The decline of the labor income share: 
A reappraisal of the driving forces*

Hector Sala
Universitat Autònoma de Barcelona and IZA†

Pedro Trivín
Universitat Autònoma de Barcelona‡

25 July 2014

Abstract

Taking as reference Bentolila and Saint-Paul (2003), we argue that the impact of the capital-output ratio on the labor share crucially depends on the degree of globalization and level of technology. This conditional effect is estimated using multiplicative interaction models (Brambor et al., 2006), which allow idiosyncratic responses across degrees of globalization and technological levels. In this context, we provide evidence of different elasticities of substitution between capital and labor in the OECD and non-OECD economies, along with specific responses of the labor share to changes in its driving forces. Our findings endorse Rodrik’s (1997) conjecture in the OECD countries, but not in the non-OECD area unless in a specific scenario of large globalization and high technological level. We also find that TFP enhances the complementarity between production factors in the OECD, but their substitutability in the non-OECD.

JEL Codes: E25, F62, E22.

Keywords: Labor share, capital-output ratio, elasticity of substitution, globalization, TFP.

*Acknowledgments: Pedro Trivín acknowledges the warm hospitality received from the School of Economics and Finance of Queen Mary University of London, where the bulk of this work was developed. Both authors are grateful to the Spanish Ministry of Economy and Competitiveness for financial support through grant ECO2012-13081.

†Departament d’Economia Aplicada, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain; tel.: + 34 93 5812779; email: hector.sala@uab.es.

‡Departament d’Economia Aplicada, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain; tel.: + 34 93 5811680; email: pedro.trivin@uab.es.
1 Introduction

The labor share is falling. Wages grow less than productivity. The distributional conflict between workers and capital owners is back in economics.

The functional distribution of income was once an interesting topic for economists (Ricardo, 1911 [1817]). This lasted until Kaldor’s (1961) stylized facts of economic growth became accepted. Then, factor shares turned into quasi-trivial constants. Their role in academic discussions, and the space they had in undergraduate textbooks, declined (Atkinson, 2009). The distributional conflict was over... until the striking and worldwide labor share declines since the 1980s (Figure 1) have caused a revival in this area.

![Figure 1. Labor Income Share trends. 1970-2008.](image)

Note: own calculations (based on raw data from the Extended Penn World Table, EPWT 4.0) obtained following Karabarbounis and Neiman (2014) as year fixed effects from a regression of the labor shares including country fixed effects to control for the entry and exit during the sample. Regressions are weighted by GDP.

What is driving the labor share down? The work by Bentolila and Saint-Paul (2003) is probably the breakpoint in the appearance of a new strand of literature on the determinants of factor shares. The core point of their work is the relationship between the labor share and the capital-output ratio, which is now well established in the literature.1

Their correlation coefficients for the OECD and the non-OECD economies, which are shown in Figure 2, are positive in most cases in both areas.

This positive correlation may also be read as a negative correlation between capital productivity (as the inverse of the capital-output ratio) and the labor share. In other words, a decrease in capital productivity goes hand to hand with a situation in which labor productivity grows less than wages (or, alternatively, in which labor productivity grows less than wages).

---

1See, among others, Arpaia et al. (2009); Rodriguez and Jayadev (2010); Azmat et al. (2012); Böckerman and Maliranta (2012); Raurich et al. (2012); Young and Lawson (2014), and Karabarbounis and Neiman (2014).
falls by more than wages do). In contrast, if capital productivity grows, then the labor share tends to decrease. This is the outcome of either wages growing less than labor productivity or, alternatively, labor productivity falling by less than wages do.

Figure 2. Correlation coefficients between labor shares and the capital-output ratio.

Two recent influential works are related to these issues. The one by Piketty (2014), where the capital-output ratio is the major driving force of inequality. And the one by Karabarbounis and Neiman (2014) focusing on relative prices (i.e., the ratio between investment and consumption prices) as the main driver of the worldwide falling labor share. Regarding the latter, it is important to note that under Bentolila and Saint-Paul’s (2003) framework, controlling for the capital-output ratio implies controlling for investment and labor prices. Therefore, the main finding in Karabarbounis and Neiman (2014) is somehow implicitly enclosed. Thus, we acknowledge their salient contribution, but we follow the original route developed by Bentolila and Saint-Paul (2003) to learn more on the relationship between the capital-output ratio and the labor share.

This choice is motivated by the crucial stylized fact uncovered by Figure 2. Situations in which capital becomes more efficient, which is seems to be the case worldwide in last decades, are associated with situations in which the labor share suffers. This holds both in the OECD and the non-OECD economies, and the reason is that capital efficiency gains end up translated more to labor productivity than to wages.

In this context, the objective of this paper is twofold. First, to reappraise the relationship between the labor share and the capital-output ratio in a context in which some crucial determinants are considered to be conditional on one another. This analysis is
inspired on previous works pointing out the incidence of globalization and technological change on the labor share (IMF, 2007), the sensitivity to globalization of some crucial elements in the labor market (Rodrik, 1997), and the economic consequences of technology (Kumar and Rusell, 2002).

On this account we will show that Bentolila and Saint-Paul’s (2003) framework admits some further development on this respect. Consideration of these variables, and their interaction, will allow a re-assessment of the relevance of these driving forces in a context in which their potential dependencies are explicitly taken into account. We will thus shed new light on the impact of the capital-output ratio on the labor share in different scenarios of globalization (from autarchy to extreme openness) and different TFP levels.

The second objective is to conduct such analysis separately for the OECD and the non-OECD countries. Some studies have focused on the first group (Bentolila and Saint-Paul, 2003), while others, such as Karabarbounis and Neiman (2014), pool together all the economies. Here we consider these two groups separately, given their contrast in key macroeconomic variables, and uncover significant differences in the way their labor shares are determined.

In order to have enough degrees of freedom in the estimation process, we use annual data rather than five-year averages. This opens the door to the estimation of dynamic models, instead of static ones. In this context, we start by considering a yearly database covering the same 93 countries than Young and Lawson (2014), for which data is available. However, because of the estimation of dynamic models, the sample of countries is restricted so that we only work with those having, at least, 14 consecutive datapoints on all variables (these economies and the corresponding sample periods are listed in Table A1 in the Appendix).²

Our targets are achieved by estimating multiplicative interaction models (Brambor et al., 2006), on top of standard linear models. Therefore, one main outcome of our analysis is the estimation of a changing elasticity of substitution between capital and labor (σ) depending on the different values taken by an index of globalization, an index of TFP, and the capital-output ratio. This elasticity is obtained from the estimated impact of the capital-output ratio on the labor share. Although this is clearly in contrast to the standard estimation of a constant elasticity of substitution (CES) production function,³ Bentolila

²This choice is made in response to the trade-off we face between favoring a larger number of countries with a smaller number of observations, or the other way around. In view of the dynamic nature of our analysis, we prefer the second alternative (less countries and a reasonable time length).

