Lisbon School of Economics & Management
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MASTER
MONETARY AND FINANCIAL ECONOMICS

MASTER´S FINAL WORK
DISSERTATION

THE IMPACT OF LABOR SHARE ON ECONOMIC GROWTH: A PANEL DATA ANALYSIS FOR EUROPEAN UNION

FRANCISCO MANUEL COELHO BAPTISTA

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Glossary

EU – European Union

IMF – International Monetary Fund

WBG – World Bank Group

ICT – Information and Communication Technology

TFP – Total Factor Productivity

GDP – Gross Domestic Product

GMM – Generalized Method of Moments

Abstract

A panel data analysis was conducted for European Union (EU) countries spanning from 1995 to 2019 to gain insights into the impact of labor share on economic growth. The primary objective was to ascertain whether labor share actually remains less influential than capital share on economic growth, or if the changing landscape over the years necessitates a policy adjustment for optimizing economic growth. Notably, wage share exhibits a positive influence on economic growth when it experiences positive growth and when is higher than growth of total factor productivity. These results challenge conventional wisdom and suggest that economic policies may need to adapt to the evolving dynamics of labor share and its impact on growth.

KEYWORDS: economic growth; labor share; total factor productivity; first-differences Generalized Method of Moments.

JEL CODES: E24; O47; C23.

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THE IMPACT OF LABOR SHARE ON ECONOMIC GROWTH: A PANEL DATA ANALYSIS FOR EUROPEAN UNION

By Francisco Baptista

A panel data analysis was conducted for EU countries spanning from 1995 to 2019 to gain insights into the impact of labor share on economic growth. The primary objective was to ascertain whether labor share remains less influential than capital share on economic growth, or if the changing landscape over the years necessitates a policy adjustment for optimizing economic growth. Notably, wage share exhibits a positive influence economic growth when it experiences positive growth and when is higher than growth of total factor productivity. These results challenge conventional wisdom and suggest that economic policies may need to adapt to the evolving dynamics of labor share and its impact on growth.

1. Introduction

Over the course of several decades, starting in the 1960s, the concept of labor share remained on the periphery of economists' attention, largely due to the enduring influence of Bowley's Law. This principle asserted that the proportion of wages in the national income remained constant over time. Consequently, many economic theories were forged on the assumption of a stable wage share, in agreement with Krämer (2011).

The highest point of labor share occurred in the late 1970s or early 1980s before embarking on a noticeable decline. This transition can be imputed to the transformation in technological progress. In the 1960s and 1970s, technological advancement was primarily labor-intensive. However, this paradigm shifted in the 1980s, where technological progress no longer had the same effect on labor. While the evidence on this matter is somewhat mixed, the decreasing labor share seems to be more prominent in emerging and developing economies compared to advanced ones, when taking into account self-employment, following Guerriero's (2012) analysis.

In the early 2000s, there was a resurgence of interest in probing into the subject of labor share to gain deeper insights into the factors steering these evolving structural dynamics. Renewing studies in this area holds paramount importance as it empowers countries to enhance their productivity through the implementation of policies attuned to their unique structural characteristics and the dynamics of their financial economy. Furthermore, exploring this subject provides valuable insights into the intricate relationship between measures of economic performance and household incomes. It sheds light on public policies in terms of income redistribution and economic inequalities, while also fostering a deeper understanding of factor sharing and welfare economics. These aspects are crucial in addressing issues of social justice, a perspective shared by Guerriero (2012).

The principal objective of this dissertation is to ascertain the effects of labor share on economic growth. As indicated by the IMF and WBG (2015) in their study on labor share in G20 economies, globalization poses a threat to labor share in high-income countries. This is due to the moderation of wages and increased competition resulting from the recruitment of workers from countries with abundant labor pools. Additionally, technological progress plays a pivotal role in driving capital accumulation and capital-augmenting technical advancements. The correlation between technological progress and automation is underscored by the findings of the Mc Kinsey Global Institute (2019), which emphasize that advancements in technology incentivize the substitution of labor with more efficient and long-lasting capital.

The process of automation, as highlighted by Autor and Salomons (2018), leads to the displacement of routine jobs typically carried out by middle-skilled employees. Conversely, a study by the OECD (2012) posits that highly skilled workers exhibit a complementary relationship with capital when utilizing Information and Communication Technologies (ICT's), thereby boosting labor share, automation in production, and overall productivity.

Human capital, crucial for economic development, has faced stagnation in the face of recent productivity slowdowns. Furthermore, as pointed out by Dünhaupt (2013), in contrast to the public sector, privatization endeavors tend to emphasize profits over employability, ultimately diminishing the importance of labor share. While these factors are currently exerting a profound influence on economies worldwide, leading to a notable decrease in labor share, it remains imperative to conduct further studies to ascertain their continued significance relative to other contributing factors.

Consideration should also be given to the possibility that we have entered a new economic cycle, necessitating adjustments in policy for optimal growth. The persistent drive to continually increase capital share across all sectors, at the expense of labor share, may be outdated. In their recent published working paper, Alcobia and Barradas (2022) made a bold and innovative statement, most European countries exhibit a wage-led economic model, though their specific analysis is focused on Portugal. Given the prevalence of wage-led economies across various nations, it becomes crucial to highlight the significance of wages through customized policies and measures in our current context. Should the results align with expectations, it may be pivotal to advocate for a shift in our current policy paradigm.

In order to study the impact of labor share on economic growth we then resort to a panel of 27 countries from the European Union, from 1995 to 2019 by employing a first-differences Generalized Method of Moments (GMM) estimation. The selection of these economies is justified by the fact that these nations have been undergoing significant shifts in their economic structural functionality.

The dissertation is structured with a comprehensive literature review in Section 2. Section 3 outlines the data and methodology employed. Section 4 explores a thorough discussion of the results. Finally, Section 5 concludes with the key insights gleaned from this study.

2. Literature Review

For several decades, beginning in the 1960s, the concept of labor share received little attention from economists, largely due to Bowley's Law, which held that the share of wages in national income remained stable over time. As a result, many economic theories were developed under the assumption of a constant wage share. In addition, three major schools of thought on macroeconomic income distribution emerged from this framework: neoclassical, post-Keynesian, and Kaleckian, as stated by Krämer (2011).

As stated by Atkinson (2009), David Ricardo, for instance, used the Cobb Douglas function to argue that factor shares were overall constant and, besides this, Ricardian distribution theory accounted three factors of production: the proprietor of land (machinery), the owner of stock (capital) and the laborers of the industry (labor). Each factor was assumed to have a specific connotation, with landlords being rich, laborers being poor, and capitalists being somewhere in between. This neoclassical paradigm did not consider exploitation, and the theory of marginal productivity suggested that each agent received compensation commensurate with their contribution. The theory relied on three pillars: preferences, production functions, and factor endowments, which may have been perceived as constant because they did not change much over time.

The Marxist perspective, on the other hand, only considered two factor shares of productivity, with workers providing labor power and capital representing the means of production, and placing greater emphasis on the labor share. Kalecki's approach also acknowledged only two factors, but he examined the impact of monopoly concentration on the economy to determine the profit share. His model assumed the presence of underemployment and imperfect competition, with prices being determined by costs, as seen on the analysis made by Abreu (2019).

Later, Solow (1956) incorporated technological progress into the model using the Harrod-Domar framework, but he adopted a more flexible approach that did not rely on fixed proportions. The use of fixed proportions resulted in greater price fluctuations.

