The Role of Financial Constraints on Labour Share Developments: macro- and micro-level evidence

By Elena Crivellaro* and Aikaterini Karadimitropoulou**

* Organization of Economic Co-operation and Development

** Bank of Greece and University of East Anglia

Abstract

Technological advancement has been affecting labour shares through a steep decline in the relative price of investment goods (Karabarbounis and Neiman, 2014; IMF, 2017). This has lowered the cost of capital allowing firms to replace labour with capital. Financing obstacles could however obstruct investment in both labour and capital. This paper aims at assessing the still under-explored channel through which financial constraints hinder the substitution of capital for labour in response to a decline in relative investment prices. In particular, we perform a three-tier (i.e., country-, industry-, and firm-level) analysis on the empirical relationship between trends in labour shares and relative investment prices interacted with different financial constraints' measures, using data for up to 29 OECD countries. Our results provide a rich body of empirical evidence. Firstly, the macro-facts reveal that there has been a global decline in the labour share that coincides with declines in the relative price of investment goods. However, this decline which has been heterogeneous across countries and financial constraints seems to play an important role for the heterogeneity of the technology channel. Secondly, the sectoral analysis suggests that industries highly dependent on external finance will face a lower decline in the labour share following a drop in the relative investment price than industries that are less dependent on external finance. This is because industries that are more dependent on external finance are likely to be more constrained in accessing funds to finance investment, e.g. because of asymmetric information between borrowers and lenders. Thirdly, the firm-level analysis suggests that industry-level investment prices affect the labour share partly through changes within firms rather than composition effects, with firms with low financial leverage and high-productivity firms typically responding more strongly to changes in industry-level investment prices.

Keywords: Labour Income Share, Financial Constraints, External Financial Dependence, Productivity, Wage Inequality

JEL Classification: D3, E24, E25, E44, F16, J20

Acknowledgement: *This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number – 746100 – GaSLS.*

Authors' correspondence: Elena.Crivellaro@oecd.org, OECD, Economics Department; AKaradimitropoulou@bankofgreece.gr, Bank of Greece, Economic Analysis and Research Department.

1. Introduction and literature review

The labour share shows how much of productivity gains accrue to workers. Over the last three decades, the labour's share of income has been falling, a fact that is at odds with Kaldor's (1961) most influential stylized fact for macroeconomic modelling: the long run stability of aggregate factor shares.

Several studies have documented a global decline in the aggregated labour share since the 1980s (Bentolia and Saint-Paul, 2003; Rodriguez and Jayadev, 2013; OECD, 2012; Karabarbounis and Neiman, 2014; Elsby et. al., 2013, IMF, 2017). While the observed fall has been associated with many potential factors, there is quite a broad consensus that the main structural drivers of labour share developments are technological change and globalisation of trade and capital.[1] While Elsby et. al., (2013) present globalization, and more specifically offshoring of labour-intensive activities, as the main culprit, others emphasize the importance of capital-augmenting technical change or technology-driven declines in equipment prices on the evolution of the labour share (see, for example Bassanini and Manfredi, 2013; Karabarbounis and Neiman, 2013; IMF, 2017; OECD, 2012, forthcoming). Technological advancement has been affecting labour shares through a steep decline in the relative price of investment goods. This has lowered the cost of capital allowing firms to replace labour with capital.

While the literature has emphasized on the global decline of the labour share, there exist large heterogeneities across countries and industries. Financing obstacles could obstruct investment in both labour and capital and therefore financial constraints could account for, at least some of, the heterogeneity of the technology channel. Better access to finance may allow firms to hire more labour, but, at the same time, it can encourage firms to invest in more capital. Therefore, if firms have a production technology with capital and labour being substitutable, an increase in capital investment may reduce a firms' labour demand (Dao and Liu, 2017). However, firms with financial constraints may face difficulties expanding business investment due to a lack of resources. Financial constraints are found to play a key role for a firm's investment decisions (Carpenter and Guariglia (2008) and Guariglia (2008)), and this could therefore have important consequences for the dynamics of the labour share.

We explore the effects of financial constraints on labour share developments. The motivation is twofold. First, behind this average global decline in the aggregated labour share lies considerable cross-country and cross-industry heterogeneity. This heterogeneity appears to be related to cross-country and cross-industry differences in the respective level of financial constraints. Second, finance has been placed at the heart of the theories of persistent inequality (Demirgüç-Kunta and Levine, 2009). There exists a bulk of empirical evidence establishing that improved financial contracts, markets and intermediaries lead to increased economic opportunities and decreased inequality. Despite that, the role of finance in exploring labour share changes has been left unexplored. Given that the literature has

[1]Another strand of literature points towards the importance of public policies such as the privatization of network industries and worker's bargaining, which have been found to play a role for labour share developments (De Serres and Schwellnus, 2018; Azmat et al., 2012; OECD, 2012), while product market regulation or employment protection don't play an important role (IMF, 2017). Finally, recent literature links labour share developments to changes in product market structure. In particular, evidence suggests that rising concentration and higher mark-ups reduce the labour share through: technology-, globalisation- or policy-induced "winner-take-most" dynamics (Autor et al., 2017; De Loecker and Eeckhout, 2017; Barkai, 2016).

focused on the prominent role of the steep decline in the relative price of investment goods for the observed fall in the labour share, one needs to account for the non-linearity in investment opportunities generated by financial obstacles.

While numerous studies have analysed the drivers of the decline in labour's share of income, to our knowledge, only one has previously linked it to the increase in external financial dependence as proxy for financial constraints (OECD, forthcoming). This paper aims at assessing the still under-explored channel through which financial constraints hinder the substitution of capital for labour in response to a decline in relative investment prices. In particular, measuring the real cost of capital requires taking into account not only the price of investment goods but also the financial frictions firms are facing, as the latter may reduce the ability of firms to take advantage of declines in investment prices in order to substitute capital for labour.

This paper attempts to fill this gap in the literature, drawing from both aggregated and disaggregated industry- and firm-level data, for a considerable number of OECD countries, over the last two decades. In particular, we follow the standard approach used in the literature (Karabarbounis and Neiman, 2014; IMF, 2017; and OECD, forthcoming) to estimate the effect of capital-augmenting technical change and use the change in the relative price of investment goods (relative to consumption) to proxy firms' incentives for capital-labour substitution. We use a set of leverage and external financial dependence measures to proxy for financial constraints to examine whether capital-labour substitution can be stronger for countries, sectors and firms that are less exposed to financial constraints.

This allows us to contribute to the literature on labour share developments in several ways. Firstly, this paper systematically analyses in a unified empirical setup the role of financial frictions on the implications of technology-induced capital-labour substitution. To our knowledge no study has previously assessed this channel from both a macro- and micro-perspective. The use of disaggregated data at the industry- and firm-level can provide meaningful mechanisms underlying aggregate labour share developments. In particular, firm-level analysis can shed light on the micro-level dynamics underpinning the estimated aggregated and industry-level effects. Secondly, we document that decline in labour share over time is larger the less financially constrained a country is. Thirdly, we provide new evidence that financial constraints systematically hinder the effect of relative investment prices on the drivers of labour share developments. Fourthly, this paper adds to the debate on labour share developments by extending the analysis to a large number of OECD countries.

Our results provide a rich body of empirical evidence on the role of financial constraints for the development of the labour share at both the macro- and micro-level. Firstly, our results suggest that labour share has remained overall constant across highly financially constrained countries and the global decline in the labour share is driven by countries that have no or low financial constraints. Secondly, the sectoral analysis suggests that industries highly dependent on external finance will face a lower decline in the labour share following a drop in the relative investment price than industries that are less dependent on external finance. This is because industries that are more dependent on external finance are likely to be more constrained in accessing funds to finance investment, e.g. because of asymmetric information between borrowers and lenders. Thirdly, the firm-level analysis demonstrates that since firms in the same industry face similar changes in relative investment prices, the industry-level response of labour shares should at least partly be driven by within-firm

developments rather than reallocation effects. 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. These results are consistent with the idea that technical change and innovations can often be obstructed or abandoned due to financing obstacles (Planes et al. 2001).