³Note, however, that the idea of a Variable Elasticity of Substitution (VES) production function was time ago developed by Revankar (1971). His original claim that σ is positively related with the degree of economic development has recently been supported by Mallick (2012). By examining the interacting impact of our variables on the labor share within and across developed and non-developed economies, we provide an indirect empirical test on this matter.
and Saint-Paul (2003) did already acknowledge the potential existence of nonlinearities in this relationship.

Our analysis uncovers different patterns in the OECD and non-OECD countries. In the OECD, we find that the larger the degree of globalization, the lower the impact of a change in the capital-output ratio on the labor share. As we explain later, the channels whereby this happens are either through a larger $\sigma$, a higher labor demand elasticity with respect to wages, or both. This provides empirical support to Rodrik’s (1997) conjecture in the OECD area. We also find that the larger is the TFP, the larger becomes the impact of the capital-output ratio on the labor share reflecting the enhanced degree of complementarity between production factors.

For the non-OECD economies, we find a complex relationship between globalization, TFP and the labor share, worth deserving further attention. For low levels of globalization, these variables and their interactions are not relevant, and do not affect significantly the impact of the capital-output ratio on the labor share. However, they do for relatively high levels of globalization (above 40%). When technology is high enough, we find a smaller impact of the capital-output ratio on the labor share along with globalization. This is the closest scenario to the one in the OECD area (with relatively more open and technology-advanced economies) and it is not surprising to find the same result than the one for the OECD. On the contrary, at the lowest level of technology, even in a globalized scenario we find that the impact of the capital-output ratio on the labor share increases with globalization. As explained later, this asymmetric response is consistent with models allowing for a different skill-biased technology that depends on countries’ endowments.

In terms of the TFP, we find the opposite effect than in the OECD area. Thus, in the non-OECD economies, the higher the technological level, the more substitutability between capital and labor.

One lesson we draw from this analysis is that the evidence of non-linear relationships between the labor share driving forces should warn researchers against the estimation of a constant $\sigma$.

The remaining of the paper is structured as follows. Section 2 deals with the analytical framework in Bentolila and Saint-Paul (2003) and its empirical extensions. Section 3 explains the data and the econometric methodology. Section 4 shows the estimated models. Section 5 presents the varying impact of the capital-output ratio on the labor share. Section 6 concludes.

2 Labor share modeling

We propose an empirical analysis taking as reference Bentolila and Saint-Paul (2003).
2.1 The share-capital schedule

In their framework, there is a unique function $g$ such that:

$$s_{Li} = g(k_i),$$

(1)

where $s_L$ is the labor share and $k$ is the capital-output ratio. Subscript $i$, which denotes industry in the original setup, here refers to country. Bentolila and Saint-Paul (2003) refer to this stable relationship as the share-capital ($SK$) schedule (or curve), which is unaltered by changes in factor prices or quantities, or in labor-augmenting technical progress. This leaves the national real price of imported oil, and shocks in capital-augmenting technical progress, as the candidates to explain shifts of the $SK$ schedule. In turn, factors that generate a gap between the marginal product of labor and the real wage are the ones able to explain shifts off the $SK$ curve. The three considered by the authors are product market power, union bargaining, and labor adjustment costs.

Accordingly, their basic estimated model is:\(^4\)

$$\ln (s_{Li}) = \beta_0 \ln (TFP_{it}) + \beta_1 \ln (k_{it}) + \beta_2 \ln (q_{it}/p_{it}) + \beta_3 \Delta \ln (n_{it}) + \beta_4 \tilde{icr}_{it} + v_{it},$$

(2)

where $TFP$ is a measure of Total Factor Productivity; $q$ is the national price of imported oil, which is deflated by $p$ (the national price); $\Delta \ln (n)$ is the growth rate of employment; and $\tilde{icr}$ is the number of labor conflicts nationwide representing the factors causing a gap between the marginal product of labor and the real wage.

Although the addition of different empirical controls may be considered an issue of judgement (reflecting what authors think is important to capture changes in or off the $SK$ curve), what cannot be considered an issue of judgement is the economic factors that surround the value of $\hat{\beta}_1$. This is clearly acknowledged in Bentolila and Saint-Paul (2003), where the analysis of the $SK$ schedule is noted to deserve special attention since it is related with the elasticity of substitution between capital and labor ($\sigma$).

Departing from a generic production function –with standard assumptions such that it has to be differentiable and with constant returns to scale–, Bentolila and Saint-Paul (2003) derive the following expression:

$$\frac{ds_{Li}}{dk_i} = -\frac{1 + \sigma_i}{k_i \eta_i}.$$  

(3)

In equation (3), the response of the labor share with respect to changes in the capital-

\(^4\)Subscript $i$ denotes countries. With respect to Bentolila and Saint-Paul (2003), equation (20), we abstain from distinguishing industries.
output ratio is related to $\sigma$, the labor demand elasticity with respect to wages holding capital constant ($\eta$), and the value of the capital-output ratio ($k$).

This expression has been used to endorse the estimation of the elasticity of the labor share with respect to the capital output-ratio ($\varepsilon_{SL-k}$) resulting in the following interpretation:

$$\hat{\varepsilon}_{SL-k} > 0 \implies \sigma_i < 1 \implies \text{Capital and labor factors are complements}$$

$$\hat{\varepsilon}_{SL-k} < 0 \implies \sigma_i > 1 \implies \text{Capital and labor factors are substitutes.}$$

In general, the first situation ($\sigma < 1$) has been associated to the developed economies, because of their largest proportion of skilled workers, which make them more complementary to capital (relative to non-skilled workers). In turn, the second scenario ($\sigma > 1$) is more connected to the situation in the developing economies, where the larger share of low-skilled workers makes capital and labor more substitutes.

### 2.2 Towards a more flexible approach

Most of the literature—either departing from Bentolila and Saint-Paul (2003) or based on Nash bargaining models—considers a constant $\sigma$ and $\eta$, and tend to overlook the potential existence of interrelations with other labor share’s driving forces.

Next, we try to relax these constraints by considering a more flexible empirical framework that brings attention to two crucial factors: globalization and technology. These factors are critical, both as drivers of labor share movements, and as determinants of the various components in equation (3).

