Finance and the Global Decline of the Labour Share

Ignacio Gonzalez  Pedro Trivín
European University Institute†  Universitat Autònoma de Barcelona†

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Abstract

The labour income share has been decreasing across countries since the early 1980s, sparking a growing literature about the causes of this trend (Elsby et al., 2013; Karabarbounis and Neiman, 2014; Piketty and Zucman, 2014). At the same time, again since the early 1980s, there has been a global steady increase in equity Tobin’s $Q$ which shows the increasing trend of asset prices in modern economies. This paper uses a simple model to connect these two phenomena and evaluates its empirical validation. In our model a raise in equity Tobin’s $Q$ increases equity returns and, importantly, depresses the capital-output ratio. The impact on the capital-output ratio reduces the labour share for standard values of the elasticity of substitution. Based on a common factor model, we find that the increase in Tobin’s $Q$ explains up to 57% of the total decline in the labour income share. This implies that financial markets have direct and significant consequences in inequality through their impact on the functional distribution of income. We highlight the implications of this result and, in the context of the model, we suggest different policies that can revert this declining trend.

JEL Codes: E25, E44, E22.

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*Department of Economics, European University Institute. ignacio.gonzalez@eui.eu
†Department of Applied Economics, Universitat Autònoma de Barcelona. pedro.trivin@uab.cat.
1 Introduction

The decline of the labour income share is becoming an increasing popular research topic. The constancy of factor shares, once featured among Kaldor’s stylised facts of economic growth, has been challenged by recent literature. For example, Karabarbounis and Neiman (2014) document that the global labour share has declined significantly since the early 1980s, with the decline occurring within the large majority of countries and industries. Elsby et al. (2013) use alternative measures of the labour share and provide convincing evidence of this declining trend for the U.S. economy. More noticeably, Piketty and Zucman (2014) show, for a set of advanced economies, a decreasing (increasing) trend of the labour (capital) income share since the late 1970s.

Figure 1.a shows the figure of concern. It displays the evolution of the global labour share according to our data by plotting the year fixed effects from a GDP weighted regression along with its 90% confidence intervals. Country fixed effects are included to eliminate the influence of countries entering and exiting the data set. Taking 1980 as the reference year, we observe that the global labour share has exhibited a clear downward trend only disrupted by the sudden -but short- rise in the early nineties. If we normalised 1980 to equal its weighted average value (57%), labour share reaches a level of roughly 52% at the end of the sample, implying an actual decline of 8.9 per cent during the period considered.

Attempts to explain the non-constant behaviour of the labour share have often departed from reconsidering at least two previously standard assumptions namely - that aggregate technology is Cobb-Douglas and that markets are perfectly competitive. Explanations based on departures from the Cobb-Douglas production function usually assume that technology is characterised by a constant elasticity of substitution (CES) production function. As long as firms produce with a CES technology and the labour market is perfectly competitive, the labour share can be expressed as a function of the capital-output ratio, \( L/S = g(K/Y) \). Given this relation, this literature emphasises the role of capital deepening as the main determinant of the labour share. This is the case in Bentolila and Saint-Paul (2003), who refer to this relationship as the share-capital schedule (or curve). This relationship is not altered by changes in factor prices or quantities, or in labour-augmenting technical progress, which are all encompassed in the schedule. Note that within this curve, when everything else is constant, labour share dynamics can only be explained if the economy is not on a balanced growth path, meaning that capital and output are not growing at the same rate, like in Piketty and Zucman (2014) and Karabarbounis and Neiman (2014).

Labour and product market imperfections are also frequently brought up as explanatory factors of the labour share decline. Even when technology is Cobb-Douglas, move-
ments of factor shares can be triggered by changes in the bargaining power of workers and/or in the monopoly power of firms, that is to say, factors that break the equality between marginal costs and marginal products/revenues.

Figure 1: Labour income share and Tobin’s $Q$, 1980-2009

![Graphs showing Labour Income Share and Tobin’s Q](image)

Notes: Own calculations obtained as year fixed effects from a GDP weighted regression including country fixed effects to control for the entry and exit of countries throughout the sample.

In light of the previous potential explanatory departures, which are the actual drivers of the downward trend of the labour share? The literature has pointed out three potential candidates: (i) globalisation, (ii) the institutional framework, and (iii) structural/technological causes. This paper contributes to the debate by exploring the role played by a new factor: the negative impact of financial markets on corporate investment, commonly referred as the financialisation process of the non-financial corporate sector, which we connect with the global evolution of equity Tobin’s $Q$.

The presence of globalisation as a driving force candidate is not surprising. The unprecedented global integration process that economies have experienced during the last decades has substantially altered many economic relationships. With regard to the distribution of income, from a theoretical perspective, globalisation has an ambiguous effect. On one side, the relative larger capital mobility makes easier for a company to change the location of its production. The change of location can decrease the labour share by the simple elimination of jobs. In addition, given the increasing international competition, firms can also use this as a threat to decrease the bargaining power of workers (Rodrik, 1997) and, thus, the labour income share. On the other side, globalisation has a counterbalance effect by increasing product competition. This increase in competition decreases firms’ mark-ups, and this can have a positive impact on the labour income share. Therefore, impact of globalisation is something that has to be empirically evaluated. Guscina (2006) and Jaumotte and Tytell (2007) find a negative relationship between
globalisation and the labour income share in developed countries. In their analysis, they include different globalisation proxies such as: international trade, trade with developing countries, offshoring, and the export/import relative prices, finding a robust negative relationship. More recently, Elsby et al. (2013) study the role played by the offshoring process in the U.S. labour share decline. They find that the increased exposure to imported goods accounted for 85% of the total decline in the past quarter century. Therefore, empirical studies suggest a negative impact of globalisation on the labour share of income.

The role of the institutional framework has also received a strong attention in the study of factor share dynamics. The literature has focused on the impact of both labour and product market regulations. Kristal (2010), for example, finds that dynamics of the labour share are largely explained by indicators for workers’ bargaining power. Blanchard and Giavazzi (2003) emphasise that labour market regulations have a positive effect in the short-run, but negative in the long-run, because in the long-run employers can substitute capital for relatively more expensive labour. With respect to product market regulations, Raurich et al. (2012) find a negative relationship between imperfect competition and the labour share, showing that estimates of the elasticity of substitution are biased when price mark-ups are ignored. Finally, Azmat et al. (2012), investigating a different channel, find that a fifth of the total labour share decline observed is a consequence of the privatisation of public companies through job shedding.

Despite the documented importance of globalisation and market regulations, most of the current literature has focused on structural/technological explanations. This branch of the literature relies on the aforementioned one-to-one relation between the labour share and the capital-output ratio \( LIS = g(K/Y) \), where the direction of the effect depends on the elasticity of substitution between capital and labour. The contribution of this literature relies on looking at structural drivers of the labour share by making endogenous the dynamics of the capital-output ratio. Piketty and Zucman (2014), for example, argue that a persistent gap between the rate of return to capital and the growth rate of output results in a growing accumulation of capital because capitalists save most of their income. This would explain the observed movements of the factor shares in advanced economies. Also based on the share-capital schedule, Karabarbounis and Neiman (2014) argue that the persistent global decrease in the relative price of investment goods has induced firms to use more capital at the expense of labour, increasing the accumulation of physical capital and depressing the labour income share. They model capital-biased technological change using a version of the model presented in Greenwood et al. (1997).

Note that although Piketty and Zucman (2014) and Karabarbounis and Neiman (2014)
emphasise different channels, both use the share-capital schedule and have the common view that the increase in the capital-output ratio has been the main cause of the recent trend of factor shares. In response to higher capital accumulation, and due to low diminishing returns, the return to capital has not adjusted sufficiently downwards and this has led to an increase in the capital share. In mathematical terms, this is equivalent to say that the elasticity of substitution is larger than one. Only when capital and labour are, in the technological sense, substitutes enough, can capital be accumulated without decreasing much its rate of return.

This degree of substitutability, however, has seldom been found in the empirical literature. Economists have often estimated values of the elasticity of substitution ($\sigma$) far below one (Antràs, 2004; Chirinko, 2008).\textsuperscript{2} Notably, Chirinko and Mallick (2014) using a sectoral dataset and combining a low-pass filter with panel data techniques, find an aggregate elasticity of substitution of 0.4. Furthermore, when they allow the elasticity to differ across sectors, they find that all the sectoral values are below 1. In the context of the current debate, they convincingly argue that the secular decline in the labour share of income cannot be explained by decreases in the relative price of investment, or by any other mechanism that increases the capital-output ratio.\textsuperscript{3}

In this paper we contribute to this recent literature by proposing a new mechanism and by evaluating its empirical validation with recent panel data techniques. Our mechanism emphasises the role of finance and the relation between financial markets and corporate behaviour. In particular, we argue that the widespread increase in equity Tobin’s $Q$ has occurred at the expense of corporate investment and the labour income share. We provide a simple model which shows that when equity Tobin’s $Q$ raises, the equilibrium capital-output ratio falls. Importantly, this fall has a standard impact on the labour income share because it requires a value of the elasticity of substitution in line with the estimates traditionally found in the empirical literature.

