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What are the effects of Macroeconomic Rates of Return of Investment on Wage Share?*

José Alves† José Carlos Coelho‡ Bernardete Moreira§

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Abstract

This article assesses the potential effects of the macroeconomic rates of return of private and public investment on wage share for 16 OECD countries from 1980 to 2022. Using the macroeconomic rates of return of investments and the wage share at factor cost and at market price, it was possible to conclude that the first has a positive effect on the wage share. Moreover, the total factor productivity negatively affects the wage share when it comes to private investment, while its influence is positive in the case of public investment. The results were also analyzed according to whether countries presented the total factor productivity of capital above or below the average. This analysis highlights the inverse pattern of the human capital index on wage share, both with respect to the type of investment and to the capital productivity observed across countries.

JEL codes: E22; E24; C23
Keywords: macroeconomic rates of return; public investment; private investment; wage share

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1. Introduction

Over the years, various theories have emerged to explain economic growth. From a neoclassical perspective, the economic growth depends primarily on the increase of the labour force, on the savings and investments of households and firms (Solow, 1956).

David Ricardo identified a negative relationship between profits and wages (Ricardo, 1821). However, a different view is presented by the Keynesians, who argue that the higher the degree of monopoly, the higher will be the mark up of prices over labor costs, resulting in a lower share of wages in national output and consequently increase in share for capital income (Kalecki, 1971).

Since the early 1980s, the rise of personal income inequality has been explained by technological change, which are seen as a substitute for unskilled labor and a complement to skilled labor (Card and Di Nardo, 2002; Stockhammer, 2015). This implies that these changes have become capital-augmenting rather than labor-augmenting, leading to a decline in the wage share (IMF, 2007; EC, 2007).

The wage share has a positive effect on real GDP per capita and, consequently, on economic growth, when it shows positive growth and when it exceeds the growth of total factor productivity (Alves et al., 2024). However, other authors claim that there is an inverse relationship between functional income distribution and real Gross Domestic Product (GDP), meaning that a higher wage share is associated with lower levels of real GDP (Gymnopoulos and Tsaliki, 2025). The rising inequalities in income and wealth challenge the concept of distribution-led growth, which argues that a more equitable distribution, through a higher wage share, could boost demand and, in turn, promote economic growth. This concept considers both the source of demand and the unit cost of production (Kalecki, 1954).

Furthermore, research studies prove that private and public investment can also create effects on each other (Afonso and Aubyn, 2009). Factors such as leverage, liquidity constraints, and labour efficiency impact the effect of public investment on private sector. Can create a crowding-in effect for firms with low leverage - which experience an increase in their investment rates following a rise in public investment - but not for those with high leverage, that are financially constrained or that have low operating efficiency (Espinoza et al., 2024).

The economic literature has mentioned several factors that influence the bargaining position of labour, especially investments. However, although this make sense from a theoretical perspective, there appears to be a lack of empirical studies that confirm this

relationship. This motivated a article into whether public and/or private investment play a role in shaping the wage share.

To that end, using a VAR approach, it was possible to observe that the macroeconomic rates of return of private and public investment – both partial and total – have a positive effect on the wage share, measured both at market prices and at factor cost. With total rates included the cross-sector effects, while partial rates are the solo effect of public or private investment. Also relevant are the result related to total factor productivity, which show a negative effect on private investment and a positive effect on public investment.

To ensure a robust and sensitivity analysis, the analysis was conducted not only on the full sample but also for countries above and below the average of total factor productivity of capital. When considering the human capital index, a negative effect is observed in the case of private investment, and a positive effect one in public investment. Nevertheless, this relationship changes when the analysis is restricted to countries where the capital productivity is below average.

This article analyses data from a sample of 16 OECD countries over the period from 1980 to 2022. The structure is as follows: Section 2 presents the literature review of labour share and the macroeconomic rates of return; Section 3 describes the theoretical framework, methodology and the information related to data; Section 4 analyses empirical results; Section 5 discuss some conclusions.

2. Literature Review

From the neoclassical theory, the economic growth depends, in the absence of technological change, on the increase of the labour force, on the savings and investments of households and firms. Despite all assumptions, the single composite commodity is produced by labour and capital (Solow, 1956). However, as literature develops, it can be stated that the process of technological adoption and innovation also affects the economic growth (Herrendorf et al., 2015).

2.1. Labor Share

Since the 19th century, labor theory has been shaped based on technical progress, capital accumulation and income distribution (Kurz, 2010). Adam Smith developed his theory around the concept of division of labor. This concept encompasses factors such as worker specialization, improvements in utilization of equipment, time savings from

avoiding shifts between activities and innovations that replace labor power by machine power contribute to enhancing productivity (Smith, 1976).

David Ricardo, for his part, played a crucial role in uncovering the inverse relationship between the general rate of profits and wages – the fundamental law of distribution. The literature also attributes to him the assumption of a given real wage rate, comprehended as an inventory of well-specified quantities of specific commodities, reflecting some social and historical level of subsistence (Ricardo, 1821).

However, this is not the only paradigm regarding the determination of the distribution of national income. Neoclassical economists refer to factor prices, which are determined by supply and demand, as the primary determinants of distribution. This implies that each factor of production is compensated according to its marginal productivity (Mankiw, 2015). In contrast, Keynesians argue that distribution of national income is influenced by the pricing behavior of firms in monopolistic markets. This means that the higher the degree of monopoly, the higher will be the mark up of prices over labor costs, resulting in a lower share of wages in national output and consequently increase in share for capital income (Kalecki, 1971).

Technical changes play also a crucial role in the economic analysis of labor share. Although Smith and Ricardo lived through the Industrial Revolution, there was a certain devaluation of the importance of technological progress (Kurz, 2010). Technical progresses are essential for the development of modern society; however, these changes can lead to both positive and negative effects (Ricardo, 1821).

Since the early 1980s, the rise of personal income inequality has been explained by a shift in income distribution towards skilled labor. This is due to technological changes, particularly those related to information and communication, which are seen as a substitute for unskilled labor and a complement to skilled labor (Card and Di Nardo, 2002; Stockhammer, 2015). This implies that these changes have become capital-augmenting rather than labor-augmenting, leading to a decline in the wage share (IMF, 2007; EC, 2007).

In most Organization for Economic Cooperation and Development (OECD) countries, income distribution has become more polarized (OECD, 2008; OECD, 2011), and the wage share has fallen. This decline has been more pronounced in continental European countries than in the Anglo-Saxon countries (Stockhammer, 2015).

In addition to technological progress, globalization can also impact wage share. Particularly in advanced economies, this is one of the factors contributing to the reduction

in the share of income accruing to labor (IMF, 2007). When considering the comparison of imports and exports with GDP as an indicator of globalization (EC, 2007), the primary effect of trade on income distribution is not through relative prices, but by influencing the bargaining position of labor and capital (Rodrik, 1997; Onaran, 2011). Jobs that are outsourced or moved from advanced to developing countries and imports of intermediate goods generally have a negative impact on unskilled labor in advanced economies. However, because of lower overall education levels in developing countries, these relocated jobs may have a positive effect on skilled labor in those economies (Feenstra and Hanson, 1997, 1999).