#### 2.2.1 Labor share vs. the capital-output ratio, globalization and technology

With respect to globalization, it is likely that the worldwide rise in the degree of openness in last decades has increased the labor demand elasticity with respect to wages (Rodrik, 1997). This rise would take place through the larger international competition in the product market (following one of the Hicks-Marshallian laws), the resulting new prospects of substitution among factors (due to the access to new markets), and through the enhanced possibilities to relocate production. Therefore, if true, Rodrik’s conjecture would imply that this elasticity should not be taken as a constant. On the contrary, its rise would be in part responsible of the transformation of the labor relations system, the increasing wage and employment volatilities, and the greater bargaining power achieved by firms. Accordingly, the proved economic influence of globalization, as reported in many studies (Protakke, 2014), certainly deserves careful empirical attention in our analysis.
In Bentolila and Saint-Paul (2003), the $SK$ schedule shifts with capital-augmenting technology. This is captured empirically by the TFP index, which reflects technical development within a country. This is the reason why a change in this index is likely to affect the elasticity of substitution between production factors ($\sigma$), which is basically a technological parameter. The channels whereby this may take place are explained in de La Grandville (2009) as follows: “In the language of the one-sector growth model, the elasticity of substitution between labour and capital appears as a parameter of the production function, a given technological fact. But the model itself is intended to “represent” an economy with many goods and many industries. In that context, substitution between labour and capital can also take the form of induced substitution on the demand side between goods with different characteristic capital-intensities. Thus a reduction in the rental rate on capital can induce direct substitution of capital for labour within each industry. In a competitive environment, it will also reduce the price of capital-intensive goods relative to labour-intensive goods. If the sales and output of capital-intensive goods rise and those of labour-intensive goods fall, capital will be substituted for labor indirectly as well. Both channels affect the measured “aggregative” elasticity of substitution. Only long-run mobility of capital is required.” [de La Grandville (2009), pp. 133-134].

Finally, the fact that globalization and TFP are interconnected is a widely documented phenomenon (see, among others, Bustos, 2011; and Thoenig and Verdier, 2003).

Given this discussion, there is a need to account for the cross-dependencies between the capital-output ratio, globalization and TFP. Thus, our aim is to take a step forward with respect to Bentolila and Saint-Paul (2003), and subsequent works, and estimate multiplicative interaction models (Brambor et al., 2006). In this way, we are able to evaluate the impact of a change in the capital-output ratio on the labor share for different values of globalization and technology.

As shown below, this is in fact equivalent to estimate a non-constant elasticity of substitution critically dependant on the different values taken by these reference variables.

### 2.2.2 Stylized facts

Empirically, it turns out that the correlations between the labor share, and our two main variables of interest, the KOF index of globalization and TFP, yield interesting pictures.

The influence of globalization on the falling labor share was already pointed out by the IMF (2007), and has received great attention in subsequent studies —for example, in Judzik and Sala (2013), and Karanassou and Sala (2013). To account for this phenomenon

---

5In their empirical expression they proxy capital augmenting technology by the TFP. However, they make explicit that the interpretation of this proxy as capital augmenting technology depends on the sign of the TFP and the capital-output coefficients (Bentolila and Saint-Paul, 2003, p. 8).
the literature has mainly relied on two indicators, the degree of openness to trade (defined as exports plus imports over GDP) and the more complete KOF index of globalization (Dreher, 2006), which distinguishes economic, social and political globalization, and has been widely used as the best proxy for the globalization process (see the survey article by Protak, 2014).

Figure 3 shows the correlation coefficients between the labor shares and the KOF index of globalization. A clear negative relationship is apparent irrespective of whether we consider the OECD or the non-OECD countries. Although this result is not surprising given the well known opposite trends in these variables, it clarifies why globalization is a phenomenon widely associated to the degradation of labor participation on total generated rents relative to the capital share.

**Figure 3. Correlation coefficients between the labor shares and the KOF index.**

![Figure 3](image)

Sources: Extended Penn World Table (EPWT 4.0) and KOF Index. 1970-2009.

Figure 4 shows the correlation coefficients between the labor shares and the TFP index for each country. In contrast to Figures 2 and 3, in this case there is a different behavior in the two areas of interest. Whereas a clear negative correlation is apparent in most OECD countries, such negative relationship is not so clear for non-OECD countries.
In a nutshell, the story that emerges from our discussion up to this point is the following. There has been a worldwide decline in the labor share (Figure 1), accompanied in most countries by a rise in globalization (Figure 3) and, in the OECD, by technological progress (Figure 4). However, since technological development within non-OECD countries has been much more heterogeneous (Figure 4), the role played by globalization, technology, and the interaction between the two in explaining the decline of the labor share across areas deserves further and detailed analysis.

2.3 Empirical implementation

We have argued that the relationship between the labor share and the elasticity of substitution between capital and labor is not straightforward to interpret due to the dependencies across the variables involved. Consequently, the estimation of standard linear additive models –where all explanatory variables are considered independent– may be inferior to the alternative of estimating multiplicative interaction models –where some explanatory variables are considered dependent. As explained in Brambor et al. (2006), this is the appropriate tool whenever the hypothesis being tested is conditional in nature, as it is the case here. This is our main reason to change the strategy and estimate new empirical versions of the estimated models in Bentolila and Saint-Paul (2003) using multiplicative interaction models.
A simple linear additive model can be expressed as follows:

\[ \hat{Y} = \alpha_0 + \alpha_1 X + \alpha_2 Z + \alpha_3 W, \]  

where \( \hat{Y} \) is the estimated value of the dependent variable, \( X, Z, \) and \( W \) are the explanatory variables, and the \( \alpha \)'s are estimated parameters. In turn, the corresponding multiplicative interaction model takes the form:

\[ \hat{Y} = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 W + \beta_4 XZ + \beta_5 XW + \beta_6 ZW + \beta_7 XZW, \]  

where the \( \beta \)'s are estimated parameters, and \( XZ, XW, ZW, \) and \( XZW \) are interactive terms (for details see Aiken and West, 1991, and Brambor et al., 2006).

The presence of the interactive terms alters the interpretation of the estimated parameters in a fundamental way. The reason is that in model (4) \( X, Z \) and \( W \) are considered independent of one another, whereas in model (5) they are not. In other words, in the additive model the effect, for example, of \( X \) on \( Y \) is considered to be constant while, in the multiplicative interaction model, this effect depends on the values taken by variables \( W \) and \( Z \). Therefore:

- \( \alpha_1 \) is the unconditional marginal effect of \( X \) on \( Y \), while \( \beta_1 \) is the conditional marginal effect of \( X \) on \( Y \) when \( W = Z = 0 \).
  
  (The equivalent interpretation holds for \( \alpha_2 \) and \( \beta_2 \) regarding \( Z \), or \( \alpha_3 \) and \( \beta_3 \) regarding \( W \)).

- \( \beta_4, \beta_5, \) and \( \beta_7 \) capture the impact of \( X \) on \( Y \) for different values of the modifying variables \( W \) and \( Z \), and allows this impact to vary. That is, the overall conditional marginal effect of \( X \) on \( Y \) is:

\[ \frac{\partial Y}{\partial X} = \beta_1 + \beta_4 Z + \beta_5 W + \beta_7 ZW. \]  

According to Brambor et al. (2006) the problem of omitted constitutive terms is one of the two common problems affecting most of the literature using this methodology. Thus, as our empirical model assesses the cross-dependencies among capital-output ratio, TFP, and globalization, the estimation of an equation such as (5) is required.