Our theoretical argument is the following. When equity Tobin’s $Q$ raises, financial wealth raises accordingly and, to hold this additional wealth, investors demand a higher return on equity. In any standard model, like ours, equity returns are linked to the marginal productivity of capital. This implies that if firms are forced to increase the return on equity, they have to reduce investment on capital. This depresses the capital-output ratio and has a direct impact on the labour share.\textsuperscript{4}

\textsuperscript{2}Chirinko (2008) provides a summary of the empirical literature and lists estimates from different papers, concluding that ”the weight of the evidence suggests that gross $\sigma$ lies in the range between 0.40 and 0.60”

\textsuperscript{3}Most of the criticisms of Piketty’s Capital have emphasised this point, like Rogulie (2015) and Acemoglu and Robinson (2015)

\textsuperscript{4}In an unpublished manuscript, Michele Boldrin and Adrian Peralta-Alva realized that corporate capital stock and market value of corporate equity were negatively correlated in U.S. data between

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Note that the mechanism of our model makes use of the shared-capital schedule: we impact the labour share through changes in the capital-output ratio. In that sense, our paper is close to structural/technological explanations like the mechanism proposed by Karabarbounis and Neiman (2014). However, in our model the share-capital schedule works very differently. In response to an increase in equity Tobin’s $Q$, investment and the capital-output ratio fall, not raise, and equity returns raise, not fall. This way, the mechanism suggests that it is not too much investment what causes the decline of the labour income share, like in Karabarbounis and Neiman (2014), but too little, making our model compatible with standard values of the elasticity of substitution (i.e., $\sigma < 1$).

The relation of our paper with Piketty and Zucman (2014) is more subtle. On one hand, they emphasize the role of increasing capital-output ratios in explaining the recent evolution of capital and labour shares. This makes their contribution closer to Karabarbounis and Neiman (2014). On the other hand, they calculate corporate capital using the stock market value of equity holdings. That is, they assume that Tobin’s $Q$ is equal to one and proceed by equating the market value of physical capital to the stock market value of the corporate sector. However, they emphasize the important role of asset prices in driving the evolution of capital-output ratios and, for a set of advanced economies, they show a clear upward trend of equity Tobin’s $Q$ during the last 35 years. Furthermore, and consistent with our theory, they find declining or stagnant trends when they calculate corporate capital-output ratios using the PIM method and, not surprisingly, they estimate that, in absence of capital gains, national wealth-income ratios would have remained stagnant or declined.5

Our theory gives rise to several questions: Does the raise of Tobin’s $Q$ capture the impact of finance on factor shares? What is behind the global evolution of Tobin’s $Q$? And more importantly, is it a relevant mechanism?

We certainly do not argue that Tobin’s $Q$ is a perfect indicator of financial activity and we neither try to show that Tobin’s $Q$ is a variable that captures the whole impact of finance on the capital-output ratio and the factor shares. We simply check the empirical validation of a model that shows that when Tobin’s $Q$ raises, the equilibrium capital-output ratio and the equilibrium labour share fall.

Our mechanism is relevant but, to the best of our knowledge, empirically unexplored. It is first relevant because it resembles the widely discussed arguments used by the literature on financialisation (Epstein, 2005; Davis, 2009), which has recently been connected

1951 and 2001. They find a correlation coefficient of -0.73 and they considered this finding a puzzle which cannot be solved by any standard theory. Our model shows that, when the demand of assets is increasing in equity returns, there is not any puzzle. The slides of the unpublished draft are available at http://www.micheleboldrin.com/research/buscycles.html

with the evolution of factor shares (Stockhammer, 2013) and inequality in general (Lin and Tomaskovic-Devey, 2013). This literature studies the increasing role of financial markets and financial motives within the non-financial corporate sector. In particular, it emphasises mechanisms that raise equity wealth and corporate payouts but depress corporate investment, just like in our model.

There are different mechanisms whose impact can be encompassed through an increase of equity Tobin’s $Q$. Among them, financialisation literature has emphasised the role played by the increasing search of "shareholder-value". According to this literature, corporations, after the early 80s, tend to pursue short-term payout policies that increase the equity price but that happen to reduce long-term investment (Stiglitz, 2015). However, there are other mechanisms which can also increase the price of equity and reduce the investment on physical capital. These are, for example, the decrease of dividend income tax rates and and the decline of stock market transaction costs. Any of these mechanisms can be embodied in a version of the model we present below. The important aspect is that they all impact the equilibrium capital-output ratio and the labour share through an increase in equity Tobin’s $Q$. For this reason we prefer to abstract from any specific factor and focus on the impact of Tobin’s $Q$ alone.

Figure 1.b shows the evolution of global Tobin’s $Q$ according to our data by plotting the year fixed effects from a GDP weighted regression where 1980 is taken as the reference year (1980 = 0). If we consider the weighted average value in 1980, Figure 1.b shows a steady Tobin’s $Q$ increase from a value below 1.2 to values around 1.7 in 2007.

Figure 5 is more illustrative. It shows a negative correlation between the labour income share and the Tobin’s $Q$ when we control for country fixed effects. It is therefore the figure that better anticipates the answer to our research question. For our empirical analysis, we rely on recently developed panel time-series techniques that account for macroeconomics data characteristics. In particular, we present different Mean Group-style estimators which rely on a common factor model approach. Importantly, with this empirical approach we can deal with unobservable heterogeneity while we also control for the panel-time-series characteristics of macro data (i.e., cross-section dependence and nonstationarity) in a tractable way. Furthermore, country-specific impact of our variables of interest can be obtained. We opt to further control for the relative price of investment goods to compare our mechanism with that of Karabarbounis and Neiman (2014).6

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6Changes in the relative price of investment goods impacts the capital-output ratio but they do not change the Tobin’s $Q$. 

Our results show a robust and significant negative impact of the Tobin’s $Q$ on the labour income share that can explain up to 57% of its decline since 1980. However, we do not find any significant impact of the relative price of investment goods. Like Chirinko and Mallick (2014), our results suggest that the decline of the labour income share cannot be explained by the secular decline of the relative price of investment goods.

Since Tobin’s $Q$ impacts the labour share through an endogenous decline of the capital-output ratio, our results reconcile the secular decline in the labour income share with standard values of the elasticity of substitution. This is starkly in contrast with the explanations given by Piketty and Zucman (2014) and Karabarbounis and Neiman (2014). We consequently conclude that deep causes for the secular decline of the labour share have to be found not in the mere accumulation of physical capital or in capital biased-technological changes, but in the way financial markets and corporations relate. In particular, the deep causes for functional inequality should be found in policies or institutional changes that have increased financial wealth at the expense of real investment.

The remaining of the paper is structured as follows. Section 2 develops the theoretical framework relating the Tobin’s $Q$ with the labour income share. Section 3 introduces and explains the data used in our empirical analysis. Section 4 and 5 present, respectively, the econometric methodology and the results. Section 6 summarises and concludes.
2 Theoretical framework

This section presents a model that connects the labour share with financial wealth, physical capital stock and the Tobin’s $Q$. We consider a representative agent economy where households accumulate financial wealth and receive direct utility from the ownership of wealth. The firm accumulates physical capital and distribute dividends to households.

2.1 Households

There is a representative household whose maximisation problem is the following (in recursive form):

$$V(s) = \max_{c,s'} c^{1-\mu} + \beta V(s')$$

subject to

$$c + ps' = w + (Qd + p)s,$$

where, $c$ represents consumption, $w$ is the average wage, $d$ is the amount of dividends distributed in the current period, $p$ is the price of stocks and $s$ represents the amount of stocks owned today. Note that $s$ is a state variable which was decided yesterday. $Q$ represents the fraction of dividend income received by the households. At every given period there is one equity share outstanding. Hence, market clearing in the market for shares requires $s = 1$ for any period.

The first term of the utility function is the standard Constant Relative Risk Aversion (CRRA) formulation of consumption utility. The second term, proposed by Carroll (1998) and used by Reiter (2004) and Piketty (2011), says that investors derive utility from the ownership of wealth $(p-1)s$ and not merely from consumption. A similar specification of wealth in the utility function has been recently used in Kumhof et al. (2015).