Economic literature argues that investment plays an important role in the bargaining position of labor. One of the effects of financialization, coupled with globalization, is that firms have more investment options. Essentially, the firms have gained mobility, both in terms of geographical location and the nature of their investments. Furthermore, it has strengthened the power of shareholders relative to workers by placing additional constraints on firms, while the development of a corporate control market has aligned management's interests with those of shareholders (Lazonick and O'Sullivan, 2000; Stockhammer, 2004).

Literature identifies the determinants of labor share mentioned above as factors that have an impact on economic growth. The wage share has a positive effect on real GDP per capita and, consequently, on economic growth, when it shows positive growth and when it exceeds the growth of total factor productivity (Alves et al., 2024).

However, others authors claim that there is an inverse relationship between functional income distribution and real Gross Domestic Product (GDP), meaning that a higher wage share is associated with lower levels of real GDP (Gymnopoulos and Tsaliki, 2025). The rising inequalities in income and wealth challenge the concept of distribution-led growth, which argues that a more equitable distribution, through a higher wage share, could boost demand and, in turn, promote economic growth. This concept considers both the source of demand and the unit cost of production (Kalecki, 1954). On the one hand, because of a higher marginal propensity to consume out of wages, a redistribution of income towards wages increases consumption demand. This, in turn, leads to higher investment and profits (Carvalho and Rezai, 2016). On the other hand, a large wage share also raises per-unit labor cost, reduces profit rates and discourages investments (Bhaduri and Marglin, 1990; Marglin and Bhaduri, 1990).

Beyond that, the increase of capital gains from investments and financial globalization has contributed to a decline in wage share of GDP (ILO, 2008), especially in countries that have undergone financial crises and significant fluctuations in their exchange rates. The favorable conditions for capital inflow, absence of restrictions on capital accounts or even foreign direct investment (FDI) are linked to low wages and a reduced labor share (Diwan, 2001; Harrison, 2002; Lee and Jayadev, 2005). In this sense, changes in labor share are driven by movements in trade shares, exchange rate crises, capital controls and foreign investment flows (Harrison, 2002).

Over time it is possible to observe fluctuations in labor share. Between 1960 and 1990, low-income countries had a low labor share, while in high-income countries, it increased (Harrison, 2002). A study of three of the most developing countries concluded that, although the wage share does not respond to growth in during the normal years, it becomes procyclical during a crisis (wages decreases as the economy contracts) in Mexico and Turkey, where capital benefits from growth and labour bears the burden of the crisis (Onaran, 2009).

2.2. Macroeconomic Rates of Return

Historically, public investment has emerged from the necessity to provide certain goods, infrastructure, or services considered crucial for national interests. As industrialization progressed, the need for new infrastructure to support the expansion of urban communities led to an increase in public investments.

Around the 21st century, private investment grew as a result of the privatization of state industries and market deregulation, which in turn led to an increase in public spending on goods and services provided by the private sectors (Lee, 2023).

Although investments can be segmented into public and private, research studies prove that one of them can create effects on the other. A rise in public investments can leverage private investments, by creating or promoting relevant infrastructures like airports, sewage systems, etc. However, it can also create a crowding-out effect on private investments, by reduce savings from private investors and the expected rate of return of private capital. This is due to the need for public capital to be financed by capital markets (Afonso and Aubyn, 2009; Perez-Sebastian and Steinbuks, 2017). In this sense, factors such as leverage, liquidity constraints, and labour efficiency impact the effect of public investment on private sector. It will create a crowding-in effect for firms with low leverage - which experience an increase in their investment rates following a rise in public

investment - but not for those with high leverage, that are financially constrained or that have low operating efficiency (Espinoza et al., 2024).

Private investment is necessary for economic progress, and for that it requires stable socio-political institutions, certainly in macroeconomic policies and flexibility in the financial markets (Cuddington, 1987; Pfeffermann and Madarassy, 1991; Servén and Solimano, 1993). When analyzing private investment trends, it is essential to consider the relationship between political risk and public investment (Le, 2004). A study conducted from 1980 to 1997 finds that public investment complements private investment, and that, on average, a 10 percent increase in public investment is associated with a 2 percent increase in private investment. However, the results also indicate that, in developing economies, private investment is limited by the availability of bank credit. So, the impact of public investments differs across countries. Factors like uncertainty, imperfect competition, effectiveness, cost of capital, market conditions or even size of government can further fuel these differences. In developed countries there is a crowding-out effect, and private investment in developed economies is influenced by different factors than private investment in developing economies (Erden and Holcombe, 2005; Gjini and Kukeli, 2012). Furthermore, empirical evidence shows that higher investment returns positively impact the stimulation of greater aggregate demand, which leads to increased tax revenues. This, in turn, enhances the fiscal sustainability and improves external sustainability by reducing the need for foreign capital and imports of goods and services (Afonso et al., 2025).

3. Methodology and Data

3.1. Theoretical Framework

To analyze whether there is a relationship between macroeconomic rates of return of investment and wage share, let us assume that a given economy is described by the traditional Cobb-Douglas production function:

$$Y\ (L, K) = A\ K^{\alpha}\ L^{1-\alpha}\ ,\ where\ 0 < \alpha < 1 \qquad (1)$$

where it will be assumed that there are constant returns of scale (A), with capital (K) and labor (L), and where α and (1 − α) represent the elasticity coefficients of production with respect to the capital and labor, respectively.

If we derive the function (1) with respect to capital and labor, we will obtain the respective marginal productivity:

$$MPK = \frac{\partial Y}{\partial K} = \alpha\, A\, K^{\alpha-1}\, L^{1-\alpha} = \alpha\, A \left(\frac{K}{L}\right)^{\alpha-1}, \quad (2)$$

$$MPL = \frac{\partial Y}{\partial L} = (1 - \alpha)\, A\, K^{\alpha}\, L^{-\alpha} = (1 - \alpha) A \left(\frac{K}{L}\right)^{\alpha}. \quad (3)$$

Accordingly, the ratio between the two marginal productivities can be expressed as:

$$\frac{MPL}{MPK} = \frac{(1-\alpha)A\left(\frac{K}{L}\right)^{\alpha}}{\alpha A\left(\frac{K}{L}\right)^{\alpha-1}} = \frac{(1-\alpha)}{\alpha}\,\frac{K}{L}\,. \quad (4)$$

Following the neoclassical distribution theory, under perfect competition, we assume that the marginal productivities of capital and labor correspond to factor returns – returns (r) and wages (w):

$$MPK = r, \quad (5)$$

$$MPL = w\,. \quad (6)$$

Therefore, equation (4) can be reformulated as:

$$\frac{w}{r} = \frac{(1-\alpha)}{\alpha}\,\frac{K}{L} \Leftrightarrow w = \frac{(1-\alpha)}{\alpha}\,\frac{K}{L}\,r. \quad (7)$$

In order to understand the effect of capital returns, r, and the capital-to-output ratio, $\frac{K}{Y}$, on the wage share, equation (7) can be rearranged as follows:

$$wL = \frac{(1-\alpha)}{\alpha} rK \Leftrightarrow \frac{wL}{Y} = \frac{(1-\alpha)}{\alpha}\, r\frac{K}{Y} \quad (8)$$

where, wL represent the compensation of employees, and $\frac{wL}{Y}$ corresponds to wage share.