Solow's model provided insights into how capital accumulation and real output would be affected in the absence of unemployment or excessive capacity.

The labor share peaked around the late 1970s or early 1980s before experiencing a decline. This shift can be attributed to the fact that, during the 1960s and 1970s, technological progress was primarily augmented labor. However, this trend changed in the 1980s, and technological progress no longer had the same effect on labor. Although the evidence on this issue is somewhat mixed, the decline in labor share appears to be more pronounced in emerging and developing economies than in advanced economies when self-employment is taken into account with proper consideration. Guerriero's (2012) analysis supports this observation.

In the early 2000s, there was renewed interest in studying the topic of labor share to better comprehend the factors driving the changing structural characteristics. Pressing issues such as income inequality, the relationship between macroeconomic and household incomes, and the importance of social justice in ensuring fair distribution of income from different sources have become more prominent. Recent researches, like Cantante's (2014) work helped in understanding economic inequality in countries like Portugal, where only a select group of professionals has seen an increase in work remuneration in recent years. Fiscal benefits tend to benefit the upper echelon of the income distribution, with capital taking more advantage of the situation than labor. Public politics of income redistribution contribute to a higher economic inequality in both Portugal and Europe.

Milanovic (2011) suggests that global economic inequalities are stabilizing, but Bourguignon (2012) argues that, although over the years inequality between countries will disappear, within countries will persist. Checchi and Garcia-Penalosa's (2010) analysis of OECD countries revealed that higher labor shares are associated with lower inequality. Similarly, Dafermos and Papatheodorou (2015) found that capital share contributes more to inequality in the long run. To gain a broader understanding of this matter, they used three different income inequality indices: the Gini coefficient, the squared coefficient of variation, and the Atkinson index. These indices capture different aspects of inequality, allowing for a more comprehensive analysis. An in-depth understanding of this topic would enable policymakers to make more informed economic and political decisions. Consequently, new models have emerged in recent years that aim to shed further light on the topic.

Finnoff and Jayadev (2006) conducted a study using a regression model to examine the relationship between feminization and labor share. Their analysis found a strong negative correlation between the two factors. Specifically, feminization served as a stabilizing force on the labor share during periods of decline.

Krueger (1999) and Glyn (2009) developed a methodology to compute functional distribution of income. However, according to Dafermos and Papatheodorou (2015), linking functional and personal income distribution is crucial for understanding these issues. To achieve this goal, the authors developed a stock-flow consistent (SFC) model that integrates accounting into dynamic macro modeling. Based on previous work by Checchi and Garcia-Penalosa (2010) and Palley (2015), the authors created a more complex model that links functional and personal income. The model includes four agents: households, firms, unemployment funds, and commercial banks. The total population is exogenous, and households are divided into low-skilled employed workers, low-skilled unemployed individuals, high-skilled workers, high-skilled unemployed individuals, and entrepreneurs-capital owners. The model also accounts for mixed incomes received by households, which more accurately reflects the reality that workers do not receive purely labor or capital income. However, the model does not account for government expenditures and taxes.

Dünhaupt (2013) in her analysis of 13 OECD countries from 1986 to 2007, found that labor income share increased for high skilled workers but decreased for low skilled workers. In previous models, such as Heckscher-Ohlin model, where a country specializes its production on resources that are abundant to them, only capital and labor were considered factors of production. However, modern versions see labor separated into high skill and low skill labor. In this modern versions, high skill labor and capital are complements, and since technological progress is capital augmenting, both have been increasing.

For more than 50 years, constant factor shares with the Cobb-Douglas function have been used to estimate long-run labor share. However, Giovannoni (2014) emphasizes the importance of distinguishing between wage share, compensation share, and labor share, as these terms may refer to different concepts depending on the author and article. In Giovannoni's (2014) perspective, income is measured by wages, compensation share includes wages and benefits, and labor share includes wages, benefits, and an estimate of the labor component of proprietors' income. He suggests that a model for labor share should employ multiple methods to compute labor share to facilitate comparisons of different results. In a similar vein, Guerriero (2012) employed six different ways to calculate labor share in her analysis of 89 countries between 1970 and 2009. One approach to computing mixed income or proprietors' income is Johnson's (1954) method, which allocates two-thirds of the income to labor. Another method assumes that the average wage is the same for both employees and self-employed individuals (Gollin's, 2002), while Gomme and Rupert's (2004) model incorporates variables such as unambiguous labor, unambiguous capital, and ambiguous labor income, which are then solved to determine the last.

In recent years, agents such as entrepreneurs and the self-employed have become more prevalent in our economy, making it increasingly important to accurately measure their income in Guerriero's (2012) perspective. Self-employment is particularly prevalent in the agriculture sector in the United States, as noted by Freeman (2011). However, self-employed individuals often underreport their income, motivated by factors such as uncertainty regarding their income, concerns over taxation, and lower participation in surveys since they attribute higher marginal value to their time. Additionally, it can be challenging to differentiate between capital earnings and other types of earnings. Despite these difficulties, Jorgenson *et al.* (2010) and Young (1995) have proposed a methodology for measuring labor income, in which the average hourly labor income of a self-employed individual is equivalent to that of an employee with the same age and sex attributes, the same level of education, and working in the same industry.

The International Monetary Fund (IMF) and World Bank Group (WBG) (2015) conducted a study on labor share in G20 economies and presented a methodology for computing both unadjusted and adjusted labor share, with the latter including self-employment. The study found that self-employment is more prevalent in developed countries. This underscores the importance of accounting for self-employment when examining labor share, particularly in economies with a significant number of self-employed individuals.

The report conducted by International Monetary Fund and World Bank Group also identified several possible reasons for the decrease in labor share, including technological change, globalization, financial markets, the bargaining power of labor, and unemployment. This decrease in labor share has resulted in an increase in capital share, leading to higher income inequality, as highlighted by Piketty (2013). The top 1% of labor share income has increased, while the bottom 99% has decreased. The OECD Employment Outlook (2012) also found that the top 1% of wage income share has increased by 20%, but the lowest-educated individuals have experienced a decline in their wage income share. The report by the IMF and WBG (2015) revealed that 80% of the decrease in labor share within-industry is due to capital deepening, and the widespread adoption of Information and Communication Technology (ICT) highly contributed to the substitution of low-skilled workers with machines.

The OECD Employment Outlook (2012) report agrees that the bargaining power of low-skilled workers has decreased due to increased competition and globalization, resulting in a 10% decrease in labor share. However, sectors such as agriculture, mining, fuel, and real estate were excluded from their analyses due to difficulties in obtaining data for these sectors, which represent one-third of the economy. As previously mentioned, capital intensity and technical change are among the main reasons for the decrease in labor share within industries, as labor and capital are substitutes, and technical change is capital-augmenting, resulting in a decrease in labor share. ICT has contributed to an increase in productivity, automation production, and substitution between labor and capital. While capital and high-skilled workers are complementary, low-skilled workers and capital are not. International competition, offshoring, and foreign direct investment also contribute to the reduction of labor share. Offshoring production to developing countries reduces costs since local workers will accept lower wages to keep their jobs, which leads to a decrease in labor share. Offshoring of intermediate stages is negatively correlated with labor share. The privatization of industries and rising product market competition also contribute to a decrease in labor share, as public ownership and labor share are positively correlated.