In a frictionless economy, households receive the total amount of dividends distributed by the firm and $Q$ equals one. In our case, we assume that there is a constant fraction of the dividend income $1 - Q$ which does not go to households. An obvious example of this type of friction is a capital income tax which detracts from households a constant fraction of dividends. However, other frictions, like financial transaction costs, can be thought similarly. In this context, the return on equity is given by $1 + r = \frac{Qd + p}{p-1}$.

We show later that $Q$ is exactly the equity Tobin’s $Q$. This is the simplest way to have a Tobin’s $Q$ different to one. In this particular case, it is also constant along the whole domain of equity returns.7

7There are other modelling strategies to achieve a Tobin’s $Q$ different than one, which rationalise other frictions. Gonzalez (2016) shows that stock market costs and different stochastic discount factors between managers and shareholders can also give rise to an equity Tobin’s $Q$ different than one. The
We can simplify the problem of the household by using a change of variable. Let $a'$ denote the value of assets acquired by the representative household at the current period. The problem becomes:

\[ V(a) = \max_{a'} \left[ \frac{(1 + r)(a) - w - a'}{1 - \mu} + \frac{\gamma a^{1-\theta}}{1 - \theta} + \beta V(a') \right] \tag{2} \]

where $a' = ps'$ and $1 + r = \frac{Qd + p}{p-1}$.

The intertemporal first order condition with respect to $a'$ gives the Euler equation:

\[ c^{-\mu} = \beta[(1 + r')c^{(-\mu)} + \gamma a^{(\theta - \mu)}], \tag{3} \]

and its corresponding steady state formulation:

\[ 1 = \beta[(1 + r) + \frac{\gamma a^{-\theta}}{c^{-\mu}}] \tag{4} \]

Note that at the steady state, consumption equals the flow of total interests plus total wage, $c = ra + w$. Given this Euler equation, we can express the steady state demand of financial wealth like:

\[ a = \left[ \frac{r^{-\mu} - \beta r^{-\mu} - \beta r^{1-\mu}}{\beta \gamma} \right]^{-\frac{1}{\theta + \mu}} \tag{5} \]

**Proposition 1.** The steady state demand of financial wealth is an increasing function of the return $r$ for $0 < r < \left( \frac{1}{\beta} - 1 \right)$ if $\mu \geq 0$ and $\theta > \mu$.

**Proof.** The derivative of $a$ with respect to $r$ is:

\[
\frac{\partial a}{\partial r} = \left[ \frac{r^{-\mu} - \beta r^{-\mu} - \beta r^{1-\mu}}{\beta \gamma} \right]^{-\frac{1}{\theta + \mu} - 1} \left[ \frac{-\mu r^{-\mu-1} + \beta \mu r^{1-\mu-1} - \beta (1 - \mu)r^{-\mu}}{\beta \gamma} \right]^{-\frac{1}{\theta + \mu}} \frac{1}{-\theta + \mu} 
\]

For $\beta \gamma > 0$, term A is positive if $0 < r < \left( \frac{1}{\beta} - 1 \right)$. Term B is negative for any value of $r$ between 0 and $\frac{1}{\beta} - 1$ if $\mu \geq 0$. Accordingly, to have $\frac{\partial a}{\partial r} > 0$ along this range of returns, term C has to be negative and, therefore, $\theta > \mu$ must be satisfied. ■

Summing up, when $r$ is below $\frac{1}{\beta} - 1$, the steady state demand of financial assets is increasing in $r$. However, the impact on equilibrium capital-output ratio, however, is similar in the sense that when Tobin’s $Q$ raises, the capital-output ratio always declines.

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8For simplicity we do not include $w$ in the steady state equation. This simplification would be equivalent to a model where, in addition to the problem of the shareholder, there is a representative worker with perfect inelastic supply where wages are simply determined by the marginal productivity of labour.
monotonically increasing with respect to capital return if \( \mu \geq 0 \) and \( \theta > \mu \). Interestingly, an increasing steady state demand of financial assets shows that using wealth in the utility function within the representative agent framework can be interpreted, for a range of realistic parameter values, as a reduced form for precautionary savings. Indeed, in the standard incomplete markets model, which is often used to model precautionary behaviour, the aggregate demand of assets is also increasing and \( r < \frac{1}{\beta} - 1 \) is satisfied in equilibrium.\(^9\) Although accumulating wealth for precautionary behaviour is a plausible interpretation for the shape of \( a(r) \), other interpretations are also possible. For example, people might also derive direct utility from wealth accumulation due to the social status conferred by wealth (Piketty, 2011). Or people might accumulate wealth for dynastic altruism, that is, to leave a bequest to their descendants. Whatever the interpretation, by using wealth in the utility function, we get an increasing demand for financial assets, which, as shown below, is crucial for the results of the paper. This is in contrast with the standard model where only consumption is included in the utility function and that, according to Carroll (1998), is unable to explain households’ saving behaviour. In that case, wealth disappears from the Euler equation and the steady state demand of assets becomes perfect elastic at \( \frac{1}{\beta} - 1 \). Finally, note that according to our specification, marginal utility is decreasing both in consumption and in wealth, but the restriction \( \theta > \mu \) means that it diminishes less rapidly in consumption.

From now onwards, the steady state demand of financial assets will be expressed as \( a(r) \), where:

\[
a(r) = \left[ \frac{r^{-\mu}(1 - \beta) - \beta r^{1-\mu}}{\beta \gamma} \right]^{\frac{1}{\beta + \gamma}}, 
\]

and:

\[
\frac{\partial a(r)}{\partial r} > 0; \; \forall r < \frac{1}{\beta} - 1 \; \text{if} \; \theta > \mu \; \text{and} \; \mu \geq 0.
\]

### 2.2 The Firm

The representative firm accumulates physical capital \( K \), pays the wage bill \( w \) and uses a CES technology to produce output \( Y \):

\[
Y = \left[ \phi K^{(\frac{1}{\sigma})} + (1 - \phi) L^{(\frac{1}{\sigma})} \right]^{\frac{\sigma}{\sigma - 1}},
\]

where \( \phi \) is a distributional parameter and \( \sigma \) is the elasticity of substitution between labour and capital. The labour share of income \( LIS \) can be expressed in terms of the current period capital-output ratio \( \frac{K}{Y} \):

\(^9\)Although concavity is not required for the desired result, it turns out that it is also satisfied, as Figure 3 shows.
\[ LIS = 1 - \phi \left( \frac{K}{Y} \right)^{\frac{\sigma - 1}{\sigma}}, \]  
where the sign of \( \frac{\partial LIS}{\partial K} \) depends on whether \( \sigma \) is higher or lower than one. In recursive formulation, the problem of the firm is:

\[
V(K) = \max d + m'V(K')
\]

\[ s.t. \quad d = F(K, L) - (K' - (1 - \delta)K) - w, \]

where \( \delta \) accounts for the depreciation rate of capital. The firm’s discount factor is:

\[
m' = \frac{\beta u_c'}{u_c - \beta v_a'} = \frac{1}{1 + r'},
\]

which makes the problem of the firm consistent with the problem of the households.

Given that, the firm solves:

\[
V(K) = \max F(K, L) - (K' - (1 - \delta)K)) - w + \frac{1}{1 + r'}V(K'),
\]

The FOC with respect to \( K' \) is

\[
F_{K'}(K', L') = \delta + r',
\]

from where we obtain a standard demand for capital \( K'(r) \), which is decreasing in the level of capital returns. Using the transversality condition \( K_\infty = 0 \), the constant-returns-to-scale assumption (which is satisfied under a CES technology) and abandoning the recursive formulation, we can express total capital stock as a function of future dividends.

\[
K_{t+1} = \sum_{j=0}^{\infty} \frac{d_{t+1+j}}{\Pi_{h=1}^{j-1}(1 + r_{t+h})},
\]

From the definition of equity returns, \( \frac{Qd' + p'}{p} = 1 + r' \), the stock price \( (p) \) can be expressed, using forward substitution, as a function of the future stream of received dividends:

\[
p_t = \sum_{j=0}^{\infty} \frac{Qd_{t+1+j}}{\Pi_{h=1}^{j-1}(1 + r_{t+h})}
\]

Tobin’s \( Q \) is the ratio of the stock market value to the replacement cost of capital. Using the expressions above, Tobin’s \( Q \) results in:
\[ Q_t = \frac{p_t}{K_{t+1}}, \quad \forall t \] (15)

Note that under this specification, Tobin’s \( Q \) is constant along the whole domain of equity returns. Since the demand of capital has been obtained from the problem of the firm, the value of financial assets is:

\[ p(r) = QK'(r) \]

### 2.3 Equilibrium

Equilibrium in the capital market would occur at the intersection between \( p(r) \) and \( a(r) \). Since \( a(r) \) is monotonically increasing and \( p(r) \) is monotonically decreasing, there is a unique equilibrium characterised by the return to equity \( (r^*) \) given by:

\[ p(r^*) = a(r^*) \] (16)

Note that since the capital demand is monotonically decreasing with respect to the return, there is a single level of capital corresponding to \( r^* \). We denote this level \( K^*(r^*) \).