Our paper is related to two major strands of literatures. Firstly, it relates to the large number of studies that have examined the role of technological changes on labour share developments. Capital-augmenting technological change or technology-driven declines in equipment prices may increase capital intensity and reduce the labour share. 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 (Lawrence, 2015). By contrast, Karabarbounis and 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. This mechanism has been extended by a number of studies to account for the implied substitution of capital for routine labour tasks. Krusell et al. (2000) distinguish between low-skilled and high-skilled labour and find that in the United States the elasticity of substitution between capital and low-skilled labour is around 1.7, well above the estimated elasticity between capital and high-skilled labour of 0.7. This is consistent with cross-country evidence, in both IMF (2017) and OECD (forthcoming), of particularly negative effects of declines in relative investment prices on labour shares in countries with high initial shares of routine jobs. Moreover, using cross-country, cross-industry data, IMF (2017) find that the elasticity of substitution between capital and labour increases with industries' routine task exposure and is above unity in about half of the industries covered by their analysis. In a cross-country-industry panel covering high-income countries, Bassanini and Manfredi (2012) find that capital-augmenting technical change reduces the labour share. By contrast, Grossman et al. (2017) develop a theoretical model in which a *decline* in the rate of technical change reduces the labour share irrespective of whether it is labour- or capital-augmenting.

Secondly, the paper is related to the strand of literature examining the effect of financial constraints on employment. Beck et al. (2005) suggest that small and medium-size enterprises are more prone to be affected by financial, institutional, and legal obstacles, with financial constraints being the major hurdle for firm growth, especially in countries with underdeveloped financial system. Ayyagari et al. (2016) show evidence of a positive relationship between credit supply and employment growth, particularly among small firms in developing countries. Doa and Liu (2017) develop a simple model showing how the link between financial constraints and firm's job creation is affected by the need of its working capital financing. Moreover, a number of studies have shown that under imperfect capital markets, the firm's fixed investment and employment choices depend on the firm's financial position (for surveys see, Hubbard, 1998 and Bond and Van Reenen, 2006). Spaliara (2009) suggests that a firm's investment and employment decision has to be jointly analysed as long as firms use both inputs of production and there is some substitutability between them. Additionally, using firm-level data from the UK, it provides evidence that more financially constrained firms face a lower capital-to-labour ratio.

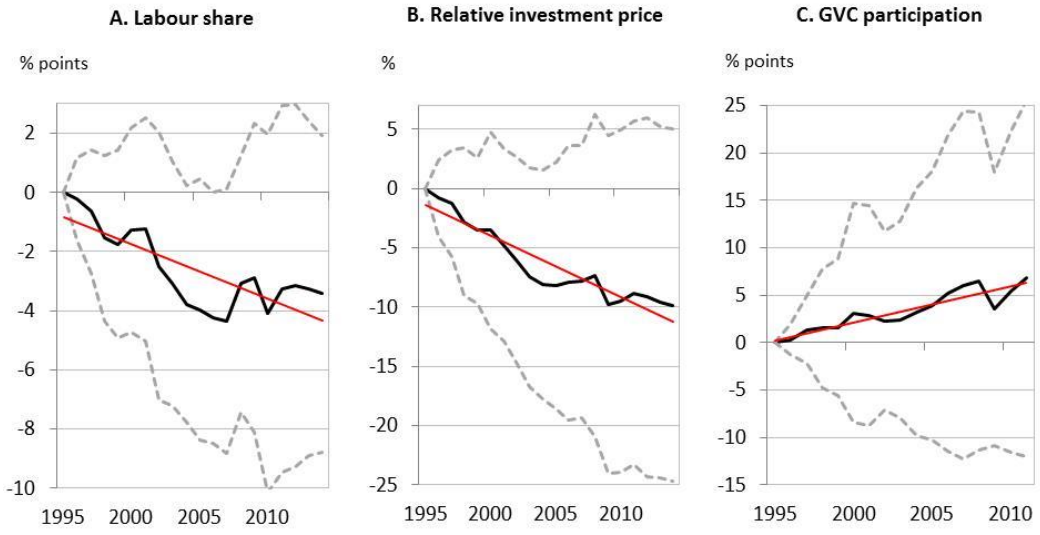
The first strand of the literature creates the basis of our first testable hypothesis: declines in the relative price of investment lead to falls in the labour share. Whereas, the second strand of the literature creates the basis of our second testable hypothesis: financially constrained firms do not have the same ability to invest in intangible capital compared to the more resilient firms and they therefore face lower capital intensity. As long as the elasticity of substitution is above unity, this would imply a stronger decline in the labour share of less vulnerable firms that are able to take advantage of the declines in the relative investment prices and to substitute capital for labour.

The rest of the paper is organized as follows. The next section presents the empirical methodology. Section 3 provides a description of the data. Section 4 presents and discusses the empirical results. Finally, Section 5 concludes.

2. Stylised Facts

This section presents some stylized facts about the evolution of labour share over the past two decades – 1995 through 2014 – in 29 countries of our sample for which data are available. The main facts that emerge are the following: first, the labour share has been on a declining trend over the examined period; second, there exist significant heterogeneities in the labour share developments across countries; third, the decline in the labour share has been typically larger in countries with lower financial constraints.

Figure 1: Trends in Labour share, relative investment price and global value chain



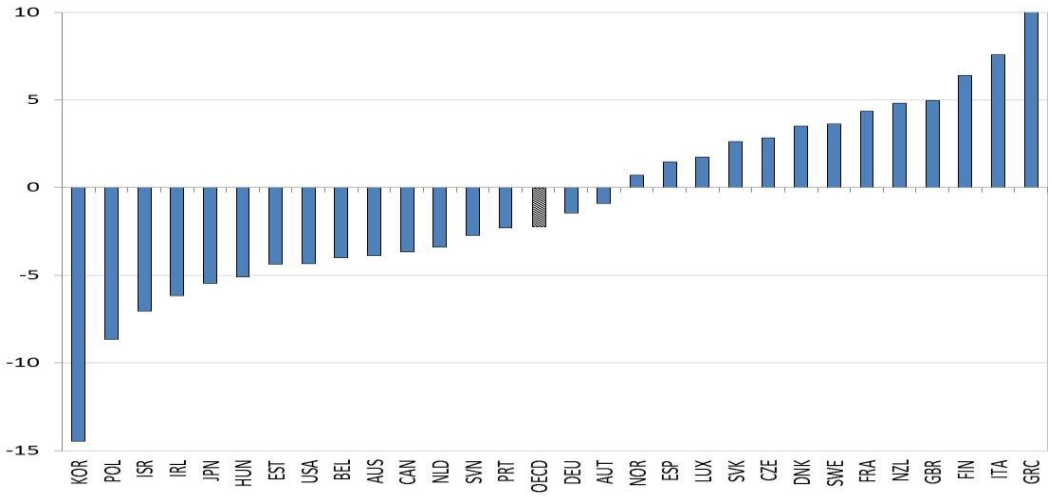
Note: GDP weighted average of 29 OECD countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United States, United Kingdom. The solid black lines indicate the cumulated changes in the weighted average, the red solid lines indicate the corresponding trend and the dotted grey lines indicate the interval around the weighted average (minus/plus the standard deviation).
Source: OECD National Accounts Database and OECD TiVA Database.

Figure 1 shows the trend in the aggregate labour share, relative investment price and global value chain for the countries included in our analysis. It emerges that aggregate labour share have declined by around 3 percentage points over the 1995-2014 period, which coincided with falls in relative investment prices and the expansion of global value chains. While the coincidence of these trends does not imply causation, consistently with previous

literature this evidence shows that, relative investment price declines may have triggered capital-labour substitution (Karabarbounis and Neiman, 2014; IMF, 2017; OECD, forthcoming), and increased global value chain participation may have led to the offshoring of the most labour-intensive tasks (Elsby et al., 2013; IMF, 2017).

However, this global decline conceals significant heterogeneity across countries (Figure 2). Actually, 13 out of the 29 countries display increased labour shares in the 1995-2014 period. Those differences could, to some extent, be directly explained by large cross-country differences in relative investment price developments and changes in global value chain participation. Cross-country heterogeneity in labour share developments is reflected in the large confidence band around the aggregate labour share decline in the covered OECD countries. Similarly, although most countries covered by the analysis have experienced declining relative investment prices and all countries have experienced increasing global value chain participation, relative investment price developments and changes in global value chain participation have not been uniform across countries.