The other common problem is the lack of computation of “marginal effects and standard errors across a substantively meaningful range of the modifying variable” [Brambor et al. (2006), p. 78]. We also proceed accurately on this front, as we compute the marginal effects and standard errors of \( X \) (in our case, the capital-output ratio) across a
substantively meaningful range of the modifying variable $Z$ (changes either in TFP or in the KOF index of globalization) for given values of $W$ (the KOF index of globalization or TFP).

3 Data and econometric methodology

3.1 Data

Table 1 lists the variables considered and offers a synoptic definition. Labor shares, capital-output ratios, GDP per capita, and employment growth rates are obtained from the Extended Penn World Table (EPWT 4.0), developed by Adalmir Marquetti and Duncan Foley. From the World Development Indicators (WDI) we get the manufacturing share over GDP, a variable that tries to control for the sectoral economic composition. The proxy for globalization comes from the KOF index database, trade union density from the OECD, and national oil prices from the International Monetary Fund (IMF). The Polity II and the TFP indices are obtained, respectively, from the Policy IV and PWT 8.0 databases.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln (LIS)$</td>
<td>(log of) the labor share</td>
<td>(1)</td>
</tr>
<tr>
<td>$\ln (k)$</td>
<td>(log of) the capital-to-output ratio</td>
<td>(1)</td>
</tr>
<tr>
<td>$\ln (RGDP)$</td>
<td>(log of) real GDP per capita in 2005 US$</td>
<td>(1)</td>
</tr>
<tr>
<td>$\Delta n$</td>
<td>Employment growth rate</td>
<td>(1)</td>
</tr>
<tr>
<td>$\ln(MAN_SHARE)$</td>
<td>(log of) manufacturing, value added (% of GDP)</td>
<td>(2)</td>
</tr>
<tr>
<td>$KOF$</td>
<td>KOF globalization index</td>
<td>(3)</td>
</tr>
<tr>
<td>$\ln(UNION)$</td>
<td>(log of) union members as % of total paid employment</td>
<td>(4)</td>
</tr>
<tr>
<td>$\ln(OIL)$</td>
<td>(log of) national oil price</td>
<td>(5)</td>
</tr>
<tr>
<td>$DEM$</td>
<td>Polity II index of democracy</td>
<td>(6)</td>
</tr>
<tr>
<td>$\ln(TFP)$</td>
<td>(log of) the Total Factor Productivity index</td>
<td>(7)</td>
</tr>
</tbody>
</table>

Notes: (1) Extended Penn World Table (EPWT 4.0); (2) World Bank Development Indicators; (3) KOF Index; (4) OECD; (5) International Monetary Fund; (6) Policy IV democracy score; and (7) Penn World Table 8.0.
3.2 Econometric methodology

Two relevant considerations relate, first, to the use of averages versus yearly data, and, second, to the estimation of static versus dynamic models. Some authors have used five (or three)-years averages arguing that such procedure allows to abstract from the incidence of business cycles. This is accompanied by a static estimation, which is generally interpreted as approaching steady-state relationships. In our view, this aggregation procedure is not only likely to hide precious information on the relationship between variables but, further, it implies strong assumptions when using a wide sample of countries: taking five-year averages imposes that all economies have the same business cycle in terms of length, and also in terms of starting and end years. Hence, we follow a different route and use all available information to estimate dynamic models with annual data. This has the advantage of increasing the number of observations so that the resulting extra degrees of freedom grant the possibility of disaggregating the analysis into the OECD and the non-OECD areas.

However, the estimation of dynamic models rises the issue of inconsistency if the estimation is conducted using traditional panel data techniques. This is so, even in the absence of serial correlation in the error terms (Nickell, 1981; Arellano and Bover, 1995; and Blundell and Bond, 1998), and this is the reason why our reference estimates will be the ones obtained through the estimation by System Generalized Method of Moments (S-GMM).

To illustrate this point, consider the following simple one-way fixed effect model:

\[ y_{i,t} = \gamma y_{i,t-1} + \delta X_{i,t} + \eta_i + \epsilon_{i,t}, \]  

where \( y_{i,t} \) is the dependent variable, \( y_{i,t-1} \) is the lagged dependent variable, \( X_{i,t} \) is a row vector of explanatory variables, \( \eta_i \) is a fixed-effect term, \( \gamma \) and \( \delta \) are parameters to be estimated, and \( \epsilon_{i,t} \) is a disturbance (\( i \) and \( t \) represent, respectively, cross-section and time dimensions).

As \( y_{i,t-1} \) is correlated with the fixed-effect term, estimation by Ordinary Least Squares (OLS) of equation (7) will result in an inconsistent estimation of \( \gamma \) and \( \delta \). One way to overcome this inconsistency is to suppress the fixed-effect term by expressing model (7) as a first-differences model:

\[ y_{i,t} - y_{i,t-1} = \gamma (y_{i,t-1} - y_{i,t-2}) + (X_{i,t} - X_{i,t-1})' \delta + (\epsilon_{i,t} - \epsilon_{i,t-1}). \]  

\[ \text{Lagging equation (7) leads to } y_{i,t-1} = \gamma y_{i,t-2} + \delta X_{i,t-1} + \eta_i + \epsilon_{i,t-1} \text{ so that it is easy to see that } y_{i,t-1} \text{ is correlated with } \eta_i. \]
However, as $y_{i,t-1}$ is correlated with $\epsilon_{i,t-1}$, estimation by OLS still yields inconsistent estimators.

To overcome this situation, several works—among others by Anderson and Hsiao (1982), Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998)—developed GMM methods that use, as instruments, the lag moments of the dependent variables. The one we use here is the System GMM method developed by Arellano and Bover (1995) and Blundell and Bond (1998), which deals better than the Difference GMM method (developed by Arellano and Bond, 1991) with the presence of persistent variables.\footnote{For details on System GMM, and its advantages over Difference GMM, see Bond et al. (2001) and Roodman (2009).}

The System GMM method consists in the estimation of two equations, one in differences and one in levels, such as:

$$
\Delta y_{i,t} = \gamma \Delta y_{i,t-1} + \delta \Delta X_{i,t} + \Delta \epsilon_{i,t},
$$

$$
y_{i,t} = \gamma y_{i,t-1} + \delta X_{i,t} + \eta_i + \epsilon_{i,t}.
$$

The key contribution of this method is that it uses further moment conditions than the Difference GMM estimator. Not only the levels of the variables lagged twice and more are used, but also the lags of the variables in differences, which are now added as instruments in the level equation of the system.