3.2. Methodology

The data was collected for 16 OECD countries, namely: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden, United Kingdom, United States, for the period of 1980-2022.

For this empirical analysis, we consider four variables related to macroeconomic rates of return of investment: private and public investments, both partial and total. Total rates include cross-sector effects, while partial rates are the solo effect of public or private investment. These data were calculated in the Afonso et al. (2025), based on a traditional Cobb-Douglas production function, displaying constant returns of scale, whose inputs are private, K_p, and public capital, K_G, and labour, L:

$$Y = K_p^{\alpha} K_G^{\gamma} L^{1-\alpha-\gamma} \quad (9)$$

where, α, γ and $1-\alpha-\gamma$ represent the output elasticities to private and public capital and labor, accordingly.

Given its relevance, we now reproduce the methodology for estimating the macroeconomic rates of return developed by Afonso et al. (2025). So, to compute output elasticities for private and public investment, the authors resorted to the VAR approach and the correspondent impulse response functions (IRF). The VAR was estimated as follows:

$$X_t = c + \sum_{i=1}^{p} A_i X_{t-i} + \varepsilon_t \quad (10)$$

where X_t is the (5×1) vector containing the five ordered endogenous variables, namely are the logarithmic growth rates of real public investment, K_G, real private investment, K_P, real output, Y, real taxes, Tax, and real interest rates, R, given by $Xt \equiv [\Delta log K_{G,t}\ \Delta log K_{P,t} \Delta log Y_t\ \Delta log Tax_t\ \Delta log R_t]'$, c is the constant term vector, A is the estimated autoregressive coefficients' matrix, ε_t is the error term vector, and p is the optimal lag length determined by AIC and BIC criteria.

The authors also assumed that orthogonal shocks, η, can be identified by imposing a set of constraints and computing them using random disturbances:

$$\eta_t \equiv B\varepsilon_t, \quad (11)$$

$$\varepsilon_t \sim \mathcal{N}(0, \Sigma) \quad (12)$$

where B is a square (n×n) matrix, and $\Sigma = Cov(\varepsilon)$ by estimating equation (10), leading to a $Cov(\eta) = I$.

Considering a 20-year investment lifetime and without accounting for crowding-in and crowding-out effects, the following partial macroeconomic rates of return of public (r_G) and private investments (r_p) can be derived as:

$$MPK_{Partial,K_G} = \left(1 + r_{Partial,K_G}\right)^{20} \Leftrightarrow r_{Partial,K_G} = \left(MPK_{Partial,K_G}\right)^{\frac{1}{20}} - 1, \quad (13)$$

$$MPK_{Partial,K_p} = \left(1 + r_{Partial,K_p}\right)^{20} \Leftrightarrow r_{Partial,K_p} = \left(MPK_{Partial,K_p}\right)^{\frac{1}{20}} - 1 \quad (14)$$

where $K_G \equiv \frac{\Delta Y}{\Delta K_G} = \varepsilon_{K_G} \frac{Y}{K_G} = \gamma \frac{Y}{K_G}$, and $MPK_p \equiv \frac{\Delta Y}{\Delta K_p} = \varepsilon_{K_p} \frac{Y}{K_p} = \alpha \frac{Y}{K_p}$.

In order to derive the macroeconomic rates of return of total investment – that is, accounting for the mutual influence between public and private investment – the model incorporates a shock to public (MPK_{Total,K_G}) or to private investment (MPK_{Total,K_p}):

$$MPK_{Total,K_G} = \left(1 + r_{Total,K_G}\right)^{20} \Leftrightarrow r_{Total,K_G} = \left(MPK_{Total,K_G}\right)^{\frac{1}{20}} - 1, \quad (15)$$

$$MPK_{Total,K_p} = \left(1 + r_{Total,K_p}\right)^{20} \Leftrightarrow r_{Total,K_p} = \left(MPK_{Total,K_p}\right)^{\frac{1}{20}} - 1, \quad (16)$$

and

$$MPK_{Total} = \frac{\Delta Y}{\Delta K_G + \Delta K_p} = \frac{1}{MPK_G{}^{-1} + MPK_p^{-1}}. \quad (17)$$

After computing the macroeconomic rates of return for public and private investments, we analyze how these macroeconomic rates of return influence the wage share. To do so, we follow the Alves et al. (2024), where the adjusted wage share at current factor cost (WS_{FC}) and at market prices (WS_{MP}), measured as a percentage of GDP. The adjusted wage share at factor cost excludes indirect taxes, which provides a better reflection of the

value generated by production before government intervention. The data was collected from the AMECO database.

Therefore, we set the following regression to estimate the impacts of macroeconomic rates of return on wage shares such as:

$$WS_{k,i,t} = +\alpha_{0,i,t} + \beta_{z,i,t} MRR_{z,i,t} + \beta_{n,i,t}.X_{n,i,t} + \psi_i + \eta_n + \varepsilon_{i,t} \quad (18)$$

where WS_k represents the wage share of k-type, $k = \{Market\ Prices; Factor\ Costs\}$, $MRR_{z,i,t}$ are the macroeconomic rates of return of z-type, $z = \{r_{Total,K_G}, r_{Partial,K_G}, r_{Total,K_P}, r_{Partial,K_P}\}$, $X_{n,i,t}$ are the control variables, detailed in the data section, and ψ_i and η_n are the country-specific and time-specific effects, respectively, while $\varepsilon_{i,t}$ are the robust standard errors.

3.3. Data

As previously mentioned, the macroeconomic rates of return of investment were computed in Afonso et al. (2025), whereas the data related to adjusted wage share were collected from the AMECO database. The adjusted wage share at factor cost excludes indirect taxes, which provides a better reflection of the value generated by production before government intervention.

For the control variables, we considered some used in Alcobia and Barradas (2023), while others were included due to their potential relevance to the study. The variables are: i) trade openness (*openness*); ii) human capital index (*HC*); iii) difference between savings and domestic investment (SI_{gap}); iv) total factor productivity (*TFP*); v) the total factor productivity, capital share (TFP_K); and vi) the total factor productivity, labor share (TFP_L).