Figure 2: Cumulative changes in labour share by country - 1995-2014, % points (excluding the primary, coke and refined petroleum, housing and non-market industries)

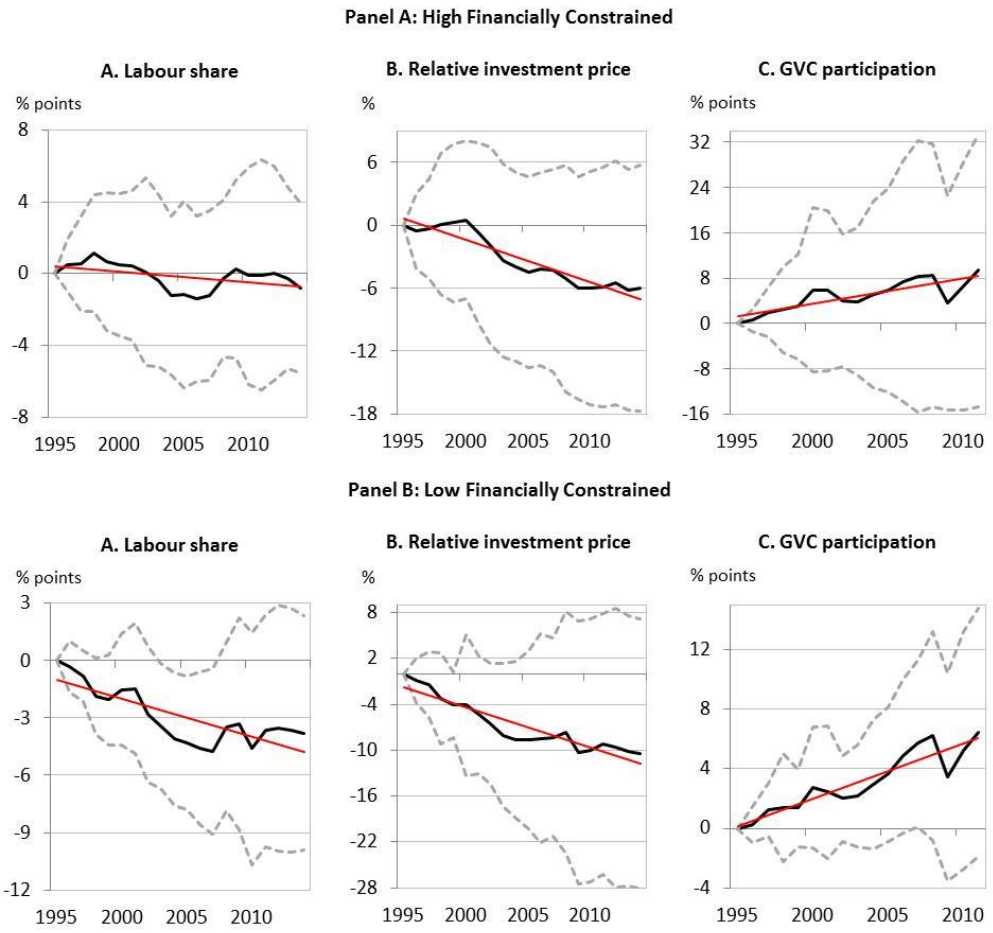


Note: Three-year averages starting and ending in indicated years. The OECD average is the GDP weighted average of changes in labour shares over the 29 countries included in the figure. Deviations from period covered: 1995-2014 for Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom; 1995-2013 for Australia and Korea; 1995-2012 for New Zealand; 1997-2012 for Canada; 1998-2014 for Ireland and United States.
Source: OECD National Accounts Database and OECD TiVA Database.

To examine whether the decline in the labour share is related to financing obstacles, we report the average trend in labour share, relative investment price and global value chain for countries with high financial constraints and for countries with low financial constraints. We make use of firm-level data (see Section 4 for further details) and define a country to be highly financially constrained if the dependence on external finance of the median firm in a given country and for the 1995-2014 period is above the median of the median firm across countries. Figure 3, Panel A, refers to high financially constrained, while panel B refers to countries for which the median firm has a level of external financial dependence below the sample median. The figure therefore reveals that the overall labour share decline is driven by countries with lower financial constraints. This figure also displays a more pronounced

(i) fall in the relative investment price of low financially constrained countries, and (ii) increase in the global value chains prices of highly financially constrained countries. Part of the observed differences between those two groups of countries might therefore directly be coming from the different trends in relative investment prices and global value chains prices. Despite that, it also clearly provides support for further examination of the potential role of financial obstacles for the development of labour share.

Figure 3: Trends in Labour share, relative investment price and global value chain for High and Low Financially Constrained countries



Note: High Financially Constrained countries are: Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Greece, Hungary, Luxembourg, Norway, Poland, Portugal, Slovak Republic, Slovenia, and Spain. Low Financially Constrained countries are: Australia, Finland, France, Germany, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Sweden, United Kingdom and the United States. The solid black lines indicate the cumulated changes in the weighted average, the red solid lines indicate the corresponding trend and the dotted grey lines indicate the interval around the weighted average (minus/plus the standard deviation).
Source: OECD National Accounts Database and OECD TiVA Database.

3. Empirical framework

We examine the role played by financial frictions for the firms' ability to take advantage of declines in investment prices in order to substitute capital for labour. We therefore address the following question: Do financial constraints reduce the impact of declines in relative investment prices on the labour share? To address this question, we perform a three-tier (i.e, country-, industry-, and firm-level) analysis on the empirical relationship between

trends in labour shares and relative investment prices interacted with different financial constraints' measures.

The robustness of the results presented in the next section suggests the existence of a systematic relationship between financial constraints and labour share developments, implying that technical change and innovations can often be obstructed or abandoned due to financing obstacles we estimate the following analysis.

3.1. Macro-level analysis:

The analysis begins with a macro-level analysis of labour share developments and of the specific role that country-level financial constraints play in hindering the effect of relative investment price declines on labour share changes. We follow the standard approach in the literature (Karabarbounis and Neiman (2014); Acemoglu and Restrepo (2016) and IMF (2017)) used to assess the contributions of the key drivers of labour shares. To estimate the effect of technology, we follow Karabarbounis and Neiman (2014) and OECD (forthcoming), by using the change in the relative price of investment goods (relative to consumption) to proxy firms' incentives for capital-labour substitution. Furthermore, an innovation of the paper is the recognition that, substitution can be stronger for countries where firms are less exposed to financial constraints. Financial constraints can indeed reduce the ability of firms to take advantage of declines in relative investment prices in order to substitute capital for labour.

Motivated by the above considerations, we estimate the following empirical specifications:

$$\Delta LS_{ct} = \beta_1 Fin_{c0} + \beta_2 Fin_{c0} * \Delta IP_{ct}^{inv} + \beta_3 \Delta IP_{ct}^{inv} + \beta_4 \Delta T_{ct} + \beta_5 \Delta OG_{ct} + \alpha_t + \alpha_c + \varepsilon_{ct} \qquad (1)$$

where subscripts c and t denote countries and periods; ΔLS_{ct} is medium-term change in the aggregate labour share, excluding primary, housing and public sectors;[2] $\mathrm{Fin_{c0}}$ is a proxy for financial constraints measured by financial leverage; $\mathrm{\Delta IP_{ct}^{inv}}$, $\mathrm{\Delta T_{ct}}$, $\mathrm{\Delta OG_{ct}}$ measure, respectively, the change in log relative investment price, the change in global value chain participation, the change in the output gap. All regressions also include period-, α_t, and country-specific, α_c , fixed effects. To maximise the use of the data, we rely on overlapping 8-year differences (e.g. 1995-2003, 1996-2004, etc) to maximise the number of observations and we cluster the standard errors at the county-level to ensure robust estimators.[3]

As it is difficult to find macro-level indicators to proxy for financial constraints, we follow the literature and use firm-level data from Worldscope to construct financial constraints measures which we then aggregate at the country-level. The first obvious candidate is the level of external financial dependence, the variable originally used by Rajan and Zingales (1998). For robustness, we run the regression with an additional proxy of financial constraints, the level of debt to total assets (see next section for details).

This macro-level estimation strategy exploits cross-country and time variation for different measures of financial constraints. Although this strategy cannot establish a conclusive causal relationship, the robustness of the results presented in the next section suggest the existence of a systematic relationship between financial constraints, changes in

[2] The primary, coke and refined petroleum manufacturing, housing and non-market industries are excluded from the analysis since labour shares in these industries are driven by changes in commodity and asset prices or by imputation choices (Schwellnus, et al. 2017).

[3] For robustness, we also run 7- and 9-year overlapping differences, and results remain unchanged.

relative investment prices and labour share developments. We also control for financial development at the macro-level to ensure that the effects of financial constraints are not driven by changes in the level of financial development. For robustness, we also run the regressions including the initial level of financial development rather than the change and results remained quantitatively the same.

