INFLATION DYNAMICS AND THE ROLE OF DOMESTIC FACTORS

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ABSTRACT

The observed inflation differentials across euro area countries, along with the divergence between the Harmonised Index of Consumer Prices (HICP) and GDP deflator trends within countries, highlight the potential role of country-specific institutional and structural characteristics in shaping inflation dynamics in response to import price shocks. This paper investigates the role of domestic factors in shaping inflationary dynamics. It employs a Dynamic Stochastic General Equilibrium (DSGE) model to examine the macroeconomic effects of a temporary import price shock under varying degrees of real wage rigidity in the labour market. The results indicate that economies with high degrees of real wage rigidity are likely to experience higher and more persistent inflationary pressures than economies with low degrees of real wage rigidity. Real wage rigidities constrain firms from absorbing part of the higher import costs through reductions in labour costs, thus resulting in greater pass-through of input costs to final prices, which in turn generates strong and persistent inflation and adversely affects employment and output. In contrast, in economies with low real wage rigidities firms have more flexibility in managing rising import costs, thereby mitigating the negative impact on output. Additionally, the paper demonstrates a relatively straightforward methodology using national accounts data to explore the relationship between domestic factors and inflation dynamics. Case studies for the euro area and Greece reveal that the rise in domestic inflation since 2021 is largely associated with an increase in profits. Labour costs are also linked to inflationary pressures, though their contribution is relatively smaller than that of profits. In Greece, the increase in profits is primarily associated with the services sector, followed by the industry sector.

Η ΔΥΝΑΜΙΚΗ ΤΟΥ ΠΛΗΘΩΡΙΣΜΟΥ ΚΑΙ Ο ΡΟΛΟΣ ΤΩΝ ΕΓΧΩΡΙΩΝ ΠΑΡΑΓΟΝΤΩΝ

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ΠΕΡΙΛΗΨΗ

Οι χώρες της ευρωζώνης αντιμετώπισαν κατά κύριο λόγο κοινές πληθωριστικές διαταραχές μετά την πανδημία του κορωνοϊού. Ωστόσο, παρατηρούνται διαφοροποιήσεις μεταξύ των χωρών ως προς το μέγεθος και την επιμονή του πληθωρισμού, όπως μετρούνται από τον Εναρμονισμένο Δείκτη Τιμών Καταναλωτή (ΕνΔΤΚ) και τον αποπληθωριστή του ΑΕΠ. Οι διαφοροποιήσεις αυτές υποδηλώνουν ότι οι παράγοντες που καθορίζουν τη δυναμική του πληθωρισμού, καθώς οι διαταραχές διαχέονται στην οικονομία, είναι κυρίως εγχώριοι. Ο σκοπός της παρούσας μελέτης είναι να διερευνήσει το ρόλο των εγχώριων παραγόντων στη διαμόρφωση της δυναμικής του πληθωρισμού στην ευρωζώνη. Η ανάλυση αξιοποιεί εθνικολογιστικά στοιχεία για να διερευνήσει πώς συνεισφέρουν στη διαμόρφωση των εγχώριων τιμών, σε επίπεδο ευρωζώνης και ελληνικής οικονομίας, οι βασικές συνιστώσες του αποπληθωριστή του ΑΕΠ, δηλαδή τα κέρδη των επιχειρήσεων, το κόστος εργασίας και οι έμμεσοι φόροι. Επιπροσθέτως, χρησιμοποιείται ένα Δυναμικό Στοχαστικό Υπόδειγμα Γενικής Ισορροπίας για να εξεταστούν οι μακροοικονομικές επιδράσεις μιας προσωρινής διαταραχής κόστους που αυξάνει τον πληθωρισμό των τιμών των εισαγόμενων παραγωγικών εισροών, υπό διαφορετικούς βαθμούς δυσκαμψίας των πραγματικών μισθών στην αγορά εργασίας. Η οικονομία του υποδείγματος παραμετροποιείται ώστε να αντιπροσωπεύει μια τυπική μικρή ανοικτή οικονομία της ευρωζώνης, καθώς η σχετική βιβλιογραφία έχει αναδείξει ότι σε αρκετές χώρες της ευρωζώνης οι μηχανισμοί καθορισμού των μισθών χαρακτηρίζονται από καθυστερήσεις στην προσαρμογή των μισθών μετά από εξωγενείς διαταραχές.

