



Issue 23/1  
October  
2023

# PRODUCTIVITY ANALYSIS ECONOMICS RESEARCH CENTRE

## INPUT COMPENSATION, INFLATION AND PRODUCTIVITY GROWTH IN CYPRUS

### SUMMARY AND POLICY CONCLUSIONS

This report examines the relationship between input compensation, productivity, and inflationary pressures in Cyprus, taking into account the implications of the Cost of Living Allowance (CoLA or ATA in Greek) mechanism. It employs fundamental economic theory to analyze patterns in labour and capital prices and their relationship with productivity growth in Cyprus. This is crucial since the relation between labour income and productivity is a key determinant of the standard of living of the employed population as well as of the distribution of income between labour and capital. Additionally, the report extends its analysis to investigate the relationship between labour income and productivity at the sectoral level. Data are from Eurostat covering the period from 1996 to 2022.

The report begins with the examination of the aggregate economy. The data indicate that the change in the compensation of the inputs fluctuates around the change in the value of their marginal product (nominal productivity). During the period between 2010 and 2016, characterized by financial crisis and substantial wage cuts, labour prices fell behind, and capital prices exceeded their nominal productivity growth. However, estimation results show that over the entire period, input compensation growth matches its nominal productivity growth.

Acknowledging that the overall economy conceals potential discrepancies between input compensation and productivity growth due to aggregation across sectors, a sector level analysis is presented. The sector-level analysis reveals significant heterogeneity, with some sectors experiencing lower labour income growth than productivity growth, while others exhibit the opposite trend. Notably, in sectors like Information & Communication (ICT) and Finance & Insurance wages do not follow the high increase in their labour productivity. Moreover, in the most recent period from 2017 to 2022, the gap between labour income and its nominal productivity growth widened for the ICT sector, and the Industry (except construction) sector's labour compensation growth fell below the change in its nominal labour productivity after 2017. This sector-level analysis underscores the necessity for tailored policies that take into account the unique dynamics within each sector. Attempting to adjust labour compensation at the aggregate level (CoLA) can exacerbate the income inequality across sectors.

The study proceeds by examining the relationship between input compensation, productivity, and inflation and emphasizes the need for caution when adjusting labour prices. The automatic link between wages and inflation has the potential to exacerbate inflationary trends. The CoLA mechanism, by ignoring changes in productivity, restricts the economy's ability to adapt to economic shocks, thereby undermining its resilience and competitiveness.

Overall, the report underscores the importance of considering productivity growth in labour compensation adjustments and recommends sector-specific policies recognizing compensation and productivity growth variations. Collaboration among policymakers, social partners, and stakeholders is crucial to striking a balance that advances economic efficiency, living standards, and protects against inflation risks.



### 1. Introduction

The debate on the reinstatement of the Cost of Living Allowance (CoLA or ATA in Greek) was settled in May 2023, when the government, trade unions and employers<sup>1</sup> agreed to set CoLA to 66.7% of last year's inflation (measured by the annual increase in the CPI)<sup>2</sup>. This adjustment was done for the public and semi-public officials and employees and for those firms that grant it. The new CoLA rate was put into effect in June 2023, while ongoing discussions aim to lead the social partners to a permanent agreement by June 2025.

Considering the ongoing inflationary pressures and the recent developments related to CoLA, this bulletin attempts to shed some light in this controversial issue. It employs economic theory to analyse the patterns of labour and capital prices as well as their relationship with productivity growth in Cyprus. This is crucial since the relation between labour income and productivity is a key determinant of the standard of living of the employed population as well as of the distribution of income between labour and capital. Data are from Eurostat for the period between 1996 and 2022.<sup>3</sup>