To assess the weight of international trade in each country's economy - trade openness, we summed up exports and imports of goods and services, as percentage of GDP. Although the exports and imports represent the total value of all goods and other market services provided to or received from the rest of the world, they exclude compensation of employees, investment income and transfer payments. These data were obtained from World Bank and OECD national accounts files. Based on years of schooling and returns to education, the human capital index was collected from the Penn World Table (PWT) version 10.01.

The difference between saving and domestic investment will also be used as a control variable. Gross savings are calculated as gross national income less total consumption, plus net transfers, and domestic investment is the gross capital formation, where consists of outlays on additions to the fixed assets of the economy (include land improvements; plant, machine, and equipment purchases; and the construction of the railways, roads, schools, hospitals, etc.) plus net changes in the level of inventories. These data were retrieved from World Bank and OECD national accounts files. Data for the total factor productivity variables were obtained from the AMECO database.

Table 1. Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Partial Private Investment (PPrI)	1.247	1.795	-8.798	6.627	597
Total Private Investment (TPrI)	1.066	1.692	-8.941	6.051	597
Partial Public Investment (PPI)	1.802	4.103	-14.825	13.955	384
Total Public Investment (TPI)	1.287	3.854	-14.825	10.953	384
Wage Share at Factor Cost ($\mathbf{WS_{FC}}$)	63.886	5.137	30.322	75.761	677
Wage Share at Market Prices ($\mathbf{WS_{MP}}$)	56.932	5.114	28.718	70.991	677
Trade Openness (openness)	72.850	40.557	15.723	250.108	688
Human Capital (HC)	3.037	0.413	1.645	3.774	640
$Savings - Domestic\ Investment$ (SI_{gap})	-0.074	4.148	-19.401	12.783	599
Total Factor Productivity (TFP)	89.049	14.599	32.561	134.106	645
Total Factor Productivity – Capital ($\mathbf{TFP_K}$)	100.545	5.528	76.917	115.038	645
Total Factor Productivity – Labor ($\mathbf{TFP_L}$)	88.336	13.106	38.610	122.544	645

Note: Author's calculations.

Table 2. Correlation matrix

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
(1) PPrI	1											
(2) TPrI	0.951	1										
(3) PPI	-0.010	0.000	1									
(4) TPI	0.045	0.045	0.932	1								
(5) WS_{FC}	0.054	0.090	0.116	0.095	1							
(6) WS_{MP}	0.148	0.214	0.124	0.092	0.906	1						
(7) Openness	-0.247	-0.355	-0.019	0.001	-0.307	-0.344	1					
(8) HC	0.206	0.246	-0.176	-0.085	-0.150	-0.175	0.006	1				
(9) SI_{gap}	-0.236	-0.250	-0.044	-0.080	-0.045	-0.124	0.300	0.299	1			
(10) TFP	0.024	0.071	-0.117	-0.144	-0.422	-0.423	0.052	0.188	0.107	1		
(11) TFP_K	-0.051	0.067	0.104	0.056	-0.091	-0.025	-0.265	-0.356	-0.164	0.607	1	
(12) TFP_L	0.052	0.081	-0.157	-0.174	-0.447	-0.467	0.123	0.339	0.175	0.975	0.425	1

Note: Author's calculations.

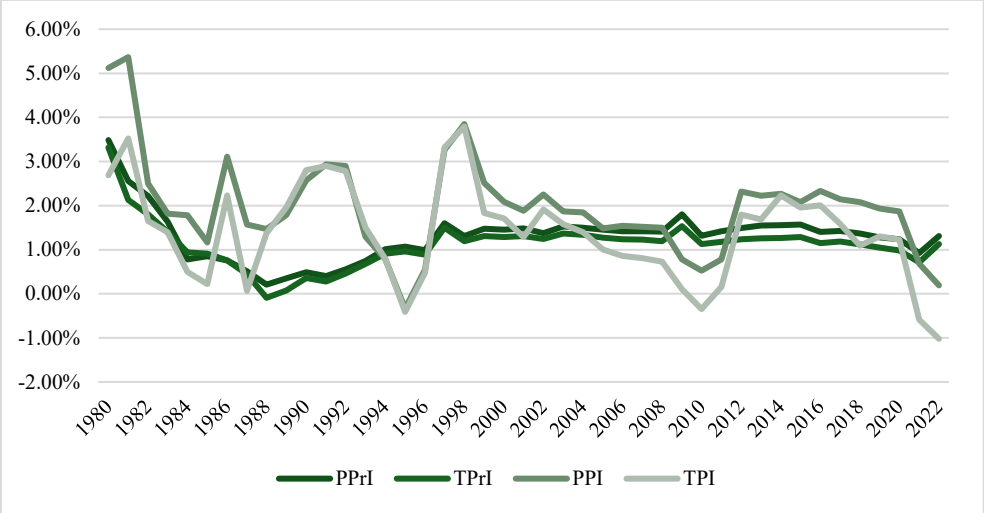
An analysis of the macroeconomic rates of return of investment from 1980 to 2022 in Figure 1 shows a broadly similar behavior between partial and total rates, though larger gaps emerge in the case of public investment. In both private and public investment, these discrepancies have become almost insignificant throughout the 1990s.

We can also observe that public investment is considerably more volatile. This pattern is likely due to public finance constraints and/or influence of political and electoral cycles.

In contrast, private investment remains relatively constant over time, particularly from the late 1990s onwards. This stability may reflect the maturity of private institutions and consequently a predictable environment, where it is possible to take much less rushed and reactive decisions.

Furthermore, public investment rates tend to be higher than those of private investment for most of the period. As shown in Table 3, this pattern holds true in the majority of countries, except for Finland, Italy, Netherlands, United Kingdom, and United States. A significant disparity between the macroeconomic rates of public and private investment can also be observed in countries Ireland, Italy, Portugal and United States.

Figure 1. Evolution of macroeconomic rates of return from 1980 to 2022.



Note: Author's calculations based on data from Afonso et al. (2025).

Table 3. Average of macroeconomic rates of return by country.