Τα ευρήματα της μελέτης δείχνουν ότι τα κέρδη των επιχειρήσεων αποτελούν την κύρια συνιστώσα των πληθωριστικών πιέσεων από το 2021 και έπειτα, τόσο στην ευρωζώνη όσο και στην Ελλάδα. Το κόστος εργασίας σχετίζεται επίσης θετικά με την εξέλιξη του πληθωρισμού, ωστόσο, η συνεισφορά του είναι μικρότερη από αυτή των κερδών. Όσον αφορά την ελληνική οικονομία ειδικότερα, η σημαντική αύξηση των κερδών συνδέεται πρωτίστως με τον τομέα των υπηρεσιών, όπου παρατηρείται και αύξηση των περιθωρίων κέρδους. Επιπλέον, τα αποτελέσματα των προσομοιώσεων με βάση το υπόδειγμα γενικής ισορροπίας υποδηλώνουν ότι μια προσωρινή αύξηση του πληθωρισμού των τιμών των εισαγομένων προκαλεί εγχώριες πληθωριστικές πιέσεις και δυσμενείς επιπτώσεις στην οικονομική δραστηριότητα, καθώς αυξάνεται το κόστος παραγωγής των εγχώριων επιχειρήσεων. Οι οικονομίες που χαρακτηρίζονται από υψηλό βαθμό δυσκαμψίας των πραγματικών μισθών είναι πιθανότερο να αντιμετωπίσουν ισχυρότερες και πιο επίμονες πληθωριστικές πιέσεις συγκριτικά με τις οικονομίες που χαρακτηρίζονται από χαμηλότερο βαθμό δυσκαμψίας των πραγματικών μισθών. Στις χώρες με υψηλό βαθμό δυσκαμψίας των μισθών οι επιχειρήσεις αδυνατούν να απορροφήσουν το αυξημένο κόστος παραγωγής μειώνοντας το εργατικό κόστος, με αποτέλεσμα να μετακυλίεται μεγάλο μέρος του αυξημένου κόστους παραγωγής στις τελικές τιμές. Αντιθέτως, στις οικονομίες με χαμηλό βαθμό δυσκαμψίας των πραγματικών μισθών, οι επιχειρήσεις έχουν μεγαλύτερη ευελιξία στη διαχείριση των αυξημένων τιμών των εισαγομένων, με αποτέλεσμα να μετριάζονται τόσο η ένταση των πληθωριστικών πιέσεων όσο και οι αρνητικές επιδράσεις στην παραγωγή και την απασχόληση.

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1 INTRODUCTION

From 2021 onwards, inflation surged globally to levels not seen for decades in many advanced economies. These strong inflationary pressures were fuelled by a sequence of adverse demand and supply shocks that hit economies worldwide. On the demand side, the literature identifies factors such as pent-up demand for goods and services following COVID-19-related restrictions and lockdowns, as well as large-scale fiscal policy stimulus and accommodative monetary policy aimed at mitigating the adverse effects of the pandemic on households and businesses. On the supply side, soaring energy and commodity prices – largely attributed to the Russian invasion of Ukraine – along with supply chain disruptions and raw material shortages significantly contributed to inflationary pressures. Supply-side shocks, particularly those related to the prices of imported inputs, have been identified as significant drivers of the observed inflation, especially in euro area countries.[1]

Although euro area countries were exposed to largely common inflationary shocks, the magnitude and persistence of inflation dynamics, as measured by the Harmonised Index of Consumer Prices (HICP) and changes in the GDP deflator, varied across Member States. The divergence in inflation dynamics across countries becomes even more apparent when considering changes in the GDP deflator. Unlike the HICP, which is heavily influenced by import price shocks, such as those in energy prices, the GDP deflator captures price changes in domestically-produced goods and services, offering insights into inflationary pressures linked to domestic factors.[2]

The observed inflation differentials across euro area countries, as well as the divergence between HICP and GDP deflator trends within countries, highlight the potential role of country-specific institutional and structural characteristics in shaping inflation dynamics. Thus, while the initial inflation surge in the euro area was largely imported, the magnitude and persistence of inflation as inflationary shocks propagate through the economy appear to be heavily influenced by country-specific characteristics. These include institutional and structural factors, such as labour market institutions, firms' pricing mechanisms, the degree of competition in product markets and the flexibility of labour markets. In this context, the relevant literature emphasises that price and wage rigidities significantly affect the channels through which exogenous shocks are transmitted to the domestic economy, thereby influencing the dynamic evolution of inflation.[3] Price rigidities refer to the slow adjustment of prices in response to changing market conditions, while wage rigidities primarily arise from institutional factors that delay wage adjustments.

To clarify the argument that the presence of price and wage rigidities matters for the trans-

1 Most of the literature suggests that the strong inflationary pressures which prevailed worldwide since 2021 primarily came from supply-side shocks (see, e.g., Lane 2022; Ball et al. 2022; Shapiro 2024; Blanchard and Bernanke 2023; Blanchard and Bernanke 2024; Ascari et al. 2024; Arce et al. 2024 and Bańbura et al. 2023). For instance, Bańbura et al. (2023) find that bottlenecks in global supply chains and elevated energy prices played a prominent role and contributed significantly to the strong inflationary pressures in 2021 and 2022 in many advanced economies. On the other hand, Giannone and Primiceri (2024) suggest that the surge in prices was driven by unexpected demand-side factors, i.e. the stronger than initially expected rebound in aggregate demand, as well as the unusually accommodative monetary policy.

2 See Coutinho and Licchetta (2023) and Buelens (2023) for a discussion regarding inflation differentials in the euro area.

3 See, for example, Christiano et al. (2005), Galí and Gertler (1999) and Blanchard and Galí (2007) for the role of price and wage rigidities in the propagation of exogenous shocks in the context of dynamic stochastic general equilibrium models.

mission of exogenous shocks to the economy, let us consider the propagation mechanism following a shock that increases the prices of imported intermediate inputs. First, soaring raw material import prices exert upward pressure on the production costs of firms. Then, in an effort to safeguard their profit margins, firms have an incentive to pass through these higher costs to domestic prices, thereby generating upward pressure on domestic inflation. If prices are sticky, firms cannot adjust their prices immediately, delaying the full transmission of the shock to final prices. If wages are rigid as well, firms cannot absorb part of the increased input costs by reducing labour costs. Consequently, they pass the higher production costs through to final prices and/or reduce production and labour demand to protect their profit margins. Over time, as firms gradually adjust their prices, the shock propagates through the economy via secondary effects on wages and labour costs. Rising prices may lead to higher wage demands, further increasing firms' costs and prolonging inflation. These dynamic interactions between labour costs and output prices can potentially create a wage-price spiral, where prices and wages feed into each other, resulting in persistently higher inflation.[4] In this context, higher domestic inflation, as captured by the GDP deflator, is related with increases in profit shares and labour costs (see, e.g., Colonna et al. 2023 and Bouras et al. 2023).