GMM estimators were originally developed for panel data with a large number of cross-sections relative to the time dimension of the panel. However, given the macro nature of our panel, the cross-section and time dimensions are at most similar in the best case. Furthermore, we are at risk of incurring into a problem of "instruments proliferation", which could bias Hansen’s test to generate $p$-values artificially close to 1 and overfit endogenous variables. As Roodman (2009) explains, this is because the instrument count quartic in the time dimension of the panel.

To avoid this problem, we have followed Roodman’s (2009) recommendations of reducing as much as possible, and make explicit, the number of instruments used in our estimations.\footnote{Accordingly, both samples are estimated allowing for just four lags of endogenous variables and using the "collapse" instruments option available in the xtabond2 Stata command developed by David Roodman.} Even in this case, however, our results on the Hansen test are "too good to be real". This is the reason why, in order to assert the robustness of our estimates, we also present the OLS, fixed-effects (FE), and fixed-effects two-stages least squares (FE-2SLS) results.\footnote{All models include time dummies.}
4 Estimated models

Tables 2 and 3 present our empirical estimations for the OECD and non-OECD countries. The base-run model is an augmented version of the empirical model in Bentolila and Saint-Paul (2003) without interactions. Results corresponding to this base-run model are always presented in the left column of tables 2 and 3.10

To the specification in Bentolila and Saint-Paul (2003) we have added some additional controls. The central one is the degree of globalization, a relevant variable in the works by the IMF (2007) and Jayadev (2007), which in our case is proxied by the KOF Index variable (KOF). The second one is the share of manufacturing production (MAN_SHARE) in order to control for differences in the productive structure of the countries (Young and Lawson, 2014). A third one, also inspired in Young and Lawson (2014), is a variable accounting for the degree of democracy (DEM), since differences in this dimension may be specially relevant in the non-OECD countries. Finally, as Young and Lawson (2014) suggest following Gollin (2002), we also consider real per capita GDP (RGDP) to control for the fact that our labor share measure does not adjust for self-employment incomes. This variable is also used by Jayadev (2007), but as a proxy of economic development.

The columns in the right block of Tables 2 and 3 show the results of this extended model including interactions between the capital-output ratio (k), globalization (KOF), and technology (TFP).

The model without interactions is estimated by FE. The estimation of the models with interactions is conducted following four different methods: OLS, FE, FE-2SLS and S-GMM. In the FE-2SLS estimation TFP, k, and the interactions are treated as endogenous. In the System GMM estimation, in addition to these variables, we also control for the potential endogeneity of two other variables: Δn and RGDP.11 Our reference estimates are always the ones obtained by System GMM estimation, presented in the last column of Tables 2 and 3.12

Regarding the OECD economies, from the estimation of the base-run model, we would conclude that the main drivers of the labor share are the capital-output ratio, the share of manufacturing production, and the real per capita GDP, all of them with the expected positive influence, and also the real oil price, which comes out as detrimental of the labor income share.

---

10 We use trade union density instead of labor conflict as a control. This variable is not used in the non-OECD model due to the lack of enough data.
11 Ultimately, all variables in the model could be treated as endogenous. However, given the "instruments proliferation" problem, we are constrained to endogenize the most risky group. In this context, RGDP is treated as predetermined.
12 As a goodness check, note that the persistent coefficients obtained by S-GMM are between the ones estimated by OLS and FE (see Bond, 2002).
Table 2. Estimated models for the OECD countries.

<table>
<thead>
<tr>
<th>Dependent Variable: ln(LIS_t)</th>
<th>BASE-RUN</th>
<th>OLS</th>
<th>MODEL WITH INTERACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FE</td>
<td>FE</td>
<td>FE 2SLS</td>
</tr>
<tr>
<td>c</td>
<td>-0.54</td>
<td>-0.51</td>
<td>-0.42</td>
</tr>
<tr>
<td>[0.024]</td>
<td>[0.047]</td>
<td>[0.149]</td>
<td>[0.041]</td>
</tr>
<tr>
<td>ln(LIS_{t-1})</td>
<td>0.97</td>
<td>1.09</td>
<td>0.96</td>
</tr>
<tr>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>ln(LIS_{t-2})</td>
<td>-0.27</td>
<td>-0.23</td>
<td>-0.29</td>
</tr>
<tr>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>ln(k_t)</td>
<td>0.11</td>
<td>-0.01</td>
<td>0.49</td>
</tr>
<tr>
<td>[0.000]</td>
<td>[0.910]</td>
<td>[0.019]</td>
<td>[0.004]</td>
</tr>
<tr>
<td>ln(TFP_t)</td>
<td>-0.04</td>
<td>0.19</td>
<td>-0.25</td>
</tr>
<tr>
<td>[0.466]</td>
<td>[0.083]</td>
<td>[0.481]</td>
<td>[0.132]</td>
</tr>
<tr>
<td>KOF_t</td>
<td>-0.06</td>
<td>0.05</td>
<td>0.14</td>
</tr>
<tr>
<td>[0.503]</td>
<td>[0.485]</td>
<td>[0.154]</td>
<td>[0.169]</td>
</tr>
<tr>
<td>ln(OIL_t)</td>
<td>-0.02</td>
<td>0.001</td>
<td>-0.03</td>
</tr>
<tr>
<td>[0.004]</td>
<td>[0.701]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>ln(UNION_t)</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.001</td>
</tr>
<tr>
<td>[0.714]</td>
<td>[0.189]</td>
<td>[0.928]</td>
<td>[0.959]</td>
</tr>
<tr>
<td>Δnt</td>
<td>-0.07</td>
<td>-0.16</td>
<td>-0.07</td>
</tr>
<tr>
<td>[0.749]</td>
<td>[0.522]</td>
<td>[0.766]</td>
<td>[0.507]</td>
</tr>
<tr>
<td>ln(MAN_SHARE_t)</td>
<td>0.05</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>[0.059]</td>
<td>[0.235]</td>
<td>[0.296]</td>
<td>[0.263]</td>
</tr>
<tr>
<td>ln(RGDP_t)</td>
<td>0.04</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>[0.086]</td>
<td>[0.135]</td>
<td>[0.769]</td>
<td>[0.895]</td>
</tr>
<tr>
<td>ln(k_t) * KOF_t</td>
<td>-0.05</td>
<td>-0.41</td>
<td>-0.65</td>
</tr>
<tr>
<td>[0.693]</td>
<td>[0.073]</td>
<td>[0.030]</td>
<td>[0.017]</td>
</tr>
<tr>
<td>ln(TFP_t) * KOF_t</td>
<td>-0.42</td>
<td>-0.04</td>
<td>0.07</td>
</tr>
<tr>
<td>[0.020]</td>
<td>[0.929]</td>
<td>[0.861]</td>
<td>[0.861]</td>
</tr>
<tr>
<td>ln(k_t) * ln(TFP_t)</td>
<td>-0.70</td>
<td>0.31</td>
<td>0.50</td>
</tr>
<tr>
<td>[0.006]</td>
<td>[0.569]</td>
<td>[0.368]</td>
<td>[0.509]</td>
</tr>
<tr>
<td>ln(k_t) * ln(TFP_t) * KOF_t</td>
<td>1.27</td>
<td>0.43</td>
<td>0.82</td>
</tr>
<tr>
<td>[0.003]</td>
<td>[0.532]</td>
<td>[0.260]</td>
<td>[0.623]</td>
</tr>
</tbody>
</table>

