

The Global Rise of Asset Prices and the Decline of the Labor Share*

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Abstract

The labor 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; among many others). At the same time, again since the early 1980s, there has been a global steady increase in equity Tobin's Q . 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, reduces corporate investment. The impact on the capital-output ratio reduces the labor 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 almost 60% of the total decline in the labor income share. We highlight three different factors that operate through the same theoretical channel, namely capital income taxes, monopoly mark-ups and corporate short-termism, and we find empirical evidence for all of them, not only for the rise of monopoly power (which has been the focus of recent literature). We also find that the impact of the relative prices of capital goods on the labor share is not significant. Finally, we use the model to suggest different policies that can revert this declining trend.

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Keywords: Tobin's Q , Labor Share, Asset Prices, Capital-Output ratios.

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1 Introduction

The labor income share has declined globally in recent decades. For example, [Karabarbounis and Neiman \(2014\)](#) document that the global labor share has declined significantly since the early 1980s, with the decline occurring within the large majority of countries and industries. Likewise, [Piketty \(2014\)](#) shows, for a set of advanced economies, an increasing (decreasing) trend of the capital (labor) income share since the late 1970s. Meanwhile, stock market prices have increased with respect to the amount of capital held by corporations. In this paper we offer a novel explanation that connects these two phenomena. We argue that the rise of corporate market valuations has had a negative impact on the labor share through a slowdown of corporate investment. Contrary to [Karabarbounis and Neiman \(2014\)](#) and [Piketty and Zucman \(2014\)](#), our theory is not based on higher capital deepening and, therefore, it does not rely on values of the aggregate elasticity of substitution σ that are not consistent with those estimated by the specialized literature ([Chirinko and Mallick, 2014](#) and [Oberfield and Raval, 2017](#), among others). Our results are consistent with several mechanisms that operate through the same theoretical channel, namely, the rise of monopoly mark-ups, the decline of dividend income taxes and the rise of corporate short-termism. Although our main empirical exercise refers to the impact of Tobin's Q (stock values relative to corporate capital) on the labor share, we find evidence consistent with these three specific mechanisms.

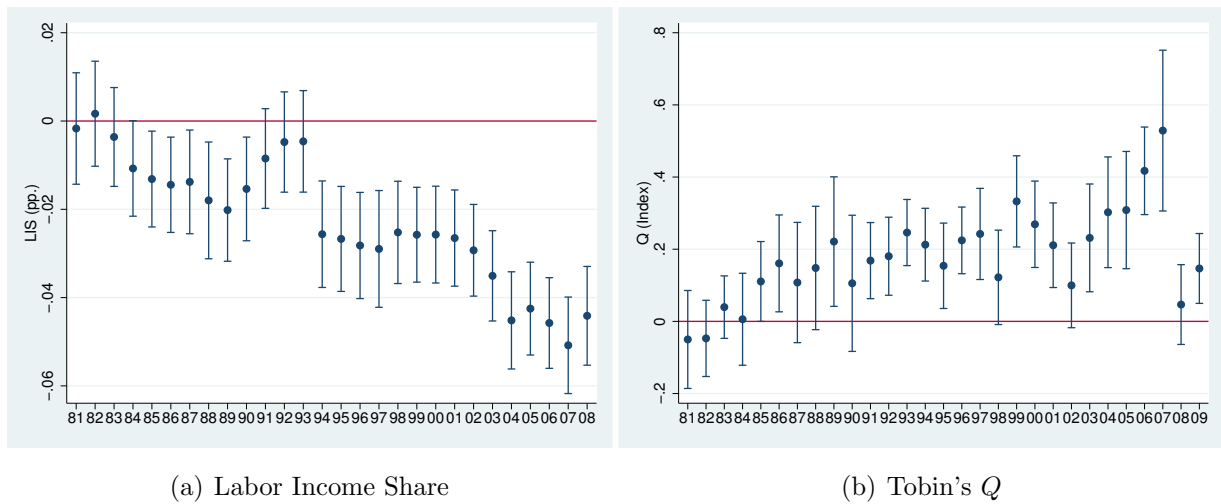
Figure 1.a shows the figure of concern. It displays the evolution of the global labor share according to our data by plotting the year fixed effects from a GDP-weighted regression along with its 90% confidence intervals. We include in the regression country fixed effects to control for countries entering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

Attempts to explain the non-constant behaviour of the labor share have departed from reconsidering 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 characterized by a constant elasticity of substitution (CES) production function. As long as firms produce with a CES technology and the labor market is perfectly competitive, the labor share (LIS) can be expressed as a function of the capital-output ratio, $LIS = g(k/y)$ ([Bentolila and Saint-Paul, 2003](#)). Given this relation, this literature emphasizes the role of capital deepening as the main determinant of the labor share. This relationship is

not altered by changes in factor prices or quantities, or in labor-augmenting technical progress, which are all encompassed in the schedule. Within this curve, when everything else is constant, changes in the labor share 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 \(2014\)](#).

Labor and product market imperfections are also frequently brought up as explanatory factors of the labor share decline¹. Even when technology is Cobb-Douglas, movements of factor shares can be triggered, for example, by changes in the bargaining power of workers 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: Labor Income Share and Tobin's Q , 1980-2009



Notes: Own calculations obtained as year fixed effects (along with its 90% confidence intervals) from a GDP-weighted regression including country fixed effects to control for the entry and exit of countries throughout the sample. The coverage is presented in Table [A1](#) (915 observations, 41 countries).

In light of the previous potential explanatory departures, which are the actual drivers of the downward trend of the labor share? The literature has pointed out three potential broad candidates: (i) globalization, (ii) labor and product market institutions, and (iii) neoclassical/technological causes. This paper contributes to the debate by exploring the role played by a new factor: the negative impact that asset prices changes have had on corporate investment, which we relate to the global evolution of equity Tobin's Q .

The reasons why globalization is a potential driver are straightforward. On one hand, higher capital mobility makes easier for a company to reallocate its production and firms can use this threat to decrease the bargaining power of workers. On the other hand, offshoring of the labor-intensive industries have a depressing effect on wages, either by in-

¹We use the term imperfection to denote market regulations but also other factors that can potentially break the equality between marginal costs and marginal revenues.

creasing capital deepening or by the direct impact that import exposure has on industries where labor is relatively expensive. [Elsby et al. \(2013\)](#) find that the increased exposure to imported goods could account for 84% of the total decline in the U.S. payroll share over the past quarter-century.

The role of the institutional framework has also received strong attention in the study of factor share dynamics. The literature has focused on the impact of both labor and product market regulations. [Kristal \(2010\)](#), for example, finds that the dynamics of the labor share are largely explained by indicators for workers' bargaining power. [Blanchard and Giavazzi \(2003\)](#) emphasize that labor 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 labor. With respect to product market regulations, [Raurich et al. \(2012\)](#) show that estimates of the elasticity of substitution are biased when price mark-ups are ignored. Recent research by [Barkai \(2017\)](#) and [Autor et al. \(2017b\)](#) emphasize, respectively, the role of imperfect competition and the "superstar firms" phenomenon, both consistent with U.S. industry data on sales concentration and labor share decline. As we show below, our theory and results are also consistent with existing evidence on the rise of monopoly power.

The neoclassical/technological branch of the literature relies on the aforementioned one-to-one relation between the labor share and the capital-output ratio $LIS = g(k/y)$ and looks for structural drivers that endogenize the dynamics of that ratio. [Piketty and Zucman \(2014\)](#), for example, argue that a persistent gap between the return to capital and the growth rate of the economy results in a growing accumulation of capital because capitalists save most of their income. [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 labor, increasing the accumulation of physical capital and depressing the labor income share. In a recent contribution, [Koh et al. \(2016\)](#) show that the rise of intellectual property products (IPP) capital accounts entirely for the observed decline of the U.S. labor share, reflecting the fact that the U.S. economy has been evolving towards a more IPP capital-intensive economy.

Note that although [Piketty and Zucman \(2014\)](#) and [Karabarbounis and Neiman \(2014\)](#) emphasize 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 driver 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 (usually denoted by σ) is larger than one. Only when capital and labor are 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 (σ) far below one (Antràs, 2004; Chirinko, 2008).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 labor 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.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 emphasizes the role of asset prices and its effect on 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 labor income share. We provide a simple model which shows that when equity Tobin's Q raises, corporate investment falls. The decline of corporate investment depresses the productive capital-output ratio and this has a negative impact on the labor income share. Our mechanism resembles that of Shell et al. (1969) who, using a version of the Solow model, show that productive capital can decrease when capital gains increase. Importantly, this mechanism relies on a elasticity of substitution that is in accordance 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.⁴ Therefore, when 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 labor share. A similar mechanism, but in the context of an Aiyagari model, is used by Gonzalez (2016) to study changes in the U.S. personal and factorial distribution of income and wealth. Our theory and results are also consistent with recent evidence found by Gutiérrez and Philippon (2016), who show an investment gap driven by firms located in industries characterized by high Tobin's Q (in contrast to traditional Q theories).

Note that the mechanism of our model is also based on the share-capital schedule: we

²Chirinko (2008) provides a summary of the empirical literature and lists estimates from different papers, concluding that “the weight of the evidence suggests that gross σ lies in the range between 0.40 and 0.60”.

³Most of the criticisms of Piketty's Capital have emphasized this point, like Rognlie (2015) and Acemoglu and Robinson (2015).

⁴Perfect identity between equity returns and marginal productivity of capital is not required.

impact the labor share through changes in the capital-output ratio. This effect occurs in addition to the standard mark-up effect due to the rise of monopoly power. In that sense, our paper is close to neoclassical/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 , equity returns raise but investment and the capital-output ratio fall, not raise. This way, the mechanism depresses the labor income share not because investment is too high, like in Karabarbounis and Neiman (2014), but because is too low, 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, we do not rely on increasing capital-output ratios to explain the recent evolution of capital and labor shares. On the other hand they emphasize in their appendix the role of asset prices and they show compelling cross-country evidence on Tobin's Q . Our main difference with them is that we do not assume that Tobin's Q is equal to one and, more importantly, we provide a framework where k/y and Q evolve divergently. Indeed, 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. This is also remarked by Rowthorn (2014).⁵

Our theory gives rise to several questions: Is the raise of asset prices a driver of factor shares itself? Is imperfect competition the key factor, as recent research seems to suggests? If not, what is behind the global evolution of Tobin's Q ? And more importantly, is it, on a global scale, a relevant mechanism compared to others?

We certainly believe that asset prices are a driver itself. We build a model where Tobin's Q , on one hand, and the capital-output ratio and labor share, on the other hand, are inversely related, and we check its empirical validation. We further explore potential factors that have driven Tobin's Q and we find that monopoly power and capital income taxes are consistent with our hypothesis. But these factors do not exhaust the determinants of Tobin's Q . We indeed spend some time discussing the role played by corporate governance mechanisms that increase equity prices but that happen to reduce long-term investment, and we show that corporate short-termism can be easily embodied in a version of our model.

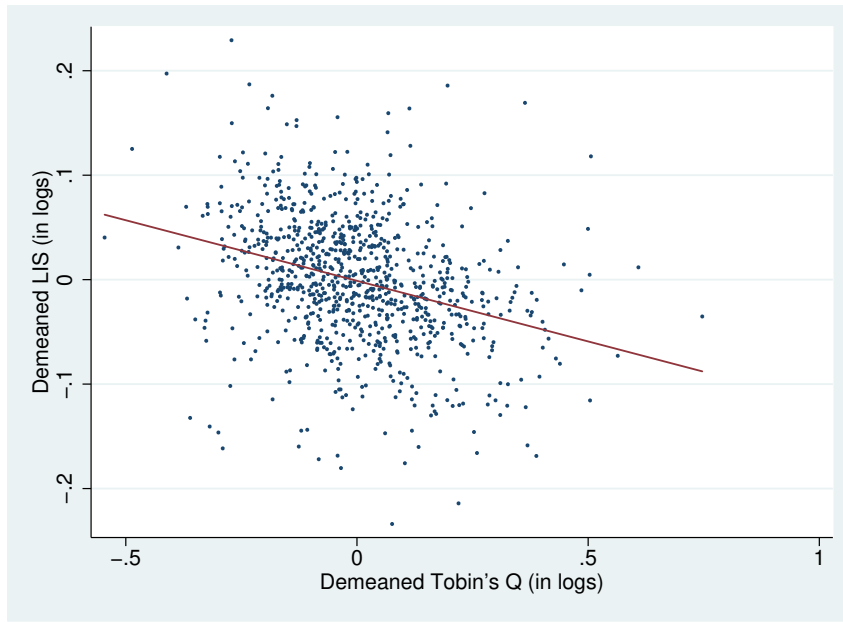
Figure 1.b shows the evolution of global Tobin's Q according to our data by plotting the year fixed effects from a GDP-weighted regression where 1980 is taken as the reference year (1980 = 0). If we consider the weighted average value in 1980, Figure 1.b shows a

⁵See Piketty and Zucman (2014), Appendix Figures A71, A92, and A129, available online at <http://piketty.pse.ens.fr/en/capitalisback>. and proceed by equating the market value of physical they show a clear upward trend of equity Tobin's Q during the last 35 years.

steady Tobin's Q increase from a value below 1.2 to values around 1.7 in 2007.⁶

It is worthy to note that, in order to identify the role of Q on the labor share, this paper exploits the within-country variation of our data. Figure 2 presents descriptive evidence of this relationship between our two variables of interest. In particular, it shows a negative correlation between the labor 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.⁷

Figure 2: Labor Income Share against Tobin's Q



Notes: Own calculation based on a (outlier-robust) sample of 41 countries and 911 observations. Variables are demeaned to control for country fixed effects. Correlation coefficient = -0.32 .

For our empirical analysis, we bank 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. We opt to further control for the

⁶Figure A1 in the Appendix shows the country-specific trends of our variables of interest in our sample. We can see that the trends showed in Figure 1 document global facts and they are not merely driven by idiosyncratic factors in large countries.

⁷Each dot represents a country-year observation after being country-specific time-demeaned in order to control for country fixed effects. Although the dots have not a simple interpretation as it would be the case in a cross-section scatter plot, the slope of the regression line represents the β_1 of the regression $lis_{it} = \beta_0 + \beta_1 q_{it} + a_i + \epsilon_{it}$, where lis and q are respectively the labor share and the Tobin's Q (in logs), a_i is country fixed effects, and ϵ is a standard disturbance term.

relative price of investment goods to compare our mechanism with that of [Karabarbounis and Neiman \(2014\)](#).⁸

Our results show a robust and significant negative impact of the Tobin's Q on the labor 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 in [Chirinko and Mallick \(2014\)](#), our results suggest that the decline of the labor income share cannot be explained by the secular decline of the relative price of investment goods. We also find empirical support for our theoretical mechanism. More specifically, we show that the driving forces considered in our analysis (dividend income tax rate, market power, and corporate governance) impact Q and physical investment in opposite directions.

Since the Tobin's Q impacts the labor share through an endogenous decline of the capital-output ratio, our results reconcile the secular decline in the labor 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 labor 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 factorial 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 labor income share. Section 3 introduces and explains the data used in our empirical analysis. Sections 4 and 5 present, respectively, the econometric methodology and the results. Section 6 explores the potential determinants of Q , and Section 7 summarizes and concludes.

2 Theoretical Framework

This section presents a model that connects the labor share with the amount of financial wealth held, the level of physical capital stock and the value of equity Tobin's Q . To be clear, we opt to model Q by the inclusion of some of its determinants, but they don't exhaust the impact of Q on the labor share. In the equilibrium subsection, we explain that other forces might change Q too and operate through the same general equilibrium mechanism.

Our environment is very simple: there is a representative household that accumulates stocks and receives direct utility from the ownership of wealth, and a firm that accumulates

⁸Changes in the relative price of investment goods impacts the capital-output ratio but they do not change the Tobin's Q . Figure A2 in the Appendix shows a lack of within-country correlation between these two variables.

physical capital and distribute dividends. Time is discrete.

2.1 Households

Consider a representative household with present utility $u(c, a) = u(c) + h(a)$, standard in consumption and with $h(a)$ increasing and concave in financial wealth a . The household consumes c , which is a CES composite consumption basket of n varieties with elasticity of substitution ξ , receives labor income w , and accumulates stocks s for which he receives after-tax equity returns $1 + r = \frac{(1-\tau)d+p}{p-1}$, where d is the amount of distributed dividends and p is the price of the stocks at current period.⁹ In every period, the household decides the amount of next period stocks s' . Therefore, the amount of financial wealth held at the end of the current period is $a' = ps'$. In recursive form, the intertemporal problem of the household can be simplified to:

$$\begin{aligned} U(a) &= \max_{c, a'} u(c) + h(a) + \beta U(a') \\ \text{s.t. } &c + a' = w + (1 + r)a, \end{aligned} \tag{1}$$

where we exploit the change of variable $a' = ps'$. At any period, there is one equity share outstanding. Hence, market clearing in the market for stocks requires $s = 1$ for any period.