Against this background, the objective of this paper is to investigate the role of domestic factors in shaping inflationary pressures. To this end, we adopt the following approach. First, we analyse inflation dynamics in the euro area, as measured by the HICP and the GDP deflator, through a cross-country comparison of selected euro area countries, highlighting the observed inflation differentials. Next, we demonstrate how a relatively straightforward methodology using national accounts data can be applied to analyse the relationship between domestic factors and inflation dynamics. Specifically, we break down the GDP deflator into its main components, profits, labour costs and indirect taxes, to assess their contributions to domestic infla-

tion. In this context, we also analyse firms' pricing behaviour using markup proxies derived from national accounts data. As case studies for this exercise, we focus on the euro area and the Greek economy. Greece serves as an illustrative example, having experienced a sharp and rapid increase in domestic prices following the rise in the prices of imported inputs. Additionally, it stands out among euro area countries for its relatively high reliance on imported intermediate inputs (see Papageorgiou 2021).

Second, we use a Dynamic Stochastic General Equilibrium (DSGE) model to examine the macroeconomic effects of a temporary cost-push shock that increases import price inflation under different degrees of real wage rigidity in the labour market. Our focus on the role of real wage rigidities in shaping domestic inflation dynamics is motivated by the relevant literature, which highlights the fact that many euro area countries are characterised by wage-setting schemes that involve delays in wage adjustments following exogenous shocks (see, e.g., Beschin et al. 2024 and Branten et al. 2018).[5] The model is calibrated to represent a typical small open economy within the euro area. First, we analyse the macroeconomic effects following the import price shock and then we investigate the role of real wage rigidities in influencing the propagation mechanism.

This paper relates and contributes to two strands of literature. The first regards the effects of import price shocks on domestic inflation in the context of general equilibrium models.[6]

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[4] It should be stressed that a rise in nominal wages does not necessarily imply a rise in prices; for example, if labour productivity exhibits stronger growth than wages, profit margins will not decrease and, thus, firms have no incentives to increase their prices. The likelihood of an economy entering a wage-price spiral is highly dependent on various macroeconomic factors. For instance, a stronger labour demand and a tight labour supply could amplify the possibility of a wage-price spiral (Boissay et al. 2022).

[5] Moreover, the literature has shown that inflationary shocks originating from the supply side (cost-push inflation) lead to higher and more persistent inflationary pressures in the euro area compared to the United States, due to differences in labour market institutions; see Peersman and Van Robays (2009) and Ball and Mazumder (2020).

[6] See, among many others, Corsetti and Dedola (2005), Corsetti et al. (2008), Burstein and Gopinath (2014), Choudhri and Hakura (2015) and Papageorgiou (2021). See also Finn (2000) and Balke and Brown (2018) for the effects of energy price shocks in DSGE models.

The second focuses on the role of wage rigidities in explaining labour market and inflation dynamics, as well as in shaping optimal policy.[7] Our paper bridges these two strands by investigating the role of real wage rigidities in the propagation of import price shocks, offering insights into the observed differentials in inflation dynamics across euro area countries. Finally, our paper is related to the recent literature that explores the relationship between domestic factors and inflation dynamics in the euro area by using national accounts data and GDP deflator decomposition.[8]

The results suggest that inflationary pressures arising from increases in the prices of imported inputs are more pronounced in economies with a high degree of real wage rigidities. Such rigidities prevent firms from absorbing part of the higher import costs through reductions in labour costs. As a result, the higher input costs are passed on to final prices, generating strong and persistent inflationary pressures, with adverse effects on employment and output. Consequently, countries with wage-setting mechanisms that delay the adjustment of wages to changes in economic conditions are likely to experience higher and more persistent inflation. In contrast, in economies with a low degree of real wage rigidities, where wages are largely determined by the marginal productivity of labour, firms have more flexibility in managing rising import costs by reducing labour costs. In such economies, the adverse effects on employment are milder, helping to mitigate the negative impact on output. While the increase in import prices still exerts upward pressure on domestic final prices, the degree of price pass-through and the resulting domestic inflation tend to be lower compared to economies with high wage rigidities.

Moreover, the results of the case studies for the euro area and Greece reveal that the rise in domestic inflation in the euro area since 2021 is largely associated with an increase in profits. Labour costs are also linked to inflationary pressures in the euro area, though their contribution is relatively smaller than that of profits. A similar pattern is observed in Greece, where domestic inflationary pressures during 2021-2022 are closely linked to rising profits. The notable increase in profits is primarily associated with the services sector, which made the largest contribution to profit growth, followed by the industry sector. Unlike the euro area, labour costs have played a smaller role in Greek inflation, but have shown a gradual recovery, contributing positively to inflation from 2023 onwards. Insights from the data suggest that the rise in profits in the services sector is related not only to higher prices, due to pass-through effects on consumer prices, but also to an increase in markups observed after 2020. In contrast, markups in the industry sector appear to be on a downward trajectory.