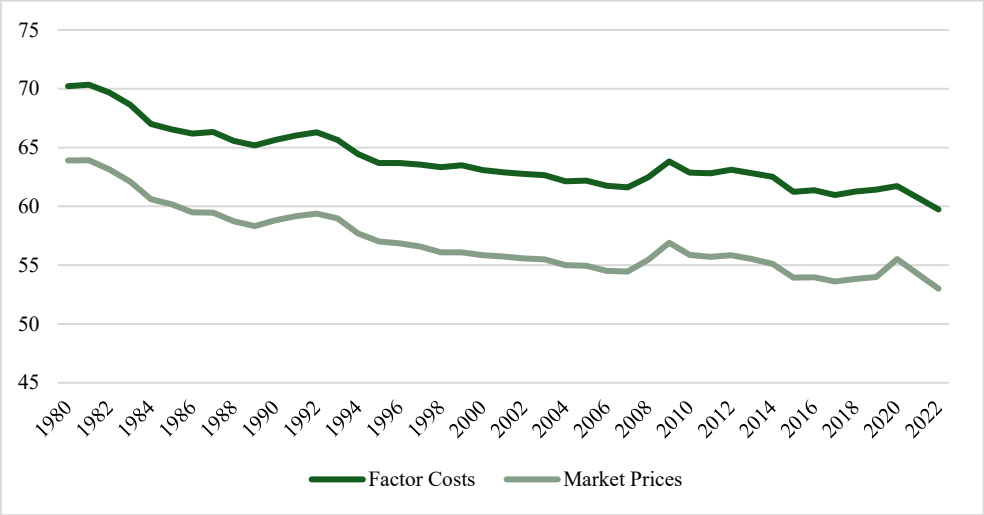
	PPrI	TPrI	PPI	TPI
Austria	1.134%	0.634%	2.215%	1.094%
Belgium	-0.889%	-0.704%	n.a	n.a
Denmark	-0.553%	-0.778%	0.682%	0.431%
Finland	0.768%	0.859%	0.347%	0.016%
France	2.426%	2.028%	0.872%	3.101%
Germany	2.561%	2.272%	4.587%	3.914%
Greece	-1.090%	-0.485%	1.803%	1.050%
Ireland	0.770%	-0.283%	2.661%	3.278%
Italy	2.553%	1.809%	-5.028%	-4.871%
Japan	-0.025%	0.360%	3.671%	1.790%
Netherlands	2.161%	1.928%	-1.595%	-1.319%
Portugal	2.135%	1.914%	5.881%	3.638%
Spain	1.758%	1.543%	3.190%	1.898%
Sweden	-0.338%	-0.311%	n.a	n.a
United Kingdom	2.897%	2.036%	0.333%	1.369%
United States	3.811%	4.306%	-0.442%	-0.269%

Note: "n.a" represent unavailable data. Author's calculations based on data from Afonso et al. (2025).

Figure 2 illustrates that the variable wage share, measured both at factor cost and at market prices, remains broadly stable throughout the period under analysis, with a slight downward trend. The two series exhibit a strong degree of co-movement, suggesting that the distinction between valuation at factor prices and market prices does not significantly alter the observed trend. Despite their similar trajectories, the level of wage at factor cost consistently exceeds that of at market price by a small margin. On average, this difference remains below 10%, indicating a relatively modest deviation between the two indicators over time.

Analyzing values by country in table 4, we observe that the pattern of wage share at factor cost and at market price remains consistent with the overall figure. However, for countries Denmark and Sweden, the difference between the two variables is notably larger compared to the other countries.

Figure 2. Evolution of country averages of wage share at factor cost and market prices from 1980 to 2022.



Note: Author's calculations.

Table 4. Averages of wage share at factor cost and market prices by country.

	WS_{FC}	WS_{MP}
Austria	65.622	57.538
Belgium	68.206	61.377
Denmark	65.166	56.060
Finland	64.628	56.963
France	67.283	58.360
Germany	63.900	58.023
Greece	58.554	52.460
Ireland	56.146	50.743
Italy	61.919	55.537
Japan	65.739	61.609
Netherlands	66.230	60.154
Portugal	65.014	57.883
Spain	64.170	58.391
Sweden	62.961	50.600
United Kingdom	63.524	56.534
United States	63.117	58.960

Note: Author's calculations.

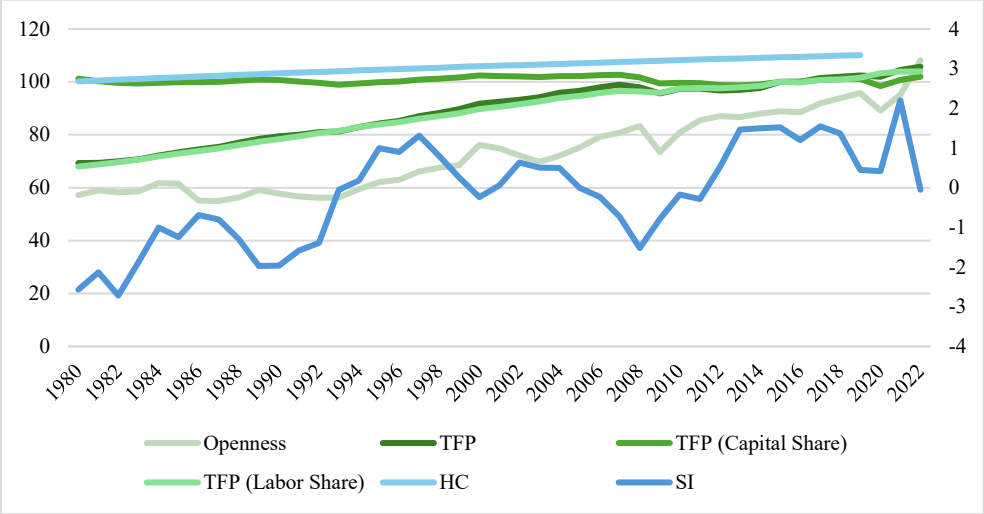
Regarding the control variables, as shown in table 5, during the period from 1980 and 2022, human capital index remains relatively stable over time, with no evident difference among the countries analyzed.

In contrast, the difference between saving and domestic investment exhibits an unstable behavior. It is noticeable that in countries Greece, Ireland, Italy, Portugal, Spain, United Kingdom and United States, the SI_{gap} is negative, indicating that domestic investment exceeds savings in these cases. Additionally, the Netherlands and Portugal represents the extremes within the sample, suggesting divergent economic dynamics between them.

Meanwhile, openness exhibited a clear upward trend over the same timeframe. Belgium, Ireland, and Netherlands are the most open economies, with openness levels of 138%, 156%, and 124% of GDP, respectively. In contrast, Japan and United States exhibit the lowest openness rates, with values of 26% and 23% of GDP.

Further analysis of Figure 3 shows that both *TFP* and TFP_L display a consistent upward trend over the years, with their values remaining closely aligned and revealing almost no divergence. Meanwhile, TFP_K remains relatively constant throughout the period, consistently maintaining values higher than those of *TFP* and TFP_L, particularly up to 2016. It is also observed that the total factor productivity converge over time, moving closer together in recent years and eventually *TFP* and TFP_L surpassing TFP_K in 2019.

Figure 3. Evolution of control variables from 1980 to 2022, country averages.



Note: Author's calculations. Variables *openness*, *TFP*, TFP_K and TFP_L are plotted on the left Y-axis. Variables *HC* and SI_{gap} are plotted on the right Y-axis.

Table 5. Average of control variables by country.