To simplify the analysis, we opt for a utility function linear in consumption $u(c, a) = c + h(a)$. The second term, $h(a)$, proposed by [Carroll \(1998\)](#) and used by [Francis \(2009\)](#), [Piketty \(2011\)](#), [Kumhof et al. \(2015\)](#) and [Saez and Stantcheva \(2017\)](#) among others, implies that households derive direct utility from the ownership of wealth. Like in [Saez and Stantcheva \(2017\)](#), the inclusion of wealth in the utility function is an essential aspect of the model. Specifically, it relaxes the assumption that wealth only serves to finance future consumption and leads to an increasing steady state asset demand which, apart from being a realistic feature, is a crucial aspect for the comparative statics of the model. For simplicity, we will assume $h(a) = \gamma \log(a)$ with $\gamma > 0$.

Solving (1), we get the Euler equation (now in non-recursive form):

$$1 = \beta \left[(1 + r_{t+1}) + \frac{\gamma}{a_{t+1}} \right], \tag{2}$$

where $1 + r_{t+1} = \frac{(1-\tau)d_{t+1} + p_{t+1}}{p_t}$. From (2), we easily obtain the corresponding inverse asset demand:

$$r_t(a_t) = \frac{1}{\beta} - \frac{\gamma}{a_t} - 1, \tag{3}$$

⁹Below we explain why we abstract from capital gains tax.

where $r_t(a_t)$ is increasing and concave for any $a_t > 0$.¹⁰ Since utility is linear in consumption, steady state asset demand is represented by equation (3) without time subscripts.

Interestingly, since $\frac{1}{\beta} - 1$ is the least upper bound of $r(a)$ when $a > 0$, the use of 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, where idiosyncratic shocks results in precautionary saving behaviour, the aggregate demand of assets is also increasing and $r < \frac{1}{\beta} - 1$ is satisfied in equilibrium.¹¹ Although accumulating wealth as a result of precautionary behaviour is a plausible interpretation for an increasing asset demand, other interpretations are also possible.¹² For example, people might derive direct utility from wealth due to the service flows of social status and power that it provides (Carroll, 1998), or people might accumulate wealth due to dynastic (impure) altruism (DeNardi, 2004).¹³

Whatever the interpretation, the inclusion of wealth in the utility function is an appropriate assumption since the bulk of stock market wealth is mostly owned by households whose saving behaviour cannot be explained by standard utility functions (Carroll, 1998).

2.2 Firms

We assume n varieties, each produced by a monopolistically competitive firm that accumulates physical capital k , pays the wage bill w and distribute dividends d to households, who own the firms. As it is standard in labor share studies, we assume that each firm produces output y using a CES technology:¹⁴

$$y_t = \left[\phi k_t^{\left(\frac{\sigma-1}{\sigma}\right)} + (1 - \phi) l_t^{\left(\frac{\sigma-1}{\sigma}\right)} \right]^{\frac{\sigma}{\sigma-1}}, \quad (4)$$

where ϕ is a distributional parameter and σ is the elasticity of substitution between labor and capital. Assuming that each firm maximize its market value and that the elasticity of substitution between different goods within the production process of each firm is the same elasticity ξ of consumers, a symmetric equilibrium is straightforward and characterized

¹⁰If CRRA specifications are used for both $u(c)$ and $h(a)$, an increasing $r(a)$ would only require the risk aversion parameter in $h(a)$ to be larger than that in $u(c)$ (i.e. marginal utility should diminishes less rapidly in consumption than in wealth).

¹¹Although concavity is not required for the desired result, it turns out that it is also satisfied.

¹²Saez and Stantcheva (2017) discuss four possible microfoundations for wealth in the utility function: (i) bequest motives, (ii) entrepreneurship, (iii) service flows of liquidity and security, and (iv) motivated beliefs and social norms.

¹³In the standard life-cycle model without bequest motive and wealth effects, an increasing savings function can be achieved but requires a CRRA parameter unrealistically low (below 1).

¹⁴Given firms' symmetry, we simplify the notation and abstract from subscripts.

by the following first order condition with respect to capital:¹⁵

$$F_k(k_t, l_t) = \left(\frac{\xi}{\xi - 1} \right) (\delta + r_t), \quad (5)$$

from where we obtain a standard demand for capital $k_t(r_t)$. Using the transversality condition and the firms' flow-and-funds constraint evaluated at the steady state, steady state capital can be expressed as a function of steady state dividends and rents:¹⁶

$$k(r) = \frac{d - \frac{1}{\xi} F(k(r), l)}{r} \quad (6)$$

Tobin's Q is defined as the market value of capital over its replacement cost. Since our toy model abstracts from corporate financial assets and non-equity liabilities, and since $s = 1$ is satisfied in equilibrium, steady state Tobin's Q is simply the ratio between equity price p and k , evaluated at the steady state. Combining steady state equity $p(r) = \frac{(1-\tau)d}{r}$, which results from the definition of equity returns, with equation (6), we get a tractable expression for steady state Q :

$$Q(r) = (1 - \tau) \left(1 + \frac{F(k(r), l)}{\xi r k(r)} \right) \quad (7)$$

Note that under this specification, Tobin's Q depends on parameters τ and ξ and is not constant along the whole domain of equity returns r , unless there is not effective monopoly power (i.e. when ξ tends to infinity). Applying Tobin's Q definition and equation (7), we obtain an expression for equity wealth $p(r)$:

$$p(r) = Q(r) k(r) = (1 - \tau) \left(k(r) + \frac{F(k(r), l)}{\xi r} \right) \quad (8)$$

Expression (8) shows that $p(r)$ can change due to changes in $k(r)$, changes in $Q(r)$ or changes in both. If $k(r)$ shifts due, for example, to a change in the relative price of capital goods or a change in the corporate tax rate (both absent from the model, for simplicity), $p(r)$ would shift accordingly.¹⁷ But $p(r)$ might change simply due to valuation effects

¹⁵Gali (1996) derives a fully-fledged neoclassical growth model modified by introducing a market structure characterized by monopolistic competition and different demand elasticities between consumers and firms. We simplify the analysis by assuming a common elasticity. This is mathematically equivalent to the common assumption in New Keynesian models that there is a final good produced as a CES composite of intermediate goods by a perfectly competitive firm.

¹⁶See Gonzalez and Mathy (2017) for a step-by-step derivation of Tobin's Q in a growth model with imperfect competition.

¹⁷Most of this effect will occur through the direct impact of $k(r)$ on $p(r)$, but side valuation effects are also present when Tobin's Q is not constant along equity returns. This is the case in expression (7).

that do not shift the demand of capital $k(r)$. This occurs, for example, when there is a change in the dividend income tax τ . In that case, $p(r)$ shifts outwards or inwards depending on whether τ increases or decreases, but $k(r)$ remains unaltered because the dividend income tax doesn't change the user cost of capital.¹⁸ Finally, $p(r)$ change when both $k(r)$ and $Q(r)$ change. The rise of monopoly power is an example of this. One hand, it raises pure equity valuation through Q because future monopoly rents $\frac{1}{\xi}F(k(r), l)$ are capitalized. On the other hand, the monopoly firm lowers the demand of production factors, including $k(r)$, because it reduces the amount output relative to the competitive market. In the standard monopoly model, where optimal capital is also characterized by (5), the magnitude of this allocation effect depends on the production elasticity σ .¹⁹

2.3 Equilibrium

Equilibrium occurs when $p(r) = a(r)$, that is to say, financial wealth supplied has to be equal to financial wealth demanded. Note that $p(r)$ satisfies $p(r) = Q(r)k(r)$ and is monotonically decreasing. Since $a(r)$ is monotonically increasing when $a > 0$, there is a unique equilibrium when $a > 0$ given by the return r^* such that:

$$a(r^*) = p(r^*) \equiv Q(r^* | \tau, \xi) k(r^*), \quad (9)$$

where the equality is the equilibrium itself and the identity is due to Tobin's Q definition. Expression (9) shows that the equilibrium depends on Q and its determinants and, therefore, it suggests that permanent pure valuation changes can also have significant permanent real effects. To understand these effects, we shall focus first on changes in those determinants that alter $Q(r)$ without shifting $k(r)$. As explained before, this happens when there is a permanent change in the dividend income tax τ . In particular, in response to a decrease in τ , Tobin's Q will increase and investors will demand a higher return in order to hold the additional financial wealth that a higher Q implies. In other words, an increase in Q implies an upward movement along the $a(r)$ curve and this movement results in a higher demanded equity return. The firm, in response to that, is forced to reduce the level of investment. This occurs because the return to equity is paired with the marginal productivity of capital through the first order condition (5).²⁰ The result is a higher r^* and lower equilibrium capital expenditures $k(r^*)$.

¹⁸This is the main result of the so called "New view of dividend taxation" literature. See [McGrattan and Prescott \(2005\)](#), among many others.

¹⁹For a given r , if the markup $\frac{\xi}{\xi-1}$ increases by 1%, capital-output ratio falls by $-\sigma\%$. This result is straightforward from FOC (5), when expressed as $\log\left(\frac{\xi}{\xi-1}\right) + \log(\delta + r) = \log\phi + \frac{-1}{\sigma}\log\left(\frac{k}{y}\right)$.

²⁰This result does not require perfect identity between the marginal productivity of capital and the return to equity. A positive relation between them is sufficient.

A similar mechanism operates when monopoly markups rise. Higher capitalized markups translate into higher Tobin's Q and higher equity valuation, implying the subsequent movement along $a(r)$ and the adjustment of firms' capital expenditures. In this case, however, this general effect is aggravated by the inwards shift of $k(r)$ that characterizes optimal capital decision of monopoly firms, just as we described above.

Changes in τ and ξ are not the only mechanisms that have real equilibrium effects by changing Q . Any other mechanism that alters Q would imply a movement along $a(r)$ and would change the equilibrium pair r^* and k^* in a similar manner. This is the reason why in our main empirical exercise we opt to be agnostic about the determinants of Q and ask the more general question of how asset prices and Q in particular impact the labor share. But other forces, similar to τ and ξ , might reach a similar outcome. For example, Q changes similarly when the discount factor of the firm changes relative to that of shareholders. This is another potential mechanism that connects with the idea that big firms have become relatively more short-term oriented over time, whose implications have been widely discussed (Lazonick and O'Sullivan, 2000; Davis, 2009; among many others) and that has been considered as one potential source for declining investment (Gutiérrez and Philippon, 2016).²¹

Proposition 1. *The relation between τ and equilibrium capital k^* is positive.*

Proof. See appendix

□

Proposition 2. *The relation between ξ and equilibrium capital k^* is positive.*

Proof. See appendix

□

Lemma 1. *The relation between equilibrium Q^* and equilibrium capital k^* is negative.*

The equilibrium of the model makes explicit the relation between equilibrium capital expenditures and Tobin's Q (τ and ξ are only some potential determinants but the mechanism operates similarly for any factor that increases asset prices, including bubbles or short-termism). A relation between the labor share and Tobin's Q is straightforward:

²¹Piketty and Zucman (2014) argue that one plausible explanation for so much variation of Tobin's Q across countries might be the different level of protection of shareholders' rights, with Anglo-Saxon countries being those with the highest level of protection and highest Tobin's Q . This hypothesis seems to be also consistent with the evidence shown by Gompers et al. (2005) for U.S. firms: firms with stronger shareholder rights seem to be also those with higher firm value and lower capital expenditures. Whether this is a relevant mechanism that drives the joint evolution of Tobin's Q and the labor share is something that we leave for future research. Our exercise, for now, focuses on the relation between Tobin's Q and the labor share and the empirical relevance of the two mechanisms that we have directly incorporated into the model: τ and ξ .

$$LIS^* = \left(\frac{\xi - 1}{\xi}\right)1 - \phi\left[\frac{k^*(Q)}{y(k^*(Q))}\right]^{\frac{\sigma-1}{\sigma}}, \quad \text{and} \quad \frac{\partial LIS}{\partial Q} = \frac{\partial LIS}{\partial \frac{k}{Y}} \frac{\partial \frac{k}{Y}}{\partial k} \frac{dk(Q)}{dQ}, \quad (10)$$

where:

$$\begin{aligned} \frac{\partial LIS}{\partial \frac{k}{Y}} &> 0 \quad \text{if } \sigma < 1; \\ \frac{\partial \frac{k}{Y}}{\partial k} &> 0 \quad \text{due to CRS;} \\ \text{and } \frac{dk(Q)}{dQ} &< 0 \quad \text{given by proposition 1.} \end{aligned}$$

Importantly, the mechanism of [Karabarbounis and Neiman \(2014\)](#) can be easily embedded into our model by adding the relative prices of capital goods (RP) in the budget constraint of the firm, as in [Greenwood et al. \(1997\)](#).

$$F(k, L) = d + RP[k' - (1 - \delta)k] + w, \quad (11)$$

where the demand of capital depends on RP , and more specifically, it raises when the relative price of capital goods falls, that is, $\frac{\partial k'(r)}{\partial RP} < 0$. 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 labor income share, this paper combines three different databases to construct our three variables of interest.

3.1 Tobin's Q

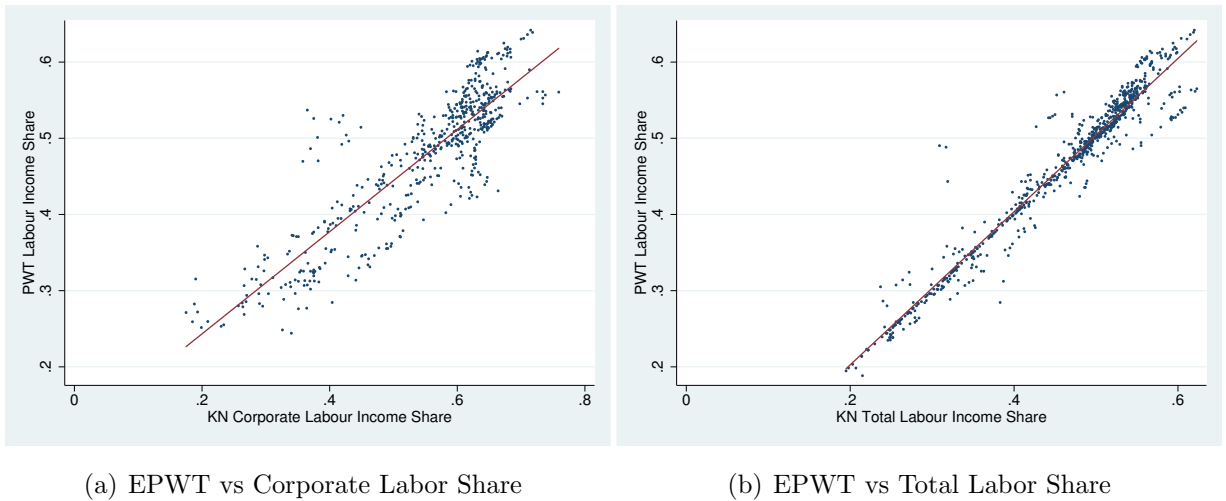
The Tobin's Q is defined as the market value of capital over its replacement cost. Empirically, we use data from the Worldscope database and follow [Doidge et al. \(2013\)](#) to compute a firm-level Tobin's Q as the sum of total assets less the book value of equity plus the market value of equity, divided by the book value of total assets, which is generally acknowledged as the most accurate available procedure, given the difficulty to obtain data of the replacement cost of capital. Indeed [Chung and Pruitt \(1994\)](#) find that a simple market-to-book ratio explains at least 96.6 percent of the variability of Tobin's Q -calculated as the market value of capital over its replacement cost.

A country-level Q is obtained by aggregating 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, and a median Q is computed for each industry.²² In a second step, countries' Q are calculated as the market value weighted average of the median industries' Q . The use of industry medians allows us to overcome the problem of potential outliers in the sample.²³

3.2 Labor Income Share

Regarding the labor share, [Karabarbounis and Neiman \(2014\)](#) have developed a database of the corporate labor 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 employ the LIS variable from the Extended Penn World Table 4.0 (EPWT 4.0).

Figure 3: EPWT LIS vs KN LIS



The EPWT 4.0 draws information from several United Nations sources and defines the labor 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 of using this LIS definition, the high correlation between our variable with the corporate labor share and the total labor

²²Table A2 in the Appendix displays the Fama-French 17 industries classification.

²³In order to be safe about potential outliers we just include sector-year pairs where we have data for at least three companies. Increasing the number of companies required per sector-year does not significantly alter our Q . In order to maximize the sample coverage of our analysis, Tobin's Q is calculated including the financial sector. Excluding the financial sector gives a Q with a 0.95 correlation with our variable.

share used by Karabarbounis and Neiman (2014) -0.88 and 0.96 respectively (Figure 3)- suggests that this should not represent a major source of concern.