The rest of the paper is organised as follows: Section 2 provides a cross-country comparison of inflation dynamics for selected euro area countries and Section 3 analyses the components of the GDP deflator in euro area and Greece. Section 4 describes the theoretical model and presents the main results of the simulations. Section 5 concludes.

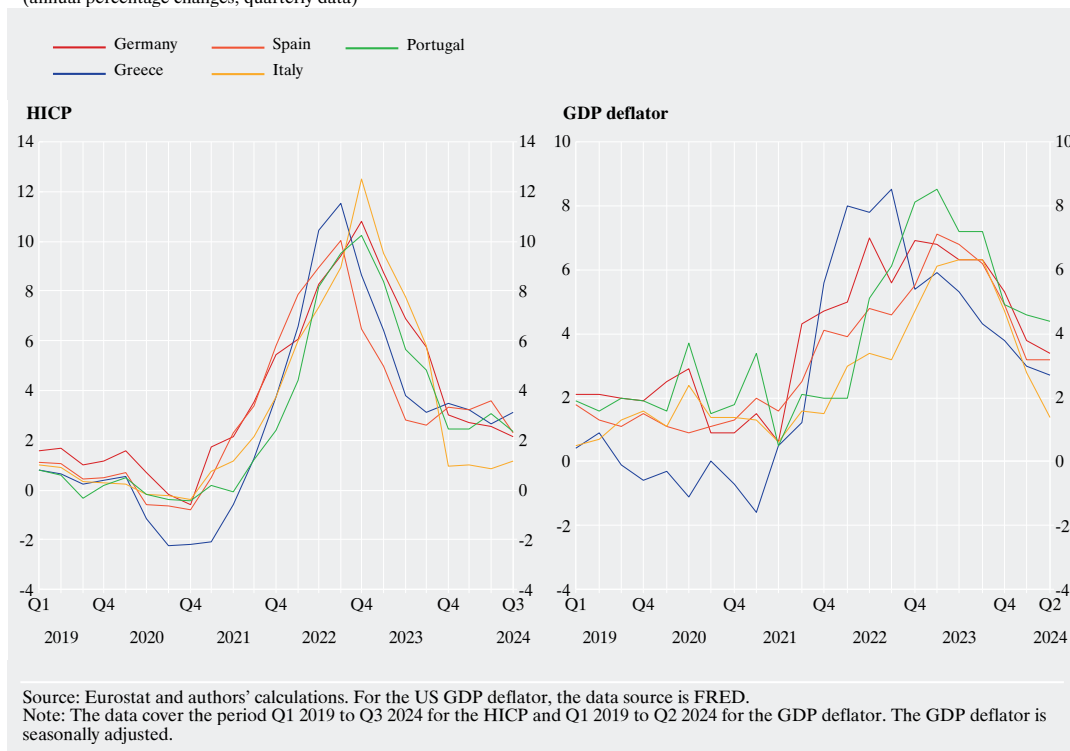## 2 INFLATION DYNAMICS: CROSS-COUNTRY COMPARISON

This section investigates inflation dynamics across selected euro area countries, focusing on two key inflation measures: the HICP and the GDP deflator. These indicators provide complementary insights, with the HICP reflecting broader consumer price trends, including the impact of import prices, and the GDP deflator capturing inflation in domestically-produced goods and services.

7 Since the seminal work of Hall (2005), real wage rigidities have been incorporated into many DSGE models to account for the sluggish response of inflation to monetary policy shocks (see, for example, Blanchard and Galí 2007; Christoffel and Linzert 2006; Krause and Lubik 2007). Moreover, several studies have examined the role of real wage rigidities in shaping disinflationary dynamics; see, for instance, Ascari and Merkl (2009), Ascari and Rossi (2011) and Tesfaselassie (2019).
8 See, for example, Hansen et al. (2023).

Chart 1 Inflation dynamics: cross-country analysis

(annual percentage changes; quarterly data)

Germany   Spain   Portugal
Greece   Italy

HICP

GDP deflator

Source: Eurostat and authors' calculations. For the US GDP deflator, the data source is FRED.
Note: The data cover the period Q1 2019 to Q3 2024 for the HICP and Q1 2019 to Q2 2024 for the GDP deflator. The GDP deflator is seasonally adjusted.

More specifically, as Chart 1 illustrates, the evolution of the HICP reveals notable differences in the pace of acceleration, the timing and level of the peaks, and the subsequent deceleration across countries. For instance, Germany and Spain experienced a rapid inflation surge starting in mid-2021, with inflation rates rising sharply. In contrast, Greece, Italy and Portugal initially exhibited a more gradual rise in inflation. However, this trend shifted markedly during the energy price shock spike in 2022, when inflation in these countries accelerated rapidly and peaked at higher levels than in other countries. The deceleration phase following the gradual decline in energy and commodity prices also varied across countries. For example, in Spain inflation peaked early and declined relatively quickly, while in countries like Germany and Portugal inflation adjusted more slowly, reflecting more persistent price pressures. By 2024, inflation rates across the euro area seem to converge, yet subtle differences in their trajectories persist.