R² 0.91 0.95 0.87 0.84

AR(1) 0.15
AR(2) 0.40
Hansen 1.00
N^ instruments 83
Obs 621 621 621 621 621
N 24 24 24 24 24

*Endogenous variables: ln(LIS_{t-1}), ln(k_t), ln(TFP_t), Δnt, ln(k_t) * KOF_t, ln(TFP_t) * KOF_t, ln(k_t) * ln(TFP_t), ln(k_t) * ln(TFP_t) * KOF_t; Predetermined variables: ln(RGDP_t);
Exogenous variables: KOF_t, ln(OIL_t), ln(TU_t), ln(MAN_SHARE_t); p-values in brackets.
Table 3. Estimated models for the non-OECD countries.

<table>
<thead>
<tr>
<th>Dependent Variable: $\ln(LIS_t)$</th>
<th>BASE-RUN</th>
<th>MODEL WITH INTERACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FE</td>
<td>OLS</td>
</tr>
<tr>
<td>$c$</td>
<td>-0.63</td>
<td>-0.08</td>
</tr>
<tr>
<td></td>
<td>[0.031]</td>
<td>[0.057]</td>
</tr>
<tr>
<td>$\ln(LIS_{t-1})$</td>
<td>0.88</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>$\ln(LIS_{t-2})$</td>
<td>-0.07</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>[0.063]</td>
<td>[0.824]</td>
</tr>
<tr>
<td>$\ln(k_t)$</td>
<td>0.01</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>[0.757]</td>
<td>[0.032]</td>
</tr>
<tr>
<td>$\ln(TFP_t)$</td>
<td>-0.002</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>[0.956]</td>
<td>[0.168]</td>
</tr>
<tr>
<td>$KOF_t$</td>
<td>0.08</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>[0.437]</td>
<td>[0.386]</td>
</tr>
<tr>
<td>$\ln(OIL_t)$</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>[0.707]</td>
<td>[0.083]</td>
</tr>
<tr>
<td>$DEM2$</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>[0.304]</td>
<td>[0.126]</td>
</tr>
<tr>
<td>$\Delta n_t$</td>
<td>-0.08</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>[0.966]</td>
<td>[0.937]</td>
</tr>
<tr>
<td>$\ln(MAN_SHARE_t)$</td>
<td>-0.01</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>[0.458]</td>
<td>[0.869]</td>
</tr>
<tr>
<td>$\ln(RGDP_t)$</td>
<td>0.05</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>[0.164]</td>
<td>[0.089]</td>
</tr>
<tr>
<td>$\ln(k_t) * KOF_t$</td>
<td>0.27</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>[0.023]</td>
<td>[0.064]</td>
</tr>
<tr>
<td>$\ln(TFP_t) * KOF_t$</td>
<td>0.46</td>
<td>1.26</td>
</tr>
<tr>
<td></td>
<td>[0.043]</td>
<td>[0.010]</td>
</tr>
<tr>
<td>$\ln(k_t) * \ln(TFP_t)$</td>
<td>0.16</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>[0.386]</td>
<td>[0.023]</td>
</tr>
<tr>
<td>$\ln(k_t) * \ln(TFP_t) * KOF_t$</td>
<td>-0.43</td>
<td>-2.78</td>
</tr>
<tr>
<td></td>
<td>[0.317]</td>
<td>[0.011]</td>
</tr>
</tbody>
</table>

$R^2$ 0.94 0.96 0.94 0.95

$AR(1)$ 0.00 0.72 1.00 82

$Hansen$ $Obs$ 650 650 650 649 650

$N$ 27 27 27 27 27

*Endogenous variables: $\ln(LIS_{t-1})$, $\ln(k_t)$, $\ln(TFP_t)$, $\Delta n_t$, $\ln(k_t) * KOF_t$, $\ln(TFP_t) * KOF_t$, $\ln(k_t) * \ln(TFP_t)$, $\ln(k_t) * \ln(TFP_t) * KOF_t$; Predetermined variables: $\ln(RGDP_t)$;

Exogenous variables: $KOF_t$, $\ln(OIL_t)$, $DEM2$, $\ln(MAN\_SHARE_t)$. $p$-values in brackets.

Moreover, the positive coefficient on the capital-output ratio points to an elasticity of substitution between capital and labor lower than one ($\sigma < 1$) reflecting, as expected,
the complementarity between these production factors in advanced economies. On the contrary, other variables, and in particular the ones proxying the impact of globalization and the level of technology, show no significant influence in explaining the labor share. This may reflect either that these variables are not relevant as labor share determinants, or that linear models are not the best tool when the explanatory variables are dependent on one another (as explained in Section 2.3).

When the model contains interactions, the share of manufacturing production, and the real per capita GDP loose most of their relevance. Although at first glance this could be interpreted as the counterpart of globalization and technology becoming significant, such assessment is only feasible by checking the marginal effects delivered by the interactive terms in the model. Indeed, as explained in Section 2.3, the influence of the variables involved in the interactions cannot be assessed unless their marginal effects are properly computed. This is done in Section 6.

The picture for the non-OECD countries is much blurred due to a base-run model in which we find scarce explanatory power from all variables, but the lagged dependent ones. However, although it could be tempting to model the labor share in the non-OECD economies as a simple autoregressive equation, the multiplicative interactive specification may still shed light on the role played by globalization and technology in shaping the labor share.

A final point worth noting is that, as expected, the persistence coefficients appear as the largest ones under the OLS estimation (0.90 in the OECD and 0.96 in the non-OECD areas, respectively), the lowest ones under the FE estimation (0.67 and 0.79), and in a middle position when estimated through System GMM (0.72 and 0.82). As mentioned before, we credit the latter and conclude that the labor share in the non-OECD area is more persistent than in the OECD countries.

\section{Marginal effects}

As argued, the impact of the capital-output ratio on the labor share needs to be assessed at different values of the KOF index of globalization and the log of TFP.

\subsection{Scenarios}

These values are selected according to the following procedure. All available sample information for the economies in the regressions is used to estimate Kernel density functions

\footnote{In the \textit{SK} schedule, the irrelevance of the capital-output ratio is consistent with a Cobb-Douglas production function ($\sigma = 1$).}
of the KOF and TFP indices in the OECD and non-OECD areas. These functions are plotted in Figure 5, with shaded areas indicating the range of values that fall within the 95% confidence interval given by a two standard deviation from the sample mean.