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 ($\frac{P_{i_i}}{P_{c_i}}$), which is calculated using ppp exchange rates, over the relative price of investment in the United States ($\frac{P_{i_{US}}}{P_{c_{US}}}$). 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 the BEA.

$$RP = \frac{\frac{P_{i_i}}{P_{c_i}}}{\frac{P_{i_{US}}}{P_{c_{US}}}} * \frac{ID_{US}}{PCD_{US}}$$

3.4 Descriptive Correlations

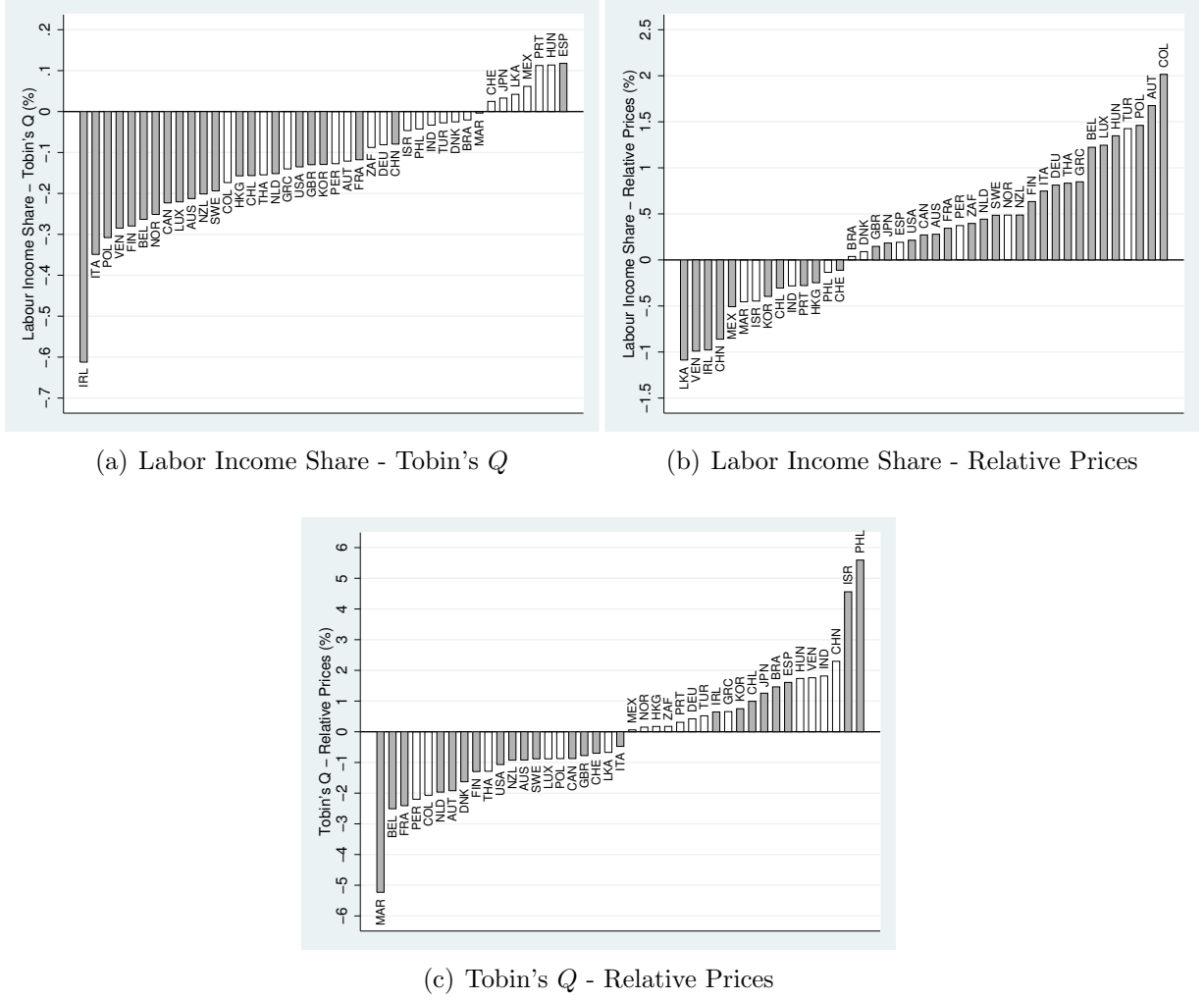
Figure 4 shows the country-specific correlations between our variables of interest.²⁴ The vertical axis reports the coefficient α_1 (in percentage) from a regression $\ln(Y_t) = \alpha_0 + \alpha_1 \ln(X_t) + \epsilon_t$, where, Y represents either the labor share or the Tobin's Q , and X stands for the Tobin's Q or the relative prices. Figure 4.a displays the already commented global negative relationship between the labor income share and the Tobin's Q . On average, an increase in the Tobin's Q of 1% is associated with a decline in the LIS of roughly 2%. Spain is the only country displaying a positive correlation between these variables significantly different from zero at 5% level. Figure 4.b studies the relationship between the labor share and our other variable of interest, the relative prices. Although the picture is less conclusive, it suggests the presence of a positive correlation between the two variables. However, Figure A3 in the Appendix shows that when we consider the information provided by all the countries, the within-country correlation is very small. Figure 4.c shows no pattern between the Tobin's Q and the relative investment prices.

4 Empirical Methodology

Assessing empirically the validity of the theoretical model carries several challenges. 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.

²⁴Table A3 in the Appendix shows their descriptive statistics.

Figure 4: Country-specific Correlations of our Variables of Interest



Notes: Own calculations obtained from $\ln(Y_t) = \alpha_0 + \alpha_1 \ln(X_t) + \epsilon_t$, where Y represents the labor share or the Tobin's Q , X stands for the Tobin's Q or the relative prices, and ϵ is a classic disturbance term. The vertical axis show α_1 in percentage. Dark bars indicate that α_1 is significant at 5% level. The coverage is presented in Table A1 (915 observations, 41 countries).

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 labor 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 labor share:

$$LIS = g\left(\frac{k}{Y}\right) = a\left(\frac{k}{Y}\right)^\alpha \quad (12)$$

In this way, our empirical specification is comparable to [Bentolila and Saint-Paul \(2003\)](#). Note that we remain agnostic about α and then we do not know ex-ante whether the impact of $\frac{k}{Y}$ on the labor share would be positive or negative.

Nevertheless, contrary to [Bentolila and Saint-Paul \(2003\)](#), we further endogenize 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 generic 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 $\frac{k}{Y}$.

$$\frac{k}{Y} = f(Q, RP) = Q^{\psi_1} RP^{\psi_2} \quad (13)$$

We use these two forms to obtain an estimable equation of the labor share in terms of Q and RP :

$$LIS = g\left(\frac{k}{Y}\right) = g(f(Q, RP)) = a(Q^{\psi_1} RP^{\psi_2})^\alpha \quad (14)$$

Taking natural logarithms:

$$\ln(LIS) = \ln(a) + \alpha\psi_1 \ln(Q) + \alpha\psi_2 \ln(RP) + \Omega_{it}, \quad (15)$$

or simplifying:

$$lis_{it} = \beta_0 + \beta_1 q_{it} + \beta_2 rp_{it} + \Omega_{it} \quad (16)$$

Where lis , q , and rp are the natural logarithm values of our variables of interest, and Ω is a standard disturbance term. Note that according to proposition 1 and expression (10) we expect β_1 to be negative. The sign of β_2 is expected to be negative if, as assumed in the model, σ is lower than one and capital and labor are complements. In that case, an increase in the relative price of capital goods depresses investment and this impacts negatively the labor share. However, if we follow [Karabarbounis and Neiman \(2014\)](#), we should expect β_2 to be positive because a decrease in the price of capital induce firms to shift away from labor towards capital, driving down the labor share.

4.2 Econometric Methodology

Characterized by a small number of cross-sectional units (N) compared to the time dimension (T), macroeconomics panel data have been traditionally estimated following microeconomics panel data techniques under the assumptions of parameter homogeneity (across countries), common impact of unobservable factors, cross-section independence, and data stationarity.²⁵ However, if these assumptions are violated, results would be subject to misspecification problems. In order to overcome these potential sources of misspecification,

²⁵See [Roodman \(2009\)](#) for a detailed explanation on the potential risks of the popular Difference and System GMM estimators.

we rely on relative recently developed panel data techniques (panel time-series), which are especially developed for macroeconomics data characteristics (Pesaran, 2015).²⁶

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 takes the following form:

$$y_{it} = \beta_i x_{it} + u_{it}, \quad u_{it} = \varphi_i f_t + \psi_i + \varepsilon_{it}, \quad (17)$$

$$x_{it} = \delta_i f_t + \gamma_i g_t + \pi_i + e_{it}, \quad (18)$$

$$f_t = \tau + \phi f_{t-1} + \omega_t, \quad g_t = \mu + \kappa g_{t-1} + \nu_t, \quad (19)$$

where y_{it} and x_{it} represent, respectively, the dependent and independent variables, β_i represents the country-specific impact of the regressor on the dependent variable, and u_{it} , aside from the error term (ε_{it}), contains unobservable factors. In particular, unobservable time-invariant heterogeneity is captured through a country fixed effect (ψ_i), while time-variant heterogeneity is accounted for through a common factor (f_t) with country-specific factor loadings (φ_i). At the same time, the model allows for 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 β_i (Kapetanios et al., 2011).²⁷

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” (i.e. Mean Group-style estimators), which leave the coefficients unconstrained (i.e. β_i is estimated for each country). In the latter, the estimator can be defined as the simple average of the country-specific coefficients (i.e. $\beta^* = N^{-1} \sum_{i=1}^N \beta_i$).²⁸

Within each group, the assumptions about the structure of the unobservable factors

²⁶Although 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 manuscript relies on several of their papers.

²⁷Equation (19) models these factors as a simple AR(1) where no constraints 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 analyze the cointegration relationship among them to infer any causal relationship.

²⁸Pesaran and Smith (1995) show that the Mean Group-style estimators produce consistent estimates of the average of the parameters. These estimators also allows for the use of weights to calculate the average.

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.²⁹ Empirically, it aims to eliminate the cross-sectional dependence by augmenting equation (16) with the cross-section averages of the variables.³⁰

With respect 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 latter is assumed to be constant, and is empirically accounted by adding country-specific linear trends (t). Therefore, the estimable equation takes the form:

$$lis_{it} = \beta_{0i}^{MG} + \beta_{1i}^{MG}q_{it} + \beta_{2i}^{MG}rp_{it} + \beta_{3i}^{MG}t + \Omega_{it} \quad (20)$$

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 might not account for all the possible cross-section dependence from the unobserved heterogeneity.

To circumvent this concern, [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 regressions augmented with these cross-section averages. The estimable equation takes the following form:

$$\begin{aligned} lis_{it} = & \beta_{0i}^{CMG} + \beta_{1i}^{CMG}q_{it} + \beta_{2i}^{CMG}rp_{it} \\ & + \beta_{3i}^{CMG}\overline{lis_t} + \beta_{4i}^{CMG}\overline{q_t} + \beta_{5i}^{CMG}\overline{rp_t} + \Omega_{it}, \end{aligned} \quad (21)$$

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](#)

²⁹POLS and 2FE estimators assume that the time-varying heterogeneity has the same impact across countries for a given year.

³⁰[Eberhardt et al. \(2013\)](#) provide the intuition behind this mechanism.

(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 sources of misspecification arising from parameter homogeneity and the existence of cross-section dependence. This paper also deals with the potential misspecification following 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 delivers a consistent estimator of both β_i and β^{CMG} . Empirically, we proceed by using an Error Correction Model of the following form:

$$\begin{aligned} \Delta lis_{it} = & \beta_0^{CMG2} + \beta_1^{CMG2} lis_{i,t-1} + \beta_2^{CMG2} q_{i,t-1} + \beta_3^{CMG2} rp_{i,t-1} + \beta_4^{CMG2} \Delta q_{it} + \beta_5^{CMG2} \Delta rp_{it} \\ & + \beta_6^{CMG2} \overline{\Delta lis_t} + \beta_7^{CMG2} \overline{lis_{t-1}} + \beta_8^{CMG2} \overline{q_{t-1}} + \beta_9^{CMG2} \overline{rp_{t-1}} + \beta_{10}^{CMG2} \overline{\Delta q_t} + \beta_{11}^{CMG2} \overline{\Delta rp_t} \\ & + \sum_{l=1}^p \beta_{12}^{CMG2} \overline{\Delta lis_{t-p}} + \sum_{l=1}^p \beta_{13}^{CMG2} \overline{\Delta q_{t-p}} + \sum_{l=1}^p \beta_{14}^{CMG2} \overline{\Delta rp_{t-p}} + \Omega_{it}, \end{aligned} \quad (22)$$

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).³¹

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.

5 Results

This section begins by showing the results of a baseline model (Section 5.1), where just the Tobin's Q is considered as a regressor. Secondly, Section 5.2 further includes the relative price of investment in the analysis. Section 5.3 provides evidence supporting the interpretation of our results as a causal relationship, and finally, Section 5.4 presents a robustness check of our results.³²

³¹Chudik 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.

³²The Technical Appendix presents an exhaustive analysis of the time-series properties of our variables of interest. The presence of nonstationary variables and cross-section dependence in our data make the use of traditional panel data techniques invalid. To be sure that our regression results are not subject to biases due to cross-section dependence or to spurious relationships due to the order of integration, we will

5.1 Baseline Results

Tables 1 and 2 present the results for our baseline model, where only the impact of Tobin's Q on the labor income share is considered. Columns [1]-[4] display the homogeneous-type estimators, where β 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, we estimate country-specific regressions, and the estimator presented is the average of the country-specific coefficients.

Table 1 presents the estimates corresponding to a static model including 41 countries for a total of 915 observations.³³ Concerning the homogeneous-type estimators, we find a negative and significant impact of the Tobin's Q on the labor income share in all but the POLS estimator (where the impact is positive and significant). However, the cross-sectional augmented panel unit root (CIPS) Pesaran (2007) test and the Pesaran (2004) CD test for cross-section dependence indicate that the residuals suffer from nonstationarity and cross-section dependence.³⁴ 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 relevance of the first two potential sources of misspecification can be tested analyzing the Mean Group-style estimators (columns [5]-[7]). A negative and significant impact of the Tobin's Q on the labor 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 suggest that, although the introduction of parameter heterogeneity improves the specification, it is not enough to solve all the potential misspecification problems.

Table 2 analyzes 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 limitations, we consider 40 countries with the number of observations ranging from 850 to 885. The first important result is that a clear negative

pay specially attention to regression residuals' characteristics. In particular, in our preferred specification residuals are stationary (which is an informal test for cointegration among the variables) and they do not have problems of cross-section dependence (which indicates that our specification successfully capture the unobservable heterogeneities).

³³Table A1 in the Appendix shows the specific countries and period under analysis.

³⁴See the Technical Appendix for a detailed explanation of these tests.

and significant long-run relationship is observed between the Tobin's Q and the labor share irrespective of the estimator used for the 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 in controlling for the unobserved factors, our preferred model is the one showed in the last column (CMGt2)) which corresponds to 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. Our findings suggest that a 1% increase in Tobin's Q causes a decrease in the labor income share of 0.08% in the long-run.

5.2 The Effect of the Relative Price of Investment Goods

As commented before, [Karabarbounis and Neiman \(2014\)](#) have argued that the global decline in the labor 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 labor 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 3 and 4 show the results.

Table 3 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 labor 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 labor income share. Nevertheless, similar to the static model analyzed in Table 1, residuals present cross-section dependence and nonstationarity.

In order to address concerns arising from the dynamic structure of our equation, this time we estimate an Error Correction Model (Table 4), where due to data restrictions we are not able to include more than 30 countries. Although we present the results for different estimators, we focus especially on the CMG-style estimators (columns [4]-[7]), which allow for a higher degree of flexibility. 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 imply that an increase of 1% in Tobin's Q would decrease the labor income share by between 0.072% and 0.11%. However, in contrast to [Karabarbounis and Neiman \(2014\)](#), we do not find any empirical support for

Table 1: Static Baseline Model

	[1] POLS	[2] 2FE	[3] CCEP	[4] CCEPt	[5] MG	[6] CMG	[7] CMGt
q	0.14 (0.052)***	-0.083 (0.025)***	-0.05 (0.017)***	-0.052 (0.016)***	-0.057 (0.015)***	-0.053 (0.020)***	-0.06 (0.016)***
t					-0.003 (0.001)**		-0.003 (0.001)**
Constant	-0.647 (0.036)***	-0.665 (0.017)***			-0.656 (0.032)***	-0.483 (0.068)***	-0.714 (0.105)***
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			
RMSE	0.2244	0.0629	0.0500	0.0474	0.0443	0.0435	0.0336
Trend					0.73		0.59
CD test	28.3495	-2.6979	8.688	-2.9706	3.8019	9.5781	5.4416
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%.
POLS = Pooled OLS (with year dummies), 2FE = 2-way Fixed Effects, CCEP = Pooled [Pesaran \(2006\)](#) Common Correlated Effects (CCE), CCEPt = CCEP with year dummies, MG = [Pesaran and Smith \(1995\)](#) Mean Group (with country-specific linear trends), CMG = [Pesaran \(2006\)](#) CCE Mean Group, CMGt = CMG with country-specific linear trends.
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 2: Dynamic Baseline Model

	[1] POLS	[2] 2FE	[3] CCEP	[4] CCEPt	[5] MG	[6] CMG	[7] CMGt	[8] CMGt1	[9] CMGt2
q	-0.009 (0.015)	-0.03 (0.019)	-0.021 (0.012)*	-0.023 (0.012)*	-0.034 (0.010)***	-0.017 (0.011)	-0.024 (0.012)**	-0.026 (0.013)**	-0.04 (0.010)***
lis_{t-1}	0.977 (0.008)***	0.771 (0.078)***	0.749 (0.037)***	0.718 (0.041)***	0.64 (0.034)***	0.767 (0.026)***	0.608 (0.032)***	0.537 (0.037)***	0.502 (0.048)***
t					-0.001 (0.000)		-0.001 (0.001)*	-0.001 (0.001)	-0.001 (0.001)*
Constant	-0.005 (0.009)	-0.141 (0.051)***			-0.232 (0.025)***	-0.135 (0.026)***	-0.358 (0.076)***	-0.418 (0.084)***	-0.318 (0.078)***
Number of id	40	40	40	40	40	40	40	40	40
Observations	885	885	885	885	885	885	885	868	850
R-squared	0.97	0.98	0.99	0.99					
RMSE	0.0403	0.0384	0.0307	0.0309	0.0338	0.0246	0.0225	0.0202	0.0178
Trend					0.25		0.24	0.33	0.23
lr- q	-0.4112	-0.1288	-0.0854	-0.0815	-0.0944	-0.0725	-0.061	-0.0564	-0.08
se- q	0.7248	0.0613	0.0466	0.0428	0.0296	0.0462	0.0306	0.0281	0.0208
CD test	-0.2311	-1.2989	-0.9679	-2.5497	8.5344	-1.3683	-1.1636	-0.4342	-0.5145
Abs Corr	0.2133	0.2253	0.2309	0.2339	0.2240	0.2171	0.2188	0.2331	0.2426
Int	Int(0)	Int(0)	Int(0)	Int(0)	Int(0)	Int(0)	Int(0)	Int(0)	Int(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), CCEPt = CCEP with year dummies, MG = Pesaran and Smith (1995) Mean Group (with country-specific linear trends), CMG = Pesaran (2006) CCE Mean Group, CMGt = CMG with country-specific linear trends, CMGt1 and CMGt2 = CMGt 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 se- q represent respectively q 's long-run impact and its standard error.