Since 1990, OECD countries have seen a decrease in trade union density, which reflects higher unemployment, privatization, and part-time and temporary work, all of which contribute to lower labor share. Moreover, a higher proportion of workers have individual fixed wages, and fewer workers are covered by collective agreements, leading to a decrease in bargaining power, concluded by OECD Employment Outlook (2012). The decentralization of labor share is caused by imports, offshore, and privatization, which all contribute to a decrease in bargaining power. Blanchard and Giavazzi (2003) developed a model with entry costs to firms, tariff barriers, and the degree of bargaining power of workers, which is determined by labor market regulation. Furthermore, the decrease in bargaining power of low-skilled workers and the increase in bargaining power of high-skilled workers make it difficult to maintain wage compression and keep groups of workers together. In the long run, an increase in statutory wages reflects a decrease in labor share since the increase in productivity will be higher than the increase in wages.

IMF and WBG (2015) as well as Guerriero (2012) argued that factors such as international trade and globalization, technological change, level of economic development and structural change, education and human capital, and regulation in labor market, all have an impact on the labor share. The McKinsey Global Institute (2019), using a micro-to-macro approach, shares this view and identifies the main factors for the decrease of labor share in the United States as globalization, capital substitution and automation, superstar effects and consolidation, rising and faster depreciation, and super cycles and boom-bursts.

Globalization has eroded unions' ability to bargain for wages and has influenced bargaining power, leading to a decrease in labor share. While a centralized bargaining would increase labor share in the short-run, it would accelerate capital substitution in the long-run. IMF and WBG (2015) also agree with this view that high-income countries that have abundant labor workers will moderate wages and increase competition, leading to a decrease in the compensation of labor workers. Relative to union density, unemployment benefits and coverage, and government consumption, they note that these factors have decreased, making bargaining power weaker and leading to a decrease in the compensation of labor workers.

McKinsey Global Institute (2019) points out that technology is an incentive to substitute labor with capital. An increase in unemployment implies a decrease in labor share of income. If we assume that capital and labor are complementary, then the recent productivity slowdown and stagnation of human capital have made labor share income decrease. IMF and WBG (2015) also state that there has been capital accumulation during recent years in addition to the capital-augmenting technical change.

Regarding the "superstar" effects and consolidation, this refers to knowledge-intensive sectors with high value on intellectual property. The top 10% of firms capture

80% of economic profit, and this has been increasing in the past 20 years. Superstar firms that belong to a superstar sector invest in Research and Development (R&D) and intangible capital. Software, R&D, and databases have higher depreciation than buildings, and since companies invest more in this new capital, then depreciation will be higher. With higher depreciation, there will be less income to be distributed between labor and capital. Autor *et al.* (2017) also approached the topic of superstar firms on a working paper called "The fall of the labor share and the rise of superstar firms", stating that globalization and technologies are the main reasons for the increase of these "super firms" where the model of business to them is "winner take most." Firms that are more productive get a higher share of profits in value-added, hence labor share decreases. Companies should focus on sales instead of labor productivity, and that's the reason why some of them sell technologies or intelligence. This is also related to privatization, as public companies are less focused on generating profits, meaning public companies have higher labor share than private companies. Dünhaupt (2013) concludes since privatization is increasing, it is implied a decrease in labor share.

The McKinsey Global Institute (2019) also notes that recent changes in the use of capital and capital misallocation before financial crises contribute to rising and faster depreciation. As previously mentioned, depreciation causes margins to decrease, meaning that there will be less income to be distributed between labor and capital, leading to a decrease in both labor and capital share.

Autor and Salomons (2018) offer insights into the impact of automation and Artificial Intelligence (AI) on the human versus machine dilemma, utilizing a total factor productivity (TFP) approach rather than patent awards to measure technological progress. In the United States, between 1909 and 1949, technological advancements led to increased productivity and decreased unemployment, while simultaneously reducing employment opportunities for middle-skilled workers performing routine functions. However, this was offset by compensatory product demand local spillovers. Unfortunately, in later years, employment opportunities and wages decreased. Conversely, in Europe, the adoption of industrial robots contributed to an increase in labor productivity, value-added, and workers' wages, without affecting overall working hours but resulting in a shift towards higher-skilled workers. Ultimately, super cycles and boom-bust justify the increase in capital share. As commodity prices rapidly rise, profits increase, resulting in a decrease in labor share. Additionally, the limited quantity of housing leads to increased rents, resulting in an increase in capital gains.

3. Empirical Framework

3.1. Data

The data was collected for 27 countries of the European Union, namely: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden. The chosen time period for analysis was from 1995 to 2019, as recent data was unavailable for some variables.

In our empirical analysis, the dependent variable is the neperian logarithm of real GDP per capita (*lnrgdppc*). This variable is calculated based on data of GDP per capita measured as expenditure-side real GDP at chained PPPs in 2017 USD millions and population, taken from the Penn World Table (PWT) version 10.1 (Feenstra *et al.*, 2015).

Analyzing now the explanatory variables, the adjusted wage share was examined, measured as a percentage of GDP, using both current factor cost (*WS_FC*) and market prices (*WS_MP*). This includes all residents, as well as non-residents, working for resident producer units, and the compensation of employees encompasses wages, salaries, and employers' social contributions. The distinction between wage share at factor cost and market price lies in the inclusion of indirect taxes. Market price incorporates these taxes, whereas factor cost excludes impositions on production and imports, and also accounts for subsidies. These data are retrieved from AMECO.[1]

Based on Alcobia and Barradas (2022), we consider as control variables: (i) human capital index (*HC*), (ii) inflation rate (*IR*), (iii) trade openness (*TO*), and (iv) collective consumption, as a percentage of GDP (*CC*). Human capital index is based on years of schooling and returns to education and it is collected from Penn World Table (PWT) version 10.1. Collective consumption data are retrieved from AMECO database. Inflation rate is computed based on Consumer Price Index Harmonized and trade openness is the sum of exports with imports as a share of GDP. Furthermore, we add as

[1] AMECO is the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs.

explanatory variables the growth rate of total factor productivity (*TFP*), the growth rate of total factor productivity, capital share (*TFP_K*) and the growth rate of total factor productivity, labor share (*TFP_E*). These variables are computed based on AMECO data.

3.2. Methodology

Regarding the methodology, the analysis employs a panel-data approach that combines cross-sectional and time-series dimensions to investigate the relationship between economic growth and labor share.

We use the following equation to examine the effects of wage share on economic growth:

$$\ln rgdppc_{i,t} = \beta \cdot \ln rgdppc_{i,(t-1)} + \gamma \cdot WS_{i,t} + \theta \cdot TFP_{i,t} + \delta \cdot X_{i,t} + \mu_i + \eta_t + \varepsilon \qquad (1)$$

To clarify, *lnrdgppc* denotes the neperian logarithm of real GDP per capita, and we have also included a lagged real GDP per capita variable to gauge the momentum of the country's economic performance. The variable *WS* represents wage share, which can manifest in the form of both wage share at factor cost and market price. Additionally, we incorporate *TFP,* which stands for growth of total factor productivity. This can be further broken down into the productivity of both capital and labor. Including these variables in our equation is crucial as it helps us assess the overall efficiency of the economy. Furthermore, we introduce X as a vector comprising control variables that enhance the statistical robustness of our analyses. The terms μ and η incorporates country and time effects across countries, respectively, while ε represents the error term. In this context, t refers to the year, and i refers to the country.

