) Change in CB coverage×EXPO	-0.31** (0.13)	-0.24 (0.14)	0.71 (0.51)	-0.09*** (0.03)
(6) Change in CB decentralisation×EXPO	-0.30** (0.13)	-0.26 (0.15)	1.12 (0.65)	-0.08* (0.04)
(7) Change in tax wedge×EXPO	-0.31** (0.12)	-0.23* (0.12)	0.80 (0.49)	-0.08** (0.03)
(8) Change in corporate tax×EXPO	-0.32** (0.12)	-0.28* (0.15)	1.10* (0.53)	-0.06 (0.04)

Notes: Selected OECD countries, 1995-2011. PMR stands for product market regulation; EPL for employment protection legislation; ALMP for active labour market policies; CB for collective bargaining; and EXPO for exposure variable. The table reports the estimated coefficients on the interaction term in the column heading, with each row reporting the estimate when controlling for the interaction term in the row heading. Coefficients in bold font show the baseline estimates in Pak & Schwellnus (2019). Public policies and institutions denote 5-year differences. Standard errors are clustered at the country level. Weighted OLS, with the share of industry-level value added in total value as weights. *, **, *** denote statistical significance at the 10%, 5% and 1% levels.
Source: Pak & Schwellnus (2019).

* *
*

This paper suggests that technological change and greater global value chain participation have reduced labour shares, including by inducing the substitution of capital for labour and strengthening "winner-takes-most" dynamics. Raising skills is key to reconnect real median wages to productivity by limiting technology-induced capital-labour substitution while competition-friendly product market policies support the transmission of productivity gains to average wages by limiting the share of rents appropriated by capital owners. Although labour market policies that strengthen workers' bargaining position may raise wages in the short term, especially for lower-wage workers, they can have unintended side effects on the sharing of productivity gains in the medium term by inducing the substitution of capital for labour.

Looking forward, continued technological change is likely to put further downward pressure on labour shares and create new challenges for the broad sharing of productivity gains. Further efficiency gains in the production of investment goods may further reduce their relative prices and raise capital-labour substitution. Technological progress may also fundamentally change the substitutability of capital and labour. For instance, technological advances in artificial intelligence and robotics could make more human tasks – including cognitive tasks – replaceable by capital in the future (Baldwin, 2019).

These technological advances may further strengthen "winner-takes-most" dynamics, with wages decoupling further from productivity at the technological frontier and market shares being reallocated to a small number of "superstar" firms with low labour shares. This paper finds no evidence that the emergence of "superstar" firms indicates the rise of anti-competitive forces rather than technological dynamism. Nonetheless, competition policy will need to find the right balance between preventing anti-competitive practices by incumbent technological leaders and encouraging innovation by allowing entrants into the technological frontier to reap the rewards for their innovations. Irrespective of the source of emerging "winner-takes-most" dynamics, policies that raise human capital through education and training will play a crucial role to broaden the sharing of productivity gains by ensuring that workers can make the most of ongoing technological advances. □

Link to Online complements: https://www.insee.fr/fr/statistiques/fichier/4253015/510-511-512_Pak_Pionnier_Schwellnus_complements_FR.pdf

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APPENDIX

THE RESPONSE OF FIRM-LEVEL LABOUR SHARES TO RELATIVE INVESTMENT PRICE DECLINES

This box analyses the extent to which firm-level labour shares respond to changes in industry-level relative investment prices and whether the response differs across firms. Two potential sources of firm heterogeneity are investigated: initial productivity to proxy for know-how required for technology adoption and initial financial leverage to proxy for external finance dependence.

In order to assess whether within-firm labour shares respond to changes in industry-level relative investment prices, the following baseline equation is estimated:

$$\Delta LS_{cjit} = \beta_1 \Delta P_{cjt}^{Inv} + \beta_2 \Delta T_{cjt} + \gamma' X_{cji0} + \alpha_{cj} + \alpha_t + \varepsilon_{cji}$$

where subscripts *c, j, i, t* denote, respectively, countries, industries, firms and time; ΔLS_{cji} denotes the annualised long difference in the firm-level labour share, with long differences computed over the longest period a firm is observed and the sample is constrained to firms that are observed for at least eight years over the period 2001-2013; ΔP_{cjt}^{Inv} denotes the annualised long difference of the log relative investment price; ΔT_{cjt} is the annualised change in global value chain participation; X_{cji} is a set of firm-level controls that include: initial values of the firm's age, size (as measured by employment) and the initial labour share[(a)]; α_{cj} denotes country-industry fixed effects and α_t are period-fixed effects that cover all permutations of possible start and end years over the period 2001-2013.

In order to address the question of whether the response of firm-level labour shares to changes in industry-level relative investment prices depends on firms' initial productivity and initial financial leverage, the baseline equation is augmented as follows:

$$\Delta LS_{cjit} = \beta_1 \Delta P_{cjt}^{Inv} + \beta_2 \Delta T_{cjt} + \beta_3 \left(C_{cji0} \times \Delta P_{cjt}^{Inv} \right) + \gamma' X_{cji0} + \alpha_{cj} + \alpha_t + \varepsilon_{cji}$$

where all definitions are as in the baseline and C_{cji0} denotes initial productivity and/or initial financial leverage, and X_{cji0} includes C_{cji0}. Including separate country-industry and year-fixed effects instead of including combined country-industry-year fixed effects has the advantage that both the effect of industry-level relative investment prices for a low-productivity/low-leverage firm and the interaction with these firm characteristics can be identified. To check the robustness of the estimated coefficient on the interaction terms, the separate industry and year-fixed effects can be replaced by combined country-industry-year fixed effects.