Table 3: Static Model with Relative Prices

	[1] POLS	[2] 2FE	[3] CCEP	[4] CCEPt	[5] MG	[6] CMG	[7] CMGt
q	0.157 (0.051)***	-0.08 (0.025)***	-0.052 (0.015)***	-0.052 (0.015)***	-0.067 (0.013)***	-0.061 (0.019)***	-0.052 (0.015)***
rp	-0.344 (0.100)***	-0.113 (0.043)***	-0.1 (0.048)**	-0.101 (0.047)**	0.005 (0.085)	-0.001 (0.111)	0.017 (0.078)
t					-0.002 (0.001)*		-0.002 (0.002)
Constant	-0.589 (0.039)***	-0.642 (0.019)***			-0.678 (0.034)***	-0.681 (0.101)***	-0.664 (0.078)***
Number of id	41	41	41	41	41	41	41
Observations	915	915	915	915	915	915	915
R-squared	0.12	0.93	0.99	0.99			
RMSE	0.2229	0.0625	0.0411	0.0399	0.0405	0.0311	0.0273
Trend					0.56		0.32
CD test	25.6361	-2.4791	5.4335	-2.3717	3.7041	2.4645	4.6826
Abs Corr	0.4506	0.4142	0.3057	0.3102	0.2821	0.2522	0.2517
Int	I(1)	I(1)	I(0)/I(1)	I(0)/I(1)	I(0)/I(1)	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), CCEPt = CCEP with year dummies, MG = Pesaran and Smith (1995) Mean Group (with country-specific linear trends), CMG = Pesaran (2006) CCE Mean Group, CMGt = CMG with country-specific linear trends.
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: ECM with Relative Prices

	[1] 2FE	[2] CCEP	[3] MG	[4] CMG	[5] CMGt	[6] CMGt1	[7] CMGt2
lis_{t-1}	-0.176 (0.026)***	-0.365 (0.049)***	-0.449 (0.034)***	-0.5 (0.053)***	-0.694 (0.061)***	-0.72 (0.085)***	-0.812 (0.125)***
q_{t-1}	0.011 (0.013)	-0.005 (0.016)	-0.035 (0.014)**	-0.039 (0.018)**	-0.067 (0.026)**	-0.076 (0.028)***	-0.058 (0.033)*
rp_{t-1}	-0.032 (0.024)	0.034 (0.047)	0.064 (0.070)	0.15 (0.091)*	0.092 (0.115)	0.129 (0.166)	-0.005 (0.186)
Δq	-0.031 (0.014)**	-0.030 (0.014)**	-0.038 (0.009)***	-0.038 (0.012)***	-0.051 (0.017)***	-0.053 (0.019)***	-0.058 (0.018)***
Δrp	-0.141 (0.050)***	-0.153 (0.068)***	-0.021 (0.065)	0.049 (0.108)	0.093 (0.099)	0.05 (0.107)	-0.11 (0.095)
t			0.001 (0.001)		0.001 (0.002)	0.001 (0.003)	0.001 (0.004)
Constant	-0.106 (0.018)***		-0.301 (0.033)***	-0.273 (0.050)***	-0.277 (0.084)***	-0.431 (0.089)***	-0.356 (0.124)***
Number of id	30	30	30	30	30	29	26
Observations	732	732	732	732	732	700	631
R-squared	0.26	0.57					
RMSE	0.0264	0.0228	0.0191	0.0142	0.0127	0.0101	0.0067
Trend			0.23		0.20	0.21	0.23
lr- q	0.0621	-0.0136	-0.0779	-0.0785	-0.0965	-0.1061	-0.0718
se- q	0.0739	0.0428	0.0327	0.0374	0.0388	0.0405	0.0422
lr- rp	-0.1826	0.0927	0.1417	0.2999	0.1325	0.1796	-0.0063
se- rp	0.1306	0.1295	0.1573	0.185	0.1661	0.2312	0.2285
CD test	-2.4749	-2.0278	4.9547	-0.0134	-0.2654	1.0079	1.3218
Abs Corr	0.1884	0.2114	0.2038	0.2189	0.2216	0.2393	0.2466
Int	I(0)	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%.

2FE = 2-way Fixed Effects, CCEP = Pooled [Pesaran \(2006\)](#) Common Correlated Effects (CCE), MG = [Pesaran and Smith \(1995\)](#) Mean Group (with country-specific linear trends), CMG = [Pesaran \(2006\)](#) CCE Mean Group, CMGt = CMG with country-specific linear trends, CMGt1 and CMGt2 = CMGt 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 se- q represent respectively q 's long-run impact and its standard error. lr- rp and se- rp represent respectively rp 's long-run impact and its standard error.

the role played by the relative prices.³⁵ This findings support our theoretical model, and, like [Chirinko and Mallick \(2014\)](#), discard the decline of investment prices as a driver of the labor income share.

To grasp the magnitude of these results consider that, as 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 labor income share has evolved from a value of 57% to 52% (−8.9%), our estimates imply that the increase in Tobin's Q can explain between 41% and 57% of the labor income share decline.

5.3 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.³⁶

Traditionally, the literature has used instrumental variable methods to circumvent this issue. However, given the nature of our data, providing a valid set of instruments is challenging (i.e. variables which are correlated with the regressor but not with the error term).³⁷ 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:

$$\Delta lis_{it} = \alpha_{1i} + \lambda_{11}\hat{u}_{i,t-j} + \sum_{j=1}^k \phi_{11ij}lis_{i,t-j} + \sum_{j=1}^k \phi_{12ij}q_{i,t-j} + \sum_{j=1}^k \phi_{13ij}rp_{i,t-j} + \epsilon_{1it}, \quad (23)$$

$$\Delta q_{it} = \alpha_{2i} + \lambda_{21}\hat{u}_{i,t-j} + \sum_{j=1}^k \phi_{21ij}lis_{i,t-j} + \sum_{j=1}^k \phi_{22ij}q_{i,t-j} + \sum_{j=1}^k \phi_{23ij}rp_{i,t-j} + \epsilon_{2it}, \quad (24)$$

$$\Delta rp_{it} = \alpha_{3i} + \lambda_{31}\hat{u}_{i,t-j} + \sum_{j=1}^k \phi_{31ij}lis_{i,t-j} + \sum_{j=1}^k \phi_{32ij}q_{i,t-j} + \sum_{j=1}^k \phi_{33ij}rp_{i,t-j} + \epsilon_{3it}, \quad (25)$$

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-

³⁵A nonsignificant impact of relative prices is compatible with an elasticity of substitution equal to one. However, the negative impact of the Tobin's Q discards this possibility, indicating that relative investment prices are not a key determinant of the labor share.

³⁶In our case, reverse causality implies that besides the relative prices and Tobin's Q affecting the labor income share, the labor income share has in turn, a significant impact on their values.

³⁷Under the presence of unobservable common factors and parameter heterogeneity, the use of internal instruments (lags of the variables) is not valid anymore.

run equilibrium relationship, the GRT requires at least one of the λ 's to be nonzero. If $\lambda_{11} \neq 0$, q and rp have a causal impact on the lis , if λ_{11} , λ_{21} , and λ_{31} are nonzero, then all variables are determined simultaneously, and no causal relationship can be identified.

Table 5: Weak Exogeneity Test

Model		no CA			CA		
		<i>lis</i>	<i>q</i>	<i>rp</i>	<i>lis</i>	<i>q</i>	<i>rp</i>
MG	Avg. λ	-0.52	-0.45	0.02	-0.50	-0.41	-0.04
	ρ	0.00	0.03*	0.48	0.00	0.21	0.60
CMG	Avg. λ	-0.57	-0.40	-0.01	-0.51	-0.54	0.00
	ρ	0.00	0.15	0.83	0.00	0.18	0.94
CMGt	Avg. λ	-0.75	-0.65	0.00	-0.69	-0.74	-0.04
	ρ	0.00	0.01*	0.98	0.00	0.12	0.72
CMG1	Avg. λ	-0.59	-0.23	0.04	-0.51	-0.58	0.03
	ρ	0.00	0.52	0.24	0.00	0.13	0.61
CMGt1	Avg. λ	-0.77	-0.12	0.06	-0.75	-0.60	0.05
	ρ	0.00	0.75	0.19	0.00	0.19	0.38
CMG2	Avg. λ	-0.73	-0.42	-0.07	-0.64	-1.04	-0.05
	ρ	0.00	0.32	0.09*	0.00	0.04*	0.56
CMGt2	Avg. λ	-0.93	-0.46	0.06	-0.82	-1.20	0.05
	ρ	0.00	0.29	0.25	0.00	0.01*	0.44

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.

Table 5 presents the results for our weak exogeneity test. Column labeled as “Model” refers to the method used to estimate the disequilibrium term (\hat{u}). The two big blocks “CA” and “no CA” indicate whether equations (23)-(25) include, or not, cross-sectional averages of the variables. Within each block, the dependent variable of the system is specified at the top of the column. The information provided shows the results for the average λ and its respective p -value. As already commented, for a causal effect of the Tobin’s Q and the relative prices on the labor share, λ_{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 the argument of a causal relationship. Therefore, our results can be safely interpreted as the causal impact of Tobin’s Q and the relative price of investment on the labor income share.

5.4 Robustness

Our study supports the argument of a long-run negative impact of the Tobin's Q on the labor share. In this subsection we prove the robustness of the results presented in Tables 1-4 to an alternative definition of Q . More specifically, in Tables A4-A7 in the Appendix the Tobin's Q is defined as the Corporate Wealth Tobin's Q obtained from the World Wealth & Income database instead of our computed Q .

By doing so, the sample of countries included in the analysis decreases to 9, for a maximum of 208 observations.³⁸ Despite of this we prove that the negative relationship between the labor share and Q found in Section 5 is unchanged and robust independently of the functional form of the empirical equation and of the variables included (i.e. static vs dynamic, with-without relative prices). Specifically, the new set of results shows that one percentage increase in the Tobin's Q decreases the labor income share by around 0.10% in the long-run.³⁹

6 Beyond the Q : Empirical Evidence

Although we show that the secular rise of the Tobin's Q is one of the main determinants of the decline in the labor share, in the empirical analysis we remained agnostic on which are the main determinants driving Q .

This section aims to empirically explore the relationship between the Tobin's Q and its potential determinants highlighted during the paper: Dividend income tax rate, firms market power and corporate governance. More specifically, Section 6.1 shows the evolution of the dividend income tax rate during the last decades for a set of countries and links this trend with the one followed by the Tobin's Q and the capital-output ratio. Section 6.2 studies the relationship between the last two variables and changes in the degree of market power using U.S. industry level data. Finally, Section 6.3 does an analogous analysis for the impact of changes in corporate governance using both country and U.S. firm-level data.

6.1 Dividend Income Tax Rate

In our model, dividend income taxes affect Q by lowering the amount of dividends that households receive. As a consequence, when dividend taxes decline, equity Tobin's Q rises.

³⁸Australia, Canada, Denmark, France, Germany, Japan, Netherlands, United Kingdom, and the United States.

³⁹Given the small number of countries included in the analysis, it is not surprising that the CD-test rejects the null of cross-section independence in some regressions.

In general equilibrium, the rise in equity Tobin's Q has a negative impact on corporate investment and physical capital.

Empirically, we check the validity of this mechanism by relating the trends on the dividend income tax rates with the pattern followed by the Tobin's Q and the capital-output ratio. The sample is restricted to a subset of countries due to data availability.⁴⁰ Country-level Tobin's Q data is calculated following the methodology used in Section 3, data on the capital-output ratio is obtained from AMECO database, and the dividend income tax rates from the OECD Tax database.⁴¹

Figure A4 in the Appendix shows the country-specific trends for our three variables of interest. Figure A4.a displays the commented global rise of Tobin's Q . In this case just 5 out of 32 countries show a significant and negative trend for the period studied (Hungary, Greece, Slovakia, Chile, and Japan). Figure A4.b displays a generalized and strong negative trend on the dividend income tax rate. Most of the countries in the sample have experienced, on average, declines on the tax rate of around 1 percentage point per year, with countries such as Japan and Italy reaching levels of around 2 percentage points per year during the period under analysis. With respect to the trend of the capital-output ratio, the pattern is more heterogeneous, and positive and negative trends are evenly distributed across the sample (Figure A4.c).

Our theoretical framework predicts that the observed decline in the dividend income tax rate (Figure A4.b) should have increased the Tobin's Q and decreased the physical capital-output ratio. Figure 5 studies these correlations by presenting the coefficients (in %) of the following country-specific OLS regressions:

$$\ln(X_t) = \alpha_0 + \alpha_1 TAX_t + \epsilon_t, \quad (26)$$

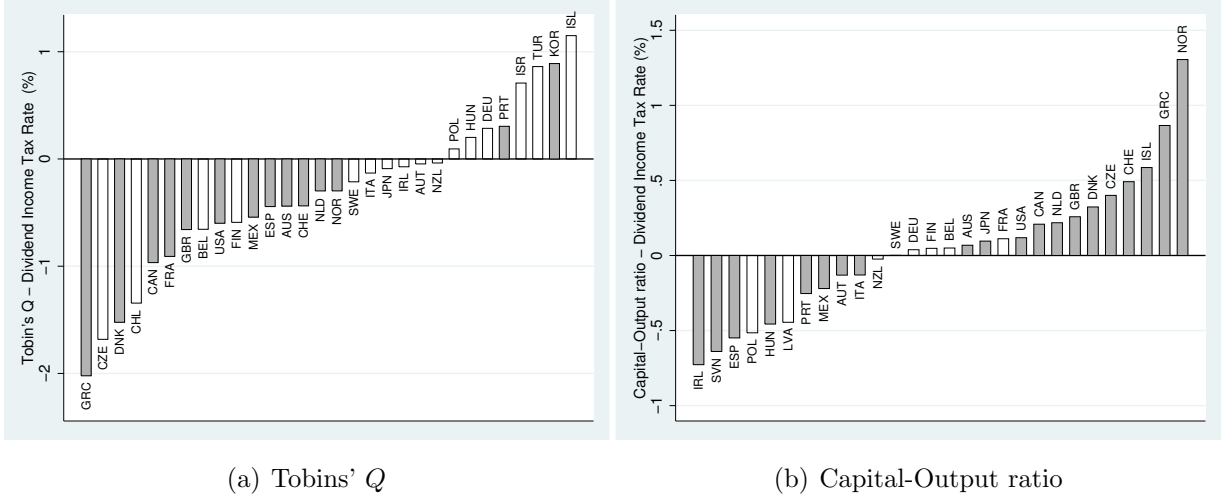
where X , depending on the specification, represents Q or the capital-output ratio, TAX stands for the dividend income tax rate, and ϵ is a classical disturbance term.

Figure 5.a shows that most countries present the expected negative correlation between Q and the dividend income tax rate, and only in two countries (Korea and Portugal) α_1 is positive and significantly different from 0 at 5% level. Figure 5.b presents the corresponding results relative to the capital-output ratio and the dividend tax. Although most of the countries have a positive coefficient for α_1 , the pattern is more heterogeneous.

⁴⁰In particular, we include in our analysis countries that have at least 10 observations for the period 1980-2014. This implies that the sample coverage could be different among the three variables under study.

⁴¹This database provides information about different indicators related with the dividend tax rate for the period 1980-2016. In particular, we use the net top statutory rate to be paid at the shareholder level. In this rate we take into account all types of reliefs and gross-up provisions at the shareholder level.