Importantly, the equilibrium \( p(r^*) = a(r^*) \) depends on \( Q \). If \( Q \) is larger, then the equilibrium equity return would be higher because investors would demand a higher return to hold the additional financial wealth. Therefore, the equilibrium level of \( r \) depends positively on \( Q \).

When \( Q \) changes, there is a change in equilibrium \( r^* \), but also a change in the amount of physical capital demanded by the firm. Figure 3 is illustrative at this point. When \( Q \) grows, the gap between \( p(r) \) and \( K(r) \) becomes smaller and \( r^* \) raises because the equilibrium is moving upwards along \( a(r) \). In response to it, the firm will tend to decrease the amount of physical capital to raise the return on equity, which from equation (12) is directly linked to the marginal productivity of capital. Therefore, we can express the equilibrium level of capital \( K^* \) in terms of \( r^* \), and subsequently, in terms of \( Q \):

\[ K^*(r^*(Q)) = K^*(Q) \] (17)
Figure 3: Market for capital

Notes: The curves \(a(r), p(r)\) and \(K(r)\) are built using standard parameter values: \(\mu = 2, \theta = 3, \sigma = 0.9\). Tobin’s \(Q\) is assumed to be constant, like in the model, and equal to 0.6.

Proposition 2. The relation between Tobin’s \(Q\) and equilibrium capital \(K^*\) is negative.

Proof. Since \(p(r) = QK(r)\), the equilibrium condition \(p(r) = a(r)\) can be expressed as \(G(K, Q) = 0\) where \(G(K, Q) = \frac{a(r(K))}{K} - Q\). Applying the implicit function theorem, we have that

\[
\frac{dK}{dQ} = -\frac{\frac{\partial G}{\partial K}(K^*, Q)}{\frac{\partial G}{\partial Q}(K^*, Q)} = -\frac{\partial a}{\partial r(K^*)} \frac{1}{\partial r(\frac{1}{\frac{\partial r}{\partial K}(K^*)})}. 
\]

Since \(\frac{\partial a}{\partial r}\) is positive and \(\frac{\partial r}{\partial K}\) is negative, \(\frac{dK}{dQ}\) has to be negative.

The equilibrium of the model makes explicit the relation between the capital level of equilibrium and the Tobin’s \(Q\). Since the labour share depends on the capital-output ratio (see equation (8)), we can make explicit the relation between the equilibrium labour share and Tobin’s \(Q\):

\[
LIS^* = 1 - \phi\left[\frac{K^*(Q)}{Y^*(K^*(Q))}\right]^{\frac{\sigma+1}{\sigma}}, \quad \text{and} \quad \frac{\partial LIS}{\partial Q} = \frac{\partial LIS}{\partial K} \frac{\partial K}{\partial Q} \frac{dK(Q)}{dQ}, \quad (18)
\]
where:
\[
\frac{\partial L I S}{\partial K} > 0 \text{ if } \sigma < 1; \\
\frac{\partial K}{\partial K} > 0 \text{ due to CRS;}
\]
and \[
\frac{dK(Q)}{dQ} < 0 \text{ given by proposition 2.}
\]

Importantly, the mechanism proposed here works through the capital-output ratio, that is, Tobin’s Q impacts the labour share through its effect on investment and capital. In that sense, as remarked before, our model is in the spirit of Karabarbounis and Neiman (2014). In particular, Karabarbounis and Neiman (2014) build a model to explain the decline of the labour income share with recent movements in the relative price of investment goods. Their mechanism can be easily embedded into our model by adding the relative prices of capital goods (\(r_p\)) in the budget constraint of the firm, like in Greenwood et al. (1997).

\[
F(K, L) = d + r_p [K' - (1 - \delta)K] + w,
\]  
(19)

where the demand of capital is dependent on \(r_p\), and more specifically, it raises when the relative price of capital goods falls, that is, \(\frac{\partial K'(r)}{\partial r_p} < 0\). We empirically evaluate the potential impact of this mechanism compared to ours.

3 Data

In order to empirically study the relationship between the Tobin’s Q and the labour income share, this paper combines three different databases.

3.1 Tobin’s Q

Tobin’s Q is the market value of capital over its replacement cost. We use data from Worldscope Database to calculate the Tobin’s Q as the market value of the sum of equity and non-equity liabilities over the sum of their book value, which is generally acknowledged as the most accurate available procedure, given the difficulty to obtain data of the replacement cost of capital. Chung and Pruitt (1994) find that a simple market-to-book ratio explains at least 96.6 per cent of the variability of Tobin’s Q -calculated as the market value of capital over its replacement cost.

We aggregate firm level data from publicly traded companies following Doidge et al. (2013) methodology. That is, in a first stage firms are clustered in 17 different sectors.
using the Fama-French 17 industries classification, where a median $Q$ is computed for each industry. Countries’ $Q$ are calculated as the market value weighted average of the median industries’ $Q$. The use of industry medians let us overcome the problem of potential outliers in the sample.

3.2 Labour income share

Regarding the LIS, Karabarbounis and Neiman (2014) have developed a database of the corporate labour income share for a considerable number of countries obtaining the data from several sources. However, the use of their database would force us to exclude a non-negligible number of countries in our analysis. As an alternative, we lean to use the LIS variable from the Extended Penn World Table 4.0 (EPWT 4.0).

The EPWT 4.0 draws information from different United Nations sources and measures the labour income share as the share of total employee compensation in the Gross Domestic Product with no adjustment for mixed rents, and without distinguishing the corporate sector. Although we are aware of the potential drawbacks from using this LIS definition, the correlation with the corporate labour share and the total labour share used by Karabarbounis and Neiman (2014) is 0.87 and 0.96 respectively (Figure 4). We consider this a safe level in order to use our variable.

Figure 4: EPWT LIS vs KN LIS

3.3 Relative prices

The relative price of investment goods with respect to consumption goods is obtained by extending Karabarbounis and Neiman (2014) database.

In order to obtain the relative price in domestic terms, we divide the country-specific
relative price obtained from the Penn World Table 7.1 ($\frac{P_i}{P_c}$), which is calculated using ppp exchange rates, over the relative price of investment in the United States ($\frac{P_{iUS}}{P_{cUS}}$). We then multiply this ratio by the ratio of the investment price deflator to the personal consumption expenditure deflator for the United States ($\frac{ID_{US}}{PCD_{US}}$) obtained from BEA.

$$RP = \frac{P_i}{P_{cUS}} \cdot \frac{P_{iUS}}{P_{cUS}} \cdot \frac{ID_{US}}{PCD_{US}}$$

Figure 5: Tobin’s $Q$ against relative prices

Notes: Own calculation based on a sample of 41 countries and 911 observations. Variables are demeaned to control for fixed-effects. Correlation coefficient $= -0.09$.

4 Empirical methodology

Beyond the theoretical relationships, we face the challenge of carrying out a robust estimation of the relationship between Tobin’s $Q$ and the labour share. This section explains in detail (i) how we go from the theoretical model to an empirical equation, and (ii) the empirical tools which allow us to infer a causal relationship.

4.1 Empirical implementation

For empirical purposes, we do not impose a specific production function and, therefore, we do not restrict the functional form of the labour share to be the one derived from a CES technology. We simply assume a general multiplicative form where changes in the capital-output ratio have an impact on the labour share:
\[ LIS = g\left(\frac{K}{Y}\right) = a\left(\frac{K}{Y}\right)^\alpha \] (20)

This way, our empirical specification is similar to Bentolila and Saint-Paul (2003). Note that we remain agnostic about \( \alpha \) and then we do not know ex-ante whether the impact of \( \frac{K}{Y} \) on the labour share is positive or negative.