The model is estimated using firm-level data from OECD-ORBIS and industry-level relative investment price indices for nine countries for which long differences in labour shares can be computed for a sufficient number of firms.[(b)] High-productivity firms are defined as the top 5% of leading firms within an industry with the highest labour productivity across the countries covered by the analysis. Access to external finance is proxied by a measure of leverage, the rationale being that highly leveraged firms may both be more dependent on external finance and find it more difficult and costly to raise external funds.[(c)] The results reported below are based on the ratio of current liabilities and long term debt to total assets.[(d)]

A decline in the relative investment price is estimated to reduce firm-level labour shares (Table A, Column 1). The average estimated firm-level semi-elasticity is around 0.15, remarkably similar to the estimated industry-level semi-elasticity of around 0.2. However, the firm- and industry-level results are not directly comparable as high-productivity firms – for which the estimated semi-elasticity of labour shares to relative investment prices is higher (Column 2) – are over-represented in OECD-ORBIS. Moreover, the firm-level analysis is based on 8-year or longer differences as compared to 5- or 6-year differences in the industry-level analysis and is based on a more limited country and year sample. Consequently, the positive and statistically significant semi-elasticity in the firm-level analysis implies that declines in the relative investment price affect aggregate labour shares at least partly through within-firm effects, but the similarity in estimated semi-elasticities across the firm- and industry-level analyses cannot be interpreted as ruling out composition effects. By contrast, the insignificance of the estimated coefficient on global value chain participation suggests that the effects of increased global value chain participation mainly operate through the reallocation of production from high-labour share to low-labour share firms, which is consistent with the reasoning in third section and the theoretical model described in Schwellnus *et al*. (2018).

High leverage (i.e. high external finance dependence) dampens the transmission of declines in the relative investment price on the labour share (Table A, Columns 3-5). In firms that are more financially leveraged a decline in the relative investment price reduces the labour share significantly less than in less leveraged firms. The semi-elasticity of labour shares to the relative investment price for a firm with a leverage ratio of 100% is about one third lower than for a firm with zero leverage. This result is robust to including the dummy for high-productivity firm and leverage simultaneously, suggesting that it does not simply capture the fact that high-productivity firms may be less financially leveraged.

(a) Given that the above specification of the firm-level regressions considers only one long difference per firm, firm fixed effects cannot be included. Including the initial values of the dependent variable allows controlling for unobserved firm characteristics in the absence of firm fixed effects (Angrist & Pischke, 2009).

(b)The analysis is constrained to the same industries as the industry-level analysis. The included countries are Belgium, Finland, France, Germany, Italy, Korea, Spain, Sweden and United Kingdom. In order to ensure that results are not driven by firms with extreme values in long differences in labour shares, firms with long differences outside the [-40,+40] percentage point interval are removed from the analysis. The analysis is further constrained to country-industry cells with more than 30 firms in order to ensure that the industry-level variables are identified by a sufficient number of firms. The results are robust to alternative sample restrictions.

(c) Ferrando & Mulier (2015) find that firms with lower leverage ratios are less likely to be financially constrained. Giroud & Mueller (2017) provide evidence for U.S. firms on a positive relationship between pre-crisis leverage ratio and financial constraints during the Great Recession. Love et al. *(2007) show that during the Asian Financial Crisis, a firm's vulnerability to financial market imperfections increased the higher its short-term debt to asset ratio. Current liabilities include loans, liabilities to credit Institutions, trade payables and any other liabilities due within one year, as well as accruals and deferred income.*

(d) The results are robust to using a dummy for low vs high financial leverage.

Table A
Financial constraints reduce the elasticity of the labour share to the relative investment price

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Change in firm-level labour share				
Change in relative investment price	0.14*** (0.05)	0.13** (0.06)	0.18*** (0.05)	0.17*** (0.06)	
Change in GVC participation	-0.02 (0.05)	-0.01 (0.05)	-0.02 (0.05)	-0.01 (0.05)	
Leader×Change in relative investment price		0.19*** (0.07)		0.19*** (0.07)	0.18** (0.07)
Leverage×Change in relative investment price			-0.06** (0.02)	-0.05** (0.03)	-0.06** (0.02)
Initial leverage and/or initial leader	No	Yes	Yes	Yes	Yes
Firm-level controls	Yes	Yes	Yes	Yes	Yes
Country×Industry fixed effects	Yes	Yes	Yes	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	No
Country×Industry×Year fixed effects	No	No	No	No	Yes
Observations	416,888	416,888	416,888	416,888	416,888
Adjusted R2	0.21	0.22	0.21	0.22	0.22

Note: Selected OECD countries, 2001-13. Firm-level controls include the initial firm-level labour share, age and employment. The included countries are Belgium, Germany, Spain, Finland, France, Italy, Korea, Sweden and United Kingdom. A leader is defined as belonging to the top 5% firms within an industry with the highest labour productivity across the countries covered by the analysis. Firm-level financial leverage is proxied by the ratio of current liabilities and long term debt to total assets. Standard errors are clustered at the country-industry level. *, **, *** denote statistical significance at the 10%, 5% and 1% levels.
Sources: OECD calculations based on OECD-ORBIS.

Overall, the firm-level results suggest that industry-level investment prices affect the labour share partly through changes within firms rather than composition effects, with high-productivity firms and firms with low financial leverage typically responding more strongly. By contrast, there is no evidence that changes in global value chain participation affect firm-level labour shares, suggesting that they operate mainly through composition effects.