The divergence in inflation dynamics across countries becomes even more pronounced when examining changes in the GDP deflator. Unlike the HICP, which is strongly affected by external shocks like energy price fluctuations, the GDP deflator reflects price changes in goods and services produced domestically, thereby providing insights into inflationary pressures stemming from domestic factors. Greece and Portugal stand out in this context, experiencing not only larger increases, but also a more rapid acceleration in the GDP deflator compared to other euro area countries. This sharp rise indicates a faster pass-through of import price shocks to domestic prices in these economies. Notably, with the exception of Germany and Greece, the GDP deflator peaks later than the HICP in most countries, indicating sustained domestic inflationary pressures even after the initial impact of import price shocks had subsided.

In sum, the observed differences in inflation dynamics across countries, along with the

divergence between HICP and GDP deflator trends within countries, underscore the potential role of domestic factors in shaping inflation dynamics. While the initial inflation surge in the euro area was largely imported, the magnitude and persistence of inflation as these shocks propagate through the economy appear to be influenced by country-specific characteristics.

3 DECOMPOSING DOMESTIC INFLATION

3.1 UNIT INDICATORS BASED ON NATIONAL ACCOUNTS DATA

In this section, we employ a straightforward methodology using national accounts data to analyse the relationship between domestic factors and inflation. This method is applied to both the euro area and Greece. The latter serves as an illustrative example, having experienced a sharp rise in domestic prices following an increase in imported input costs. Furthermore, Greece stands out within the euro area due to its significant reliance on imported intermediate goods (see Papageorgiou 2021).

To analyse this, the change in the GDP deflator is decomposed into its three primary components: labour costs, profits and indirect taxes (net of subsidies). The GDP deflator is an indicator of the general price level of domestically-produced goods and services and incorporates information on inflationary pressures stemming from domestic sources. This decomposition helps to identify which domestic factors are linked to the evolution of domestic inflation. Moreover, it provides information to policymakers regarding the domestic sources of inflation (e.g. profit inflation or wage inflation) and offers guidance on the policies that could be adopted to mitigate price pressures.

Before proceeding with this analysis, we should acknowledge the following caveats. First, and most important, this analysis is purely an accounting exercise that does not allow for any causal interpretation; it merely shows how

changes in the GDP deflator are reflected in labour costs, profits and indirect taxes (net of subsidies). Second, this exercise does not provide evidence about the uses of these components; for example, firms could use their profits to increase their profit margins for precautionary motives, e.g. to shield their operations against future wage increases or to finance future investment projects.

The income approach of GDP from national accounts implies that nominal GDP can be written as the sum of compensation of employees ($COMP$), gross operating surplus and mixed income (GOS) and taxes less subsidies on production and imports ($TAXS$):

$$P \times Y = COMP + GOS + TAXS \qquad (1)$$

where $P \times Y$ is nominal GDP (P is the GDP deflator and Y is real GDP). By dividing both sides of equation (1) with real GDP (Y), we obtain unit indicators (i.e. per unit of real GDP), and the GDP deflator is broken down into unit components.[9] Thus:

$$P = \frac{COMP}{Y} + \frac{GOS}{Y} + \frac{TAXS}{Y} \qquad (2)$$
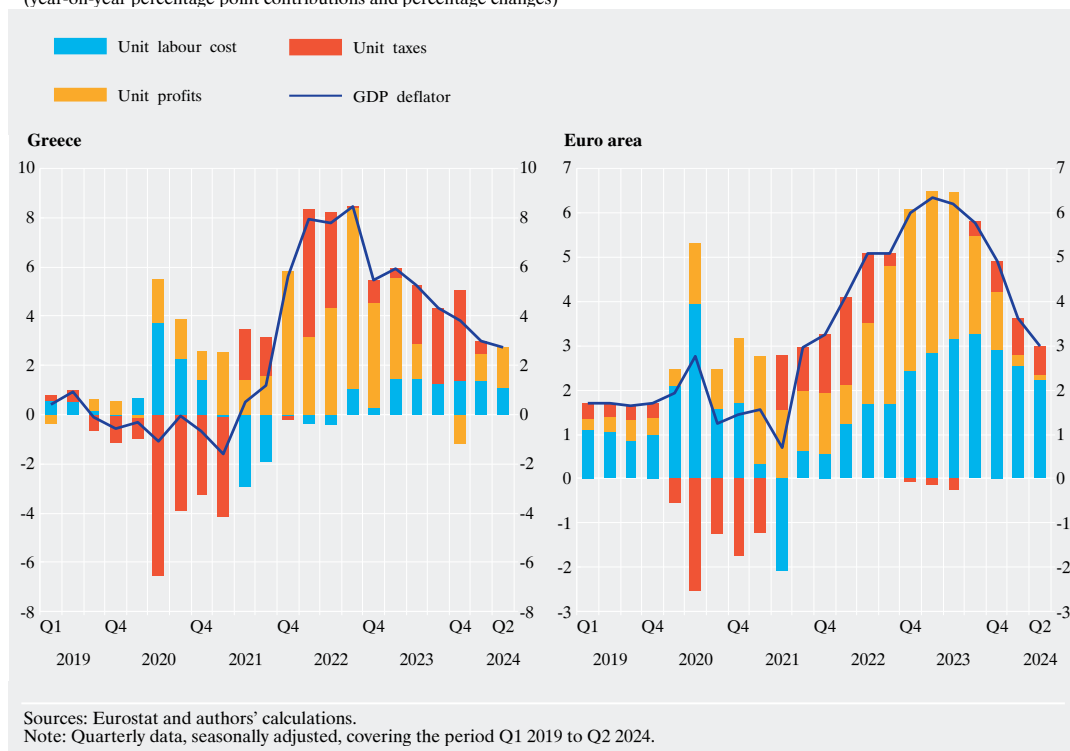
or, equivalently,