Nevertheless, contrary to Bentolila and Saint-Paul (2003), we further endogenise the capital-output ratio. Our model shows that the equilibrium capital-output ratio depends, among other things, on the Tobin’s \( Q \), and that the sign of this relation is negative. However, and again for empirical purposes, we do not impose a particular relation derived from the specifics of the model. Rather, we also assume a general multiplicative form where the capital-output ratio is expressed as a function of Tobin’s \( Q \). Following Karabarbounis and Neiman (2014), we also include the relative price of investment goods \( (RP) \) as an argument of \( \frac{K}{Y} \):

\[ \frac{K}{Y} = f(Q, RP) = Q^{\psi_1} RP^{\psi_2} \] (21)

We use these two forms to obtain an estimable equation of the labour share in terms of \( Q \) and \( RP \):

\[ LIS = g\left(\frac{K}{Y}\right) = g(f(Q, RP)) = a(Q^{\psi_1} RP^{\psi_2})^\alpha \] (22)

Taking natural logarithms:

\[ \log(LIS) = \log(a) + \alpha \psi_1 \log(Q) + \alpha \psi_2 \log(RP) + \Omega_{it}, \] (23)

or simplifying:

\[ lis_{it} = \beta_0 + \beta_1 q_{it} + \beta_2 r p_{it} + \Omega_{it} \] (24)

Where \( lis \), \( q \), and \( rp \) are the natural logarithm values of our variables of interest, and \( \Omega \) is a standard error term. Note that according to proposition 2 and expression (18) we expect \( \beta_1 \) to be negative. The sign of \( \beta_2 \) is expected to be negative if, as we assume in the model, \( \sigma \) is lower than one and capital and labour and complements. In that case, an increase in the relative price of capital goods depresses investment and this impacts negatively on the labour share. However, if we follow Karabarbounis and Neiman (2014), we should expect \( \beta_2 \) to be positive because declines in the price of capital induce firms to shift away from labour and toward capital, driving the labour share down.

### 4.2 Econometric methodology

Characterised by a small number of cross-sectional units (N) compared to the time dimension (T), macroeconomics panel data have been traditionally estimated following microe-
conomics panel data techniques under the assumptions of parameter homogeneity (across countries), common impact of unobservable factors, cross-section independence, and data stationarity.\textsuperscript{10} However, if these assumptions are violated, results would be subject to misspecification problems. In order to overcome these potential sources of misspecification, we rely on relative recently developed panel data techniques (panel time-series), which are especially developed for macroeconomics data characteristics (Pesaran, 2015).\textsuperscript{11}

Our empirical framework is based on a common factor model (for details, see Eberhardt and Teal, 2011, 2013a,b). Formally, assuming for simplicity an one-input model, a common factor model is as follows:

\begin{align*}
  y_{it} &= \beta_i x_{it} + u_{it}, \\
  x_{it} &= \delta_i f_t + \gamma_i g_t + \pi_i + \epsilon_{it}, \\
  f_t &= \tau + \phi f_{t-1} + \omega_t, \\
  g_t &= \mu + \kappa g_{t-1} + \nu_t,
\end{align*}

where $y_{it}$ and $x_{it}$ represent, respectively, the dependent and independent variables, $\beta_i$ represents the country-specific impact of the regressor on the dependent variable, and $u_{it}$, apart from the error term ($\epsilon_{it}$), contains unobservable factors. In particular, unobservable time-invariant heterogeneity is captured through a country fixed effect ($\psi_i$), while time-variant heterogeneity is accounted through a common factor ($f_t$) with country-specific factor loadings ($\varphi_i$). At the same time, the model allows the regressor to be affected by these or other common factors ($f_t$ and $g_t$). These factors represent both unobservable global shocks that affect all the countries, although with different intensities (e.g., oil prices or financial crisis), and local spillovers (Chudik et al., 2011; Eberhardt et al., 2013). The presence of the same unobservable process ($f_t$) as a determinant of both the independent and the dependent variable raise endogeneity problems which make difficult the estimation of $\beta_i$ (Kapetanios et al., 2011).\textsuperscript{12}

We can see the previous common factor model as a general empirical framework which encompasses several simpler structures. In particular, we can classify the models between “Homogeneous models”, where the impact of the regressors on the dependent variable is common across countries (i.e., $\beta_i = \beta$), and “Heterogeneous models”, which leave the coefficients unconstrained (i.e., $\beta_i$ is estimated for each country). In the latter case,

\textsuperscript{10}See Roodman (2009) for a detailed explanation on the potential risks of the popular Difference and System GMM estimators.

\textsuperscript{11}Although empirical applications of these methods are still not widespread in the literature, it is worthy to acknowledge the valuable contribution made to the field by Markus Eberhardt and coauthors in the last years. The empirical methodology of this Chapter relies on several of their papers.

\textsuperscript{12}Equation (27) models these factors as a simple AR(1), where no constrains are imposed to get stationary processes. Note that nonstationarity could provoke a spurious relationship between our variables of interest. If our variables are nonstationary, we have to analyse the cointegration relationship among them to infer any causal relationship.
the estimator is defined as the simple average of the country-specific estimators (i.e., \( \beta^* = N^{-1} \sum_{i=1}^{N} \beta_i \)).

Within each group, the assumptions about the structure of the unobservable factors leads to different estimation methods. For the case of homogeneous estimators, we consider the common Pooled Ordinary Least Square (POLS), the Two-way Fixed Effects (2FE), and the Pooled Common Correlated Effects (CCEP) estimators. While the first two are standard in the literature and account for unobservable heterogeneity through time and country dummies, the CCEP estimator has a more flexible structure, which allows for a different impact of the unobserved factors across countries and time.\(^{13}\) Empirically, it aims to eliminate the cross-sectional dependence by augmenting equation (24) with the cross-section averages of the variables.\(^{14}\)

With regard to heterogeneous models, we consider different Mean Group estimators. In particular, we present the results for the Pesaran and Smith (1995) Mean Group estimator (MG), the Pesaran (2006) Common Correlated Effects Mean Group estimator (CMG), and the Chudik and Pesaran (2015) Dynamic CMG estimator (CMG2).

Pesaran and Smith (1995) Mean Group estimator (MG) allows for a country-specific impact of both the regressor and the unobservable heterogeneity. The impact of the last one is assumed to be constant, and is empirically accounted by adding country-specific linear trends \((t)\). Therefore, the estimable equation takes the form:

\[
\text{lis}_{it} = \beta_{0i}^{MG} + \beta_{1i}^{MG} q_{it} + \beta_{2i}^{MG} p_{it} + \beta_{3i}^{MG} t + \Omega_{it}
\]  \hspace{1cm} (28)

where \( \beta_j^{MG} = N^{-1} \sum_{i=1}^{N} \beta_{ij}^{MG} \). As explained before, the MG estimator is computed as the simple average of the different country-specific coefficients, which are calculated by regressing the previous equation for each country. However, although it overcomes the potential misspecification from assuming parameter homogeneity, the introduction of country-specific linear trends could be too simple to rule out all the possible cross-section dependence from the unobserved heterogeneity.

In this sense, Pesaran (2006) proposes the Common Correlated Effects Mean Group estimator (CMG), which is a combination of the MG and the CCEP estimators. In particular, it approximates the unobserved factors by adding the cross-section averages of the dependent and explanatory variables, and then running standard panel regressions.

\(^{13}\)POLS and 2FE estimators assume that the time-varying heterogeneity has the same impact across countries for a given year.

\(^{14}\)Eberhardt et al. (2013) provide the intuition behind this mechanism.
augmented with these cross-section averages. In this case, the estimable equation is:

$$\text{lis}_{it} = \beta_{0i}^{CMG} + \beta_{1i}^{CMG} q_{it} + \beta_{2i}^{CMG} r_{it}$$

$$+ \beta_{3i}^{CMG} \text{lis}_{i,t-1} + \beta_{4i}^{CMG} \text{q}_{i,t-1} + \beta_{5i}^{CMG} \text{r}_{i,t-1} + \Omega_{it}$$

where $$\beta_j^{CMG} = N^{-1} \sum_{i=1}^{N} \beta_{ji}^{CMG}$$. It is easy to see that the first line is the Pesaran and Smith (1995) MG estimator (without linear trend), and the second line is the way the Pesaran (2006) CMG estimator approximates the unobservable processes.