As stated before, the analysis employs a dynamic panel data model, the Arellano-Bond estimator, based on the model introduced by Bhargava and Sargan (1983). The original model leverages past, present and future values of strictly exogenous variables to create instruments for lagged dependent variables and other non-exogenous variables, effectively removing permanent effects. However, when there is uncertainty about the strict exogeneity assumption of an explanatory variable, alternative identification arrangements become relevant, focusing on the restriction of serial correlation errors.

Observing that the first-differences GMM estimates of lagged dependent variable tends to be close to or below the fixed effect model, it suggests a downward bias due to weak instrumentation. In such cases, employing system GMM is advisable. We employ an estimation, which relies on a homoscedastic error term due to its constant nature, and the unbalanced panel data does not adversely affect estimation for this model.

Using lags as instruments under the assumption of white noise errors can compromise consistency if errors are actually serially correlated. Therefore, it is crucial to assess the validity of instrumental variables by reporting test statistics along with parameter estimates.

4. Analysis and discussion of results

This analysis will go through three different phases: starting with a baseline result of impact on GDP per capita, and then doing two different sensitivity analyses, one for growth rate of wage share at factor cost and, another, for the same growth rate of wage share at factor cost comparing to the total factor productivity. In each phase, we will see how our results will change with the impact of total factor productivity and with both total factor productivity of labor and capital discriminated.

4.1. Baseline Results

While the baseline table is not the central focus of our analysis, a quick review of its values can offer insights and preliminary predictions about forthcoming results. Not surprisingly *lnrgdppc* has a high significance in all cases. Among the other explanatory variables, it becomes apparent that *human capital*, when the TFP variable is introduced, exhibits an unexpected significant negative effect on real GDP per capita. This implies that reduced education levels might paradoxically contribute to greater economic growth. On the other hand, *inflation rate* has the opposite significance behavior, with the introduction of TFP variables it loses its significance. To justify the negative correlation between inflation rate and economic growth it is important to note that raising interest rate is a tool to curb inflation. The rationale behind this approach is that higher interest rate tends to incentivize saving and discourage spending, ultimately leading to a decrease in economic growth. In the European Union, for instance policymakers typically aim to maintain inflation at a target rate of 2%, which has been seen as a stimulus for the economy, in order to sustain controlled economic growth. If inflation rate is high and uncontrolled it will lead to severe loss of consumer purchasing power, and in this case, will affect negatively the economic growth.

Trade openness consistently demonstrates a positive significance. This can be attributed to the fact that increased trade, encompassing both exports and imports, effectively stimulates the economy, fostering higher economic growth. Conversely, the case is different for *public consumption*, which consistently shows negative significance.

Further elaboration will be provided in the sensitivity analysis.

Table 1: Baseline Results

Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.885***	0.973***	0.987***	0.889***	0.975***	0.989***
	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.011)
HC	-0.019	-0.057***	-0.060***	-0.027	-0.063***	-0.064***
	(0.023)	(0.020)	(0.019)	(0.023)	(0.020)	(0.019)
IR	-0.080***	0.002	0.008	-0.078***	0.003	0.009
	(0.024)	(0.021)	(0.020)	(0.024)	(0.021)	(0.020)
TO	0.096***	0.058***	0.042***	0.095***	0.057***	0.041***
	(0.014)	(0.012)	(0.012)	(0.014)	(0.012)	(0.012)
CC	-1.585***	-0.981***	-0.900***	-1.546***	-0.958***	-0.880***
	(0.219)	(0.190)	(0.181)	(0.219)	(0.190)	(0.181)
WS_FC	-0.323***	-0.228***	-0.216***			
	(0.046)	(0.040)	(0.038)			
WS_MP				-0.386***	-0.277***	-0.262***
				(0.051)	(0.044)	(0.042)
TFP		0.830***			0.823***	
		(0.048)			(0.048)	
TFP_K			0.905***			0.882***
			(0.100)			(0.100)
TFP_E			0.807***			0.817***
			(0.102)			(0.102)
Observations	612	612	612	612	612	612

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

4.2. I Sensitivity Analysis

In our sensitivity analysis, we can observe a consistent pattern: each time TFP variables are introduced and the growth of wage share at factor cost falls below zero, the significance of the *inflation rate* diminishes. This suggests that the *inflation rate* holds greater relevance for economic growth when wage share experiences positive growth. Consistently, trade openness exhibits a significant positive influence, indicating that an increase in trade will invariably have a beneficial effect on economic growth in all circumstances.

Another set of variables warranting exploration are wage share at factor cost and wage share at market price. Wage share at factor cost consistently maintains significance, though to a lesser degree when its growth is positive. Specifically, when the growth of wage share at factor cost is positive, it demonstrates a positive effect. Conversely, when this growth is negative, the outcome is inverted.

Turning to wage share at market price, a noteworthy observation emerges: it only exhibits significance when the growth of wage share at factor cost surpasses zero, and TFP variables are absent. However, a contrasting trend appears when the growth of wage share at factor cost is negative; in this scenario, wage share at market price consistently maintains significance, displaying a negative impact.

In conclusion, when the growth of wage share at factor cost is below zero, wage share at market price exhibits higher negative significance, indicating that taxes contribute to this negative effect.

Based on these findings, we can propose the following policy recommendations: increase the inflation rate when wages are on the rise, decrease public consumption mainly when the growth of wage share is positive, and in cases of negative growth in wage share, consider reducing the percentage of indirect taxes.

Regardless of the scenario, increasing the exchange of goods and services consistently leads to a positive impact.

Table 2: I Sensitivity Analysis, variation of wage share factor cost

	WS_FC_gr > 0	WS_FC_gr < 0	WS_FC_gr > 0	WS_FC_gr < 0	WS_FC_gr > 0	WS_FC_gr < 0
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.675***	0.683***	0.881***	0.802***	0.983***	0.877***
	(0.040)	(0.036)	(0.036)	(0.037)	(0.035)	(0.040)
HC	-0.005	0.016	-0.141*	0.038	-0.167**	0.017
	(0.092)	(0.071)	(0.076)	(0.066)	(0.069)	(0.066)
IR	0.112***	-0.063**	0.104***	0.003	0.086***	0.010
	(0.043)	(0.031)	(0.035)	(0.030)	(0.032)	(0.030)
TO	0.109***	0.112***	0.090***	0.095***	0.034*	0.070***
	(0.024)	(0.021)	(0.020)	(0.020)	(0.018)	(0.020)
CC	-1.770***	-1.199***	-1.040***	-0.588	-0.989***	-0.489
	(0.348)	(0.413)	(0.291)	(0.392)	(0.265)	(0.385)
WS_FC	0.348**	-0.988***	0.269**	-0.566***	0.227**	-0.449***
	(0.139)	(0.109)	(0.114)	(0.113)	(0.103)	(0.114)
TFP			0.807***	0.615***		
			(0.061)	(0.073)		
TFP_K					1.763***	0.901***
					(0.180)	(0.160)
TFP_E					0.324**	0.477***
					(0.144)	(0.146)
Observations	270	322	270	322	270	322

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth of wage share at factor cost higher than zero (WS_FC_gr > 0) and lower than zero (WS_FC_gr < 0).