Figure 5: Tobins' Q , Capital-Output Ratios and Dividend Income Tax Rates (I)



Notes: Own calculations obtained from $\ln(X_t) = \alpha_0 + \alpha_1 TAX_t + \epsilon_t$, where X represents the Tobin's Q or the capital-output ratio, TAX stands for the dividend income tax rate, and ϵ is a classic disturbance term. The vertical axis shows the coefficient α_1 in %. Dark bars indicate that α_1 is significant at 5% level. Each graph shows countries for which we have at least 10 observations for the period under analysis (Max. 1980-2014). Luxembourg is excluded from the graph due to be a clear outlier.

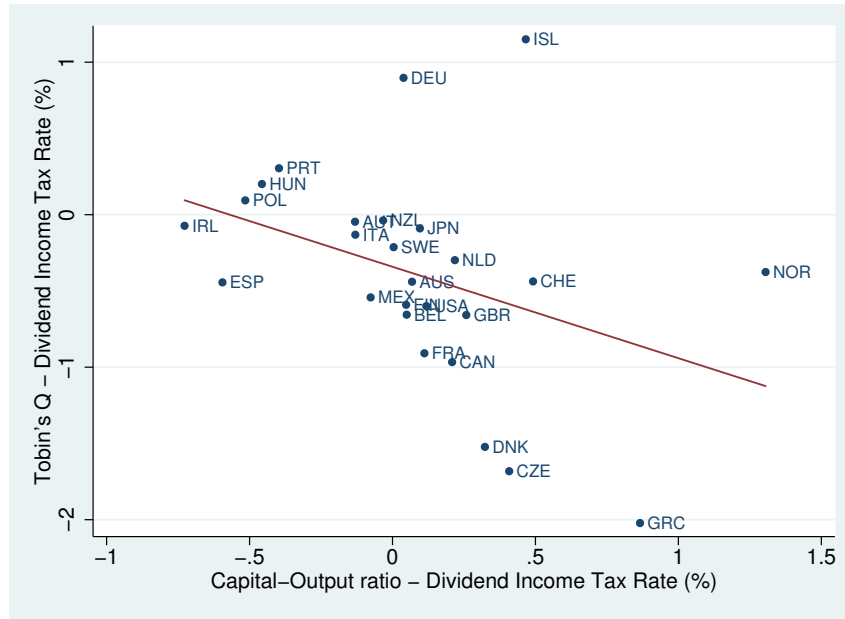
The correlations between our variables of interest and the dividend tax rate presented in Figure 5 are likely to capture also the effect of other unobserved factors affecting both sides of equation (26).⁴² In order to further study the validity of the dividend tax mechanism, Figure 6 exploits the cross-country variation by presenting a scatter plot where the vertical axis displays the regression coefficients relating Tobin's Q with the dividend tax rate, and the horizontal axis displays the regression coefficients of the capital-output ratio with respect to the dividend tax rate.⁴³ We can clearly observe, as expected, a negative relation. This indicates that countries where the capital-output ratio is more sensitive to changes in the dividend tax rate experience a larger decrease in the Tobin's Q in response to an increase in this tax rate.

Although it is worthy to remind that the goal of this section is not to claim any causality, the empirical evidence supports the role of the mechanism emerged in our model, where declines in dividend taxes raises equity Tobin's Q and, in general equilibrium, this raise has a negative impact on physical capital.

⁴²For example, a new Government in office could implement simultaneously a tax reform and policies which foster capital accumulation, this would cause the patterns observed in Figure 5 without any connection between Q and the capital-output ratio due to the change in taxes.

⁴³These coefficients are slightly different than the ones presented in Figure 5. The source of discrepancy is that this time both equations are constrained to include the same sample.

Figure 6: Tobins' Q , Capital-Output Ratios and Dividend Income Tax Rates (II)



Notes: Own calculations obtained from $\ln(X_t) = \alpha_0 + \alpha_1 TAX_t + \epsilon_t$, where X represents the Tobin's Q and the capital-output ratio in the vertical and the horizontal axis respectively. TAX is the dividend income tax rate, and ϵ is a classic disturbance term. Both axis show the coefficient α_1 in %. Both equations are constraint to have the same number of observations (Max. 1980-2014). The scatter plot is obtained after excluding outliers. An outlier is defined as an observation with a weight of 0 after using the *rreg* command in STATA.

6.2 Market Power: The Industry Concentration Rate

Another factor that could potentially lead to an increase in asset prices and declines investments is monopoly power. When firms charge higher markups, their market value also reflects the discounted future sum of monopoly rents and, therefore, we would observe a gap as the one described in the model between the financial value of the firm and its physical capital. As such, the Tobin's Q can rise due to the rise of market power.

Two recent contributions (Autor et al., 2017a; Barkai, 2017) have emphasized, for the U.S. context, the role that an increase in the degree of market power has played in the decline of the labor share.⁴⁴ This mechanism can be easily embodied in our labor share - Q framework, and this subsection aims precisely at exploring the presence of a positive correlation between a proxy of market power and our measure of Q , and a negative correlation between the market power and the capital-output ratio.

Given the difficulty to obtain proxies for the degree of aggregate market power in different countries, we opt to focus on the specific case of the U.S. by exploiting industry-level variations. Tobin's Q data comes from the Worldscope database, the capital-output ratio is obtained from the NBER-CES Manufacturing Industry database by dividing the

⁴⁴In a more recent version of their paper, Autor et al. (2017b) also provide some international evidence.

total real capital stock over the real value of the shipments, and the degree of market power is proxied by four different measures of industry concentration obtained from the U.S. Economic Census for the years 2002, 2007, and 2012.⁴⁵

Merging the three databases requires various steps. Tobin's Q firm-level data is aggregated at the 4-digit SIC industry level by calculating the median Q of the industry for the years 2002, 2007, and 2012. Data on industry concentration is classified following the NAICS industry classification applied by the U.S. Economic Census. In order to homogenize both samples we transform the NAICS code into SIC codes. More specifically, we first constraint our analysis to industries (6-digit NAICS) that are consistently defined among the 3 census waves used. Similar to Barkai (2017), we further homogenize the NAICS codes to the 1997 year definition using the concordances provided by the census. In order to assign 6-digit NAICS industry codes to 4-digit SIC industry classification, we use the crosswalk file provided by David Dorn, where the transformation is based on the employment weights of NAICS on SIC industries.⁴⁶ The NBER-CES Manufacturing Industry database provides data already disaggregated at 4-digit SIC industry classification.⁴⁷

Our study of the relationship between the Tobin's Q and the market power includes a maximum of 480 4-digit industries covering 6 large sectors of the economy (Manufacturing, Utilities, Retail Trade, Wholesale Trade, Finance, and Services). Due to the nature of the NBER-CES database, our study is limited to a maximum of 280 4-digit industries within the manufacturing sector when the capital-output ratio is included.

Empirically, we estimate:

$$\Delta \ln (X_{it}) = \alpha_0 + \alpha_1 \Delta \ln (ConY_{it}) + \epsilon_{it}, \quad (27)$$

where $\Delta \ln (X_{it})$ represents the 5 year log differences of the Tobin's Q or the capital-output ratio, $\Delta \ln (ConY_{it})$ is the 5 year log differences of the share of sales for the 4, 8, 20 and 50 largest companies in the industry, and ϵ_{it} is the classical error term. Subscripts i and t represent respectively the cross-section (4-digit SIC industries) and time dimension of the panel.

Table 6 presents the estimates of equation (27) for the four different measures of industry concentration. Columns [1]-[8] display results when the dependent variable is the 5 year log differences of Tobin's Q (Δq). Results for the specification using the 5 year log differences of the capital-output ratio (Δky) are showed in columns [9]-[12].⁴⁸

⁴⁵Following Autor et al. (2017a,b) and Barkai (2017) we consider the share of sales of the 4, 8, 20 and 50 largest companies in an industry.

⁴⁶The crosswalk file is available at <http://www.ddorn.net/data.htm>.

⁴⁷The NBER-CES database covers 459 4-digit SIC industries for the period 1958-2011. We match 2011 capital-output values with the 2012 values of the Tobin's Q and industry concentration.

⁴⁸Columns [1]-[4] include fixed effects for the 6 sectors, and columns [5]-[8] include fixed effects for

Table 6: Tobin's Q , Capital-Output Ratio and Industry Concentration

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	Dependent variable: Δq								Dependent variable: Δky			
$\Delta Con4$	0.066 (0.078)				0.087 (0.083)				-0.153 (0.068)**			
$\Delta Con8$		0.088 (0.109)				0.120 (0.118)				-0.172 (0.087)*		
$\Delta Con20$			0.271 (0.126)**				0.332 (0.134)**				-0.160 (0.097)	
$\Delta Con50$				0.340 (0.157)**				0.413 (0.174)**				-0.099 (0.094)
Constant	0.28 (0.031)***	0.28 (0.030)***	0.278 (0.030)***	0.28 (0.031)***	0.315 (0.027)***	0.315 (0.027)***	0.315 (0.027)***	0.317 (0.028)***	-0.079 (0.014)***	-0.082 (0.014)***	-0.083 (0.014)***	-0.083 (0.015)***
R-squared	0.11	0.11	0.12	0.12	0.16	0.16	0.17	0.17	0.26	0.26	0.25	0.25
Observations	834	833	832	825	834	833	832	825	467	467	465	458
SIC4	480	480	480	473	480	480	480	473	280	280	280	273
SIC2	59	59	59	59	59	59	59	59	20	20	20	20
Sectors	6	6	6	6	6	6	6	6	1	1	1	1
Sector FE	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
SIC2 FE	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
TIME FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Robust standard errors clustered at 2-digit SIC level in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%. SIC4 and SIC2 indicate the number of groups included in the regressions classified at the 4 and 2-digit SIC level. Sectors indicates the number of groups included using the broader sector definition.

A positive relationship between industry concentration and Tobin's Q emerges in all the regressions.⁴⁹ When industry concentration is proxied by the share of sales of the 20 and 50 largest companies in the industry we find a positive and significant impact implying that a 1% raise in industry concentration is associated with an increase in the Tobin's Q between 0.27% and 0.41%. This result is robust to the inclusion of fixed effects at the sector level and at 2-digit SIC level. However, when the industry concentration is proxied by the share of the sales of the 4 and 8 largest companies in the industry, although the impact is positive, its magnitude is small and not significantly different from zero at the standard levels. One possible explanation for this disparity has to do with the way we defined the Tobin's Q , that is, based on the median company within each 4-digit SIC industry level. While this measure allows us to control for potential outliers, on the other hand it implies that changes in Q are not driven by companies at the top of the distribution, which are likely to be also the ones at the top of the sales distribution.⁵⁰

59 different 2-digit SIC industries. Given that the capital-output ratio is limited to the manufacturing sector, we only included 2-digit SIC industries fixed effects. All regressions control for time fixed effects and the standard errors are clustered at 2-digit SIC industry level. Results are also robust to the inclusion of 3-digit SIC level fixed effects and alternative choices of the level at which errors are clustered. These results are available upon request. For simplicity, in Table 6 $\Delta ConY$ represents the 5 year log differences of the share of sales.

⁴⁹In a recent version of their paper, David Autor and coauthors briefly comment the relationship of the Tobin's Q with monopoly power (Autor et al., 2017b, p.20). In the context of their Superstar firm theory they also argue that a positive relationship should exist. They show that an increase in the industry concentration rate of the largest 20 companies in the industry ($Con20$) it is related to an increase of the Tobin's Q of 0.411 (Autor et al., 2017b, footnote 32). In the same footnote, using the Tobin's Q as a proxy of market power, Autor et al. (2017b) also relate the labor share with the Q . The coefficient they find (-0.085) for the U.S. is similar to our estimations.

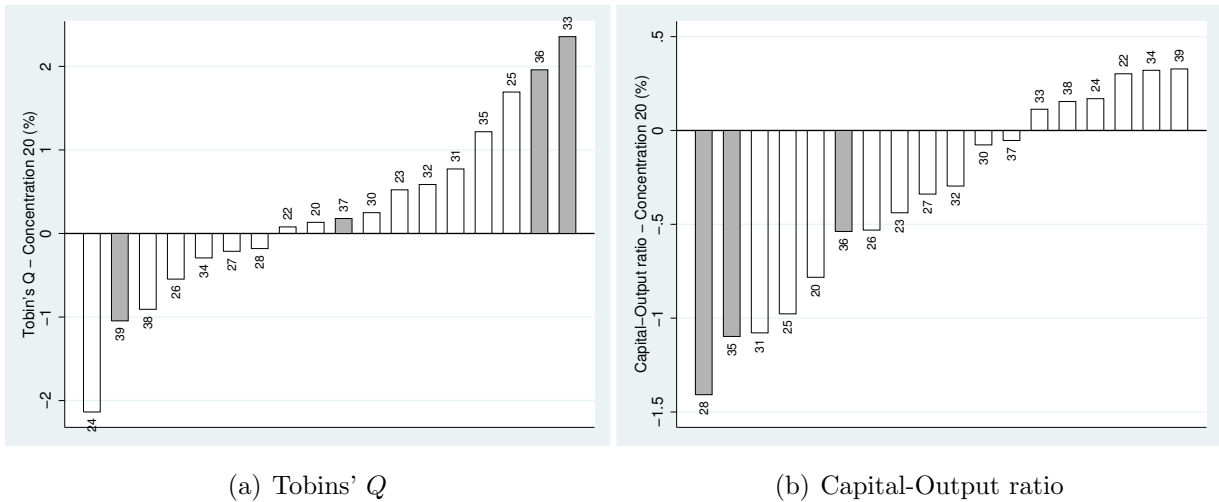
⁵⁰In order to check this possibility, we rerun regressions [1]-[8] when Tobin's Q is calculated as the

As predicted by our model, columns [9]-[12] report a negative relationship between the growth rate of the capital-output ratio and the growth rate of the market concentration. In this case, the coefficient is more precisely estimated when the industry market power is proxied by the share of sales of the 4 and 8 largest companies. More specifically, we find that an increase of 1% in the industry concentration is associated with a capital-output ratio decline of around 0.16%.

In order to assess the validity of our model, we follow the same strategy of Section 6.1 for the dividend income tax. Figure 7 presents the correlations between our variables of interest and the share of sales of the largest 20 companies in the industry by displaying the α_1 coefficients (in %) of equation (27). Separate regressions are estimated for the different 2-digit SIC manufacturing industries included in our sample.

Although coefficients are not precisely estimated, Figure 7.a suggests that most of the industries present the expected positive correlation between Q and the proxy of market power. On the other hand, Figure 7.b shows the corresponding results with respect to the industry concentration indicator and the capital-output ratio. Consistent with the results of Table 6, most industries display a negative correlation between these two variables.⁵¹

Figure 7: Tobins' Q , Capital-Output Ratios and Industry Concentration (I)



Notes: Own calculations obtained from $\Delta \ln(X_{it}) = \alpha_0 + \alpha_1 \Delta \ln(ConY_{it}) + \epsilon_{it}$, where X represents the Tobin's Q and the capital-output ratio, $Con20$ is the share of sales of the 20 largest companies in the industry, and ϵ is a classic disturbance term. The vertical axis shows the coefficient α_1 in %. Dark bars indicate that α_1 is significant at 5% level. Each graph shows SIC 2 industries for which we have at least 5 observations.

Figure 8 further exploits the 2-digit cross-industry variation by presenting a scatter plot where the vertical axis displays the coefficients of a regression of the Tobin's Q on the

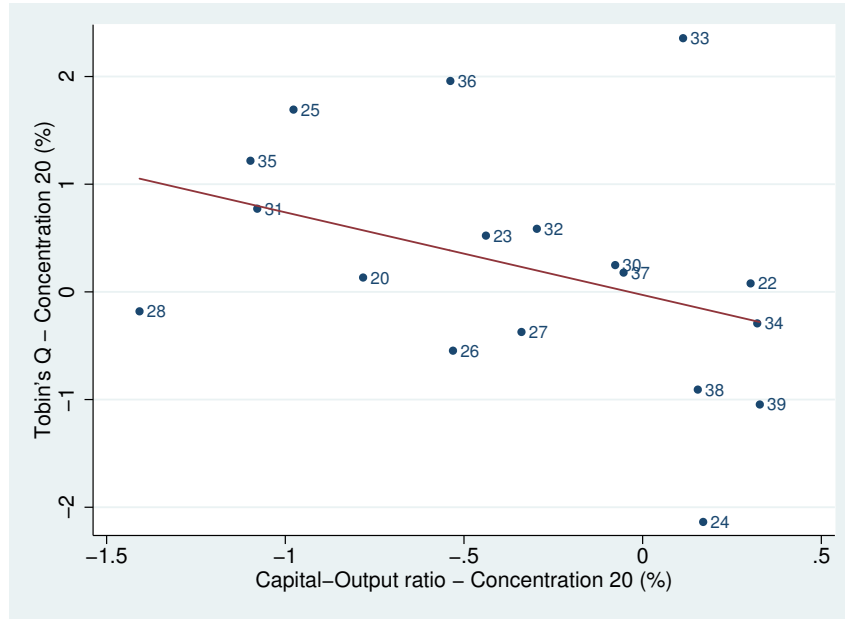
industry average. Although under some assumptions (i.e. minimum number of companies in the industry, cap the Q at different values...) the concentration indicator for the 4 and 8 largest companies become more relevant, it remains nonsignificant in a non-negligible number of cases.