### 2. Data analysis

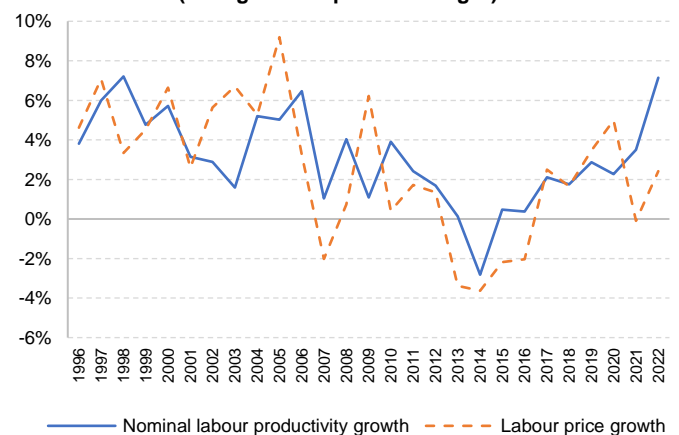
#### 2.1. Aggregate Economy

Basic economic theory dictates that the nominal price of an input equals the value of its marginal product (price of output times the marginal product). Under certain assumptions, the marginal product of labour can be considered as proportional to its labour productivity, which is defined as real output per hour of work.<sup>4</sup> The value of the marginal product of labour is then equal to the price of output times labour productivity. That is, it is equal to the nominal labour productivity. Two things related to conceptual measurement issues should be noted. Firstly that, for the price of labour the per unit compensation should be used and not just wages & salaries (compensation comprises of total wages and salaries and total employers' social contributions), and secondly, that the implicit price deflator of the economy's

value-added and not the CPI should be used for the calculation of the value of the marginal product of labour.<sup>5</sup>

Figure 1 presents the growth of labour price together with the growth of the nominal labour productivity. The nominal labour productivity growth is the sum of value-added price growth and labour productivity growth.<sup>6</sup> On average during the entire period, between 1996 and 2022, the growth in the labour price (2.63%) is close to the nominal labour productivity growth (3.10%). In contrast, between the years 2010 and 2016, the labour price growth becomes negative (-1.11%) and well below the nominal labour productivity growth (0.88%). This is not surprising given that this period the recession and the banking crisis took place, resulting in substantial wages cuts, especially in the public sector. During the latest period of the sample, between the years 2017 and 2022, nominal labour productivity recovered faster than wages, showing an average 3.28% and 2.49% growth, respectively. In all, as Figure 1 shows, with some exceptions, the growth in the labour price and nominal labour productivity growth move together.

Figure 1: Labour price and nominal (value) labour productivity (average annual percent changes)



Source: Eurostat and authors calculations

To further examine the above relationship, we estimate a simple regression equation relating the growth of labour price to the growth of the nominal labour productivity. If labour is paid according to the value of its marginal product, we expect the estimated coefficient to be equal to one. The

proportional to its productivity; it will also depend on the elasticity of substitution between capital and labour.

<sup>5</sup> See Feldstein (2008) for a discussion on the appropriate deflator.

M. Feldstein, "Did wages reflect growth in productivity?". *Journal of Policy Modeling*, 30 (2008) 591-594.

<sup>6</sup> All growth rates are based on logarithmic differences.

<sup>1</sup> Employers and Industrialists Federation (OEV) and the Cyprus Chamber of Commerce and Industry (KEVE).

<sup>2</sup> This was 8.71% in 2022.

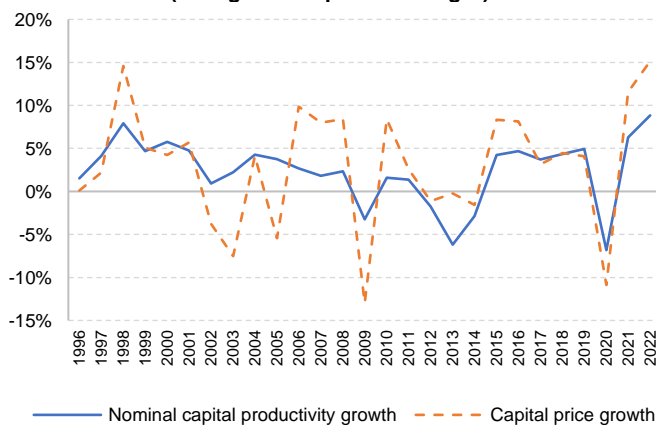
<sup>3</sup> Last update of data: March 2023.