Table 3: I Sensitivity Analysis, variation of wage share market price

	WS_FC_gr > 0	WS_FC_gr < 0	WS_FC_gr > 0	WS_FC_gr < 0	WS_FC_gr > 0	WS_FC_gr < 0
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.632***	0.704***	0.854***	0.816***	0.972***	0.891***
	(0.042)	(0.036)	(0.039)	(0.036)	(0.037)	(0.039)
HC	0.158*	-0.033	-0.011	-0.025	-0.066	-0.034
	(0.092)	(0.073)	(0.077)	(0.068)	(0.070)	(0.068)
IR	0.135***	-0.083***	0.106***	-0.009	0.076**	0.001
	(0.041)	(0.031)	(0.034)	(0.030)	(0.031)	(0.030)
TO	0.086***	0.114***	0.068***	0.099***	0.020	0.072***
	(0.022)	(0.020)	(0.019)	(0.019)	(0.017)	(0.019)
CC	-2.230***	-0.932**	-1.400***	-0.337	-1.201***	-0.248
	(0.343)	(0.413)	(0.293)	(0.390)	(0.266)	(0.382)
WS_MP	0.381**	-1.148***	0.210	-0.718***	0.168	-0.561***
	(0.156)	(0.117)	(0.130)	(0.120)	(0.117)	(0.122)
TFP			0.774***	0.617***		
			(0.061)	(0.073)		
TFP_K					1.880***	0.940***
					(0.174)	(0.164)
TFP_E					0.204	0.463***
					(0.139)	(0.146)
Observations	265	324	265	324	265	324

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth of wage share at factor cost higher than zero (WS_FC_gr > 0) and lower than zero (WS_FC_gr < 0).

4.3. II Sensitivity Analysis

For this sensitivity analysis, instead of examining whether the growth of wage share at factor cost is positive or negative, we will interpret the results based on whether the growth rate of wage share at factor cost is higher or lower than that of TFP. This involves a comparison between wage share and the overall efficiency level of production.

Tables 4 and 5 exhibit similar patterns, with a slight distinction in the control variable: wage share at factor cost in Table 4 and at market price in Table 5. When the growth rate of wage share exceeds that of total factor productivity, we observe a positive connection with inflation rate, indicating its noteworthy significance. This can be attributed to the fact that even if interest rates rise to stabilize inflation, leading to a reduction in consumption, firms can still find ways to enhance their efficiency.

Conversely, when the growth rate of wage share falls below that of total factor productivity, we find a significant positive link with human capital. This suggests the necessity to enhance education, training, and skills of workers when wages are below the efficiency level.

Turning to collective consumption, it consistently exhibits a negative influence, but this effect is most pronounced when the growth rate of wage share is lower than total factor productivity. These negative values imply that public expenditure should be minimized across all scenarios, particularly when wages are below the efficiency level.

Wage share at factor cost shows a significant negative impact when its growth rate is lower than total factor productivity, although this impact is less negative than when it was below zero. Nonetheless, wage share still exerts a negative impact when it falls below the efficiency level.

Total factor productivity of labor displays a significant positive result when the growth rate of wage share is lower than that of total factor productivity. This implies that enhancing labor efficiency is crucial when the wage share growth rate lags behind the overall efficiency level.

Examining trade openness, it consistently presents positive and significant values, indicating its positive influence. Similarly, total factor productivity of capital consistently shows positive and significant values, signifying that enhancing capital efficiency consistently yields positive impacts.

Table 4: II Sensitivity Analysis, wage share factor cost vs total factor productivity

	WS_FC_gr_r > TFP	WS_FC_gr_r < TFP	WS_FC_gr_r > TFP	WS_FC_gr_r < TFP	WS_FC_gr_r > TFP	WS_FC_gr_r < TFP
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.434***	0.735***	0.736***	0.836***	0.884***	0.902***
	(0.048)	(0.026)	(0.057)	(0.026)	(0.057)	(0.027)
HC	-0.347***	0.271***	-0.123	0.151***	-0.091	0.107**
	(0.132)	(0.056)	(0.122)	(0.053)	(0.114)	(0.052)
IR	0.132***	-0.064**	0.125***	-0.013	0.094**	-0.006
	(0.050)	(0.027)	(0.045)	(0.025)	(0.043)	(0.025)
TO	0.116***	0.118***	0.108***	0.095***	0.042*	0.069***
	(0.028)	(0.017)	(0.025)	(0.015)	(0.025)	(0.015)
CC	-1.416***	-1.261***	-0.948*	-0.796***	-0.748	-0.730***
	(0.540)	(0.294)	(0.493)	(0.274)	(0.464)	(0.266)
WS_FC	0.454***	-0.650***	0.289*	-0.419***	0.190	-0.316***
	(0.167)	(0.081)	(0.153)	(0.076)	(0.144)	(0.075)
TFP			0.813***	0.614***		
			(0.098)	(0.056)		
TFP_K					1.824***	1.009***
					(0.262)	(0.129)
TFP_E					0.382*	0.424***
					(0.217)	(0.116)
Observations	185	427	185	427	185	427

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth rate of wage share at factor cost higher than growth rate of total factor productivity (WS_FC_gr_r > TFP) and lower than growth rate of total factor productivity (WS_FC_gr_r < TFP).

Table 5: II Sensitivity Analysis, wage share market price vs total factor productivity

	WS_FC_gr_r > TFP	WS_FC_gr_r < TFP	WS_FC_gr_r > TFP	WS_FC_gr_r < TFP	WS_FC_gr_r > TFP	WS_FC_gr_r < TFP
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.422***	0.770***	0.693***	0.857***	0.829***	0.926***
	(0.051)	(0.026)	(0.058)	(0.025)	(0.059)	(0.027)
HC	-0.486***	0.263***	-0.258**	0.159***	-0.202*	0.105**
	(0.134)	(0.054)	(0.124)	(0.050)	(0.117)	(0.049)
IR	0.153***	-0.069**	0.134***	-0.013	0.101**	-0.005
	(0.048)	(0.027)	(0.044)	(0.025)	(0.042)	(0.025)
TO	0.117***	0.113***	0.113***	0.095***	0.049**	0.071***
	(0.028)	(0.017)	(0.025)	(0.015)	(0.025)	(0.015)
CC	-1.858***	-1.182***	-1.211**	-0.709***	-0.849*	-0.657**
	(0.538)	(0.295)	(0.493)	(0.274)	(0.468)	(0.266)
WS_MP	0.655***	-0.655***	0.405**	-0.404***	0.273	-0.295***
	(0.193)	(0.087)	(0.177)	(0.082)	(0.168)	(0.081)
TFP			0.722***	0.639***		
			(0.094)	(0.055)		
TFP_K					1.703***	1.060***
					(0.270)	(0.128)
TFP_E					0.278	0.429***
					(0.209)	(0.115)
Observations	175	437	175	437	175	437

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth rate of wage share at factor cost higher than growth rate of total factor productivity (WS_FC_gr_r > TFP) and lower than growth rate of total factor productivity (WS_FC_gr_r < TFP).