3.2. *Industry-level analysis:*

Additional evidence on the role of financial constraints on labour share developments comes from industry-level data. This subsection complements the analysis of aggregate labour shares by analysing their changes across countries and industries. While the literature has established that the global labour share of income has experienced a declining trend over the past 20 years, this aggregate picture conceals considerable heterogeneities across industries, as well as cross-country differences within industries (OECD, forthcoming). There are some comparative advantages associated with this disaggregate analysis. Firstly, it allows for a more credible identification of the structural drivers of labour share developments. Secondly, using an appropriate fixed-effect structure, one can control for country- and industry-specific trends that are uncorrelated with the structural drivers of labour share development. Finally, this layer of analysis will provide evidence on whether sectors that are more dependent on external finance have experienced smaller declines in labour share following a fall in the relative investment price than sectors that are less dependent on external finance. We therefore estimate the following empirical specification:

$$\Delta LS_{cjt} = \beta_1 FC_{cj0} + \beta_2\left(FC_{cj0} \times \Delta P_{cjt}^{Inv}\right) + \beta_3 \Delta P_{cjt}^{Inv} + \beta_4 \Delta T_{cjt} + \alpha_{ct} + \alpha_{jt} + \varepsilon_{cjt} \quad (2)$$

where subscripts i, j and t denote, respectively, countries, industries and periods; as for the macro-level analysis, ΔLS_{ijt} denotes the medium-term (8-year) changes in the labour share; FC_{ijt} denotes initial financial constraints at industry-level; ΔP_{ijt}^{Inv} denotes the medium-term change in the relative investment price; ΔT_{ijt} is the medium-term change in participation in global value chains; α_{it} and α_{jt} denote country-by-period and sector-by-period fixed effects. The inclusion of these two types of fixed-effects provides two important advantages compared to the cross-country analysis: (i) country-by-period fixed effects allow controlling for any variation that is common to all sectors of a country's economy, as well as macroeconomic shocks; (ii) sector-by-period effects allow controlling for industry-specific factors.[4] However, a drawback of this fixed-effect structure is that it does not allow identifying business cycle effects since changes in the output gap are perfectly collinear with country-by-period fixed effects. Some of the results reported in the next section replace country-by-period and industry-by-period fixed effects with country-industry and period-fixed effects to include long differences in the output gap as control.

In order to test the hypothesis that financial constraints limit the impact of changes in the relative price of investment on the labour share, we use industry-specific external financial dependence measure as defined by Rajan and Zingales (1998) and constructed by De Serres et al. (2006), combined with national accounts data.

Equation (2) is estimated over the period 1995-2014. To maximise the number of observations, we follow the strategy used in the macro-level analysis focusing on

[4] The inclusion of country-period and industry-period fixed effects is likely to address endogeneity concerns related to omitted variable bias.

overlapping 8-year differences. We cluster the standard errors at country-industry pair level to ensure robust estimators (Andrews et al., 2016 and Bloom et al., 2015).

3.3. *Firm-level analysis:*

The third and final tier of this analysis makes use of firm-level data to shed light on the micro-level mechanisms underlying the estimated aggregate and industry-level effects. This angle enables us to understand the extent to which key drivers of labour share developments (i.e. relative investment prices and global value chain participation) affect (aggregate and) industry-level labour shares primarily through changes in labour shares within firms or trough changing firm composition. Given that it is plausible to assume that firms in the same industry face similar changes in relative investment prices, the industry-level response of labour shares should at least partly be driven by within-firm developments rather than reallocation effects. However, even within narrowly defined industries, there may be large differences in the extent to which firms are able to take advantage of relative investment price declines as firms with better access to external finance respond more strongly to changes in industry-level investment prices.

In order to assess whether within-firm labour shares respond to changes in industry-level relative investment prices, and whether the response of labour share to changes in industry-level relative investment prices depends on initial financial constraints, we estimate the following equation:

$$\Delta LS_{cjit} = \beta_1 FC_{cjt} + \beta_2\left(FC_{cji0} \times \Delta log P_{cjt}^{Inv}\right) + \beta_3 \Delta P_{ijt}^{Inv} + \beta_4 \Delta T_{ijt} + \gamma' X_{cji0} + \alpha_{cj} + \alpha_t + \varepsilon_{cjit} \quad (3)$$

where subscripts *c, j, i, t* denote, respectively, countries, industries, firms and time; ΔLS_{cjit} 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 8 years over the period 2001-13; ΔP_{cjt}^{Inv} denotes the annualised long difference of the log relative investment price; ΔT_{ijt} 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; α_{cj} denotes country-sector fixed effects and α_t are period-fixed effects that cover all permutations of possible start and end years over the period 2001-13.[5] We use leverage as proxy for access to external finance, 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.[6] The inclusion of country-sector fixed effects is particularly important as it implies that we compare the change in average labour share between more and less credit constrained firms within narrowly defined country-sector cells. This control is crucial because it is well established, for instance, that some sectors rely more heavily on external finance than others, and tend to have higher leverage ratios as a result (Rajan and Zingales, 1998).

[5] The above specification of the firm-level regressions implies that only one long difference per firm is considered, therefore, 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 and Pischke, 2009).

[6] Ferrando and Mulier (2015) find that firms with lower leverage ratios are less likely to be financially constrained. Giroud and 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.

Throughout the three layers of the analysis presented above, in order to test the hypothesis that financial constraints limit the impact of changes in the relative price of investment on the labour share, we focus on the coefficient, β_2, of the interaction term between the measure of financial constraint and the change in the relative investment price. If $\beta_2 < 0$, then it implies that financial constraints are hindering the substitution of capital for labour in response to a decline in relative investment prices.[7]

We focus on medium-term changes in labour shares and relative investment prices, while using the financial constraints measure in the initial year so as to minimise possible endogeneity with changes in the labour share, as well as to ensure orthogonality with changes in the relative investment price. This medium-term changes approach allows: (1) capturing slow adjustments of labour shares to structural changes triggered by technological change and global integration; (2) reducing the likelihood of biases arising from cyclical or temporary components; (3) for a more realistic setup for the implied assumption that the elasticity of substitution between labour and capital is above 1.[8]

4. Data

We make use of a variety of data sources to obtain country-level macroeconomic indicators and industry-level data and firm-level panel data. We define below our key variables and in the first sub-section we present the sources for the macro- and industry-level analysis, while in the second sub-section we describe the firm-level dataset.

4.1. Country- and Industry-level data

The macro-level empirical analysis is conducted on 19 OECD countries over the time period 1995-2014.[9] The industry-level empirical analysis is conducted on 26 OECD countries over the period 1995-2014.[10]

The labour share is defined as the ratio of total nominal labour compensation over nominal gross value added. Labour compensation is the sum of compensation of salaried workers and the imputed compensation of self-employed workers. The imputation is based on the average hourly or per-capita compensation of salaried workers at industry-level. Nominal value added is expressed at factor costs, that is, net of taxes less subsidies on production. Using value added at factor costs in the denominator ensures that labour and capital shares of value added sum to one.[11] The industry-level labour shares are constructed from the OECD Annual National Accounts Database complemented with additional data from the archives of the OECD STAN database and the EU-KLEMS database. For the macro-level analysis, the country-level labour shares data are obtained by aggregating industry-level data.

[7] The next section will present details of the different financial constraints measures used.

[8] For more work using this strategy, see for instance: Harrison (2005); Rodrigues and Jayadev (2013); Elsby, et al. (2013); Karabarbounis and Neiman (2014); Acemoglu and Restrepo (2016); and IMF (2017); OECD (forthcoming).

[9] The countries included in the macro-level econometric analysis are: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovak Republic and Sweden, United Kingdom and the United States.

[10] The countries included in the industry-level econometric analysis are: Australia, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, Latvia, Netherlands, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, and United States.

[11] The primary, coke and refined petroleum manufacturing, housing and non-market industries are excluded from the analysis since labour shares in these industries are driven by changes in commodity and asset prices or by imputation choices (Schwellnus, et al. 2017).

Country- and industry-level relative investment price indices are constructed from the OECD Annual National Accounts database with additional data from the EU-KLEMS database and the archives of the OECD STAN database. Price deflators for gross fixed capital formation divided by value added price deflators. The same reference year (2000) is used for all indices.[12]

Country-level participation in global value chains is proxied by the sum of forward and backward linkages, in percent of value added. In line with previous studies and with OECD (forthcoming), 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 intermediate inputs and are defined as domestic value added used as intermediate inputs in trading partners' exports.[13] The data are sourced from the OECD TiVA database. Finally, the output gap is defined as the deviation of actual GDP from potential GDP in percent of potential GDP. Data are drawn from the OECD Economic Outlook database.