⁵¹Our sample includes industries containing at least 5 observations. On average we have 26 observations per 2-digit SIC industry when the dependent variable is Δq , and 25 for Δky .

industry concentration rate, and the horizontal axis displays the coefficients of a regression of the capital-output ratio on the industry concentration rate.⁵²

Altogether, we find evidence supporting the market power mechanism highlighted in our model. More specifically, Figure 8 shows a clear negative relationship, which indicates that industries where Tobin's Q raises the most when the industry concentration rate increases are those where the capital-output decreases the most in response to that change in market concentration.

Figure 8: Tobins' Q , Capital-Output Ratios and Industry Concentration (II)



Notes: Own calculations obtained from $\Delta \ln(X_{it}) = \alpha_0 + \alpha_1 \Delta \ln(ConY_{it}) + \epsilon_{it}$, where X represents the Tobin's Q and the capital-output ratio in the vertical and the horizontal axis respectively. $Con20$ is the share of sales of the 20 largest companies in the industry, and ϵ is a classic disturbance term. Both axis show the coefficient α_1 in %. Both equations are constraint to have the same number of observations. The scatter plot is obtained after excluding outliers. An outlier is defined as an observation with a weight of 0 after using the *rreg* command in STATA.

6.3 Corporate Governance

The last factor under analysis is the corporate governance (GOV). Changes in corporate governance may affect both firm Q and physical investment by changing the incentives towards more short-termism goals and by increasing the shareholder control in the company. Empirically, we proxy the level of corporate governance by using the Corporate Governance Pillar (CGVSCORE) Index obtained from the Asset4 ESG Database provided by Datastream.⁵³ This database provides yearly firm-level data for the period 2002-2014.

⁵²As in the tax exercise, these coefficients are slightly different than the ones presented in Figure 7. The source of discrepancy is that this time both equations are constrained to include the same sample.

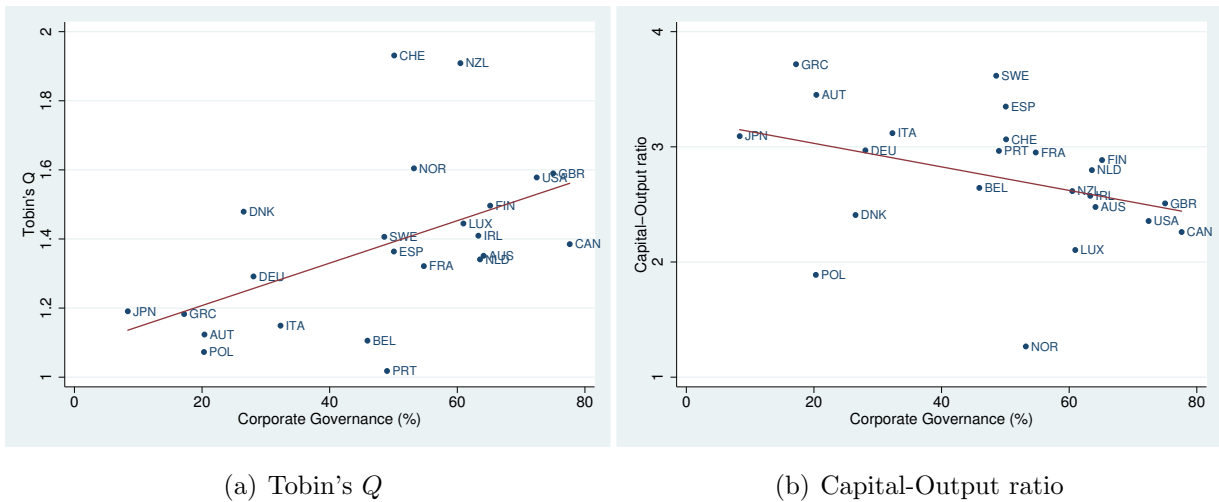
⁵³CGVSCORE defines corporate governance in the following way: "The corporate governance pillar measures a company's systems and processes, which ensure that its board members and executives act

We split this section in two different parts. First, we study the relation among the Q , the capital-output ratio and the corporate governance index at the aggregate (country) level. Secondly, we focus on the U.S. and exploit the firm-level dimension of our data using a different proxy of investment.

6.3.1 Aggregate Analysis

In order to obtain country-level data of the Tobin's Q and the corporate governance, we follow the same strategy explained in Section 3 for the Tobin's Q . That is, firm-level data is first clustered in 17 different industries using the Fama-French classification, where we compute the industry median of our variables of interest. Country data is therefore aggregated as the market value weighted average of the median industries.⁵⁴ It is worthy to note that before aggregating at the country-level, we constraint the sample to include only firms which have data on both the Tobin's Q and the corporate governance.⁵⁵ In terms of the capital-output ratio, country-level data is directly obtained from AMECO.

Figure 9: Tobin's Q , Capital-Output ratio and Corporate Governance (I)



Given the shorter time dimension available, we start by exploiting the cross-section variation among countries to study the relationship between the Q , the capital-output ratio and the corporate governance. More specifically, Figure 9.a presents the relation

in the best interests of its long term shareholders. It reflects a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances in order to generate long term shareholder value".

⁵⁴As before, in order to be safe about potential outliers we just include sector-year pairs where we have data for at least three companies.

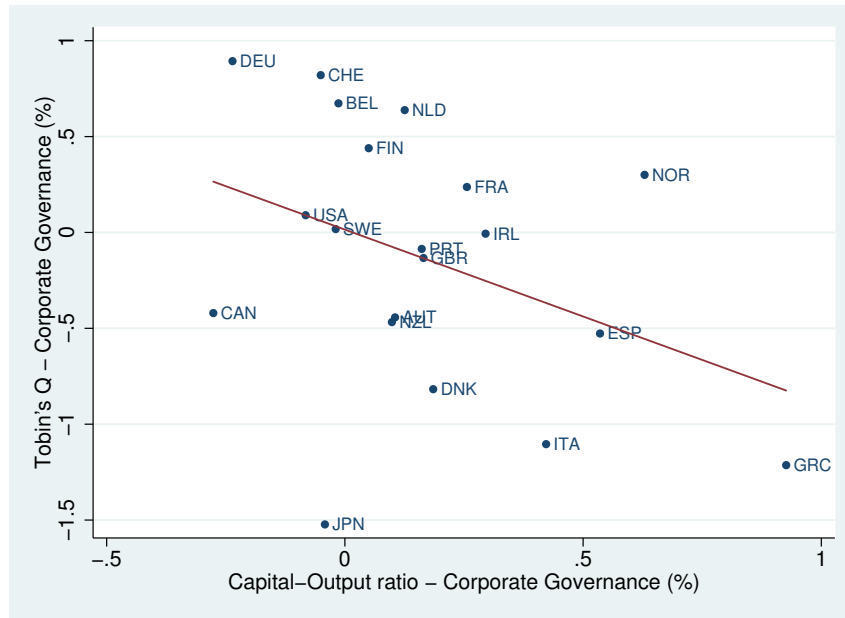
⁵⁵This implies that the Tobin's Q used in this section is slightly different than the one used in the core part of the paper. The results, however, are robust to the different Q definitions and available upon request.

between the Tobin's Q and the corporate governance, while 9.b displays a comparable picture when we consider the capital-output ratio instead of the Tobin's Q .

The first noticeable result is the existence of country heterogeneity regarding the value of corporate governance. Among the countries with the smallest value we find Japan, Greece, Austria and Poland, all of them with values of the corporate governance around 20%. On the other extreme, Anglo-Saxon countries (U.S., U.K. and Canada) appear to be the ones more “shareholder oriented”, with corporate governance values of around 80%.

Figure 9 presents two important facts: (i) there is a clear and positive relationship between the corporate governance and the Tobin's Q (Figure 9.a), and (ii) a negative relationship exists between the corporate governance and the capital-output ratio (Figure 9.b). In other words, Figure 9 confirms our hypothesis that countries where companies' goals are more shareholder oriented present a larger Q and a smaller capital-output ratio.

Figure 10: Tobin's Q , Capital-Output ratio and Corporate Governance (II)



Notes: Own calculations obtained from $\ln(X_t) = \alpha_0 + \alpha_1 GOV_t + \epsilon_t$, where X represents the Tobin's Q and the capital-output ratio in the vertical and the horizontal axis respectively. GOV is the corporate governance index, and ϵ is a classic disturbance term. Both axis show the coefficient α_1 in %. Both equations are constraint to have the same number of observations. Each regression only includes countries which have at least 10 observations for the period 2002-2014. The scatter plot is obtained after excluding outliers. An outlier is defined as an observation with a weight of 0 after using the *rreg* command in STATA.

This analysis, however, does not allow us to study, as in previous sections, if countries where the Q is more sensitive to changes in corporate governance are also the countries where the capital-output ratio decreases the most in response to changes in the latter variable. In order to overcome this issue, we exploit all the information available, and Figure 10 presents a scatter plot where the vertical (horizontal) axis displays the coefficients α_1 from a country-specific equation such as $\ln(X_t) = \alpha_0 + \alpha_1 GOV_t + \epsilon_t$, where X represents

the Q (KY), GOV is the corporate governance index, and ϵ is a classic disturbance term.

We can clearly observe a negative relationship which indicates that countries where the Tobin's Q increases the most due to an increase in the corporate governance, are the countries where the capital-output ratio decreases the most in response to an increase in GOV .⁵⁶

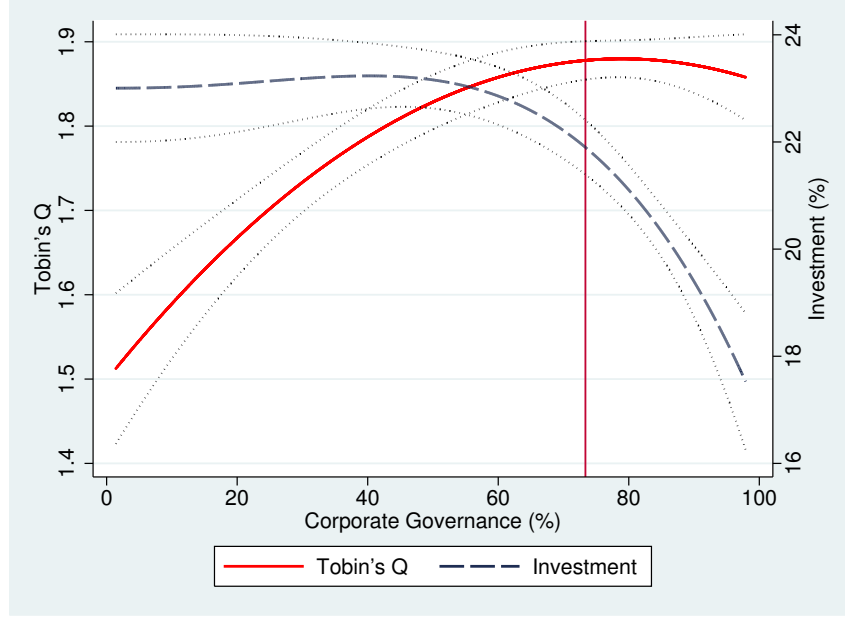
6.3.2 Firm-level Analysis

In order to further exploit our database, this section uses the firm-level dimension of our data. Tobin's Q and corporate governance firm-level data is directly obtained from, respectively, Worldscope and Asset4 ESG database through Datastream. In order to obtain a proxy of investment at the firm-level, we follow [Gompers et al. \(2005\)](#) and [Gutiérrez and Philippon \(2016\)](#) and use the firm capital expenditure over the firm net property, plant and equipment obtained from Worldscope. We restrict our sample to include only firm-year pairs which have data on our three variables of interest, and following [Gutiérrez and Philippon \(2016\)](#) we capped Q at 10. Finally, we have 14,434 yearly observations on 1772 U.S. publicly listed companies.

Figure 11 shows a descriptive picture of our data by displaying the fractional polynomial regression line between our variables of interest (Tobin's Q and investment (INV)) and the corporate governance along with the 95% confidence intervals. The vertical line represents the median value for the corporate governance value (73.36). This figure confirms the two different correlations between our variables of interest and the corporate governance. As expected, Tobin's Q increases together with the corporate governance. The pattern followed by the investment variable is a little bit more surprising. While we still observe that larger values of corporate governance are related with smaller investment levels, this negative relationship only (but strongly) appears for values above 60% of the corporate governance index.

⁵⁶It is worthy to note that this data has some peculiar characteristics. Contrary to our hypothesis and the cross-country analysis, Figure A5 in the Appendix shows that most of the countries has a negative within-country correlation between the Q and the corporate governance, and a positive relation between the latter and the capital-output ratio. Figure A6 limits the analysis to the period 2002-2007 and proves that this odd result is due to the inclusion of the Great Recession period in a relatively small sample. Figure A7 replicates Figure 10 when just the period 2002-2007 is considered, showing that the negative relationship between the coefficients is still present.

Figure 11: Tobin's Q , Investment and Corporate Governance (I)



Notes: Fractional polynomial regression line (along with the 95% confidence intervals). The vertical line represents the median value for the corporate governance (73.36). The sample consists of 14,434 observations for 1772 publicly listed U.S. companies during the period 2002-2014.

Despite these relations, a more serious econometric exercise must be done in order to confirm our hypotheses. In Table 7 we follow [Gompers et al. \(2005\)](#) and [Gutiérrez and Philippon \(2016\)](#) and present the results for the following regressions:

$$\begin{aligned} \ln(Q_{it}) &= \alpha_0 + \alpha_1 GOV_{it-1} + \mu_{it} + \epsilon_{it} \\ INV_{it} &= \beta_0 + \beta_1 GOV_{it-1} + \mu_{it} + \varepsilon_{it}, \end{aligned} \quad (28)$$

where we regress our variables of interest on the proxy of corporate governance lagged one year, and we include different dummies to control for potential unobservable factors (μ_{it}).

Tobin's Q (Investment) regressions are presented in Panel A (Panel B). Each column include different fixed effects. Column [1] includes 2-digit SIC fixed effects. Column [2] furthers controls by year fixed effects. Columns [3]-[4] interact respectively 2 and 3-digit SIC industries with year dummies. Column [5] include 4-digit SIC fixed effects, and columns [6]-[7] control for the interaction between 2-digit SIC industries and year dummies along with, respectively, 3 and 4-digit SIC industries fixed effects.

Independently of the specification, our results show a robust positive relationship between the corporate governance and the Tobin's Q , and a negative one between investment and GOV . More specifically, an increase of the corporate governance index of 1 percentage point is associated with increases of the Tobin's Q between 0.08 and 0.19 percent.

Regarding the investment, we find that a rise of 1 percentage point of the corporate governance, is related with investment decreases of around 0.05 percentage points.

Table 7: Tobin's Q , Investment and Corporate Governance

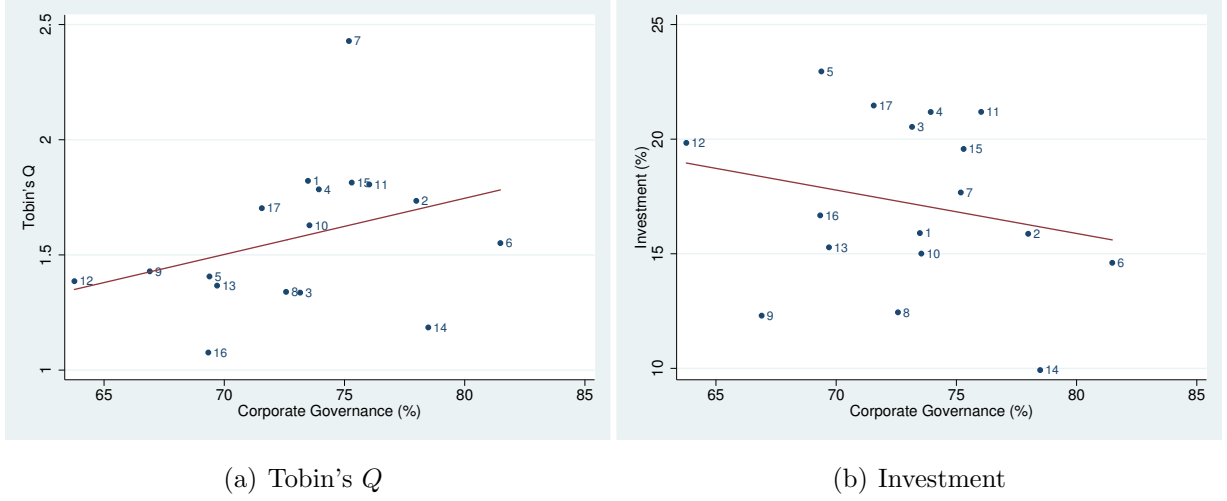
Panel A	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Dependent variable: q							
GOV_{t-1}	0.170 (0.044)***	0.178 (0.047)***	0.187 (0.048)***	0.160 (0.051)***	0.083 (0.036)**	0.151 (0.045)***	0.112 (0.040)***
Constant	0.350 (0.029)***	0.446 (0.029)***	0.340 (0.032)***	0.358 (0.034)***	0.409 (0.024)***	0.377 (0.031)***	0.446 (0.026)***
R-squared	0.25	0.28	0.33	0.48	0.42	0.44	0.5
Panel B	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Dependent variable: INV							
GOV_{t-1}	-0.042 (0.019)**	-0.044 (0.019)**	-0.046 (0.019)**	-0.039 (0.018)**	-0.044 (0.018)**	-0.043 (0.017)**	-0.050 (0.019)***
Constant	0.242 (0.013)***	0.218 (0.014)***	0.245 (0.013)***	0.241 (0.012)***	0.244 (0.012)***	0.245 (0.011)***	0.261 (0.012)***
R-squared	0.09	0.1	0.14	0.25	0.18	0.19	0.22
Observations	12574	12574	12574	12574	12574	12574	12574
SIC4	365	365	365	365	365	365	365
SIC3	212	212	212	212	212	212	212
SIC2	62	62	62	62	62	62	62
SIC2 FE	YES	YES	NO	NO	NO	NO	NO
SIC3 FE	NO	NO	NO	NO	NO	YES	NO
SIC4 FE	NO	NO	NO	NO	YES	NO	YES
Time FE	NO	YES	NO	NO	NO	NO	NO
SIC2*Time	NO	NO	YES	NO	NO	YES	YES
SIC3*Time	NO	NO	NO	YES	NO	NO	NO

Notes: Robust standard errors clustered at 2-digit SIC level in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%. SIC4, SIC3 and SIC2 indicate the number of groups included in the regressions classified at the 4, 3 and 2-digit SIC level.