$$P = Unit\ Labour\ Cost + Unit\ Profits + Unit\ Taxes \qquad (3)$$

Chart 2 depicts the contribution of the abovementioned unit indicators to inflation, based on the GDP deflator, for Greece and the euro area from Q1 2019 onwards. It is evident that domestic price pressures, as measured by the annual growth of the GDP deflator, have markedly increased since Q3 2021 in Greece.

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9 We use national accounts data from the Eurostat database on a quarterly basis up to Q2 2024. Specifically, we employ data for the compensation of employees, gross operating surplus and mixed income and taxes less subsidies on production and imports at current prices. Also, we use data for GDP and the GDP deflator (both at constant prices 2015=100). All data are seasonally adjusted. The operating surplus, which is used as a proxy of profits in the analysis, measures the surplus accruing from production by non-financial and financial corporations, government, households and non-profit institutions serving households. Mixed income is the surplus accruing from production by unincorporated enterprises owned by households.

Chart 2 Contributions to inflation (based on the GDP deflator)

(year-on-year percentage point contributions and percentage changes)

Legend:
- Unit labour cost
- Unit taxes
- Unit profits
- GDP deflator

Greece

Euro area

Sources: Eurostat and authors' calculations.
Note: Quarterly data, seasonally adjusted, covering the period Q1 2019 to Q2 2024.

Specifically, following the outbreak of the pandemic in 2020, inflation in Greece was slightly negative, with unit taxes contributing negatively to the annual GDP deflator growth. This reflected government support measures aimed at mitigating the adverse effects of the pandemic on firms and households. The negative contribution of unit taxes mitigated the positive contribution of unit labour costs and unit profits. From Q3 2021, inflation in Greece began to rise gradually, driven by surging imported energy prices that increased production costs. In 2022, inflation increased sharply, with the GDP deflator growing by 6.5%. Unit profits contributed significantly by 4.7 percentage points (pps), followed by unit taxes (2.1 pps), while the contribution of unit labour costs was marginally negative (-0.3 pps). However, from Q2 2023, the contribution of unit profits began to decline, as imported inflationary pressures eased. In 2023, the GDP deflator inflation reached 5.8%, with unit profits contributing 2.1 pps and unit labour costs
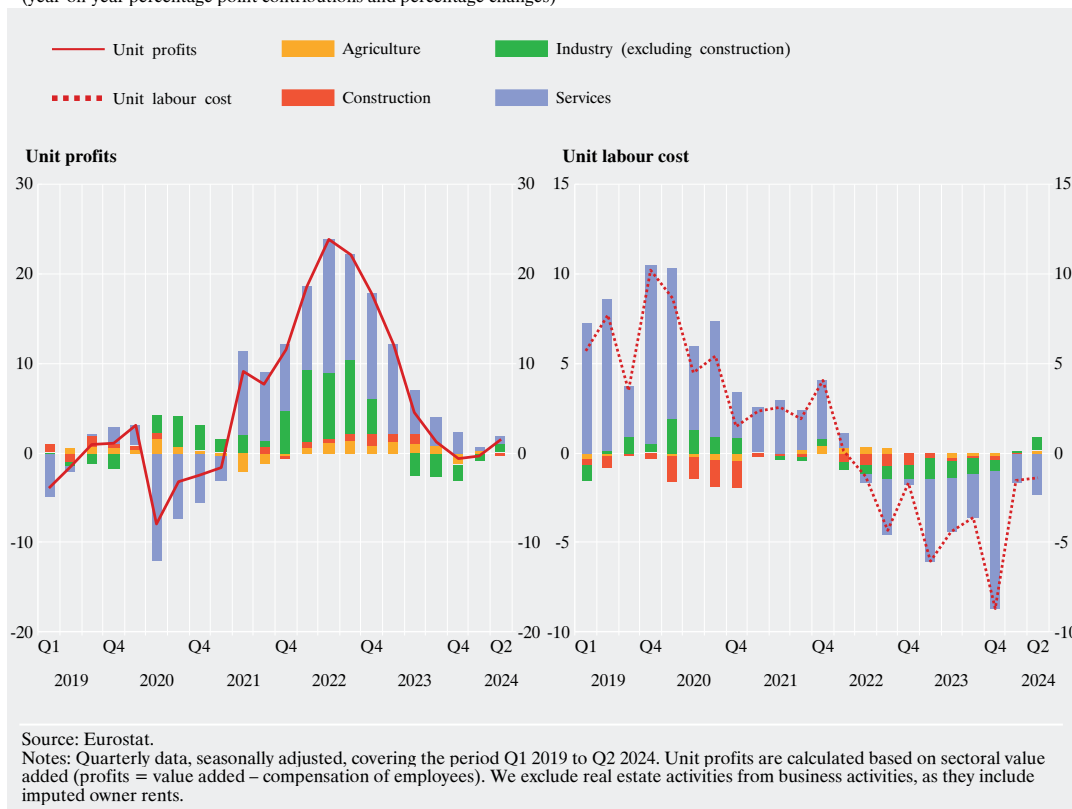
returning to positive territory (1 pp). However, the largest contribution to the GDP deflator came from unit taxes (2.7 pps).[10] In the first two quarters of 2024, inflation continued to gradually de-escalate to 2.9%, with unit profits making the largest contribution (1.4 pps), followed by unit labour costs (1.2 pps).