Following Demirgüç-Kunt and Levine (1996), we define financial development as the sum of financial intermediary development and stock market development. The former is the sum of the ratio of liquid liabilities to GDP and the credit going to the private sector over GDP. The latter is the sum of stock market capitalization over GDP, total value traded over GDP, and total value traded over market capitalization. The data are taken from the Global Financial Development Database of the World Bank.

4.2. Measures of financial Constraints at aggregate level

Measuring financial constraints in an economy requires capturing the effect of financial conditions on real activity. Therefore, finding comparable indicators of financial constraints at country-level is not trivial. Cross-country financial development indicators (e.g. BIS data) have a number of drawbacks, particularly reverse causality, and do not allow identifying the effective role of financial constraints. The more natural way to measure country-level financial constraints would be to calculate, by country, the share of highly indebted firms using comparable enterprise surveys. However, due to data limitation, we are not able to obtain such measure. We therefore follow the literature to construct firm-level leverage and external financial dependence indicators to proxy for financial constraints.

We use data from Thompson Reuters WORLDSCOPE to construct country-level indicators of financial constraints. Worldscope provides data on the balance sheets, cash flows, and income statement for all listed non-financial companies, for the 19 OECD economies included in the aggregate analysis. Since Worldscope data covers publicly listed firms only, therefore it could be argued that the constructed financial constraints indicators do not necessarily reflect the level of financial constraints of the whole economy. However, results obtained with these data can be considered as a lower bound of the real effect of

[12] For the industry-level analysis, extreme outliers in ICT manufacturing for some countries likely reflect measurement error and are dealt with by using the relative investment price in ICT manufacturing for the United States as an instrumental variable for the relative investment price in ICT manufacturing for all countries. Dropping ICT manufacturing from the regressions neither qualitatively nor quantitatively affects the results reported below.

[13] Backward and forward linkages are normalised by aggregate value added to account for the overall trade openness of the country.

financial constraints, given that small and medium-sized firms are generally more likely to be financially constrained (Banerjee, 2014). Moreover, listed firms account for a large share of output and employment in most developed countries.

The sample period is 1995-2014. Several proxies of financial constrains are constructed:

- External finance dependence: the country-level approximation of firm's dependence on external finance is constructed following the methodology first developed by Rajan and Zingales (1998). Specifically, external finance dependence is measured, excluding firms in the financial sector, as capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure. [14]This indicator reveals the median company in the country for which the desired investment cannot be financed through internal cash flow. It gives a sense of the demand for external finance in the economy.

- Debt ratio: debt over total assets. [15] The debt ratio is an indicator of firm's (long-term) debt-paying ability. The rationale is that high leveraged firms might find it difficult and costly to raise more funds. This is because firms with higher debt-to-asset ratios will need higher profits to pay off their debt, therefore facing a higher probability of default.

For both proxies of financial constraints, we first calculate, for each firm, the average value of the indicators over the three decades (1990-1999; 2000-2009; 2010-2014), based on annual data.[16]Then, we define the country-level value of the indicators by calculating the median across all firms in each country by decade.[17] To minimize the influence of outliers in subsequent analysis, we winsorize those measures at both the top and bottom 1%.

For the industry-level analysis, we exploit heterogeneity across industries in dependence on external finance (Rajan and Zingales, 1998). In this case, industry-level financial constraints are proxied by the measure of external financial dependence constructed by De Serres et al. (2006). It is assumed that industries that are more dependent on external finance are also more constrained in accessing funds to finance investment, e.g. because of asymmetric information between borrowers and lenders. External financial dependence was likely to be a particularly binding constraint on the financing of investment during the global financial crisis of 2008-09. In general, observed external finance dependence indicator captures both demand for funds – which is largely determined by industry characteristics, such as R&D intensity or capital intensity – and supply of funds – which is determined by the development of the financial system. But observed external funding is likely to reflect mainly the technology-determined demand for funds in highly developed financial markets. Following Rajan and Zingales (1998), De Serres et al. (2006) therefore measure external financial dependence as industry-level capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure in the United States over 1994-2003. The analysis then assumes that the same value of external financing dependence applies to the corresponding sector in all other economies, based on the argument that US firms are judged

[14] Throughout, financial firms (Standard Industrial Classification (SIC) 6000–6999) are excluded from the sample.

[15] We construct two measures of debt ratio, both a measure of long term debt to total assets and a measure of total debt (i.e. long term and short term debt) to total asset.

[16] We restrict to firms that contains at least 5 years of observations per decade.

[17] A different method to aggregate indicators at country-level has been checked to test the robustness of the results. Particularly, the starting from firm-level indicators, we have aggregated at the industry-level (at the Standard Industrial Classification [SIC] two-digit level), separately by country and decade by taking the median of all firms in each sector. The sector-level indicators are then aggregated using a common set(s) of industry weights. Specifically, we use industry's share of employment on total employment.

least likely to suffer from financing constraints relative to firms in other countries due to a relatively high level of financial development in the US. Therefore, the US value of the index for a particular sector likely represents a minimum-value for the same-sector firms in other countries.

4.3. Micro-level data

The firm-level analysis is based on the 2013 OECD-ORBIS database for the years 2001-2013, a unique cross-country longitudinal dataset of both listed and unlisted firms provided by Bureau van Dijk. The dataset features harmonized and rich information on firms' productive activities (for instance, value-added output, capital stock, employment) and financial situation based on balance sheets and income statements (for instance, debt, assets, tangible and intangible fixed assets, long-term debt). In order to limit the influence of erratic or implausible firm-behaviour, the dataset is cleaned by removing extreme outliers using the procedure described in Gal (2013).[18]

The analysis focuses on nine OECD countries for which long differences in labour shares can be computed for a sufficient number of firms and for which information on aggregate financial and credit conditions is available.[19] The analysis is constrained to the same industries as the industry-level analysis: the sample is restricted to the non-primary non-financial business sector; industries with a high share of self-employed and ICT using sectors which were found to have problematic relative investment prices have been excluded (NACE Rev.2 codes 10-82, excluding 01-09, 19, 26-27, and 68). Finally, country-industry-years for which there are less than 30 firms have been removed. The analysis is based on a harmonized consolidation level of accounts using unconsolidated and consolidated accounts. To ensure consistency and comparability of monetary variables across countries and over time, data have been cleaned using the standard methodology followed in particular by Gal and Hijzen (2016). In addition, we exclude very small firms (less than 3 employees), a common practice in studies using firm-level data, due to concerns regarding the reliability of the data as well as the consistency of variables over time. [20]

The literature on firm-level financial constraints is yet to provide a clear-cut consensus on a financial measure estimate (Silva and Carreira, 2012). Despite that, the literature evidences a positive relationship between firms' leverage ratio and financial constraints. For instance, Ferrando and Mulier (2015) have found that firms with lower leverage ratios are less likely to be financially constrained. Giroud and Mueller (2017) provide evidence for U.S. firms on a positive relationship between pre-crisis leverage ratio and financial constraints during the Great Recession. Additionally, Mocking et al. (2016) use the average debt-to assets ratio in the period before the crisis as indicator for dependence on external finance. Hence, as regards our measures of firms' financial constraints, the preferred one is the leverage ratio. This is calculated as the ratio of the sum of current liabilities and long-term debt to total assets.[21] We use both the continuous and a discrete measure of leverage.

[18] See Gal (2013), Kalemli-Özcan et al. (2015) and Gal and Hijzen (2016) for a more detailed description of the dataset.

[19] Namely, Belgium, Finland, France, Germany, Italy, Korea, Spain, Sweden and the United Kingdom.

[20] 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.

[21] 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.

We also create some alternative measures of financial constraints to prove the robustness of the results.[22]

5. Results

The first part of the results covers the macro-level specification analysing cross-country differences in labour share developments. The second part covers the industry-level analysis. The third and last part of this section exploits firm-level data to sheds light on the effect of financial constraints on labour share developments.

5.1. Macro-level

Table 1 summarises the aggregate regression results obtained by estimating equation (1). Column 1 shows the baseline estimation results, columns 2 and 3 present the results further augmenting with alternative measures of financial constraints, and columns 4 and 5 displays the results when controlling for changes in financial development. Regarding the role of technology, the empirical estimates imply that the estimated semi-elasticity of the labour share to the relative investment price good is approximately 0.25. This means that a decline of 10 percent in the relative price of investment goods leads to a 2.5 percentage point decline in the labour share.