	Openness	***HC***	SI_{gap}	***TFP***	TFP_K	TFP_L
Austria	85.647	3.106	2.679	88.195	100.992	87.508
Belgium	137.552	2.921	1.490	90.424	100.169	90.286
Denmark	84.883	3.272	3.312	88.806	99.597	88.969
Finland	67.471	3.125	1.329	87.394	99.776	87.315
France	53.682	2.908	0.510	89.978	101.062	89.132
Germany	59.718	3.513	0.799	n.a	n.a	n.a
Greece	52.260	2.719	-2.894	100.280	106.307	95.687
Ireland	156.270	2.870	-1.368	66.461	89.767	70.646
Italy	47.535	2.752	-0.362	97.835	103.733	94.776
Japan	25.645	3.324	2.765	86.567	100.338	86.525
Netherlands	124.156	3.128	4.172	89.831	99.159	90.344
Portugal	67.583	2.137	-4.197	93.597	106.012	89.082
Spain	50.872	2.610	-2.532	96.367	107.123	91.012
Sweden	74.537	3.207	1.894	86.392	98.054	87.547
United Kingdom	54.318	3.435	-3.282	86.414	96.422	88.831
United States	23.465	3.562	-2.860	87.194	99.661	87.384

Note: "n.a" represent unavailable data. Author's calculations.

4. Empirical Analysis

To estimate the effects of macroeconomic rates of return on wage share, we divide the results into two subsections: the first examines the influence of private investment rates on the wage share, while the second focuses on the corresponding effects of public investment rates. The results use OLS econometric technique with country and time fixed effects to address heterogeneity between countries and overtime.

Moreover, to ensure a robust and sensitivity analysis, the same was conducted not only on the full sample but also for countries above and below the average of TFP_K. Considering the average of TFP_K to be 100.545, Tables 7 and 10 focus on Austria, France, Greece, Italy, Portugal and Spain, whereas Tables 8 and 11 present results refer to the remaining countries in the sample.

4.1. Private Investment Effects on the Wage Share

In this subsection, the effects of private investment – both partial and total – on the wage share at factor cost and at market price was evaluated through the regression model previously described. The results, presented in Tables 6 to 8, assess not only the overall impact but also the effect on countries above or below the country average of TFP_K.

When the full sample is considered, the results indicate that macroeconomic rates of return on private investment, whether partial or total, have a positive effect on the wage share. Regarding the control variables, *openness*, the difference between savings and domestic investment and the total factor productivity of labor shows a negative relationship with the wage share. This behavior is also observed for human capital and total factor productivity, where the former significantly affects only wage share at the market prices, and the latter affecting wage share at factor costs. Among the control variables considered, only total factor productivity of capital has a positive effect.

For the countries where TFP_K is below the average of this control variable, a positive relationship between the explanatory variables can be observed. However, for the remaining countries, the results do not have a statistically significant effect. Also relevant is the difference in the behavior regarding the human capital index. When compared to the results based on the full sample, the relationship changes for countries where the total factor productivity of capital is below average. For these countries, a positive effect on the wage share at the factor cost occurs.

By analyzing more closely the degree of openness to the external economies, we conclude that the greater it is, the lower the wage share. This behavior is consistent with the studies referenced above, which associate the effects of globalization with wage share. This may be due to the migration from advanced countries to developing ones, which negatively affects the unskilled labor in advanced economies.

Examining the behavior of the human capital index, the negative impact on the wage share changes in countries with lower capital productivity. The negative effect may be explained by the fact that, as the index increases, so does investment in education and health – resulting in a more skilled and healthier workforce. This supports the development of processes, automation, and technology, which enable the substitution of labor and thus reduce wage share. In contrast, in countries with lower capital intensity – i.e., less investment in machinery and equipment – and with a lower HCI, labor becomes relatively more valuable, causing the wage share to increase.

Regarding the positive impact of the total factor productivity of capital on wage shares, it can be explained by the fact that more productive capital investments (in machinery, technology, etc.), enhance labor productivity, leading to higher output and, consequently, create greater scope for wage payments. On the other hand, labor productivity exhibits the opposite behavior, which may be justified by the automation of repetitive routine tasks and assembly-line processes.

The negative effect of the total factor productivity on the wage share, in the context of private investment, may stem from the stronger adverse effects of labor productivity. Technological advances that replace tasks performed by workers, automation of processes and routines, can reduce the wage share.

Table 6. Regression results: impact of private investment on the wage share

	(1) WS_{FC}	(2) WS_{FC}	(3) WS_{FC}	(4) WS_{FC}	(5) WS_{MP}	(6) WS_{MP}	(7) WS_{MP}	(8) WS_{MP}
$PPrI_{t-1}$	0.344*	0.420**			0.307	0.370**		
	(0.202)	(0.174)			(0.188)	(0.163)		
$TPrI_{t-1}$			0.563***	0.490***			0.522***	0.463***
			(0.202)	(0.174)			(0.185)	(0.162)
$Openess_{t-1}$	-0.103***	-0.104***	-0.106***	-0.107***	-0.088***	-0.088***	-0.090***	-0.091***
	(0.026)	(0.023)	(0.027)	(0.023)	(0.023)	(0.021)	(0.023)	(0.021)
HC_{t-1}	-2.990	-1.924	-2.614	-1.427	-8.568***	-7.668***	-8.241***	-7.246***
	(2.984)	(2.663)	(2.879)	(2.585)	(2.843)	(2.581)	(2.730)	(2.491)
$SI_{gap_{t-1}}$	-0.240***	-0.152***	-0.240***	-0.155***	-0.200***	-0.130***	-0.201***	-0.133***
	(0.049)	(0.050)	(0.048)	(0.050)	(0.043)	(0.044)	(0.042)	(0.044)
TFP_{t-1}	-0.081**		-0.078**		-0.027		-0.024	
	(0.035)		(0.035)		(0.030)		(0.030)	
$TFP_{K_{t-1}}$		0.450***		0.432***		0.398***		0.382***
		(0.069)		(0.068)		(0.063)		(0.063)
$TFP_{L_{t-1}}$		-0.461***		-0.447***		-0.337***		-0.324***
		(0.049)		(0.050)		(0.045)		(0.046)
Obs.	426	426	426	426	426	426	426	426
R^2	0.764	0.804	0.768	0.805	0.805	0.832	0.808	0.833

Note: * indicates the level of significance of 10%, ** a level of 5% and *** a level of 1%. In brackets we report the robust standard errors. Constant term was estimated but omitted for reasons of parsimony. Obs. are the observations for each regression.