<sup>4</sup> This will be true if the production function is a Cobb-Douglas. With a more general technology, though, the marginal product of labour is not necessarily

results show a statistically significant coefficient equal to 0.83. Further testing confirms that the hypothesis that this coefficient is equal to one cannot be rejected ( $p$ -value = 0.47)<sup>7</sup>. In addition, to account for the fact that changes in productivity depend on business cycles and are therefore not immediately reflected in compensation, we extend the specification to include a one-year lagged annual change in productivity.<sup>8</sup> The sum of the estimated productivity coefficients is equal to 1.02 and again the hypothesis that their sum is equal to one cannot be rejected ( $p$ -value = 0.93). Estimation results thus show that on average, at the economy level, labour's unit compensation growth matches its nominal productivity growth.

Given that income is distributed between labour and capital, investigating the behaviour of the other input of production, capital, is also necessary. Figure 2 presents, the relationship between the growth in capital's price<sup>9</sup> and the growth of its marginal revenue product (the nominal capital productivity growth)<sup>10</sup>.

**Figure 2: Capital price and nominal (value) capital productivity (average annual percent changes)**



Source: Eurostat and authors calculations

Figure 2 illustrates that capital price growth fluctuates around its nominal capital productivity growth. On average, spanning from 1996 to 2022, capital price and nominal

capital productivity growth stood at 3.14% and 2.44%, respectively. In contrast to labour, during the recession years (between 2010 and 2016), the growth in capital price (3.51%) was higher than nominal capital productivity growth (0.15%). However, the change in the marginal product of capital is underestimated relative to its productivity growth. A closer examination of the data reveals that during this period, capital expands more rapidly than labour, signifying a substitution of labour with capital.

To test the relationship between the growth in capital price and the growth of its nominal productivity, the study employs the same regression analysis applied to labour over the entire sample period. The results show a coefficient of 1.32 for the relationship between the two. Similar to the labour analysis, the hypothesis that this coefficient equals one cannot be rejected in the case of capital (with a  $p$ -value of 0.21).

In summary, spanning the years from 1996 to 2022, the econometric analysis supports that, at the economy level, both inputs, labour and capital, received compensation closely aligned with the value of their respective marginal products.

## 2.2. Sectorial trends

The overall economy hides potential disparities between input compensation and productivity growth because it represents a weighted average across sectors. This section analyses the labour price and productivity growth trends across different sectors.

Table 1 displays the labour price and nominal labour productivity growth rates for the private sectors of the economy, covering the entire sample period (1996–2022) and the more recent period from 2017 to 2022.<sup>11</sup> According to the data, in most sectors, labour's compensation growth was higher than the growth of the value of marginal product throughout the entire period. Exceptions to this trend are

<sup>7</sup> All testing is conducted at a 95% confidence level.

<sup>8</sup> See Feldstein (2008). M. Feldstein, "Did wages reflect growth in productivity?". *Journal of Policy Modeling*, 30 (2008) 591–594.

<sup>9</sup> Calculated residually by subtracting from the value of output the compensation of labour and dividing by the capital stock. Details on most of the variables can be found in the latest productivity bulletin: Issue 22/1 – December 2022. You can find all previous bulletins on "Productivity Analysis" on the Economics Research Website: <https://www.ucy.ac.cy/erc/productivity-analysis/?lang=en>

<sup>10</sup> The capital stock is calculated using the perpetual inventory method with a constant depreciation rate of 7%. Capital productivity is then defined as the output–capital ratio.