A similar pattern emerges from the decomposition of the GDP deflator for the euro area, where profits have made the largest contribution to inflationary pressures since Q1 2021. It is worth noting that the contribution of unit labour costs in the euro area is significantly higher compared to that in the Greek economy. At the same time, the euro area experienced a decrease in the contribution of unit

10 The increased contribution of unit taxes in 2022 and 2023 can be attributed to the rise in the final prices of goods and services, which led to higher tax revenues from indirect taxes, such as VAT. Additionally, this increase may be linked to improved VAT collection efficiency, partly due to measures aimed at reducing tax evasion, such as the requirement for taxpayers to link point-of-sale (POS) payment devices with the issuance of tax receipts.

Chart 3 Unit profits, unit labour cost and sectoral contributions in Greece

(year-on-year percentage point contributions and percentage changes)

— Unit profits   ▮ Agriculture   ▮ Industry (excluding construction)

···· Unit labour cost   ▮ Construction   ▮ Services

Unit profits

Unit labour cost

Source: Eurostat.
Notes: Quarterly data, seasonally adjusted, covering the period Q1 2019 to Q2 2024. Unit profits are calculated based on sectoral value added (profits = value added – compensation of employees). We exclude real estate activities from business activities, as they include imputed owner rents.

taxes during 2023, in contrast to Greece, where their contribution to inflationary pressures was significantly higher.

Unit profits and unit labour costs fluctuate over time and vary across sectors. Examining a more detailed breakdown of the contributions across sectors, Chart 3 presents how the different sectors contributed to the evolution of unit profits and unit labour costs in the Greek economy in the period Q1 2019 to Q2 2024. The marked increase in unit profits from Q3 2021 to Q2 2023 is associated with the services sector, which made the largest contribution to the growth rate of unit profits, followed by the industry sector (excluding construction).[11] The significant and persistent contribution of services to unit profit growth is mainly attributed to the large dependence of the Greek economy on tourism-related activities, which are included in the services sector. From Q2 2023, the contri-

bution of industry (excluding construction) to unit profits turned negative, while the contribution of services de-escalated, albeit remaining in positive territory, following the milder growth of unit profits. On the contrary, unit labour costs decreased, as real GDP increased faster than the nominal compensation of employees. This is primarily linked to a negative contribution by the services sector.

3.2 PROFIT SHARES, FIRM MARKUPS AND THE PRICING BEHAVIOUR OF FIRMS

The significant contribution of unit profits to domestic inflation does not necessarily imply that firms have changed their pricing strategies or markups. For example, increases in profits

11 The services sector includes the business sector activities minus agriculture, construction and industry. We also exclude real estate activities from business activities, as they include imputed owner rents. Therefore, when calculating unit profits and unit labour costs at the sectoral level, real estate activities are excluded.

Chart 4 Gross profit share and production costs

(lhs: % of gross value added; rhs: EUR billions)

—— Gross profit share (lhs)

······ Intermediate consumption (rhs)

Source: Eurostat and authors' calculations.
Notes: The data cover the period Q1 2019 to Q2 2024. Data for intermediate consumption up to Q1 2024. Intermediate consumption measures the value of the goods and services consumed as inputs by a process of production.

can result from rising marginal production costs with constant markups or from increases in the markup itself due to strategic actions taken by firms or from a combination of these factors (see, e.g., Colonna et al. 2023). In this section, we systematically analyse the evolution of profits in Greece to gain deeper insights into whether rising profits reflect changes in firms' pricing strategies or broader cost-push factors.

To do so, we first examine the evolution of the gross profit share in relation to a proxy for production costs. The profit share, a commonly used indicator to explore developments in profits using national accounts data, is defined as the ratio of gross operating surplus and mixed income to gross value added. As a proxy for production costs, we use intermediate consumption, which measures the value of goods and services consumed as inputs in the production process. Chart 4 illustrates the evolu-

tion of these two variables for the Greek economy from Q1 2019 onwards.

As depicted in Chart 4, profit shares increased since the outbreak of the COVID-19 pandemic (Q2 2020), picking up in Q4 2022, before slightly dropping, though remaining higher than pre-2020 levels. This upward shift of profit shares took place despite the sharp rise in input costs from Q2 2021 onwards, driven by the soaring energy prices that led to higher production costs. This indicates that firms did not absorb these rising costs, but instead passed them through to output prices, thereby contributing to the acceleration of domestic price pressures. Since 2023, the stabilisation of both profit shares and production costs suggests a moderation in the pass-through of rising costs to output prices.