Table 6: II Sensitivity Analysis, wage share factor cost vs total factor productivity, capital share

	WS_FC_gr_r > TFP_K	WS_FC_gr_r < TFP_K	WS_FC_gr_r > TFP_K	WS_FC_gr_r < TFP_K	WS_FC_gr_r > TFP_K	WS_FC_gr_r < TFP_K
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.613***	0.654***	0.812***	0.756***	0.927***	0.858***
	(0.039)	(0.034)	(0.040)	(0.033)	(0.042)	(0.035)
HC	-0.069	0.162**	-0.114	0.149**	-0.105	0.091
	(0.090)	(0.067)	(0.080)	(0.061)	(0.077)	(0.060)
IR	0.130***	-0.086***	0.119***	-0.018	0.084**	-0.013
	(0.043)	(0.029)	(0.038)	(0.027)	(0.037)	(0.026)
TO	0.121***	0.122***	0.107***	0.097***	0.076***	0.051***
	(0.023)	(0.020)	(0.021)	(0.018)	(0.020)	(0.019)
CC	-2.049***	-1.411***	-1.233***	-0.836**	-0.997***	-0.724**
	(0.369)	(0.367)	(0.339)	(0.336)	(0.328)	(0.326)
WS_FC	0.409***	-0.945***	0.279**	-0.572***	0.166	-0.436***
	(0.140)	(0.097)	(0.125)	(0.095)	(0.121)	(0.095)
TFP			0.746***	0.644***		
			(0.068)	(0.063)		
TFP_K					1.603***	1.217***
					(0.191)	(0.147)
TFP_E					0.270*	0.308**
					(0.160)	(0.130)
Observations	274	338	274	338	274	338

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth rate of wage share at factor cost higher than growth rate of total factor productivity, capital share (WS_FC_gr_r > TFP_K) and lower than growth rate of total factor productivity, capital share (WS_FC_gr_r < TFP_K).

Table 7: II Sensitivity Analysis, wage share market price vs total factor productivity, capital share

	WS_FC_gr_r > TFP_K	WS_FC_gr_r < TFP_K	WS_FC_gr_r > TFP_K	WS_FC_gr_r < TFP_K	WS_FC_gr_r > TFP_K	WS_FC_gr_r < TFP_K
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.611***	0.680***	0.836***	0.774***	0.956***	0.872***
	(0.041)	(0.031)	(0.041)	(0.031)	(0.043)	(0.034)
HC	-0.199**	0.081	-0.133*	0.047	-0.104	0.017
	(0.090)	(0.056)	(0.079)	(0.051)	(0.076)	(0.051)
IR	0.145***	-0.099***	0.108***	-0.030	0.068*	-0.020
	(0.044)	(0.028)	(0.039)	(0.027)	(0.038)	(0.026)
TO	0.113***	0.117***	0.100***	0.099***	0.067***	0.059***
	(0.024)	(0.018)	(0.021)	(0.017)	(0.021)	(0.017)
CC	-1.687***	-1.790***	-0.907***	-1.137***	-0.763**	-0.944***
	(0.389)	(0.351)	(0.351)	(0.329)	(0.336)	(0.323)
WS_MP	0.532***	-1.055***	0.217	-0.698***	0.082	-0.515***
	(0.163)	(0.098)	(0.147)	(0.098)	(0.141)	(0.100)
TFP			0.789***	0.588***		
			(0.069)	(0.062)		
TFP_K					1.664***	1.182***
					(0.195)	(0.148)
TFP_E					0.318*	0.278**
					(0.166)	(0.124)
Observations	259	353	259	353	259	353

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth rate of wage share at factor cost higher than growth rate of total factor productivity, capital share (WS_FC_gr_r > TFP_K) and lower than growth rate of total factor productivity, capital share (WS_FC_gr_r < TFP_K).

Moving on to the examination of Tables 6 and 7, we continue with the same methodology, but now we compare the wage share growth rate with the total factor productivity of capital share. This means we are now assessing situations where wage share growth is either below or above the efficiency of capital production.

When the growth rate of wage share at factor cost surpasses the total factor productivity of capital, we once again observe a positive and highly significant connection with inflation rate, albeit with slightly lower values compared to the analysis of previous tables. This leads us to the same conclusions as before regarding this control variable.

However, when the growth rate of wage share at factor cost falls below the total factor productivity of capital, wage share at factor cost exhibits negative and significant values. This indicates a detrimental impact when the wage share growth rate is below the efficiency level of capital.

Furthermore, with the growth rate of wage share at factor cost below that of total factor productivity of capital, we find that total factor productivity of labor remains positive and significant, although to a slightly lesser degree. This underscores the continued importance of enhancing labor efficiency when the growth rate of wage share falls below the efficiency level of capital.

In terms of trade openness, collective consumption, and total factor productivity of capital, these three variables consistently demonstrate similar values, irrespective of whether the growth rate of wage share at factor cost is higher or lower than the total factor productivity of capital.

Trade openness consistently displays positive and significant values, aligning with observations in previous tables. Collective consumption exhibits negative and significant values, with even greater strength than in the preceding tables, reaffirming previous findings. Total factor productivity of capital maintains its positive and significant stance, emphasizing that improving the efficiency of capital production will yield positive outcomes.

Analyzing the outcomes presented in Tables 8 and 9, we note that when the growth rate of wage share at factor cost falls below the total factor productivity of labor share, there is a positive relationship with human capital, and this is consistently significant. As seen earlier, this implies a need for increased investment in education, training, and skills development of workers to align with the efficiency level.

However, in Table 9, when we introduce wage share at market price as the control variable, it loses significance when the growth rate of wage at factor cost is lower than the total factor productivity of labor. Conversely, it gains some significance when the growth rate exceeds total factor productivity of labor. This suggests that the focus on education, training, and skills development of workers could be relatively less intensive.

Wage share at market price exhibits a behavior similar to wage share at factor cost, but with stronger values and greater significance, particularly when the growth rate of wage share at factor cost is higher than the total factor productivity of labor. This indicates that indirect taxes have a positive effect when wage share growth exceeds the efficiency level of labor.

With wage share at market price as the control variable, total factor productivity of labor becomes significant regardless of whether the growth rate of wage share at factor cost is higher or lower than the total factor productivity of labor. This underscores the consistent positive impact of increasing labor efficiency, especially when considering wages at market price.

In summary, within this segment of analysis, it's evident that higher levels of trade openness consistently yield positive benefits for the economy. Similarly, enhancing the efficiency of capital is advantageous, without necessitating an increase in capital share.

Conversely, a reduction in public expenditure makes a positive contribution to economic well-being. Policies aimed at boosting the education and skill development of workers should be prioritized when the wage share growth rate falls below the levels of TFP or TFP of labor. However, when the wage share growth surpasses the efficiency of labor, these policies may have a detrimental impact on economic growth and should be reconsidered.

Additionally, promoting the efficiency of labor proves beneficial to the economy in all scenarios, especially when considering wage share at market prices in comparison to the growth rate of wage share at factor cost in relation to total factor productivity of labor.

Table 8: II Sensitivity Analysis, wage share factor cost vs total factor productivity, labor share

	WS_FC_gr_r > TFP_E	WS_FC_gr_r < TFP_E	WS_FC_gr_r > TFP_E	WS_FC_gr_r < TFP_E	WS_FC_gr_r > TFP_E	WS_FC_gr_r < TFP_E
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.551***	0.750***	0.821***	0.846***	0.950***	0.904***
	(0.045)	(0.028)	(0.047)	(0.027)	(0.045)	(0.029)
HC	-0.186	0.185***	-0.085	0.121**	-0.131	0.084
	(0.120)	(0.060)	(0.104)	(0.056)	(0.094)	(0.055)
IR	0.124***	-0.049*	0.097**	0.014	0.067*	0.017
	(0.046)	(0.030)	(0.040)	(0.028)	(0.036)	(0.027)
TO	0.076***	0.116***	0.079***	0.090***	0.031	0.068***
	(0.027)	(0.018)	(0.023)	(0.017)	(0.021)	(0.017)
CC	-2.036***	-1.312***	-1.092***	-0.855***	-0.681*	-0.845***
	(0.481)	(0.326)	(0.423)	(0.303)	(0.384)	(0.295)
WS_FC	0.431***	-0.698***	0.227*	-0.391***	0.148	-0.295***
	(0.156)	(0.093)	(0.136)	(0.091)	(0.122)	(0.090)
TFP			0.811***	0.622***		
			(0.078)	(0.060)		
TFP_K					1.949***	0.983***
					(0.203)	(0.141)
TFP_E					0.225	0.414***
					(0.157)	(0.127)
Observations	203	408	203	408	203	408

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth rate of wage share at factor cost higher than growth rate of total factor productivity, labor share (WS_FC_gr_r > TFP_E) and lower than growth rate of total factor productivity, labor share (WS_FC_gr_r < TFP_E).