Participation into global value chain is estimated to have a negative effect on the labour share of income: the estimated elasticity of the labour share to GVC participation is around -0.06, suggesting that an increase of backward and forward linkages of 10 percentage points of value added reduces the labour share by 0.6 percentage points. The idea here is that as wages are higher in advanced than in emerging economies, tasks that are labour-intensive could be offshored from the former to the latter. IMF (2017) explains that in advanced economies offshored tasks are relatively labour-intensive, and increased participation in global value chains leads to a fall in the labour share as the composition of production becomes more capital-intensive. Given that our sample is composed by advanced economies, our finding supports the notion that offshored tasks are labour-intensive.

Moreover, the baseline results are also consistent with the evidence that the labour share is counter-cyclical as the coefficient of changes in the output gap is negative and statistically significant at the 5% level.

Finally, the results of Columns (3) and (4) confirm that the effect of changes in relative investment prices varies depending on the degree of financial constraints the median firm is facing in a given country. In particular, the results suggest that a decline in relative investment price reduces the labour share by more in countries relatively less exposed to financial constraints. This result is consistent across different definition of financial constraints, and the estimated coefficients are remarkably consistent regardless of the measure of financial constraints. In particular, the results suggest that both high external financial dependence and high debt to total asset ratio dampen the transmission of declines in the relative investment price to aggregate labour share.[23] We can therefore conclude that the effect of the relative investment prices on labour share developments is lower for countries that are more financially constrained: while the estimated semi-elasticity for

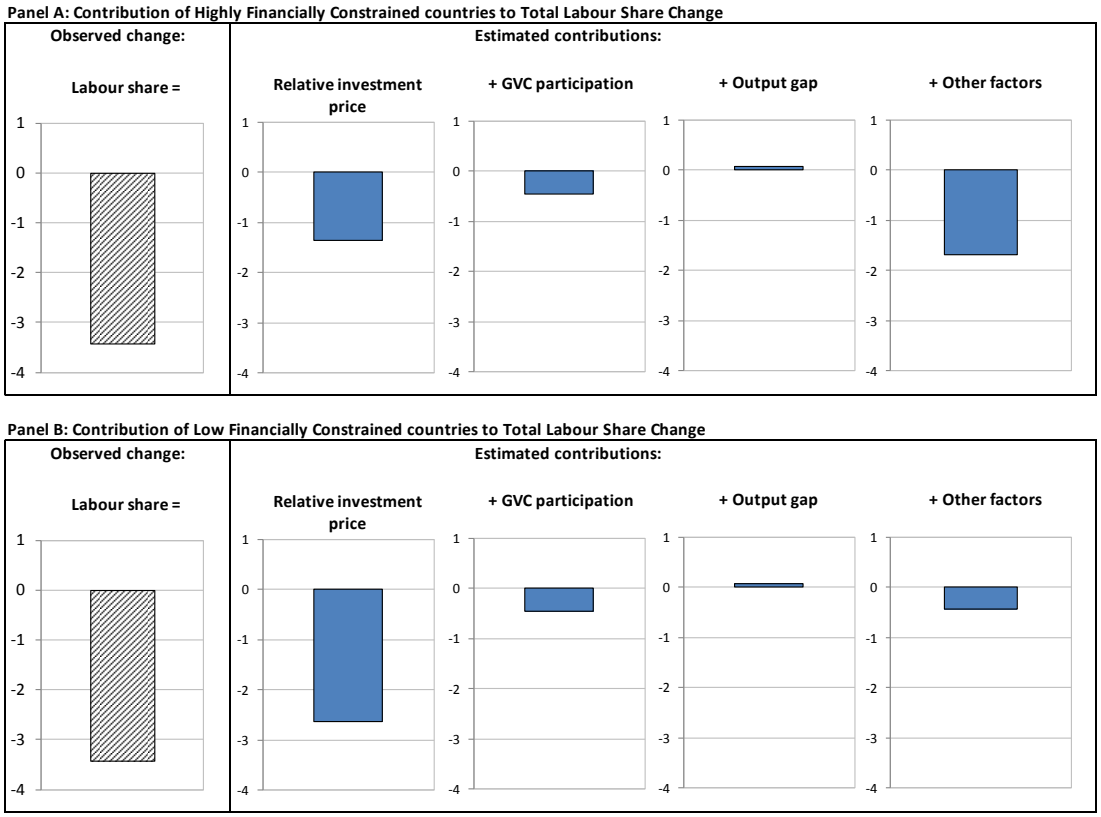
[22] In particular, we create two more measures of leverage to proxy for financial constraints: (i) a firm's ***total liabilities to total assets*** ratio, which is the same as our preferred leverage ratio but including also other liabilities (i.e., *provisions*); and, (ii) ***short term loans to total assets*** ratio.

[23] High debt to assets ratio refers to those countries whose initial level of debt to total assets is at the 75th percentile of the distribution or above.

countries with low financial constraints is ranging between 0.29 and 0.33, it is around 0.09 and 0.17 for countries with high financial constraints, with the difference being significant.[24,25]

In Figure 4, we make use of the weighted average of the aggregate labour share decline for all countries in the sample and using the results presented in table 1, we estimate the contributions of (1) the relative investment price for highly financially constrained (Panel A) and low financially constrained (Panel B) countries; (2) the global value chain participation; (3) the output gap; and (4) any other factors.[26]

Figure 4: Estimated contributions to the weighted averaged OECD labour share decline



The above figure suggests that the largest part of the weighted average change in labour share for low financially constrained countries is explained by the fall in the relative investment price, whereas for high financially constrained firms, there seems to be other factors that are driving this observed drop in the labour share.[27]

5.2. Industry-level analysis

This subsection presents the results of the sectoral analysis of aggregate labour share. As for the macro-level analysis, according to the baseline specification, declines in the relative

[24] The overall effect of changes in relative investment prices on relatively more financially constrained countries is given by $\beta_2 + \beta_3$.

[25] Those results remain unchanged when using the continuous measure of financial constraints rather than the dummies.

[26] This is simply estimated by multiplied the weighted averages of aggregate changes in relative investment price, global value chain participation and output gap by the respective estimated coefficients presented in Table 1 – Column 1. The 'other factors' corresponds to the part of the observed change in the labour share that is not explained by any of the three factors presented in the figure.

[27] It is beyond the scope of this paper to explain these other factors that could be leading the observed drop in the labour share of highly financially constrained countries. We therefore leave this to future research.

price of investment and increases in GVC participation have been associated with declines in labour shares (Table 2, Column 1). The estimated semi-elasticity of the labour share to the relative investment price is 0.11, slightly lower than for the macro-level analysis and the estimated semi-elasticity of labour share to GVC participation is -0.1. Replacing country-period fixed effect by including among the explanatory variables changes in output gap, to measure the effect of the business cycle, does not change the results on relative investment price and GVC participation. Additionally, the coefficient on output gap changes, being negative and significant, is consistent with the macro-level findings (Table 2, Column 2). Furthermore, to test for heterogeneous effects of changes in the relative price of investment across industries that are more or less exposed to financial constraints, the change in the relative investment price is interacted with a measure of external finance dependence (Table 2, column 3). The results are economically and statistically significant: the estimated semi-elasticity of the labour share to relative investment price is 0.24 for industries less dependent on external finance whereas it's around 0.05 for industries highly dependent on external finance. As for the aggregated analysis and consistent with the view that financial constraints dampen the transmission of declines in relative investment prices to the labour share, results suggest that industries that are more dependent on external finance are likely to be more constrained in accessing funds to finance investment, e.g. because of asymmetric information between borrowers and lenders. Consequently, firms that are highly dependent on external finance may not be able to take advantage of declines in the relative investment price to substitute capital for labour.[28] In order to gain an insight behind the mechanisms underlying the estimated industry-level effects, we make use of firm-level analysis.

5.3. Firm-level analysis

To analyse the extent to which firm-level labour shares respond to changes in industry-level relative investment prices and whether the response differs across firms with different initial financial constraints, we use firm-level data from OECD-ORBIS and industry-level relative investment price indices for 9. We rely on the cross-firm variation in initial leverage, to assess the impact of financial constraints. The results reported below are based on a financial constraint measure defined as the ratio of current liabilities and long term debt to total assets. We also investigate another potential source of firm heterogeneity, initial productivity, in order to proxy for know-how required for technology adoption. 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.

Table 3 summarises the main empirical results of the firm-level analysis and clearly shows that firm-level data appear to capture the key dynamics of the economy-wide data. A decline in the relative investment price is estimated to reduce firm-level labour shares (Table 3, Column 1). The average estimated firm-level semi-elasticity is around 0.15, remarkably similar to the estimated industry-level and macro-level semi-elasticities 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 4) – are over-represented in OECD-ORBIS. Moreover, the firm-level analysis 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

[28] These results are robust to the inclusion of country-period fixed effects and the removal of controls for changes in output gap. Estimates are not shown but available upon request.