Table 7. Regression results: impact of private investment on the wage share (above TFP_K)

	(1) WS_{FC}	(2) WS_{FC}	(3) WS_{FC}	(4) WS_{FC}	(5) WS_{MP}	(6) WS_{MP}	(7) WS_{MP}	(8) WS_{MP}
$PPrI_{t-1}$	-0.100	0.264			-0.116	0.199		
	(0.265)	(0.275)			(0.240)	(0.256)		
$TPrI_{t-1}$			0.089	0.370			0.097	0.342
			(0.242)	(0.234)			(0.220)	(0.219)
$Openess_{t-1}$	-0.108***	-0.101***	-0.106***	-0.103***	-0.083***	-0.076***	-0.079***	-0.077***
	(0.025)	(0.021)	(0.025)	(0.021)	(0.023)	(0.020)	(0.022)	(0.019)
HC_{t-1}	-6.008	-6.845	-5.627	-6.343	-13.861**	-14.522***	-13.434**	-13.994***
	(5.730)	(4.880)	(5.635)	(4.751)	(5.400)	(4.619)	(5.298)	(4.479)
$SI_{gap_{t-1}}$	-0.099	-0.038	-0.101*	-0.033	-0.051	0.001	-0.053	0.006
	(0.062)	(0.065)	(0.061)	(0.064)	(0.055)	(0.057)	(0.054)	(0.056)
TFP_{t-1}	-0.254***		-0.260***		-0.184***		-0.190***	
	(0.062)		(0.061)		(0.057)		(0.057)	
$TFP_{K_{t-1}}$		0.436***		0.441***		0.409***		0.416***
		(0.153)		(0.153)		(0.144)		(0.144)
$TFP_{L_{t-1}}$		-0.621***		-0.626***		-0.504***		-0.513***
		(0.089)		(0.087)		(0.086)		(0.084)
Obs.	224	224	224	224	224	224	224	224
R^2	0.893	0.912	0.893	0.913	0.906	0.922	0.906	0.922

Note: * indicates the level of significance of 10%, ** a level of 5% and *** a level of 1%. In brackets we report the robust standard errors. Constant term was estimated but omitted for reasons of parsimony. Obs. are the observations for each regression.

Table 8. Regression results: impact of private investment on the wage share (below TFP_K)

	(1) WS_{FC}	(2) WS_{FC}	(3) WS_{FC}	(4) WS_{FC}	(5) WS_{MP}	(6) WS_{MP}	(7) WS_{MP}	(8) WS_{MP}
$PPrI_{t-1}$	0.582***	0.694***			0.555***	0.633***		
	(0.204)	(0.193)			(0.168)	(0.163)		
$TPrI_{t-1}$			0.774***	0.745***			0.804***	0.783***
			(0.227)	(0.206)			(0.178)	(0.170)
$Openess_{t-1}$	0.002	-0.020	-0.005	-0.022	-0.006	-0.021	-0.013	-0.025
	(0.037)	(0.033)	(0.036)	(0.032)	(0.032)	(0.030)	(0.031)	(0.030)
HC_{t-1}	11.387**	15.277***	13.880***	18.003***	1.735	4.457	3.941	6.675
	(5.166)	(4.712)	(5.055)	(4.754)	(4.439)	(4.263)	(4.370)	(4.283)
$SI_{gap_{t-1}}$	-0.268***	-0.210***	-0.270***	-0.218***	-0.238***	-0.196***	-0.239***	-0.205***
	(0.072)	(0.068)	(0.070)	(0.068)	(0.061)	(0.059)	(0.059)	(0.058)
TFP_{t-1}	-0.118		-0.099		-0.086		-0.063	
	(0.081)		(0.078)		(0.069)		(0.065)	
$TFP_{K_{t-1}}$		0.275***		0.233**		0.194**		0.159*
		(0.098)		(0.094)		(0.085)		(0.081)
$TFP_{L_{t-1}}$		-0.281***		-0.246***		-0.203***		-0.164**
		(0.086)		(0.086)		(0.076)		(0.075)
Obs.	202	202	202	202	202	202	202	202
R^2	0.891	0.905	0.894	0.905	0.910	0.917	0.915	0.920

Note: * indicates the level of significance of 10%, ** a level of 5% and *** a level of 1%. In brackets we report the robust standard errors. Constant term was estimated but omitted for reasons of parsimony. Obs. are the observations for each regression.

4.2. Public Investment Effects on the Wage Share

In analyzing the impact of public investment on the wage share, the same pattern observed in the previous section for the private investment is found. There is a positive effect, which is more significant in countries where the total factor productivity of capital is below average – Belgium, Denmark, Finland, Ireland, Japan, Netherlands, Sweden, United Kingdom and United States.

Conversely to the results concerning private investment, the total factor productivity has a positive relationship with wage share, both at factor cost and at market prices. This

may be because higher public investment helps mitigate social inequalities and promotes a more equitable wage distribution. As productivity and efficiency increase, the economy can produce more with the same resources, potentially leading to higher wages, thereby increasing the wage share.

Despite the statistical significance, the behavior of capital and labor productivity is similar when the investment is private. Therefore, the possible justifications provided above may also be applicable to this section, where the investment is public.

The human capital index shows a positive effect on wage share, but with greater statistical significance in Austria, France, Greece, Italy, Portugal and Spain. This may be because, when investment in education and health is publicly provided, income and wealth inequalities are lower, leading to a more equitable wage distribution and consequently an increase in the wage share. The difference between savings and domestic investment shows a negative relationship.

This section also shows that, when analyzing the results for countries segmented based on average capital productivity, the outcomes are not as statistically significant as in the previous section.

Table 9. Regression results: impact of public investment on the wage share

	(1) WS_{FC}	(2) WS_{FC}	(3) WS_{FC}	(4) WS_{FC}	(5) WS_{MP}	(6) WS_{MP}	(7) WS_{MP}	(8) WS_{MP}
PPI_{t-1}	0.118***	0.091**			0.093***	0.073**		
	(0.037)	(0.037)			(0.033)	(0.033)		
TPI_{t-1}			0.114***	0.090**			0.093***	0.075**
			(0.035)	(0.035)			(0.031)	(0.031)
$Openess_{t-1}$	0.025	-0.005	0.024	-0.007	0.022	-0.000	0.020	-0.002
	(0.017)	(0.018)	(0.017)	(0.018)	(0.016)	(0.017)	(0.016)	(0.017)
HC_{t-1}	29.969***	26.468***	30.686***	26.941***	23.966***	21.283***	24.531***	21.684***
	(3.145)	(2.941)	(3.083)	(2.903)	(2.791)	(2.676)	(2.755)	(2.660)
$SI_{gap_{t-1}}$	-0.361***	-0.269***	-0.345***	-0.254***	-0.308***	-0.240***	-0.294***	-0.227***
	(0.052)	(0.056)	(0.055)	(0.058)	(0.047)	(0.051)	(0.048)	(0.052)
TFP_{t-1}	0.098***		0.098***		0.127***		0.127***	
	(0.037)		(0.037)		(0.032)		(0.033)	
$TFP_{K_{t-1}}$		0.299***		0.305***		0.266***		0.269***
		(0.063)		(0.063)		(0.061)		(0.061)
$TFP_{L_{t-1}}$		-0.107		-0.111*		-0.026		-0.027
		(0.066)		(0.066)		(0.063)		(0.062)
Obs.	259	259	259	259	259	259	259	259
R^2	0.872	0.880	0.872	0.880	0.881	0.886	0.881	0.887

Note: * indicates the level of significance of 10%, ** a level of 5% and *** a level of 1%. In brackets we report the robust standard errors. Constant term was estimated but omitted for reasons of parsimony. Obs. are the observations for each regression.