So far, we have discussed how to deal with different sources of misspecification like the assumption of parameter homogeneity or the existence of cross-section dependence. This paper also analyses potential misspecification arising from a possible dynamic structure of the relation under study by estimating both static and dynamic specifications. Although Pesaran (2006) CMG estimator yields consistent estimates under a variety of situations (see Kapetanios et al., 2011; Chudik et al., 2011), it does not cover the case of dynamic panels or weakly exogenous regressors. Chudik and Pesaran (2015) propose an extension of the CMG approach (CMG2) to account for the potential problems arising from dynamic panels. In particular, they prove that the inclusion of extra lags of the cross-section averages in the CMG approach gives a consistent estimator of both $$\beta_i$$ and $$\beta^{CMG}$$. Empirically, we proceed by using an Error Correction Model of the following form:

$$\Delta \text{lis}_{it} = \beta_{0i}^{CMG2} + \beta_{1i}^{CMG2} \text{lis}_{i,t-1} + \beta_{2i}^{CMG2} q_{i,t-1} + \beta_{3i}^{CMG2} r_{i,t-1} + \beta_{4i}^{CMG2} \Delta q_{it} + \beta_{5i}^{CMG2} \Delta r_{it}$$

$$+ \beta_{6i}^{CMG2} \Delta \text{lis}_{i,t-1} + \beta_{7i}^{CMG2} \Delta q_{i,t-1} + \beta_{8i}^{CMG2} \Delta r_{i,t-1} + \beta_{9i}^{CMG2} \Delta q_{it} + \beta_{10i}^{CMG2} \Delta r_{it}$$

$$+ \sum_{l=1}^{p} \beta_{11l}^{CMG2} \Delta \text{lis}_{i,t-l} + \sum_{l=1}^{p} \beta_{12l}^{CMG2} \Delta q_{i,t-l} + \sum_{l=1}^{p} \beta_{13l}^{CMG2} \Delta r_{i,t-l} + \sum_{l=1}^{p} \beta_{14l}^{CMG2} \Delta q_{it-l} + \sum_{l=1}^{p} \beta_{15l}^{CMG2} \Delta r_{it-l} + \Omega_{it},$$

where the first line represents the Pesaran and Smith (1995) MG estimator, the inclusion of the second gives the Pesaran (2006) CMG estimator, and the three lines together are the Chudik and Pesaran (2015) Dynamic CMG estimator (CMG2).\(^{15}\)

Likewise, given the way they control for unobservables, CMG style estimators are suitable for accounting for structural breaks and business cycle distortions, thus making the use of yearly data perfectly valid in order to infer long run relationships.

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\(^{15}\)Chudik and Pesaran (2015) recommend to set the number of lags equal to $$T^{1/3}$$. We consider up to 2 extra lags of the cross-section averages.
5 Results

In order to give a systematic view of our results, this section is divided in four subsections. Subsection 5.1 presents an exhaustive analysis of the time-series properties of our variables of interest. Subsection 5.2 shows the results for a baseline model, where just the Tobin’s Q is considered as a regressor. Subsection 5.3 further includes the relative price of investment in the analysis, and Subsection 5.4 provides evidence supporting the interpretation of our results as a causal relationship.

5.1 Time-series properties

The order of integration and potential cross-section dependence in the data play a central role in panel time series. In order to deal with potential problems, Tables 1 and 2 analyse, respectively, the order of integration and the cross-section dependence of the variables used in our analysis.

Regarding the order of integration, Table (1) presents the results for two specifications of the cross-sectional augmented panel unit root (CIPS) Pesaran (2007) test. In particular, panel 1.a) shows the results when a constant is included in the Augmented Dickey-Fuller (ADF) regressions, while 1.b) further includes a deterministic trend.

<table>
<thead>
<tr>
<th>Lags</th>
<th>$lis$ $(p)$</th>
<th>$q$ $(p)$</th>
<th>$rp$ $(p)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.431</td>
<td>-2.744</td>
<td>-0.118</td>
</tr>
<tr>
<td>1</td>
<td>0.390</td>
<td>-2.405</td>
<td>-0.141</td>
</tr>
<tr>
<td>2</td>
<td>1.802</td>
<td>0.103</td>
<td>0.655</td>
</tr>
<tr>
<td>3</td>
<td>5.477</td>
<td>6.091</td>
<td>7.211</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lags</th>
<th>$lis$ $(p)$</th>
<th>$q$ $(p)$</th>
<th>$rp$ $(p)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.044</td>
<td>-2.068</td>
<td>2.483</td>
</tr>
<tr>
<td>1</td>
<td>0.390</td>
<td>-1.628</td>
<td>2.052</td>
</tr>
<tr>
<td>2</td>
<td>5.280</td>
<td>1.304</td>
<td>0.998</td>
</tr>
<tr>
<td>3</td>
<td>8.090</td>
<td>6.785</td>
<td>6.006</td>
</tr>
</tbody>
</table>

Table 1: Unit root tests

Notes: Pesaran (2007) CIPS test values are obtained from the standardised Z-tbar statistic. $H_0 =$ nonstationarity. Lags indicates the number of lags included in the ADF regression.

Pesaran (2007) CIPS test belongs to a $2^{nd}$ generation of panel unit root tests, which are
characterised by allowing potential cross-section dependence of the variables. Similar to Im et al. (2003), Pesaran (2007) CIPS test proposes a standardised average of individual ADF coefficients, where the ADF processes have been augmented by the cross-sectional averages to control for the unobservable component.

Table (1) presents the Pesaran (2007) CIPS test values along with their corresponding $p - value$ for our three variable of interest. “Lags” indicates the lag augmentation in the Dickey-Fuller regression. Given that the null of nonstationarity is only rejected in 4 out of 30 cases, we can safely assert that the variables under analysis are nonstationary.

Table 2: Cross-section dependence tests

<table>
<thead>
<tr>
<th>a) Levels:</th>
<th>b) Diff:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>lis</td>
</tr>
<tr>
<td>CD-test</td>
<td>16.73</td>
</tr>
<tr>
<td>$p$-value</td>
<td>0.00</td>
</tr>
<tr>
<td>corr</td>
<td>0.132</td>
</tr>
<tr>
<td>abs(corr)</td>
<td>0.472</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c) Het. AR(2)</th>
<th>d) Het. AR(2) CCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>lis</td>
</tr>
<tr>
<td>CD-test</td>
<td>9.93</td>
</tr>
<tr>
<td>$p$-value</td>
<td>0.00</td>
</tr>
<tr>
<td>corr</td>
<td>0.088</td>
</tr>
<tr>
<td>abs(corr)</td>
<td>0.243</td>
</tr>
</tbody>
</table>

Notes: CD-test shows the Pesaran (2004) cross-section dependence statistic, which follows a $N(0, 1)$ distribution. $H_0 = \text{cross-section independence}$. corr, and abs(corr) report, respectively, the average and average absolute correlation coefficients across the $N(N−1)$ set of correlations.

Table 2 shows the Pesaran (2004) CD test for cross-section dependence. This test uses correlation coefficients between each country time-series and is robust to nonstationarity, parameter heterogeneity and structural breaks, even in small samples.\(^{16}\) Table 2 is divided in four different quadrants representing different variable transformations. Quadrants a) and b) present the CD test for the levels and growth rates of our variables, and show that the null hypothesis of cross-section independence is rejected in all the cases. Quadrants c) and d) complement the analysis by checking the power of the cross-section averages to control for cross-section dependence. In particular, they present the results for the

\(^{16}\)The test is computed as:

$$CD = \sqrt{\frac{2}{N(N−1)}} \sum_{i=1}^{N−1} \sum_{j=i+1}^{N} \sqrt{T_{ij} \rho_{ij}},$$

where $\rho_{ij}$ represents the correlation coefficient between country $i$ and $j$, while $T_{ij}$ is the number of observations used to computed that correlation.
Pesaran (2004) CD test when it is applied to the residuals of an autoregressive regression of order 2 for each variable of interest. While regressions in quadrant c) are estimated by the Pesaran and Smith (1995) Mean Group estimator, panel d) shows the results when the AR process is augmented with cross-section averages in the spirit of Pesaran’s (2006) CMG estimator. We can see that, while all the variables reject the null of cross-section independence in panel c), the inclusion of cross-sectional averages in panel d) alleviates the problem for the labour income share and the Tobin’s $Q$.

The presence of nonstationary variables and cross-section dependence in our data make the use of traditional panel data techniques invalid. In order to validate our results, we pay specially attention to the characteristics of the residuals. More specifically, we analyze the presence of stationarity and cross-sectional independence in the residuals. The former is an indicator of the existence of cointegration relationship among our variables, ruling out the possibility of an spurious relationship, and the latter would indicates that our model is able to control for the unobserved heterogeneity.

5.2 Baseline results

Tables 3 and 4, present the results for our baseline model, where just the impact of Tobin’s $Q$ on the labour income share is studied. Columns [1] - [4] display the homogeneous-type estimators, where $\beta$ is constrained to be the same across countries. We present results for the standard OLS estimator with time-dummies (POLS), the 2FE estimator and the CCEP estimator, with and without including a country-specific linear trend. Columns [5] - [7] present the heterogeneous-type estimators. In particular, we show the estimates for the MG, and the CMG estimator with and without country-specific trends. As commented before, country-specific regressions are estimated, and the estimator presented is the average of the country-specific coefficients.\[17\]

Table 3 presents the estimations corresponding to a static model, where we consider 41 countries and 915 observations.\[18\] Regarding the homogeneous-type estimators, we find a negative and significant impact of the Tobin’s $Q$ on the labour income share in all but the POLS estimator (where the impact is positive and significant). However, CIPS and CD tests indicate that the residuals present nonstationarity and cross-section dependence. That is to say, [1] to [4] regressions are suffering from some type of misspecification, which from our discussion before could be: (i) the imposition of parameter homogeneity, (ii) an unsuitable structure of the unobservable heterogeneity, or (iii) that the nature of the relationship is not static. The importance of the first two potential sources of misspecification

\[17\]Pesaran and Smith (1995) show that the Mean Group-style estimators will produce consistent estimates of the average of the parameters.

\[18\]Table A.1 in the appendix shows the specific countries and period under analysis.
can be tested analysing the Mean Group-style estimators (columns [5] - [7]). A negative and significant impact of the Tobin’s $Q$ on the labour income share is still present, ranging from $-0.053$ to $-0.06$. However, although the residuals present an improvement in terms of absolute correlation, we still observe cross-section dependence. Stationarity in the residuals is now present in 2 out of the 3 regressions. These results indicate that, although the introduction of parameter heterogeneity improves the specification, it is not enough to solve all the potential misspecification problems.