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 estimated coefficient on global value chain participation is insignificant, suggesting that the macro and industry-level effects mainly operate through the composition effect, that is the reallocation of production from high-labour share to low-labour share firms.

High leverage (i.e. high external finance dependence) dampens the transmission of declines in the relative investment price on the labour share (Table 3, Columns 2-4). 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. These findings hold measuring financial constraints both with the initial level of firms' leverage and with a discrete variable measuring high initial leverage (Table 3, column 3-4).[29] This result is robust to including the dummy for high-productivity firm and leverage simultaneously; suggesting that results are not driven by the fact that more constrained firms may be less productive (Table 3, Column 3). These results are confirmed also by replacing the country-industry and year-fixed effects with a combined country-industry-year fixed effects, the estimated coefficient on the interaction terms is remarkably consistent with the main specification (Table 3, column 5).[30] Overall, the results based on firm-level suggest that industry-level investment prices affect the labour share partly through changes within firms rather than composition effects, with firms with low financial leverage and high-productivity firms typically responding more strongly to changes in industry-level investment prices. 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.

6. Conclusions

In this paper, we have tested an under-explored channel through which relative investment price affects labour share developments at both aggregated and disaggregated level. While past literature has often established that changes in relative investment prices matter for labour share development, both at macro and micro level, no particular channel has been explicitly analyzed. We argue that firms need external finance to make the most of relative investment prices declines and to fund their investments in technology that allow to substitute labour with capital. We take this prediction to the data and we test it empirically using macro-level, industry-level and firm-level data. We find strong evidence of financial constraints acting as a channel to hamper the effect of relative investment prices change on labour share. Our analysis presents evidence that an increase in the share of firms facing financial constraints at the country level tends to be associated with an overall lower effect of relative investment prices on labour share developments. Additional evidence from industry-level data confirm this result: sectors that rely more on external finance can benefit less from a relative investment price declines. Finally, firm-level data are consistent with cross-firm heterogeneity as they show that firms whose leverage ratio is lower, experience a stronger decline in their labour share as a response to declines in industry-level relative investment price. The results therefore suggest that the effect of changes in relative

[29] High leverage is a dummy variable that takes value 1 for firms with initial leverage higher than the sample's mean, and zero otherwise.

[30] Including combined country-industry-year fixed effects does not allow identifying explicitly the effect of changes in industry-level relative investment prices and in GVC participation.

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.

Certainly, these results call for more research on the mechanisms behind the drivers of labour share. Additionally, despite the labour share not being a policy objective, it is clear that the design of specific policies should depend on country circumstances: extent of decline in labor shares, relative importance of underlying drivers (i.e. the degree of financial constraints).

TABLES:

Table 1. Baseline aggregate results

Selected OECD countries, 1995-2014

	1	2	3	4	5
Dependent Variable	Change in business labour share excluding primary, coke and housing industries				
Change in RIP	0.176*	0.267***	0.323***	0.294***	0.334***
	(0.0905)	(0.0853)	(0.0948)	(0.0767)	(0.0953)
Change in GVC participation	-0.0496	-0.0657**	-0.0584*	-0.0658**	-0.0585*
	(0.0289)	(0.0280)	(0.0305)	(0.0269)	(0.0295)
Change in output gap	-0.206**	-0.188**	-0.158*	-0.189**	-0.169**
	(0.0785)	(0.0835)	(0.0776)	(0.0817)	(0.0795)
Change in financial development				-0.556	-0.987
				(1.040)	(0.999)
High EFD * Changes in RIP		-0.128**		-0.125**	
		(0.0506)		(0.0488)	
High Debt to Assets * Changes in RIP			-0.295**		-0.241**
			(0.113)		(0.0998)
Initial Financial Constraints	NO	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES
Period fixed effects	YES	YES	YES	YES	YES
Observations	213	209	209	203	203
R-squared	0.641	0.688	0.680	0.716	0.707

Note: *RIP* stands for relative investment price and *EFD* for external financial dependence. The countries included are: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovak Republic and Sweden, United Kingdom and the United States. Changes denote 8-year overlapping differences. Robust standard errors are clustered at the country level. *, **, *** denote statistical significance at the 10%, 5% and 1% levels.
Source: *Authors' calculations based on data sources presented in Section 4*.

Table 2. Industry-level results

Selected OECD countries, 1995-2014

	1	2	3
Dependent Variable	Change in business labour share excluding primary, coke and housing industries		
Change in RIP	0.118***	0.123***	0.240***
	(0.0187)	(0.0194)	(0.0797)
Change in GVC participation	-0.132**	-0.134***	-0.130***
	(0.0491)	(0.0429)	(0.0426)
Change in output gap		-0.255*	-0.221*
		(0.147)	(0.122)
High EFD * Changes in RIP			-0.188**
			(0.0889)
High external finance dependence	NO	NO	YES
Industry x period fixed effects	YES	YES	YES
Country x period fixed effects	YES	NO	NO
Country fixed effects	NO	YES	YES
Number of countries	26	26	26
Number of industries	19	19	19
Observations	4,101	4,101	4,101
R-squared	0.343	0.280	0.305

Note: The included countries are: Australia, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, japan, Korea, Luxembourg, Latvia, Netherlands, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States. Changes denote 8-year overlapping differences. Weighted OLS, with the share of industry-level value added in total value as weights. Robust standard errors are clustered at the country-industry level. *, **, *** denote statistical significance at the 10%, 5% and 1% levels.
Source: *Authors' calculations based on data sources presented in Section 4.*

Table 3. Firm-level results

Selected OECD countries, 2001-2013

	1	2	3	4	5
Dependent Variable	Change in firm-level labour share				
Change in RIP	0.14***	0.18***	0.15***	0.17***	
	(0.05)	(0.05)	(0.05)	(0.06)	
Change in GVC participation	-0.02	-0.02	-0.02	-0.01	
	(0.05)	(0.05)	(0.05)	(0.05)	
Leverage x Change in RIP		-0.06**		-0.05**	-0.06**
		(0.02)		(0.03)	(0.02)
High leverage x Change in RIP			-0.02*		
			(0.01)		
Leader x Change in RIP				0.19***	0.18**
				(0.07)	(0.07)
Initial leverage and/or initial leader	NO	YES	YES	YES	YES
Firm-level controls	YES	YES	YES	YES	YES
Country x industry fixed effects	YES	YES	YES	YES	NO
Year fixed effects	YES	YES	YES	YES	NO
Country x industry x year fixed effects	NO	NO	NO	NO	YES
Observations	416,888	416,888	416,888	416,888	416,888
Adjusted R^2	0.21	0.21	0.21	0.22	0.22

Note: 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.
Source: *Authors' calculations based on data sources presented in Section 4.*

References:

Acemoglu D., and D. Autor (2010), "Skills, Tasks and Technologies: Implications for Employment and Earnings", *NBER Working Paper*, No. 16082, National Bureau of Economic Research.

Acemoglu D., and P. Restrepo, 2016. "The Race Between Machine and Man: Implications of Technology for Growth, Factor Shares and Employment", *NBER Working Papers*, No. 22252, National Bureau of Economic Research.

Aghion, P, P. Askenazy, N. Berman, G. Cette, and L. Eymard, 2012. "Credit Constraints and the Cyclicality of R&D Investment: Evidence from France," Journal of the European Economic Association, 10 (5), 1001-1024.

Aghion, P., G.M. Angeletos, A. Banerjee, and K. Manova (2010), "Volatility and Growth: Credit Constraints and the Composition of Investment". *Journal of Monetary Economics*, 57(3):246-65.

Andrews, D., C. Criscuolo and P. Gal (2016), "The Global Productivity Slowdown, Technology Divergence and Public Policy: A Firm Level Perspective", *OECD Productivity Working Papers*, No. 5.

Angrist, J. and J.-S. Pischke (2009), *Mostly Harmless Econometrics: An Empiricist's Companion, Princeton*, NJ: Princeton University Press.

Autor D., D. Dorn, L. F. Katz, C. Patterson and J. Van Reenen (2017), "Concentration of on the Fall of the Labor Share", *NBER Working Paper*, No. 23108, National Bureau of Economic Research.

Ayyagari M., P. Juarros, Marinez Peria M. S., and S. Singh (2016), " Access to Finance and Job Growth: Firm-Level Evidence across Developing Countries". *World Bank*, Policy Research Working Paper, WPS 7604.