This selection yields values for the OECD countries ranging from 40% to 100% for the KOF index, and from -0.35 to 0.18 for the TFP. In turn, the ones for the non-OECD economies go from 22% to 68% for the KOF index, and range between -0.34 and 0.38 for the TFP. Note that the wider interval in the non-OECD area implies a larger volatility of the TFP, and does not reflect at all a better technological level.14

Figures 5. Kernel density estimates of the KOF index and TFP.

Note: The TFP is measured in logarithms.

Figures 6 and 7 present the estimated marginal effects of the capital-output ratio on labor share in the OECD and non-OECD areas respectively. As noted before, the underlying regression is the one by System GMM. Asterisks in these figures denote significant marginal effects at the 95% confidence interval.

In Figures 6a and 7a, the continuum of values of the KOF index is presented in the horizontal axis. Then, the impact of a change in the capital-output ratio on the labor share

---

14 This is so by definition of the TFP variable in the Penn World Table 8.0, where users are forced to choose between a definition of this variable that allows for comparison across countries at a point in time, or a measure that allows comparisons within countries across years (see Feenstra et al., 2013). The later is the one we use.
along these values is evaluated in five levels of TFP comprising the minimum, maximum, and average values of the relevant sample, and the upper and lower bounds computed as 1 standard deviation from the average. These are denoted, respectively, as TFP minimum, TFP maximum, TFP average, TFP upper bound, and TFP lower bound.

In turn, in Figures 6b and 7b, we have the continuum of values of the TFP in the horizontal axis, and we consider 5 different trajectories of the KOF index ranging from one extreme case—a value 0% reflecting autarchy—to the other extreme—a country 100% globalized. In the intermediate scenarios, we consider KOF index values of 25%, 50% and 75%. It is important to remark that both figures (a and b) give the same information from two different perspectives. We focus on one or another depending on the ease of interpretation of each point we make.

5.2 OECD

The first result for the OECD area is that the larger the degree of globalization, the lower the impact of a change in the capital-output ratio on the labor share (Figure 6a) independently of the countries’ technological level. To be more precise (Figure 6b), note that from the range of KOF values going from 0% to 75%, we find \( \frac{d\ln(L)}{dk_i} > 0 \), whereas for extreme levels of globalization \( (KOF = 100\%) \) the impact of the capital-output on the labor share is negative (implying \( \sigma > 1 \)).

To complement the analysis, let us take a different perspective and consider a reference value for the TFP of -0.15, for example. At this point, observe (Figure 6b) that the larger the values of the globalization index, the smaller is the impact of a change in the capital-output ratio on the labor-share. For example, when the KOF index is equal to 0%, the impact of the capital-output ratio on the labor share is 0.6, implying that a 1% increase in the capital-output ratio will increase the labor share by 0.6%. For larger values of the globalization index, take for example KOF=50%, the impact of the capital-output ratio on the labor share is 0.2, which is a third of the effect in the extreme case of autarchy.

To understand the implications of this result, recall equation (3).

\[
\frac{d\ln(L)}{dk_i} = -\frac{1 + \sigma_i}{k_i \eta_i}
\]

For a given capital-output ratio \( (k_i) \), \( \frac{d\ln(L)}{dk_i} \) could become smaller either because \( \sigma \) (defined as negative, following Bentolila and Saint-Paul, 2003) gets larger (in absolute value); or because \( \eta_i \), which by definition is always negative (Hamermesh, 1993), also becomes larger. Therefore, our analysis of the globalization impact on the labor share is an empirical test of Rodrik’s (1997) conjecture, according to which globalization increases the labor demand
elasticity with respect to wages. This may happen because of the extension of offshoring practices, increased international competition, and the enhanced substitutability of the production factors ($\sigma$). Although Rodrik's (1997) conjecture cannot be tested directly in our context, our findings are consistent with his statement to the extent that the larger the degree of globalization, the smaller the impact of the capital-output on the labor share (i.e. the larger $\sigma$, $\eta$ or both).

Figure 6. Marginal effects in OECD countries. System GMM.

a. Across varying degrees of globalization

b. Across varying levels of technology

The second main result concerns the effect of technology on the elasticity of the labor share with respect to the capital-output ratio. We find, as shown in Figure 6b, that the higher the technological level, the larger the impact of the capital-output on the labor
share for whatever value taken by the KOF index. This implies that either the degree of substitution between the production factors ($\sigma$) or the labor demand elasticity with respect to wages ($\eta$) become smaller. Given that the TFP represents technology, our hypothesis is that this result is mainly driven by $\sigma$, reflecting that capital and labor enhance their degree of complementarity.

Finally, a third main result is the evidence on the varying values of $\sigma$, which is estimated above or below unity depending on the scenario.\(^{15}\) As shown in Figure 6, in most scenarios we find capital and labor to be complements. However, for extremely large degrees of globalization (say $KOF > 80\%$) and relatively low technological levels (not larger than the average, as plotted in Figure 6a; or lower than -0.05, as shown in Figure 6b), capital and labor appear as substitutes.

Summing up, our results provide robust evidence that globalization in the OECD area has helped to increase the substitutability between production factors, whereas technological progress has, on the contrary, pushed their complementarity.

5.3 Non-OECD

Figure 7 shows the equivalent analysis for the non-OECD economies, where globalization and TFP exert different influences on the impact of the capital-output ratio on the labor share depending on their values.

The first issue deserving attention is the presence of an inflection point where all lines intersect (around a value of 40% in the KOF index of globalization in Figure 7a, and around a zero value in the log of TFP in Figure 7b). These points reveal a significant asymmetric relationship among globalization, TFP, and the impact of the capital-output ratio on the labor share.

In terms of results, we find that the higher the technological level (and for a given degree of globalization), the lower the impact of the capital-output ratio on the labor share, and thus the larger the elasticity of substitution (Figure 7b). This is the opposite result than for the OECD countries.

This elasticity, however, may be above or below 1 depending on the technological level. When the technological level is relatively low, we find a positive elasticity of the labor share with respect to the capital-output ratio $\left(\frac{d\sigma}{dk_l} > 0\right)$ implying complementarity between the production factors (i.e., $\sigma < 1$). However, when it is relatively high, we find $\frac{d\sigma}{dk_l} < 0$, thus $\sigma > 1$, and a larger substitutability between capital and labor.