Table 4 analyses the third potential source of misspecification through the estimation of a Partial Adjustment Model (PAM), where the first lag of the dependent variable is included as a regressor. Due to data restrictions, we consider 40 countries with the number of observations ranging from 850 to 885. The first important result is that a clear negative and significant long-run relationship is observed between the Tobin’s $Q$ and the labour share irrespective of the estimator under analysis. The second remarkable fact is that most of the residuals show cross-sectional independence and stationarity, indicating the absence of the previous source of misspecification. Given its flexibility to control for the unobserved factors, our preferred model is the one showed in the last column (CMGt2)) which represents the Chudik and Pesaran (2015) Dynamic CMG estimator, where 2 extra lags of the cross-section averages are included in the regression to control for the potential dynamic bias. We observe that a 1% increase in Tobin’s $Q$ decreases the labour income share in the long-run by 0.08%.

5.3 The Effect of the Relative Price of Investment Goods

As explained before, Karabarbounis and Neiman (2014) have argued that the global decline in the labour share can be explained, at least partially, by the decrease in the relative price of investment goods. They estimate that the lower price of investment goods explains roughly half of the observed decline in the labour share. In this section we test their hypothesis by including the relative price of investment goods in our regressions and compare their mechanism with our Tobin’s $Q$ channel. Tables 5 and 6 show the results.

Table 5 displays the results from the static model. The inclusion of the relative price of investment does not alter the negative relationship found between the Tobin’s $Q$ and the labour share. With respect to their effect, they present a negative impact under the homogeneous-type estimators. However, once we allow for parameter heterogeneity, they no longer show any kind of influence on the labour income share. Nevertheless, similar to the static model analysed in Table 3, residuals present cross-section dependence and nonstationarity.

In order to assess problems arising from the dynamic structure of our equation, this
Table 3: Static baseline model

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POLS</td>
<td>2FE</td>
<td>CCEP</td>
<td>CCEPt</td>
<td>MG</td>
<td>CMG</td>
<td>CMGt</td>
</tr>
<tr>
<td>( q )</td>
<td>0.14</td>
<td>-0.083</td>
<td>-0.05</td>
<td>-0.052</td>
<td>-0.057</td>
<td>-0.053</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td>(0.052)***</td>
<td>(0.025)***</td>
<td>(0.017)***</td>
<td>(0.016)***</td>
<td>(0.015)***</td>
<td>(0.020)***</td>
<td>(0.016)***</td>
</tr>
<tr>
<td>( t )</td>
<td>-0.003</td>
<td>-0.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)**</td>
<td>(0.001)**</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Constant</td>
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<td>-0.665</td>
<td>-0.656</td>
<td>-0.483</td>
<td>-0.714</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.036)***</td>
<td>(0.017)***</td>
<td>(0.032)***</td>
<td>(0.068)***</td>
<td>(0.105)***</td>
<td></td>
<td></td>
</tr>
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Number Id 41 41 41 41 41 41 41
Observations 915 915 915 915 915 915 915
R-squared 0.11 0.93 0.99 0.99 0.99 0.99 0.99
RMSE 0.2244 0.0629 0.0500 0.0474 0.0443 0.0435 0.0336
Trends 0.73 0.59
Abs Corr 0.4730 0.4211 0.3710 0.3660 0.3052 0.3243 0.2658
Int I(1) I(1) I(0)/I(1) I(1) I(1) I(1)/I(0) I(0)

Notes: Robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%
CD-test reports the Pesaran (2004) test statistics, under the null of cross-section independence of the residuals. Int indicates the order of integration of the residuals (I(0) - stationary, I(1) - nonstationary) obtained from Pesaran (2007) CIPS test. RMSE presents the root mean squared error. Trend show the share of countries where the linear trend is significant at 5%.
Table 4: Dynamic baseline model

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Notes: Robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%. 
CD-test reports the Pesaran (2004) test statistics, under the null of cross-section independence of the residuals. Int indicates the order of integration of the residuals (I(0) - stationary, I(1) - nonstationary) obtained from Pesaran (2007) CIPS test. RMSE presents the root mean squared error. Trend show the share of countries where the linear trend is significant at 5%. lr-q and se-q represent respectively $q$'s long-run impact and its standard error.
Table 5: Static model with relative prices

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Notes: Robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

CD-test reports the Pesaran (2004) test statistics, under the null of cross-section independence of the residuals. Int indicates the order of integration of the residuals I(0) - stationary, I(1) - nonstationary) obtained from Pesaran (2007) CIPS test. RMSE presents the root mean squared error. Trend show the share of countries where the linear trend is significant at 5%.
Table 6: ECM with relative prices

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Number of id: 30 30 30 30 30 29 26
Observations: 732 732 732 732 732 700 631
R-squared: 0.26 0.59
RMSE: 0.0264 0.0224
Trends: 0.23 0.20 0.21 0.23
lr-$q$: 0.0621 -0.0307 -0.0779 -0.0785 -0.0965 -0.1061 -0.0718
sc-$q$: 0.0739 0.0357 0.0327 0.0374 0.0388 0.0405 0.0422
lr-$rp$: -0.1826 -0.0405 0.1417 0.2999 0.1325 0.1796 -0.0063
sc-$rp$: 0.1306 0.1016 0.1573 0.185 0.1661 0.2312 0.2285
CD test: -2.4749 -1.5637 4.9547 -0.0134 -0.2654 1.0079 1.3218
Abs Corr: 0.1884 0.217 0.2038 0.2189 0.2216 0.2393 0.2466
Int: I(0) I(0) I(0) I(0) I(0) I(0)

Notes: Robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%.
POLS = Pooled OLS (with year dummies), 2FE = 2-way Fixed Effects, CCEP = Pooled Pesaran (2006) Common Correlated Effects (CCE), CCEP t = CCEP with linear trend, MG = Pesaran and Smith (1995) Mean Group (with country trends), CMG = Pesaran (2006) CCE Mean Group, CMG t = CMG with country-specific linear trends, CMG t 1 and CMG t 2 = CMG t with, respectively, one and two extra cross-sectional averages lags, as indicated by Chudik and Pesaran (2015). CD-test reports the Pesaran (2004) test statistics, under the null of cross-section independence of the residuals. Int indicates the order of integration of the residuals (I(0) - stationary, I(1) - nonstationary) obtained from Pesaran (2007) CIPS test. RMSE presents the root mean squared error. Trend show the share of countries where the linear trend is significant at 5%. lr-$q$ and sc-$q$ represent respectively $q$’s long-run impact and its standard error. lr-$rp$ and sc-$rp$ represent respectively $rp$’s long-run impact and its standard error.
time we estimate an Error Correction Model (Table 6), where due to data restrictions we are not able to include more than 30 countries. Although we present the results for different estimators, given its larger flexibility, we focus on the ones obtained from the CMG-style estimators (columns [4]-[7]). The first remarkable fact is the presence of stationarity and cross-section independence in the residuals, indicating the absence of the previous misspecification problems. Regarding the impact of our variables of interest, we observe a negative impact of the Tobin’s $Q$ in both the short and long run. If we focus on the long run relationship, our estimations show that an increase of 1% in Tobin’s $Q$ would decrease the labour income share between 0.072% and 0.11%. However, in contrast to Karabarbounis and Neiman (2014), we do not find any empirical support for the role played by the relative prices. This findings support our theoretical model, and, like Chirinko and Mallick (2014), discard the decline of investment prices as a driver of the labour income share.

In order to evaluate the relevance of the Tobin’s $Q$ in the secular decline of the labour income share, we undertake a simple simulation exercise. Given the fact that the GDP weighted average Tobin’s $Q$ in our sample has increased from a value of 1.15 in 1980 to a value of 1.68 in 2007 (46%), and that the labour income share has evolved from a value of 57% to 52% ($-8.9\%$), our results imply that the increase in Tobin’s $Q$ can explain between 41% and 57% of the labour income share decline.