Azmat G., A. Manning and J. Van Reenen (2012), "Privatization and the Decline of Labour's Share: International Evidence from Network Industries", *Economica*, No. 79/315, pp. 470–92.

Barkai S. (2016), "Declining Labor and Capital Shares", *New Working Paper Series*, No. 2, Stigler Center for the Study of the Economy and the State, University of Chicago Booth School of Business.

Bassanini, A. and T. Manfredi (2012), "Capital's Grabbing Hand? A Cross-Country/Cross-Industry Analysis of the Decline of the Labour Share", *OECD Social, Employment and Migration Working Papers*, No. 133, OECD Publishing.

Beck, T., A. Demirguc-Kunt, and V. Maksimovic (2005), "Financial and Legal Constraints to Growth: Does Firm Size Matter?". *The Journal of Finance*, 60(1):137-77.

Bentolilla, S., and G., Saint-Paul (2003), "Explaining Movements in the Labor Share". *Contributions to Macroeconomics*, 3.

Berkowitz D., H. Ma and S. Nishioka (2017), "Markups and Decling Labor Shares: Evidence from China"

Berlingieri G., P. Blanchenay and C. Criscuolo (2017), "The great divergence(s)", *OECD Science, Technology and Innovation Policy Papers*, No. 39, OECD Publishing

Bond, S., an J. Van Reenen (2006), "Microeconometric models of investment and employement", in Heckman, J., and E. Leamer (Eds.), *Hanbook of Econometrics,* 6, Elsevier, North-Holland.

Carpenter, R., and A. Guaringlia (2008), "Cash flow, investment, and investment opportunities: New tests using UK panel data", *Journal of Banking and Finance*, 32: 1894-1906.

Dao M. C., and L. Q., Liu (2017), " Finance and Employment in Developing Countries: The Working Capital Channel". *International Monetary Fund*, WP/17/189.

De Loecker J. and J. Eeckhout (2017), "The Rise of Market Power and the Macroeconomic Implications", *NBER Working Paper*, No. 23687.

De Serres, A. and C. Schwellnus (2018), "Inequality and structural reforms: The role of labour and product market reforms", in: Proceedings of the ECFIN Structural Reforms Workshop, Brussels, forthcoming.

De Serres, A., S. Kobayakawa, T. Slok and L. Vartia (2006), "Regulation of Financial Systems and Economic Growth in OECD Countries: An Empirical Analysis", OECD Economic Studies, No. 43, 2006/2.

Demirgüç-Kunt, A., and R. Levine, 2009. "Finance and Inequality: Theory and Evidence," Annual Review of Financial Economics, Annual Reviews, 1(1): 287-318.

Duffy J., C. Papageorgiou, and F. Perez-Sebastian (2004), "Capital-Skill Complementarity? Evidence from a Panel of Countries", *The Review of Economics and Statistics*, 86, issue 1, p. 327-344

Elsby M., B. Hobijn and A. Sahin (2013), "The Decline of the U.S. Labor Share", *Brookings Papers on Economic Activity*, No. 2013-27, September 2013.

European Commission (2008), "II. Income inequality and wage share: Patterns and determinants". Quarterly Report on the Euro Area, European Commission, Directorate General for Economic and Financial Affairs.

Ferrando A. and K. Mulier (2015), "Firms' Financing Constraints: Do Perceptions Match the Actual Situation?", *The Economic and Social Review*, Vol. 46, No. 1, pp. 87-117.

Frank R.H. and P.J. Cook (1995), *The Winner-Take-All Society*, New York: The Free Press, 1995.

Furman J. and P. Orszag (2015), "A Firm-Level Perspective on the Role of Rents in the Rise in Inequality", Presentation at "A Just Society" Centennial Event in Honor of Joseph Stiglitz, Columbia University.

Gal, P. (2013), "Measuring Total Factor Productivity at the Firm Level using OECD-ORBIS", *OECD Economics Department Working Papers*, No. 1049, OECD Publishing, Paris.

Gal, P. and A. Hijzen (2016), "The Short-term Impact of Product Market Reforms: A Cross-country Firm Level Analysis", *OECD Economics Department Working Paper*, No. 1311.

Giroud X. and H. M. Mueller (2017), "Firm Leverage, Consumer Demand, and Employment Losses during the Great Recession", *US Census Bureau Center for Economic Studies Paper* No. CES-WP-17-01.

Grossman G. M., and E. Rossi-Hansberg (2008), "Trading Tasks: A Simple Theory of Offshoring." *American Economic Review*, 98(5): 1978-97.

Guaringlia, A. (2008), "Internal Financial Constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms", *Journal of Banking and Finance*, 32: 1795-1809.

Harrison A. (2005), "Has Globalization Eroded Labor's Share? Some Cross-Country Evidence", *MPRA Papers*, No. 39649, Munich Personal RePEc Archive.

Haugh, D., A. Kopoin, E. Rusticelli, D. Turner and R. Dutu (2016), "Cardiac Arrest or Dizzy Spell : Why is World Trade So Weak and What can Policy Do About It?", *OECD Economic Policy Papers*, No. 18, , OECD Publishing, Paris.

Hausman, J. A. “Specification Tests in Econometrics,” *Econometrica*, vol. 46, no. 6, pp. 1251–1271.

Hubbard, G. (1998), “Capital market imperfections and investment”, *Journal of Economic Literature*, 35: 193-225.

IMF (2015), “Chapter 4. Private investment: what’s the holdup”, in World Economic Outlook, April 2015: Uneven Growth: Short and Long-term factors, USA: International Monetary Fund

IMF (2017), “Chapter 3. Understanding the Downward Trend in Labor Income Shares”, in World Economic Outlook, April 2017: Gaining Momentum?, USA: International Monetary Fund

IMF (2017a), “*Fiscal Monitor:Tackling Inequality.”,* Washington, October.

Kaldor N. (1961) Capital Accumulation and Economic Growth. In: Hague D.C. (eds) The Theory of Capital. International Economic Association Series. Palgrave Macmillan, London

Kalemli-Ozcan, S., B. Sorensen, C. Villegas-Sanchez, V. Volosovych and S. Yesiltas (2015), “How to Construct Nationally Representative Firm Level Data from the Orbis Global Database”, *NBER Working Papers*, No. 21558.

Karabarbounis L. and B. Neiman (2014), “The Global Decline of the Labour Share”, *Quarterly Journal of Economics*, Vol. 129, No. 1, pp. 61–103.

Katz, L. F., and A. B. Krueger (2016), “The Rise and Nature of Alternative Work Arrangements in the United States, 1995-2015,” *NBER Working Paper* No. 22667.

Krusell P., L. E. Ohanian, J.-V. Ríos-Rull, and G. L. Violante (2000), “Capital-skill complementarity and inequality: A macroeconomic analysis.”, *Econometrica*, 68, 1029–1054.

Lawrence, R. Z. (2015), “Recent Declines in Labor's Share in US Income: A Preliminary Neoclassical Account”, *NBER Working Paper* No. 21296.

Love, I., L. Preve and V. Sarria-Allende (2007), “Trade credit and bank credit: Evidence from recent financial crises”, *Journal of Financial Economics*, 83(2), pp. 453-469.

Mocking, R., J. Möhlmann, and A. Palali (2016), "Dependence on External Finance and SME Survival." *CPB Netherlands Bureau for Economic Policy Analysis*, Background Document.

OECD (2012), OECD Employment Outlook 2012, Chapter 3. Labour Losing to Capital: What Explains the Declining Labour Share?, OECD Publishing, Paris.

OECD (forthcoming), Decoupling of wages from productivity: Micro-level mechanisms.

Rajan R. G. and L. Zingales (1998), “Financial Dependence and Growth”, *American Economic Review*, 88(3): 559-586.

Rodriguez, F., and A. Jayadev, (2013), “The Declining Labor Share of Income”, *Journal of Globalization and Development*, 3(2): 1-18.

Rosen S. (1981), “The Economics of Superstars”, *American Economic Review*, 71(5): 845-858.

Schwellnus C., A. Kappeler and P.A. Pionnier (2017), “Decoupling of wages from productivity: Macro-level facts”, *OECD Economics Department Working Papers*

Silva, F., and C. Carreira (2012), "Measuring Firms' Financial Constraints: A Rough Guide". GEMF Working Papers 2012-14, GEMF, Faculty of Economics, University of Coimbra.

Spaliara M. (2009), “Do financial factors affect the capital-labour ratio? Evidence from UK firm-level data”. *Journal of Banking and Finance*, 33: 1932-47.