\(^{15}\)Recall that values above unity are interpreted in the literature as evidence that capital and labor are substitutes, while values below unity reflect complementarity. Substitutability is in general associated with low skill levels of labor (dominant in less developed countries), while complementarity is usually connected to high skill labor (prominent in developed countries). Related evidence for the OECD is provided in Krussel et al. (2000).
Another important implication is that this effect is larger, the higher the degree of globalization (note that for higher levels of globalization the curve in Figure 7b becomes steeper). Therefore, in a context of technical progress, globalization helps the substitutability between production factors (i.e., the higher the degree of globalization, the larger the decrease in the impact of the capital-output ratio on the labor share provided there is technological progress).

With respect to globalization, its effects are not unanimous (Figure 7a). For relatively high levels of globalization (say above 40%), the impact of the capital-output ratio on the labor share takes negative values (reflecting $\sigma > 1$) only when technology is high enough (i.e., when evaluated at the upper bound scenario or above). In this context, the more globalized a country is, the smaller the impact of the capital-output ratio on the labor share. This implies that, along with the globalization process, either $\sigma$ or $\eta$ become larger, as in the OECD.

However, this relationship is the opposite at the lowest level of technology, in which case $\sigma < 1$ and the impact of the capital-output ratio on the labor share increases with globalization (i.e., either $\sigma$ or $\eta$ become smaller). Hence, in a non-developed economy with low levels of technology, but relatively globalized, extra degrees of globalization reduce the substitutability (or enhance the complementarity) between the two production factors.

These findings are consistent with the models developed by Acemoglu (2003) and Behar (2013), where technology and globalization are endogenous and depend on the local conditions. As Behar (2013) states: “countries do not absorb new methods automatically; they consider domestic factor markets before choosing appropriate technologies” [Behar (2013) p. 11]. And, as he points out, these technologies may replace skilled or unskilled labor.

Indeed, when evaluating the marginal effects in five different scenarios of TFP (Figure 7a), we are implicitly considering the technological level as a local condition of the evaluated area. Thus, in a developing country with low-skill labor and a low technological level (represented by TFP minimum in Figure 7a), the increase in the degree of globalization enhances the complementarity between labor and capital because such country chooses to import capital goods that allow its productive structure to better adapt to its local endowments. In turn, in a developing country with low-skill labor, but a relatively high technological level (represented by TFP upper bound and TFP maximum in Figure 7a), an increase in the degree of globalization reduces the impact of the capital-output on the labor share, hence increasing factor substitutability. This is the outcome of their ability to import skill-biased capital goods from developed countries.16 Hence, different local

---

16 For an analysis of how developing countries acquire their technology, see Eaton and Kortum (2001). Also, Meschi and Vivarelli (2009) provide evidence on how international trade can affect technological
conditions cause different effects of the globalization process.

**Figure 7. Marginal effects in non-OECD countries. System GMM.**

**a. Across varying degrees of globalization**

Finally, the results for low levels of globalization should not be interpreted as reflecting a fundamental change in the network of impacts we have just described. The reason is that this network of impacts ceases to be significant in closed enough economies. The perspective given in Figure 7b conveys this message in the clearest way: the significant degrees of globalization are for values of the KOF index between 50% and 75% (not lower); the relevant technology levels are below the lower bound scenario and above the upper bound scenario (not in between); and the inflection point takes place around value 0.

change depending on the countries’ capacity in absorbing technologies.
6 Conclusions

The structural decline of the labor share is by now a generally accepted phenomenon. In this paper, we reappraise the connection between the labor share and the capital-output ratio, which has become central in the analysis of labor share movements. Our focus is placed on the effects that the interaction between some crucial variables—the capital-output ratio, globalization and technology—has on the elasticity of the labor share with respect to the capital-output ratio which is, in turn, connected with the elasticity of substitution ($\sigma$) and the labor demand elasticity with respect to wages ($\eta$).

Our analysis is conducted in a more flexible empirical framework than the one usually followed in the literature. It starts acknowledging that some of the variables that determine the labor share—in particular the TFP and the KOF index of globalization—do also affect the elasticity of substitution. This implies that the impact of the capital-output ratio on the labor share is most likely conditioned by these variables.

Regarding technology, the connection stems from the fact that both the TFP and $\sigma$ are technology-related variables. With respect to globalization, Rodrik (1997) argues that it rises the own-price labor demand elasticity ($\eta$) due to several factors, one of them being the enhanced possibilities of substituting the production factors (i.e., a larger $\sigma$).

Accordingly, we explore the empirical relevance of the non-linear relationships accruing from the cross-dependent impact of these variables on the labor share. We do so by estimating multiplicative interaction models to reappraise the impact of the capital-output on the labor share when the TFP and globalization are allowed to influence this impact. And we work with the largest possible amount of observations to be able to conduct separate analyses for the OECD and the non-OECD areas, which is a must according to the different results they deliver.

Our findings provide a robust picture for the OECD countries, where the globalization process has delivered a larger substitutability between production factors while, in the opposite direction, technological progress has tended to push their complementarity. This gives support to Rodrik’s (1997) conjecture on account of the lower impact of the capital-output ratio on the labor share resulting from globalization.

We conjecture, in turn, that Rodrik’s arguments in terms of the weakening bargaining power and growing offshoring practices are relevant in developed countries, such as the OECD ones, but not in developing economies in a scenario of relative closeness, and far from a high technological level. Nevertheless, still in the non-OECD area, but in a scenario of large globalization and high technology (that is, in a scenario close to the OECD countries), Rodrik’s conjecture does indeed hold. We have argued that this could be plausible to the extent that at high technology levels, globalization allows developing
countries to import skill-biased capital.

In terms of TFP, in contrast to the result obtained for the OECD, higher technological levels increase the substitutability between production factors, a plausible result given the relatively larger share of low-skilled workers that characterize developing countries.

Further research should aim at disaggregating these results by type of workers—skilled/non-skilled—and sectors—at least, manufacturing and service sectors. Given available data, this is only feasible for the OECD group of economies, which is thus the natural next step forward in this research.

References


## APPENDIX 1

Table A1. Selected economies and sample period

<table>
<thead>
<tr>
<th>OECD</th>
<th>Sample</th>
<th>NON-OECD</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>1976-2008</td>
<td>Bolivia</td>
<td>1970-2008</td>
</tr>
<tr>
<td>Denmark</td>
<td>1970-2009</td>
<td>Cameroon</td>
<td>1979-2004</td>
</tr>
<tr>
<td>Finland</td>
<td>1975-2009</td>
<td>Chile</td>
<td>1970-2008</td>
</tr>
<tr>
<td>Italy</td>
<td>1970-2008</td>
<td>Honduras</td>
<td>1980-2005</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1971-2008</td>
<td>Namibia</td>
<td>1990-2003</td>
</tr>
<tr>
<td>Poland</td>
<td>1995-2008</td>
<td>Panama</td>
<td>1980-2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trinidad &amp; Tobago</td>
<td>1984-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunisia</td>
<td>1992-2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Venezuela</td>
<td>1970-2006</td>
</tr>
</tbody>
</table>