Table 9: II Sensitivity Analysis, wage share market price vs total factor productivity, labor share

	WS_FC_gr_r > TFP_E	WS_FC_gr_r < TFP_E	WS_FC_gr_r > TFP_E	WS_FC_gr_r < TFP_E	WS_FC_gr_r > TFP_E	WS_FC_gr_r < TFP_E
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
lnrgdppc t-1	0.538***	0.785***	0.800***	0.872***	0.920***	0.927***
	(0.048)	(0.028)	(0.046)	(0.027)	(0.043)	(0.029)
HC	-0.320**	0.097*	-0.164	0.071	-0.194*	0.041
	(0.135)	(0.054)	(0.112)	(0.050)	(0.099)	(0.049)
IR	0.126***	-0.064**	0.098***	0.001	0.074**	0.007
	(0.046)	(0.029)	(0.038)	(0.027)	(0.033)	(0.027)
TO	0.099***	0.099***	0.092***	0.084***	0.034*	0.060***
	(0.027)	(0.017)	(0.022)	(0.016)	(0.020)	(0.016)
CC	-1.820***	-1.348***	-1.086***	-0.625*	-0.877***	-0.621**
	(0.426)	(0.339)	(0.356)	(0.319)	(0.315)	(0.311)
WS_MP	0.548***	-0.852***	0.294**	-0.505***	0.214	-0.409***
	(0.180)	(0.096)	(0.150)	(0.094)	(0.133)	(0.093)
TFP			0.813***	0.626***		
			(0.073)	(0.060)		
TFP_K					1.706***	0.974***
					(0.195)	(0.141)
TFP_E					0.422***	0.435***
					(0.162)	(0.124)
Observations	191	420	191	420	191	420

Notes: (a) The dependent variable is the neperian logarithm of real GDP per capita; (b) All estimations were obtained by first-differences Generalized Method of Moments; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively; (f) We consider two different constraints: growth rate of wage share at factor cost higher than growth rate of total factor productivity, labor share (WS_FC_gr_r > TFP_E) and lower than growth rate of total factor productivity, labor share (WS_FC_gr_r < TFP_E).

5. Conclusions

For many decades, labor share received limited attention, largely attributed to models suggesting a stable wage share and a common initial perception on technological progress. However, a structural shift occurred, reigniting interest in the study of this topic to better comprehend its impact on economic growth. Alcobia and Barradas (2022) working paper showed that most European countries operate on a wage-led economic model. This implies that some of the policies being implemented may not be the most effective. In response, a panel analysis was conducted for 27 EU countries spanning from 1995 to 2019 to shed light on how wage share influences economic growth.

In the empirical analysis, a first-differences GMM estimations were employed to analyze the effects of labor share on economic growth. The investigation aimed to uncover the relationship between labor share and economic growth by utilizing the following explanatory variables: real GDP per capita, human capital, inflation rate, trade openness, public consumption, wage share at factor cost and market price, total factor productivity, and the discrimination of TFP between capital and labor. To gain a deeper understanding of how labor share impacts economic growth, the analysis is divided into three key segments. We commence by examining a baseline results impacting on real GDP per capita. Following this, we further explore two distinct sensitivity analyses. The first assesses the growth of wage share in relation to its inherent value, whether positive or negative. The second compares the growth rate of wage share with total factor productivity, allowing us to interpret results when wages are either above or below the efficiency level, and thus make policy recommendations accordingly.

Through our analyses, it's clear that increasing wage share positively impacts real GDP per capita. Importantly, this rise in wages doesn't necessarily require a simultaneous increase in human capital. Additionally, boosting the inflation rate when wage share growth is positive leads to positive outcomes. Contrarily, when wage share growth is negative, indirect taxes have a negative impact.

In cases where the growth rate of wage share falls behind TFP or TFP of labor, it's advisable to promote human capital development. However, once wage share growth surpasses TFP or TFP of labor, a reevaluation of these policies may be warranted. This could be because workers' wages may not align with their efficiency levels, making additional education or training unnecessary.

Trade openness consistently benefits the economies of the selected countries, indicating that an increase in trade activities is advantageous. On the other hand, collective consumption has an overall negative impact on the economy, suggesting that public spending should be used prudently and only when necessary.

Furthermore, total factor productivity consistently has a positive impact on economic growth, emphasizing the importance of continually striving for enhanced resource efficiency.

In conclusion, the majority of European countries have transitioned towards a wage-led economic model. This suggests that policies to promote an increase of wages should be adopted without necessarily increasing the level of education further. We can increase the efficiency of labor, and capital as well but this does not imply an increase of capital share. Policies promoting a better use of the existing resources of capital should be adopted, instead of promoting policies that generate more capital.

Besides these conclusions, we recommend further exploration of this topic, expanding the analysis beyond countries and considering alternative methodologies for a more comprehensive understanding.

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Appendix

Table A1: Synthesis of Empirical Literature Review

Reference	Sample	Methodology	Results	Comments
Alcobia and Barradas (2022)	Portugal 1970 – 2020	- Labor share exogenous (structural approach) - Aggregative approach - GMM Estimator	**(i)** Economic growth depends: - Labor share (+) - Lagged growth rate of real gross domestic product per capita (+) - Inflation rate (-) - Government spending (-) - Educational attainment (-) - Degree of trade openness (+) **(ii)** ↑w ⇒ ↑c > ↓I (↑Util. < ↑Profit) ⇒ economic growth wage-led ↑c < ↓I lower economic growth profit-led	- instrument variables ≥ independent variables - instrument variables are exogenous and strongly correlated to independent variables
IMF and WBG (2015)	OECD countries 1990 - 2009	- Econometric method, arrays: cross industry, cross country, time series - GMM Estimator	**(i)** Trend in labor share ⇒ C (-); I (-); X (-); G (-) **(ii)** ↓ Labor share income; ↓ Labor share compensation **(iii)** ↑capital share ⇏ ↑I **(iv)** Labor share is countercyclical at economic downturn moments	- Some information about adjusted and unadjusted labor share - Possible main responsible about ↓LS - Some information about substitution of labor by capital (ICT & TFP)

Reference	Sample	Methodology	Results	Comments
Freeman (2011)	USA 2003 – 2010	- Proposed methodology: Labor Income (following Jorgenson, Ho, Samuels 2010 and Young 1995) - DataFerret (microdata set), arrays: age, education, industry, sex	**(i)** self-employed tend to underreport their income, this information may conflict for LS because it might not be possible to distinguish capital earnings **(ii)** agriculture is the sector with higher self-employment **(iii)** average hourly labor income of self-employed = to an employee with the same age and sex attributes, same level of education and working in the same industry	- Reasons for self-employed underreport their income - Labor compensation formula
McKinsey Global Institute (2019)	USA	DuPont type decomposition	**(i)** Super cycles and boom-bust effect justify 1/3 of ↑CS **(ii)** ↑investment on R&D and intangible capital and the classic substitution of labor contributes to ↑CS **(iii)** ↑dep has a huge roll on ↓LS because: ↑dep ⇒ ↓margins ⇒ less to be distributed between labor and capital	- 5 main reasons for the decrease in LS in US - Detailed analyses by work sectors
Abreu (2019)	Portugal 1960 - 2017	Regression Linear Model: $\Delta(WSt - WSt\text{-}1) = b0 + b1Gt + b2Ut + b3\pi t + et$	**(i)** 1960 - 1975: negative correlation between PIB growth and LS **(ii)** 1976 - 1996: negative correlation between inflation rate and LS **(iii)** 1997 - 2017: negative correlation between unemployment and LS	History of this empirical topic in Portugal