<sup>11</sup> The public sector has been omitted from the sectorial analysis because of measurement issues related to the output and inputs in the sector. Unlike the private sector, the public sector often deals with intangible inputs and outputs that are difficult to quantify. Many public sector services, such as education, healthcare, and public safety, are considered non–market goods. These services do not have well–defined market prices, making it difficult to measure their value in monetary terms.

observed in the Information & Communication (ICT), Finance & insurance, and Arts, entertainment, and recreation sectors. It is worth emphasizing that, although, the ICT and the Finance & Insurance show, on average, the highest nominal labour productivity growth, labour compensation does not keep pace with their high productivity.

When focusing solely on the most recent period from 2017 to 2022, the gap between the growth in labour prices and the value of its marginal product widens significantly for the ICT sector. Moreover, in contrast to the entire period, the growth in Industry's (except construction) labour compensation fell below its nominal productivity growth after 2017. Similarly, the Construction and Professional, scientific, and technical activities sectors also experience lower compensation growth compared to the growth in the value of their marginal product during the latest period. On the contrary the compensation growth in the Arts, entertainment, and recreation sector becomes higher than its productivity growth after 2017.

**Table 1: Labour price and nominal (value) labour productivity (average annual percent changes)**

Period	1996-2022		2017-2022	
	Labour price	Nominal labour productivity	Labour price	Nominal labour productivity
Agriculture, forestry and fishing*	3.50	2.06	3.26	2.66
Industry (except construction)	4.12	3.95	2.15	6.14
Construction	2.14	1.59	1.41	1.94
Wholesale & retail trade, transport, accommodation and food service activities	2.49	2.14	2.62	2.40
Information and communication	2.94	4.91	-0.23	4.82
Financial and insurance activities	3.03	5.27	2.07	3.63
Real estate activities	3.18	1.55	3.02	-0.89
Prof. scientific and tech activities; adm. & support services	2.00	1.94	1.34	2.58
Arts, entertainment and recreation; other activities	0.03	0.62	2.26	0.33

Source: Eurostat and authors calculations.

\*The results for the Agriculture sector should be interpreted with caution: labour hours in the sector are overstated, as a result, labour productivity is understated.

### 2.3. Inflationary pressures and input compensation

Considering the ongoing inflationary pressures and the recent developments related to CoLA or any labour compensation adjustment mechanism that overlooks productivity growth, there is a concern that this could

potentially exacerbate existing inflationary trends. Table 2 presents the growth in the implicit price deflator of value-added and its decomposition to the weighted growth of the input prices<sup>12</sup> and the Total Factor Productivity (TFP) growth.<sup>13</sup> This decomposition serves in emphasizing that caution is required when adjusting the price of labour. The adjustment should not be automatic since it does not account for changes in the price of capital and TFP growth, and it will thus generate inflation.

**Table 2: Value-added price deflator growth decomposition (average annual percent changes)**

Period	$\hat{P} = s_L \hat{P}_L + s_K \hat{P}_K - \hat{T}$			TFP
	Output price $\hat{P}$	Contribution of price of labour* $s_L \hat{P}_L$	Contribution of price of capital* $s_K \hat{P}_K$	
1996-2002	2.45	3.10	1.49	(2.14)
2003-2009	2.53	2.81	0.18	(0.46)
2010-2016	0.17	-0.66	1.33	(0.49)
2017-2022	1.84	1.46	1.94	(1.56)
1996-2022	1.75	1.69	1.21	(1.15)

Source: Eurostat and authors calculations.

\*The growth rates of the labour price ( $\hat{P}_L$ ) and capital price ( $\hat{P}_K$ ) are weighted by the revenue shares of labour ( $s_L$ ) and capital ( $s_K$ ).

On average, over the 1996–2022 period, the 1.75% growth in the output price comes from a 1.69% and 1.21% contribution of the price growth of labour and capital respectively, minus a 1.15% increase in TFP growth. In most periods, the labour price growth is the biggest contributor to the growth of the price deflator. Exception is the period between 2010 and 2016, during which the financial and banking crisis occurred resulting in wage cuts (the weighted unit labour compensation fell on average by–0.66%). In this case the upward pressure in price deflator comes from the price of capital (1.33%). Finally, note that during all periods, TFP growth is on average positive, thus helping in alleviating the inflationary pressure.