5.4 Weak exogeneity test

Our analysis has dealt with the presence of endogeneity from common factors driving both inputs and output. However, it is not uncommon in macroeconomics to suffer from endogeneity due to a reverse causality problem.\footnote{In our case, reverse causality implies that besides the relative prices and Tobin’s $Q$ affecting the labour income share, the labour income share has in turn, a significant impact on their values.}

Traditionally, the literature has used instrumental variable methods to solve this problem. However, given the nature of our data, it is difficult to find a valid set of instruments (i.e., variables which are correlated with the regressor but not with the error term).\footnote{Under the presence of unobservable common factors and parameter heterogeneity, the use of internal instruments (lags of the variables) is not valid anymore. Therefore, provided that our series are nonstationary and cointegrated, we follow Canning and Pedroni (2008); and Eberhardt and Presbitero (2015) to estimate an informal causality test based on the Granger Representation Theorem (GRT). The GRT (Engle and Granger, 1987) states that cointegrated series can be represented in the form of an...}
ECM, which in our case is:

\[
\Delta lis_{it} = \alpha_{1i} + \lambda_{11} \hat{u}_{i,t-j} + \sum_{j=1}^{K} \phi_{11ij} lis_{i,t-j} + \sum_{j=1}^{K} \phi_{12ij} q_{i,t-j} \sum_{j=1}^{K} \phi_{13ij} rp_{i,t-j} + \epsilon_{1it},
\]

(31)

\[
\Delta q_{it} = \alpha_{2i} + \lambda_{21} \hat{u}_{i,t-j} + \sum_{j=1}^{K} \phi_{21ij} lis_{i,t-j} + \sum_{j=1}^{K} \phi_{22ij} q_{i,t-j} \sum_{j=1}^{K} \phi_{23ij} rp_{i,t-j} + \epsilon_{2it},
\]

(32)

\[
\Delta rp_{it} = \alpha_{3i} + \lambda_{31} \hat{u}_{i,t-j} + \sum_{j=1}^{K} \phi_{31ij} lis_{i,t-j} + \sum_{j=1}^{K} \phi_{32ij} q_{i,t-j} \sum_{j=1}^{K} \phi_{33ij} rp_{i,t-j} + \epsilon_{3it},
\]

(33)

where \(\hat{u}_{it} = lis_{it} - \hat{\beta}_{1i} q_{it} + \hat{\beta}_{2i} rp_{it}\) is the disequilibrium term. In order to identify a long-run equilibrium relationship, the GRT requires at least one of the \(\lambda\)'s to be nonzero. If \(\lambda_{11} \neq 0\), \(q\) and \(rp\) have a causal impact on the \(lis\), if \(\lambda_{11} , \lambda_{21}, \text{ and } \lambda_{31}\) are nonzero, then all variables are determined simultaneously, and no causal relationship can be identified.

Table 7 presents the results for our weak exogeneity test. Column “Model” refers to the method used to estimate the disequilibrium term \((\hat{u})\). The two big blocks “CA” and “no CA” indicate whether equations (31)-(33) include, or not, cross-sectional averages of the variables. Within each block, the dependent variable of the system is indicated at the top of the column. The information provided shows the results for the average \(\lambda\) and its respective \(p\)-value. Regarding our previous discussion, for a causal effect of the Tobin’s \(Q\) and the relative prices on the labour share, \(\lambda_{11}\) should be different from 0, while \(\lambda_{21} = \lambda_{31} = 0\). We find that just 5 out of 42 cases (highlighted with asterisks) are against a causal relationship in our study. Therefore, we safely conclude that our analysis represents the causal impact of Tobin’s \(Q\) and the relative price of investment on the labour income share.
Table 7: Weak exogeneity test

<table>
<thead>
<tr>
<th>Model</th>
<th>Avg. λ</th>
<th>λ</th>
<th>ρ</th>
<th>Avg. λ</th>
<th>λ</th>
<th>ρ</th>
</tr>
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<tbody>
<tr>
<td>MG</td>
<td>-0.52</td>
<td>-0.45</td>
<td>0.02</td>
<td>-0.50</td>
<td>-0.41</td>
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<tr>
<td></td>
<td>0.00</td>
<td>0.03*</td>
<td>0.48</td>
<td>0.00</td>
<td>0.21</td>
<td>0.60</td>
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<tr>
<td>CMG</td>
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<td>-0.40</td>
<td>-0.01</td>
<td>-0.51</td>
<td>-0.54</td>
<td>0.00</td>
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<td>0.15</td>
<td>0.83</td>
<td>0.00</td>
<td>0.18</td>
<td>0.94</td>
</tr>
<tr>
<td>CMGt</td>
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<td>-0.65</td>
<td>0.00</td>
<td>-0.69</td>
<td>-0.74</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
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<td>0.98</td>
<td>0.00</td>
<td>0.12</td>
<td>0.72</td>
</tr>
<tr>
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<td>-0.23</td>
<td>0.04</td>
<td>-0.51</td>
<td>-0.58</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
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<td>0.24</td>
<td>0.00</td>
<td>0.13</td>
<td>0.61</td>
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<tr>
<td>CMGt1</td>
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<td>0.06</td>
<td>-0.75</td>
<td>-0.60</td>
<td>0.05</td>
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<tr>
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<td>0.00</td>
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<td>0.00</td>
<td>0.19</td>
<td>0.38</td>
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<tr>
<td>CMG2</td>
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<td>-0.42</td>
<td>-0.07</td>
<td>-0.64</td>
<td>-1.04</td>
<td>-0.05</td>
</tr>
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<td>0.25</td>
<td>0.00</td>
<td>0.01*</td>
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Notes: Avg. λ shows the robust mean coefficient for the disequilibrium term on the ECM. Asterisks highlight cases which do not support a causality relationship for our analysis.

6 Conclusions

The secular decline of the global labour share has received vivid attention in the last years. We contribute to this recent literature by proposing a new mechanism that links the evolution of the labour share with the evolution of financial wealth, physical capital stock, and equity Tobins Q.

In our model, an increase in equity Tobins Q boosts financial wealth pushing investors to demand a higher return on equity. Firms are forced to reduce investment and, consequently, the capital-output ratio. This raises equity returns but drives the labour share down when capital and labour are complements. Therefore, our paper reconciles the labour share - capital-output framework with the standard values of the elasticity of substitution (σ < 1).

We test the validity of our model estimating different Mean Group-style estimators based on a common factor model. Results suggest that the global increase of Tobin’s Q since 1980 accounts for between 41% and 57% of the decline in the labour income share. When the relative price of investment is included in our estimations, we find that they do not have any significant effect on the labour income share.
Our results show that the relationship between financial markets and corporations, embodied in the equity Tobin’s Q ratio, is crucial to understand the dynamics of the capital-output ratio and factor shares. In light of our findings, we believe that the decline in the labour income share is not the irreversible consequence of technological or structural factors, like in Karabarbounis and Neiman (2014) and Piketty and Zucman (2014), but the result of a change in the functioning of financial markets and its relation with corporate investment decisions. According to our model, policies aiming at reversing the trend in the labour share should target incentives on corporate investment, even if this is at the expense of equity valuation and equity returns. This could be achieved, for example, by imposing higher taxes on corporate distributions, like dividends or share repurchases.

References


APPENDIX: Supplementary tables and figures

Table A.1: Selected economies and sample period

<table>
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<th>Sample period</th>
<th>id</th>
<th>Country</th>
<th>Sample period</th>
</tr>
</thead>
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<td>Luxembourg</td>
<td>1991-2008</td>
</tr>
<tr>
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<td>Austria</td>
<td>1980-2008</td>
<td>23</td>
<td>Mexico</td>
<td>1988-2008</td>
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<td>30</td>
<td>Poland</td>
<td>1995-2008</td>
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<tr>
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<td>Germany</td>
<td>1983-2008</td>
<td>33</td>
<td>Spain</td>
<td>1986-2008</td>
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<td>Hong Kong</td>
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<td>Sweden</td>
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<td>1981-2008</td>
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<td>Turkey</td>
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Table A.2: Descriptive statistics

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</tr>
<tr>
<td>LIS</td>
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<tr>
<td>Q</td>
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<tr>
<td>RP</td>
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</table>

<table>
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<th>Panel B: Regression variables (in logs)</th>
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<td>----------</td>
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<tr>
<td>( \text{lis} )</td>
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<tr>
<td>( q )</td>
</tr>
<tr>
<td>( rp )</td>
</tr>
</tbody>
</table>

Figure A1: Labour income share against relative prices

Notes: Own calculation based on a sample of 41 countries and 911 observations. Variables are demeaned to control for fixed-effects. Correlation coefficient= 0.11