Reference	Sample	Methodology	Results	Comments
Atkinson (2009)	UK 1954 - 2005	Macroeconomic Model: Variation of income (labor vs capital), equations with skilled and unskilled workers	**(i)** we can analyze the elasticity between capital, skilled workers and unskilled workers with this model	- Reasons for the unmatched household income vs national accounts - Earned income vs unearned income
Autor and Salomons (2018)	19 countries 1990 - 2007	Macroeconomic Model using TFP within and across industries	**(i)** cannot distinguish contributions on productivity growth of automation vs non-automation **(ii)** technology progress is employment augmenting in the aggregate **(iii)** fraction on the reallocation of employment across industries and aggregate fall in LS over the last three decades	- Very detailed macroeconomic model: hours labor input vs labor-share value added - LS value added within and across industries; within industry direct effect of TFP growth on own industry outcome
Autor et al. (2017)	USA 1982 - 2012 (comparison to some European countries)	- Macroeconomic Model regarding Superstar firms - OLS regression estimate for six sectors individually	**(i)** More productive firms get higher share of profits in value added, hence LS decrease **(ii)** concentration of companies in industry have been increasing over time **(iii)** reallocation and incumbent component contribute negatively to LS **(iv)** industry concentration & patenting intensity are positively correlated **(v)** ↓technology diffusion & ↑ concentration ⇒ ↓ LS	- ↓ LS ⇒ reallocation between firms > within firms; model analyzes including S (survivors), X (exitors) and E (entrants) - Barkai (2016) is a complement to this paper

Reference	Sample	Methodology	Results	Comments
Cantante (2014)	Portugal	-	-	Comments about politics, fiscal measures and other motives which are behind internal and global inequality
Dafermos and Papatheodorou (2015)	-	- Model linking Personal and Functional income through a matrix - 4 agents: Households, Firms, Unemployment Fund and Commercial Banks - 3 income inequality indices: Gini coefficient, squared coefficient of variation and Atkinson index - Income sources: Labor, unemployment benefits, profits and interests	**(i)** ↑wls ⇒ ↓inequality in SR but ↑inequality in LR **(ii)** ↑dividend ⇒ ↑inequality in SR and LR	- References to Checchi & Garcia-Penalosa Model and Palley Model - Appendixes with numerical simulations reaching steady state conditions - 2 different cases regarding sensitivity of investment rate to rate of retained profits and to the rate of utilization
Guerriero (2012)	89 countries 1970 - 2009	Six different measures of LS have been computed and compared	**(i)** ↓LS since 1980s **(ii)** LS is not directly related to the stages of economic development **(iii)** positive relationship between LS and employment **(iv)** LS in Europe has low fluctuation, in opposition Asia LS has higher fluctuations	- Main problem: measuring self-employment income - Workforce classified into 6 different categories

Reference	Sample	Methodology	Results	Comments
Dünhaupt (2013)	13 OECD countries 1986 - 2007	Presentation of various Models but focusing on modern versions	**(i)** ↑interest and dividend payments ⇒ ↓LS **(ii)** financial globalization and external liabilities ⇒negative impact on wage share **(iii)** 1960s, 1970s technological progress was labor augmenting so ↑LS, 1980s onwards tech. progress was capital augmenting so ↓LS **(iv)** negative correlation between trade openness and LS **(v)** cost of reallocation: capital < labor and capital has higher return abroad ⇒↓LS **(vi)** government spending & capital control ⇒↑LS **(vii)** ↑trade shares, foreign direct investment and exchange rate crisis ⇒↓LS **(viii)** ↑capital mobility ⇒↓LS **(ix)** ↑Privatization ⇒ ↓LS	- Reference to Hecker-Ohlin Model, Stolper-Samuelson theorem, Blanchard and Giavazzi model (right to manage model) and efficient bargaining model - IMF and European Commission policy suggestions
Solow (1956)	-	-	-	Detailed Solow model and reference to the Harrod-Domar model

Reference	Sample	Methodology	Results	Comments
Giovannoni (2014)	USA 1977 - 2007	Average of four alternative mixed income apportionment methods	**(i)** LS looks relative stable when looked to % **(ii)** Sector shares had variation but overall, they cancel each other on aggregate level **(iii)** ↓manufacturing's compensation share happened because of job losses (technology displaced workers) **(iv)** ↑finance's compensation share because of average employment growth (skill biased technology change or monopoly power) **(v)** ΔLS is due to changing sector weights, if we remove composition effect it becomes more stable **(vi)** LS of the bottom 90%, 99% and 99.9% have fallen since 1980s, there is a concentration of incomes at the top	- Calls the different types of share - Different ways to account proprietors' income - Reference to Finnoff and Jayader regression model regarding correlation between Feminization and LS
OECD (2012)	OECD countries 1990 – 2007	- Shift-share Model - Econometric model LS within-industry	**(i)** ↓LS mainly within-industry due to TFP, capital deepening and ICT **(ii)** offshoring of intermediate stages production negatively related to LS **(iii)** public ownership positively related to LS **(iv)** ↓trade union density since 1990 in OECD countries **(v)** LR: ↑statutory wage ⇒ ↑productivity > ↑wages ⇒ ↓LS	Analysis excludes agriculture, mining, fuel and real estate, this is 1/3 of the economy

Table A2: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min.	Max.
lnrgdppc	675	10.303	0.491	8.939	11.635
HC	675	3.116	0.316	2.074	3.849
IR	720	0.035	0.074	-0.017	1.515
TO	756	1.164	0.631	0.371	3.881
CC	756	0.085	0.016	0.037	0.195
WS_FC	756	0.602	0.066	0.291	0.846
WS_MP	756	0.530	0.056	0.274	0.764
TFP	729	0.014	0.028	-0.127	0.215
TFP_K	729	0.001	0.017	-0.085	0.101
TFP_E	729	0.010	0.017	-0.060	0.104

Table A3: Correlation Matrix

	lnrgdppc	HC	IR	TO	CC	WS_FC	WS_MP	TFP	TFP_K	TFP_E
lnrgdppc	1.000									
HC	0.238	1.000								
IR	-0.398	-0.105	1.000							
TO	0.380	0.186	-0.101	1.000						
CC	-0.568	-0.037	0.013	-0.205	1.000					
WS_FC	0.026	-0.124	0.051	-0.341	-0.055	1.000				
WS_MP	0.022	-0.139	0.097	-0.306	-0.079	0.960	1.000			
TFP	-0.324	-0.011	0.029	0.020	0.073	-0.222	-0.220	1.000		
TFP_K	-0.108	-0.012	-0.013	0.050	0.019	-0.141	-0.152	0.809	1.000	
TFP_E	-0.274	-0.060	0.051	0.115	-0.017	-0.206	-0.189	0.843	0.588	1.000