Table 10. Regression results: impact of public investment on the wage share (above TFP_K)

	(1) WS_{FC}	(2) WS_{FC}	(3) WS_{FC}	(4) WS_{FC}	(5) WS_{MP}	(6) WS_{MP}	(7) WS_{MP}	(8) WS_{MP}
PPI_{t-1}	0.006	0.000			-0.009	-0.012		
	(0.043)	(0.044)			(0.041)	(0.042)		
TPI_{t-1}			-0.023	-0.028			-0.032	-0.034
			(0.046)	(0.048)			(0.042)	(0.043)
$Openess_{t-1}$	0.010	0.013	0.012	0.014	0.012	0.015	0.014	0.016
	(0.023)	(0.023)	(0.023)	(0.024)	(0.021)	(0.021)	(0.021)	(0.022)
HC_{t-1}	36.988***	31.038***	37.267***	30.963***	33.330***	30.452***	33.484***	30.344***
	(7.533)	(9.134)	(7.364)	(8.937)	(6.641)	(7.960)	(6.425)	(7.766)
$SI_{gap_{t-1}}$	-0.159***	-0.142***	-0.165***	-0.147***	-0.077	-0.071	-0.082*	-0.075
	(0.053)	(0.053)	(0.051)	(0.052)	(0.049)	(0.050)	(0.047)	(0.049)
TFP_{t-1}	0.060		0.065		0.107*		0.111*	
	(0.067)		(0.067)		(0.064)		(0.064)	
$TFP_{K_{t-1}}$		0.204		0.215*		0.164		0.173
		(0.123)		(0.122)		(0.117)		(0.116)
$TFP_{L_{t-1}}$		-0.004		-0.004		0.084		0.084
		(0.095)		(0.094)		(0.088)		(0.087)
Obs.	128	128	128	128	128	128	128	128
R^2	0.964	0.965	0.964	0.965	0.962	0.963	0.963	0.963

Note: * indicates the level of significance of 10%, ** a level of 5% and *** a level of 1%. In brackets we report the robust standard errors. Constant term was estimated but omitted for reasons of parsimony. Obs. are the observations for each regression.

Table 11. Regression results: impact of public investment on the wage share (below TFP_K)

	(1) WS_{FC}	(2) WS_{FC}	(3) WS_{FC}	(4) WS_{FC}	(5) WS_{MP}	(6) WS_{MP}	(7) WS_{MP}	(8) WS_{MP}
PPI_{t-1}	0.208***	0.211***			0.156**	0.170**		
	(0.071)	(0.076)			(0.067)	(0.072)		
TPI_{t-1}			0.213***	0.210***			0.184***	0.188***
			(0.050)	(0.051)			(0.045)	(0.047)
$Openess_{t-1}$	0.101*	0.104	0.097*	0.092	0.061	0.078	0.058	0.070
	(0.060)	(0.068)	(0.057)	(0.066)	(0.058)	(0.064)	(0.056)	(0.062)
HC_{t-1}	-14.785	-15.142	-13.107	-12.964	-9.432	-10.747	-8.618	-9.447
	(12.378)	(12.601)	(11.535)	(11.690)	(11.972)	(12.156)	(11.424)	(11.527)
$SI_{gap_{t-1}}$	-0.117	-0.125	-0.061	-0.059	-0.125	-0.151*	-0.075	-0.094
	(0.080)	(0.090)	(0.080)	(0.090)	(0.079)	(0.089)	(0.077)	(0.086)
TFP_{t-1}	0.078		0.102		0.088		0.111*	
	(0.062)		(0.065)		(0.061)		(0.061)	
$TFP_{K_{t-1}}$		0.043		0.087		0.008		0.039
		(0.100)		(0.097)		(0.104)		(0.097)
$TFP_{L_{t-1}}$		0.080		0.086		0.118		0.131
		(0.091)		(0.089)		(0.084)		(0.081)
Obs.	131	131	131	131	131	131	131	131
R^2	0.893	0.892	0.900	0.899	0.915	0.915	0.921	0.921

Note: * indicates the level of significance of 10%, ** a level of 5% and *** a level of 1%. In brackets we report the robust standard errors. Constant term was estimated but omitted for reasons of parsimony. Obs. are the observations for each regression.

5. Conclusions and policy implications

The objective of this article was to analyse the impact of macroeconomic rates of return of investment on the wage share. For this purpose, the explanatory variables were segmented into public and private investment, both partial and total, and wage share measured at factor cost and at market prices. Total rates include cross-sector effects, while partial rates are the solo effect of public or private investment. Moreover, several control variables were included to improve the robustness of the results, such as human capital index, openness, total factor productivity, among others.

The analysis was covered 16 countries over the period from 1980 to 2022, using OLS econometric technique with country and time fixed effects to address heterogeneity between countries and overtime. To ensure a robust and sensitivity analysis, the same was conducted not only on the full sample but also for countries above and below the average of total factor productivity of capital.

The results indicate that both public and private macroeconomic rates of return positively affect the wage share at factor cost and at market prices. Regarding the control variables, the difference between savings and domestic investment and *openness* has a negative effect; however, statistical significance for the latter is observed only in private investment. Thus, in the context of private investment, the greater the openness to external markets is associated with a reduced wage share. Nevertheless, the literature refers to different behavior depending on countries' level of development. Since in this article the results for countries above or below the average of total factor productivity of capital do not represent their development economy, future research would benefit from expanding the analysis to include more countries and distinguishing between developed and developing ones.

The total factor productivity shows different behavior depending on the type of investment, a negative impact on private investment and a positive impact on public investment. The implementation of institutional policies and increased support for labor unions, aimed at protecting employers and enhancing their bargaining power, may serve as measures to mitigate the negative impact of private investment. Legislation that benefits those who invest in more efficient production methods and expanding their business in a way that preserves jobs can prevent the substitution of labor with capital. Such policies not only positively influence the wage share directly but also, through increased productivity, indirectly contribute to its further enhancement.

The wage share is positively influenced when total factor productivity is related to capital. When considering the full country sample, the total factor productivity of labor negatively affects the wage share.

Regarding the human capital index, a negative effect is observed in the case of private investment, and a positive effect one in public investment. Nevertheless, this relationship changes when the analysis is restricted to countries where the capital productivity is below average. This behavior may stem from the relative valuation of unskilled labor and inequalities in education and health, with the pattern shifting according to the country's capital factor productivity. Policy measures that incentive private investment in public

infrastructure and systems – aimed at reducing social inequalities – could contribute to increasing the wage share.

In future research, it would be interesting apply the same methodological approach to a broader country sample, focusing on understanding the impact in both developed and developing economies, and to assess the influence of artificial intelligence on variables such as total factor productivity and human capital index – both of which exhibited non-linear patterns in this article.

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