To conclude, we further exploit our data by analyzing the cross-industry variation for U.S. More specifically, Figure 12 shows the relationship between our variables of interest and the corporate governance for the 17 Fama-French industry classification. Once again we clearly see that industries where its board members and executives are more aligned with the interest of its shareholders present a larger Q and smaller investment.⁵⁷

⁵⁷Under the use of the firm-level investment proxy, we do not find that firms where the Q is more sensitive to changes in corporate governance are also the ones where the investment declines the most in response to changes in GOV . This could be due to the difficulties to control for other firm relevant factors, and deserves further research.

Figure 12: Tobin's Q , Investment and Corporate Governance (II)



All in all, we find supporting evidence for the three determinants of Q proposed in this paper. However, it is important to keep in mind that this section is not claiming any causal relation, and that further analysis would be needed in order to assess the relevance of the different channels affecting the Tobin's Q . The key result of the paper however, (i.e. a long-run negative impact of Tobin's Q on the labor share) is valid regardless which are the driving forces behind Q .

7 Conclusions

The secular decline of the global labor 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 labor 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 labor share down when capital and labor are complements. Therefore, our paper reconciles the labor share - capital-output framework with the standard values of the elasticity of substitution ($\sigma < 1$).

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 labor income share. When the relative price of investment is included in our estimations, we find that it does not have any significant effect on the labor income share.

Our results show that the relationship between asset prices and corporate capital, embodied in the equity Tobin's Q ratio, is crucial to understand the dynamics of the capital-output ratio and the labor share. We also find evidence suggesting that the global rise of asset prices might be due to widespread changes in dividend taxation and the rise of monopoly power.

In light of our findings, we believe that the decline in the labor 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 policies that have boosted asset prices. According to our model, policies aiming at reversing the trend in the labor 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 increasing competition or by imposing higher taxes on corporate distributions, like dividends or share repurchases.

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APPENDIX: Supplementary tables and figures

Table A1: Selected Economies and Sample Period

id	Country	Sample period	id	Country	Sample period
1	Australia**	1980-2008	22	Luxembourg*	1991-2008
2	Austria**	1980-2008	23	Mexico**	1988-2008
3	Belgium**	1980-2008	24	Morocco	1998-2007
4	Brazil*	1992-2008	25	Netherlands**	1980-2008
5	Canada**	1980-2008	26	New Zealand**	1986-2008
6	Chile*	1990-2008	27	Norway**	1980-2007
7	China	1995-2007	28	Peru	1992-2003
8	Colombia	1993-2007	29	Philippines**	1988-2008
9	Denmark**	1980-2009	30	Poland	1995-2008
10	Finland**	1987-2009	31	Portugal**	1988-2009
11	France**	1980-2009	32	South Africa**	1980-2008
12	Germany**	1983-2008	33	Spain**	1986-2008
13	Greece**	1988-2009	34	Sri Lanka	1994-2008
14	Hong Kong**	1980-2003	35	Sweden**	1982-2009
15	Hungary	1995-2008	36	Switzerland**	1980-2007
16	India*	1991-2008	37	Thailand	1988-2003
17	Ireland**	1981-2008	38	Turkey	1990-2003
18	Israel	1993, 1995-2008	39	UK**	1980-2008
19	Italy**	1980-2008	40	US**	1980-2008
20	Japan**	1980-2007	41	Venezuela	1992-2006
21	Korea**	1980-2003			

Notes: Countries with at least one asterisk indicate they are used in the regressions presented in columns [1]-[5] of Table 4. Countries with two asterisks indicate they are used in the regression presented in column [7] of Table 4.

Table A2: Fama-French 17 Industries Classification

id	Sector	id	Sector
1	Food	9	Steel
2	Mining	10	Fabricated Products
3	Oil	11	Machinery
4	Textiles & Apparel	12	Automobiles
5	Consumer Durables	13	Transportation
6	Chemicals	14	Utilities
7	Consumables	15	Retail
8	Construction	16	Financials
		17	Other

Table A3: Descriptive Statistics

Panel A: Raw variables					
Variable	Obs	Mean	Std. Dev.	Min	Max
<i>LIS</i>	915	0.468	0.096	0.214	0.636
<i>Q</i>	915	1.241	0.268	0.519	3.229
<i>RP</i>	915	1.041	0.097	0.767	1.413
Panel B: Regression variables (in logs)					
Variable	Obs	Mean	Std. Dev.	Min	Max
<i>lis</i>	915	-0.785	0.234	-1.543	-0.452
<i>q</i>	915	0.195	0.200	-0.655	1.172
<i>rp</i>	915	0.036	0.092	-0.265	0.346

Table A4: Static Baseline Model: Robustness

	[1] POLS	[2] 2FE	[3] CCEP	[4] CCEPt	[5] MG	[6] CMG	[7] CMGt
q	0.003 (0.012)	-0.035 (0.014)**	-0.06 (0.013)***	-0.056 (0.014)***	-0.07 (0.034)**	-0.067 (0.027)**	-0.081 (0.028)***
t					-0.001 (0.001)		0.0004 (0.001)
Constant	-0.563 (0.027)***	-0.672 (0.027)***			-0.625 (0.050)***	0.009 (0.110)	-0.023 (0.126)
Number Id	9	9	9	9	9	9	9
Observations	208	208	208	208	208	208	208
R-squared	0.26	0.87	0.99	0.99			
RMSE	0.0545	0.023	0.0177	0.0182	0.0182	0.0147	0.0126
Trend					0.44		0.56
CD test	-2.3006	-3.8079	-2.3008	-3.425	5.6844	-2.3963	-2.9375
Abs Corr	0.3168	0.3821	0.3235	0.335	0.3411	0.2692	0.2924
Int	I(1)	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%.
POLS = Pooled OLS (with year dummies), 2FE = 2-way Fixed Effects, CCEP = Pooled Pesaran (2006) Common Correlated Effects (CCE), CCEPt = CCEP with year dummies, MG = Pesaran and Smith (1995) Mean Group (with country-specific linear trends), CMG = Pesaran (2006) CCE Mean Group, CMGt = CMG with country-specific linear trends.
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 A5: Dynamic Baseline Model: Robustness

	[1] POLS	[2] 2FE	[3] CCEP	[4] CCEPt	[5] MG	[6] CMG	[7] CMGt	[8] CMGt1	[9] CMGt2
q	0.001 (0.004)	-0.004 (0.008)	-0.025 (0.009)***	-0.027 (0.010)***	-0.032 (0.020)*	-0.015 (0.013)	-0.051 (0.024)**	-0.062 (0.026)**	-0.062 (0.033)*
lis_{t-1}	0.98 (0.019)***	0.868 (0.047)***	0.73 (0.054)***	0.711 (0.059)***	0.638 (0.075)***	0.625 (0.088)***	0.566 (0.092)***	0.508 (0.121)***	0.391 (0.145)***
t					-0.0003 (0.001)		-0.0003 (0.001)	0.0003 (0.001)	0.0005 (0.001)
Constant	-0.014 (0.012)	-0.094 (0.033)***			-0.216 (0.053)***	0.05 (0.088)	0.059 (0.071)	0.094 (0.126)	0.082 (0.186)
Number of id	9	9	9	9	9	9	9	9	9
Observations	203	203	203	203	203	203	203	199	195
R-squared	0.96	0.96	0.99	0.99					
RMSE	0.0127	0.0124	0.0108	0.0113	0.013	0.0088	0.0085	0.0078	0.0071
Trend					0.11		0	0.11	0.11
lr- q	0.044	-0.027	-0.0935	-0.095	-0.0896	-0.0397	-0.1175	-0.126	-0.1016
se- q	0.1776	0.0585	0.0332	0.0349	0.057	0.0359	0.06	0.0612	0.0588
CD test	-3.6909	-3.7403	-2.8713	-3.4496	6.5542	-2.9223	-2.922	-2.0366	-1.0797
Abs Corr	0.2249	0.2224	0.2544	0.2726	0.3468	0.2557	0.2235	0.1927	0.186
Int	I(0)	I(0)/I(1)	I(0)	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), CCEPt = CCEP with year dummies, MG = Pesaran and Smith (1995) Mean Group (with country trends), CMG = Pesaran (2006) CCE Mean Group, CMGt = CMG with country-specific linear trends, CMGt1 and CMGt2 = CMGt 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 se- q represent respectively q 's long-run impact and its standard error.

Table A6: Static Model with Relative Prices: Robustness

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	POLS	2FE	CCEP	CCEPt	MG	CMG	CMGt
q	-0.012 (0.013)	-0.035 (0.014)**	-0.065 (0.014)***	-0.063 (0.014)***	-0.061 (0.028)**	-0.039 (0.03)	-0.099 (0.030)***
rp	0.321 (0.077)***	-0.02 (0.051)	0.072 (0.069)	0.096 (0.073)	-0.079 (0.135)	0.096 (0.177)	0.073 (0.149)
t					-0.002 (0.002)		0.001 (0.003)
Constant	-0.651 (0.031)***	-0.672 (0.027)***			-0.612 (0.063)***	0.001 (0.205)	-0.139 (0.184)
Number of id	9	9	9	9	9	9	9
Observations	208	208	208	208	208	208	208
R-squared	0.31	0.87	0.99	0.99			
RMSE	0.0528	0.023	0.0168	0.0176	0.0173	0.0123	0.0096
Trend					0.44		0.56
CD test	-2.8146	-3.7943	-2.3723	-3.3179	5.2023	-2.2852	-2.2934
Abs Corr	0.3707	0.3856	0.3366	0.3499	0.3145	0.2531	0.25
Int	I(1)	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%.
POLS = Pooled OLS (with year dummies), 2FE = 2-way Fixed Effects, CCEP = Pooled Pesaran (2006) Common Correlated Effects (CCE), CCEPt = CCEP with year dummies, MG = Pesaran and Smith (1995) Mean Group (with country-specific linear trends), CMG = Pesaran (2006) CCE Mean Group, CMGt = CMG with country-specific linear trends.
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 A7: ECM with Relative Prices: Robustness

	[1] 2FE	[2] CCEP	[3] MG	[4] CMG	[5] CMGt	[6] CMGt1	[7] CMGt2
lis_{t-1}	-0.136 (0.047)***	-0.192 (0.068)***	-0.461 (0.111)***	-0.442 (0.112)***	-0.579 (0.155)***	-0.714 (0.181)***	-0.958 (0.337)***
q_{t-1}	-0.001 (0.009)	-0.003 (0.012)	-0.039 (0.036)	-0.001 (0.007)	-0.05 (0.029)*	-0.066 (0.038)*	-0.135 (0.078)*
rp_{t-1}	0.043 (0.032)	0.075 (0.055)	0.151 (0.108)	0.108 (0.093)	-0.019 (0.054)	-0.044 (0.124)	0.296 (0.461)
Δq	-0.039 (0.018)**	-0.052 (0.022)**	-0.061 (0.039)	-0.043 (0.018)**	-0.042 (0.010)***	-0.049 (0.020)**	-0.091 (0.036)**
Δrp	0.088 (0.076)	0.078 (0.080)	-0.062 (0.104)	0.038 (0.077)	0.02 (0.075)	0.158 (0.054)***	0.094 (0.297)
t			0.001 (0.001)		0.002 (0.003)	0.001 (0.004)	-0.002 (0.004)
Constant	-0.066 (0.034)*		-0.349 (0.082)***	0.048 (0.129)	0.143 (0.130)	0.273 (0.179)	0.181 (0.253)
Number of id	9	9	9	7	7	7	6
Observations	199	199	199	175	175	171	149
R-squared	0.51	0.75					
RMSE	0.0124	0.0098	0.0106	0.0067	0.0061	0.0051	0.0039
Trend			0.22		0.43	0.14	0
lr- q	-0.0052	-0.0164	-0.0847	-0.0011	-0.0863	-0.0919	-0.1404
se- q	0.065	0.0599	0.0799	0.0149	0.0556	0.0576	0.0949
lr- rp	0.3149	0.3911	0.3266	0.2434	-0.0324	-0.062	0.3092
se- rp	0.2716	0.3177	0.247	0.2199	0.0938	0.1747	0.4931
CD test	-3.8732	-2.7485	3.7987	-2.0474	-2.347	-2.4567	-1.9305
Abs Corr	0.2378	0.2169	0.3325	0.2104	0.2141	0.2757	0.2229
Int	I(0)	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%.

2FE = 2-way Fixed Effects, CCEP = Pooled [Pesaran \(2006\)](#) Common Correlated Effects (CCE), MG = [Pesaran and Smith \(1995\)](#) Mean Group (with country trends), CMG = [Pesaran \(2006\)](#) CCE Mean Group, CMGt = CMG with country-specific linear trends, CMGt1 and CMGt2 = CMGt 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 se- q represent respectively q 's long-run impact and its standard error. lr- rp and se- rp represent respectively rp 's long-run impact and its standard error.

Figure A1: Trends in Country Labor Income Shares and Tobins' Q

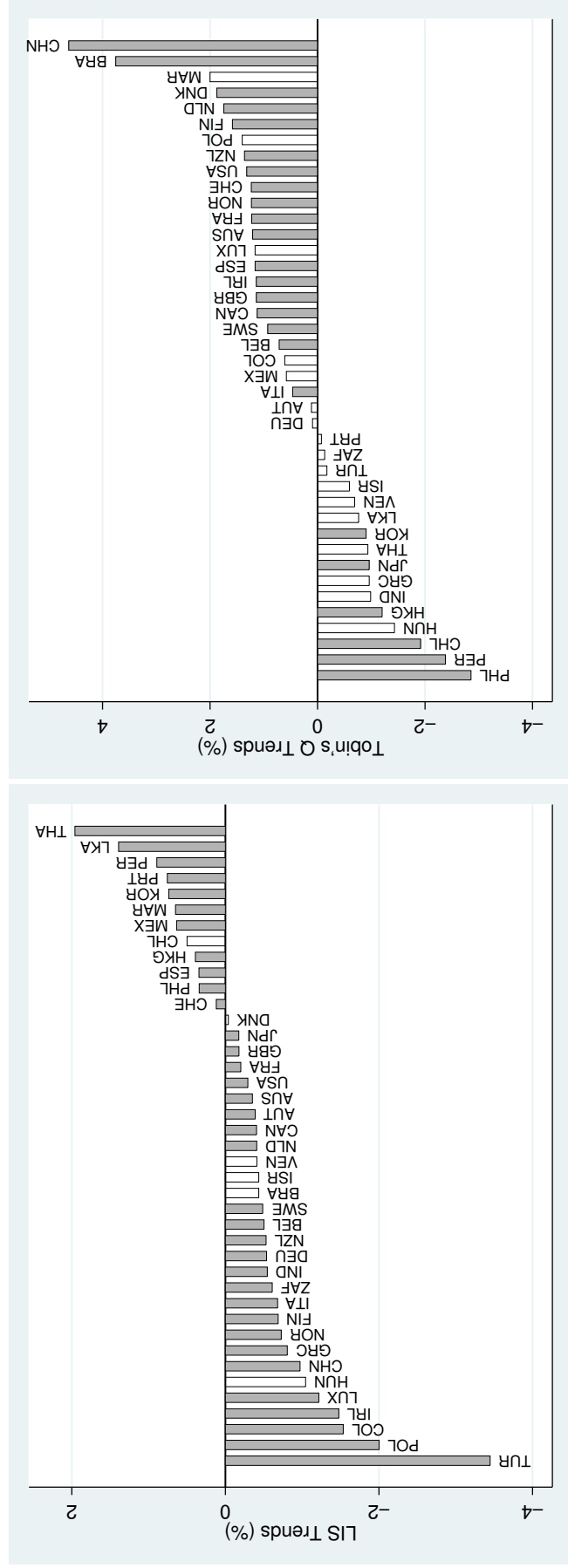
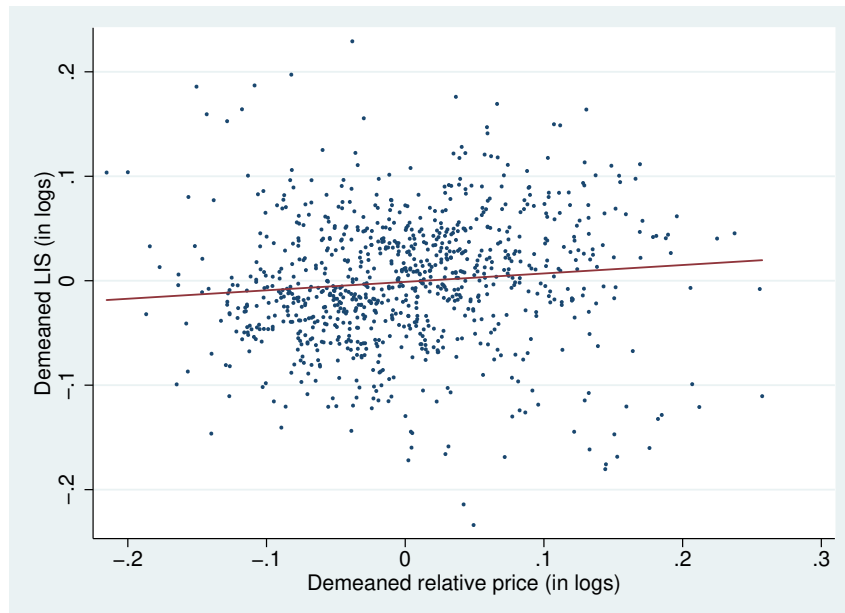