### 3. Conclusion and Policy Implications

The relation between labour income and productivity is a key determinant of the standard of living of the employed population as well as of the distribution of income between labour and capital. This bulletin examined the relationship between the inputs' prices and their productivity growth in

<sup>12</sup> The weights are the revenue shares of labour and capital, and they sum to unity.

<sup>13</sup> TFP is defined as the part of output growth that is not explained by share-weighted input growth (Törnqvist growth index), where the weights are based on two-period average input shares.



Cyprus over the period of 1996–2022. The aggregate economy analysis revealed that, on average, throughout the entire period, the change in the compensation of the inputs fluctuates around the change in the value of their marginal product (nominal productivity). During the years from 2010 to 2016, marked by financial crisis and significant wage cuts, labour prices fell behind, and capital prices exceeded their productivity growth. Overall, the estimation results confirm that over the entire period, input compensation growth matches its nominal productivity growth.

However, the total economy conceals potential discrepancies between input compensation and productivity growth due to its aggregation across sectors. Sector level analysis reveals significant heterogeneity. In some sectors the growth of labour income is lower than productivity growth while in others, the opposite trend is observed. Notably, in the Information & Communication (ICT) and Finance & Insurance sectors, labour compensation does not keep pace with their high productivity. Focusing on the most recent period from 2017 to 2022, the gap between labour income growth and the growth in the value of its marginal product was amplified for the ICT sector. Furthermore, the growth in labour compensation in the Industry (except construction) sector fell below the change in its nominal productivity after 2017.

The sector level analysis emphasizes the significant heterogeneity across sectors and underscores the need for tailored policies that account for the unique dynamics within each sector. Attempting to adjust labour compensation at the aggregate level (CoLA) can exacerbate the income inequality across sectors.

This study concludes by examining the relationship between input compensation, productivity, and inflation and emphasizes the need for caution when adjusting labour prices. The CoLA mechanism ignores changes in productivity, thereby limiting the economy's capacity to adapt to economic shocks. This, in turn, undermines resilience and competitiveness. The automatic link between wages and inflation can also potentially exacerbate inflationary trends and lead to unjust distribution of the income both across inputs and across the sectors of the economy.<sup>14</sup>

To summarize the following policy implications are outlined below:

*Caution in labour compensation adjustments:* Policymakers and social partners should exercise caution, ensuring that labour compensation adjustments consider productivity growth.

*Balancing labour and capital compensation:* Policies that encourage efficient allocation of both labour and capital resources are crucial for economic growth. This can further help mitigate inflationary risks associated with skewed compensation.

*Sector-specific policies:* Acknowledging variations in compensation and productivity trends among sectors, policymakers should adopt sector-specific approaches. Sectors with significant differences in productivity and compensation growth may require tailored approaches to ensure equitable growth and socio-economic stability. Neglecting productivity growth can lead to an inequitable income distribution across sectors.

*Enhancing labour market flexibility:* Labour market flexibility can promote efficiency and productivity growth. Policies that encourage workforce mobility and adaptation to changing economic conditions can help avoid inflationary pressures stemming from rigid labour market regulations.

In all, addressing the complex interplay between labour compensation, productivity, and inflationary pressures requires a comprehensive approach. Policymakers, social partners, and stakeholders must collaborate to strike a balance that promotes economic efficiency, enhances living standards, and protects against the potential risks of inflation.

<sup>14</sup> For a brief discussion see, IMF, 2023, "Cyprus: Staff Concluding Statement of the 2023 Article IV Mission", Mission Concluding Statement, March 30, 2023.



Issue 23/1

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ECONOMICS RESEARCH CENTRE

October 2023

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