Figure A2: Tobin's Q against Relative Prices



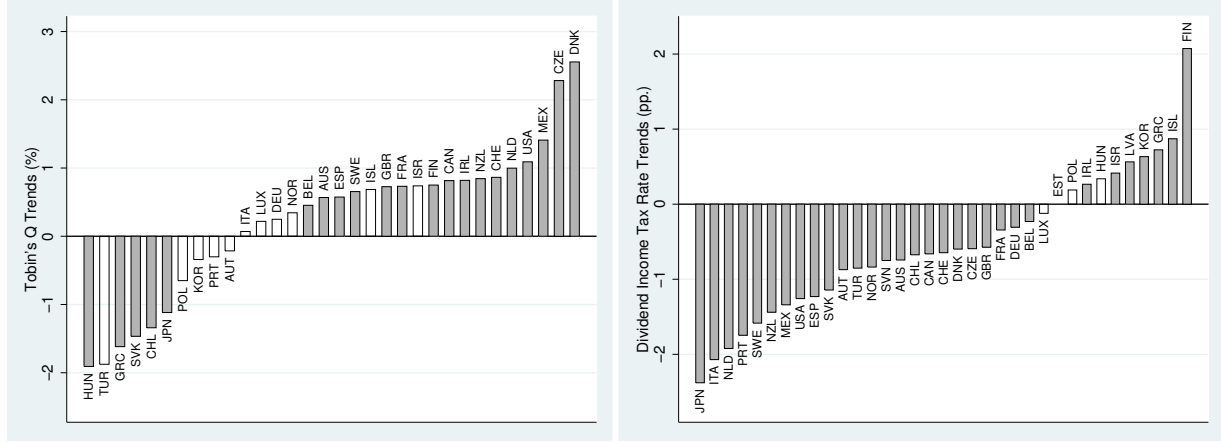
Notes: Own calculation based on a (outlier-robust) sample of 41 countries and 913 observations. Variables are demeaned to control for fixed effects. Correlation coefficient= -0.11 .

Figure A3: Labor Income Share against Relative Prices



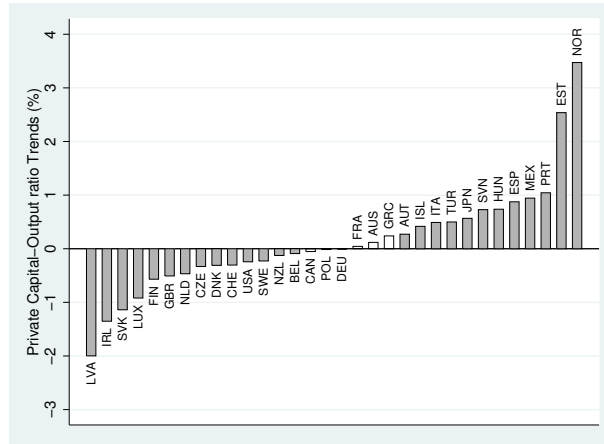
Notes: Own calculation based on a (outlier-robust) sample of 41 countries and 911 observations. Variables are demeaned to control for fixed effects. Correlation coefficient= 0.10

Figure A4: Country-specific Trends: Unrestricted Sample



(a) Tobin's Q

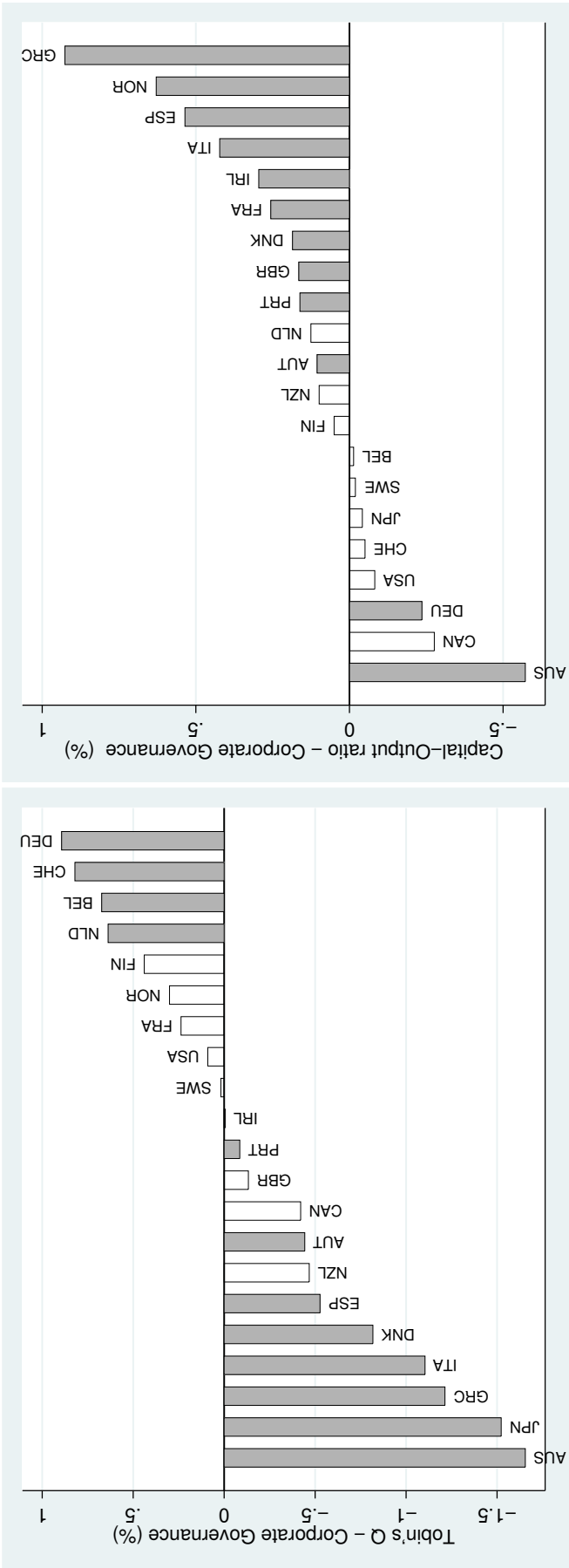
(b) Dividend Income Tax Rate



(c) Capital-Output ratio

Notes: Own calculations obtained from $X_t = \alpha_0 + \alpha_1 t + \epsilon_t$, where X represents our variables of interest (Q and the capital-output ratio in logs), t is a linear trend, and ϵ_t is a classic disturbance term. The vertical axis show α_1 in %. Dark bars indicate that α_1 is significant at 5% level. Each regression only includes countries which have at least 10 observations for the period 1980-2014.

Figure A5: Tobins' Q , Capital-Output ratio and Corporate Governance (All sample)

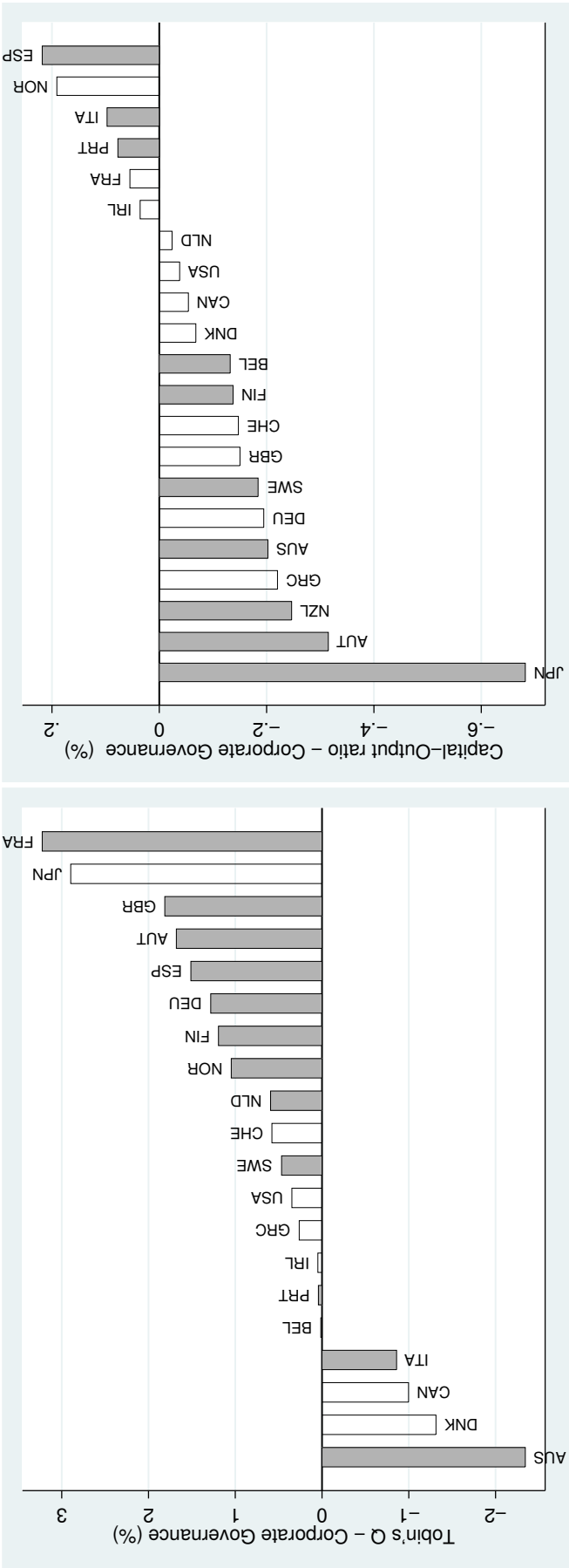


(a) Tobins' Q

(b) Capital-output ratios

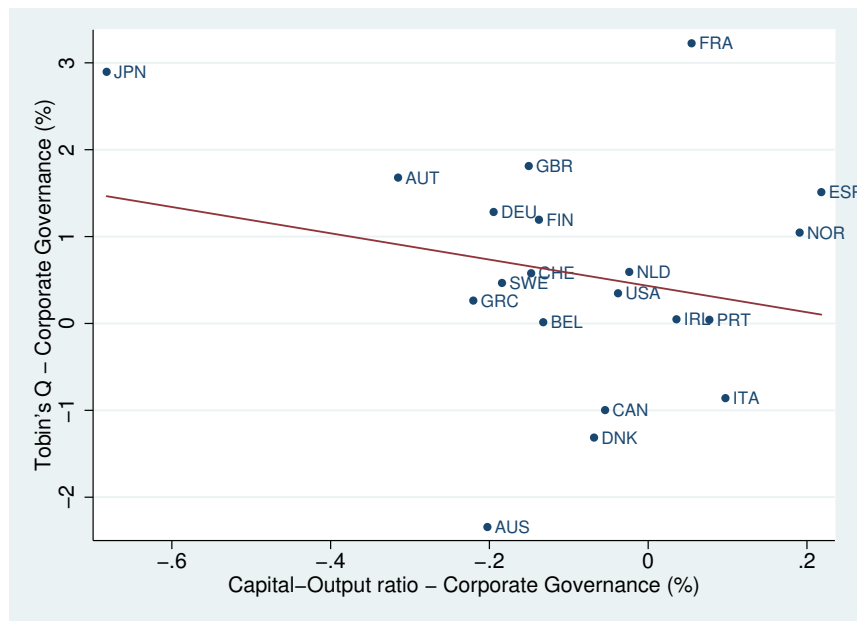
Notes: Own calculations obtained from $\ln(X_t) = \alpha_0 + \alpha_1 GOV_t + \epsilon_t$, where X represents the Tobin's Q or the capital-output ratio, GOV is the corporate governance, and ϵ is a classic disturbance term. The vertical axis show α_1 in %. Dark bars indicate that α_1 is significant at 5% level.

Figure A6: Tobins' Q , Capital-Output ratio and Corporate Governance (2002-2007)



Notes: Own calculations obtained from $\ln(X_t) = \alpha_0 + \alpha_1 GOV_t + \epsilon_t$, where X represents the Tobin's Q or the capital-output ratio, GOV is the corporate governance, and ϵ is a classic disturbance term. The vertical axis shows α_1 in %. Dark bars indicate that α_1 is significant at 5% level.

Figure A7: Tobin's Q , Capital-Output ratios and Corporate Governance (2002-2007) II



Notes: Own calculations obtained from $\ln(X_t) = \alpha_0 + \alpha_1 GOV_t + \epsilon_t$, where X represents the Tobin's Q and the capital-output ratio in the vertical and the horizontal axis respectively. GOV is the corporate governance index, and ϵ is a classic disturbance term. Both axis show the coefficient α_1 in %. Both equations are constraint to have the same number of observations. Each regression includes countries which have at least 2 observations for the period 2002-2007. The scatter plot is obtained after excluding outliers. An outlier is defined as an observation with a weight of 0 after using the *rreg* command in STATA.

TECHNICAL APPENDIX:

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 B1 and B2 analyze, respectively, the order of integration and the cross-section dependence of the variables used in our analysis.

Regarding the order of integration, Table B1 presents the results for two specifications of the cross-sectional augmented panel unit root (CIPS) Pesaran (2007) test. In particular, panel B1.a) shows the results when a constant is included in the Augmented Dickey-Fuller (ADF) regressions, while B1.b) further includes a deterministic trend.

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

Table B1 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 B1: Unit Root Tests

a) Pesaran (2007) CIPS test: Constant						
Lags	<i>lis</i>	(<i>p</i>)	<i>q</i>	(<i>p</i>)	<i>rp</i>	(<i>p</i>)
0	0.431	0.667	-2.744	0.003	-0.118	0.453
1	-0.207	0.418	-2.405	0.008	-0.141	0.444
2	-1.199	0.115	0.103	0.541	0.655	0.744
3	1.802	0.964	2.942	0.998	2.254	0.988
4	5.477	1.000	6.091	1.000	7.211	1.000
b) Pesaran (2007) CIPS test: Constant and deterministic trend						
Lags	<i>lis</i>	(<i>p</i>)	<i>q</i>	(<i>p</i>)	<i>rp</i>	(<i>p</i>)
0	1.044	0.852	-2.068	0.019	2.483	0.993
1	0.390	0.652	-1.628	0.052	2.052	0.980
2	-0.033	0.487	1.304	0.904	0.998	0.841
3	5.280	1.000	6.785	1.000	6.006	1.000
4	8.090	1.000	8.949	1.000	9.127	1.000

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

Table B2 shows the Pesaran (2004) CD test for cross-section dependence in panel time-series data. This test uses correlation coefficients between the time-series for each panel

member and has proved to be robust to nonstationarity, parameter heterogeneity and structural breaks, even in small samples.⁵⁸ Table B2 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 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 labor income share and the Tobin's Q .

Table B2: Cross-section Dependence Tests

a) Levels:				b) Diff:			
Variable	<i>lis</i>	<i>q</i>	<i>rp</i>	Variable	Δlis	Δq	Δrp
CD-test	16.73	29.76	42.37	CD-test	12.99	34.45	6.66
<i>p</i> -value	0.00	0.00	0.00	<i>p</i> -value	0.00	0.00	0.00
corr	0.132	0.250	0.345	corr	0.11	0.296	0.049
abs(corr)	0.472	0.394	0.558	abs(corr)	0.235	0.349	0.223
c) Het. AR(2)				d) Het. AR(2) CCE			
Variable	<i>lis</i>	<i>q</i>	<i>rp</i>	Variable	<i>lis</i>	<i>q</i>	<i>rp</i>
CD-test	9.93	33.58	3.40	CD-test	-0.24	-0.66	-2.38
<i>p</i> -value	0.00	0.00	0.00	<i>p</i> -value	0.81	0.51	0.02
corr	0.088	0.301	0.027	corr	-0.006	-0.011	-0.023
abs(corr)	0.243	0.344	0.213	abs(corr)	0.220	0.237	0.213

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

⁵⁸The 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 ρ_{ij} represents the correlation coefficient between country i and j , while T_{ij} is the number of observations used to computed that correlation.