The observed rise in profits should be interpreted with caution because it does not necessarily imply changes in the pricing behaviour and markups of domestic enterprises. For example, the IMF (World Economic Outlook, October 2022) shows that there was no evidence of a markup increase in advanced economies in 2021. In a similar vein, Bouras et al. (2023) provide evidence that inflation in Canada was driven mainly by shifts in firms' costs and the contribution of markups to inflation was significantly compressed. On the contrary, Glover et al. (2023a) provide evidence of an increase in markups in the US in 2021, but their contribution to US inflation faded away in 2022 (Glover et al. 2023b).[12]

To gain further insights into firms' pricing strategies, we construct a rough proxy for price markups for the total economy, as well as for two major sectors, namely services and industry. Markups are defined as the ratio of the net operating surplus and mixed income to total input costs in the respective sectors.[13]

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[12] Colonna et al. (2023) discuss the link between firms' profits shares in value added and markups and provide the conditions under which profits can increase even if markups remain unchanged or even decline. See the Appendix for an illustrative example.

[13] As a proxy for total input costs, we use the sum of intermediate consumption and consumption of fixed capital.

Chart 5 Dynamic mark-ups

(%)

─── Mark-up

Total economy

Services sector

Industry sector (excluding construction)

Sources: Eurostat and authors' calculations.
Notes: Annual data covering the period 2014 to 2023. Total economy includes total business activities excluding real estate activities, as the latter include imputed owner rents. In addition, we exclude public administration and defence, and compulsory social security, as these categories refer to the public sector.

Chart 5 portrays the dynamic paths of these markups from 2014 to 2023 for the Greek economy. The data reveal a clear upward trend in markups across all sectors starting in 2020, with the services sector exhibiting the most significant increase. The markup trajectory for the total economy closely mirrors that for the services sector, indicating that the latter has played a pivotal role in driving the overall rise in markups. This pattern is particularly pronounced in 2023, when the services sector continued its upward trajectory, while the industrial sector showed a decline. The recent sharp increase in services sector markups suggests that firms in this sector might be strategically adjusting their markups to ensure profitability.

4 WAGE RIGIDITIES AND INFLATION DYNAMICS

In this section we employ a DSGE model to analyse the macroeconomic impact of a temporary cost-push shock that drives up import price inflation, under varying degrees of real wage rigidity in the labour market.

4.1 DESCRIPTION OF THE THEORETICAL MODEL

The model employed is a version of the Bank of Greece micro-founded Dynamic Stochastic General Equilibrium (DSGE) model that shares the standard main characteristics of structural models used by most central banks and international institutions.[14]

In particular, the domestic economy is modelled as a typical small open economy that belongs to a currency area in the sense that the nominal exchange rate is exogenous and there is no monetary policy independence. In the absence of autonomous monetary policy, the domestic nominal interest rate is determined by an exogenously given, risk-free, foreign nominal policy interest rate and a risk-premium component. The domestic economy consists of a large number of households, firms and a government. There are two types of households, differing in their ability to partic-

ipate in asset markets. The first type of households has access to the financial markets and can transfer wealth intertemporally by trading bonds and accumulating physical capital, whereas the second type of households is assumed to be liquidity-constrained, in the sense that it cannot lend or borrow. Both types of households receive labour income by working in the private and the public sector.

The model incorporates a number of real and nominal frictions, such as price and wage rigidities and monopoly distortions in product and labour markets. As regards the labour market in the private sector, households supply differentiated labour services and there are labour unions that act as wage setters in monopolistically competitive labour markets. As a result, private sector real wages can deviate from the marginal product of labour and respond sluggishly to economic conditions due to the existence of frictions and imperfections in the labour market. In particular, the real wage rate per hour, w_t, is a weighted average of the past wage rate and the optimal wage rate chosen by unions: $w_t = (w_{t-1})^n (w_t^*)^{1-n}$, where $0 \leq n \leq 1$ denotes the degree of real wage rigidity and w_t^* is the optimal wage rate chosen by unions that is equal to a markup over the marginal product of labour. The higher the value of parameter n, the higher the degree of wage rigidity. When $n=0$, changes in wages are determined by changes in the marginal productivity of labour.[15]

With regard to the production sector, the model features monopolistically competitive firms that produce tradable and non-tradable differentiated intermediate goods. Firms in the tradable sector sell their output both in the domestic market and in the rest of the world (recorded as exports), while firms in the non-tradable sector sell their output in the domestic market only. There are also importing firms that import intermediate goods from abroad

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14 For details on the main features of the model, see Papageorgiou and Vourvachaki (2017) and Papageorgiou (2014).
15 For more details, see also Hall (2005), Blanchard and Galí (2007) and Papageorgiou (2014).

and operate under monopolistic competition. Once differentiated, the imported intermediate goods are then supplied as inputs into the production of final goods. Firms set the prices of their differentiated output according to the Calvo-type scheme with partial indexation. All types of intermediate goods are used as inputs to produce consumption and investment final goods. The latter are produced by perfectly competitive firms and are sold to domestic households and the government.

The model also includes a relatively detailed fiscal policy block. In particular, the government hires labour and combines public consumption and public employment to produce public goods that provide direct utility to households. It levies taxes on consumption and on income from labour and capital earnings, as well as lump-sum taxes, and issues one-period government bonds in the domestic bond market and the international markets. Total tax revenues plus the issue of new government bonds are used to finance public purchases of goods and services, public investment, government transfers and public sector wages. Public investment is used for the accumulation of public capital that creates production externalities to the private sector, thereby affecting the productivity of the private sector's factors of production, namely capital and labour. The model also features sovereign risk premia that are positively correlated with government indebtedness, thereby introducing a sovereign risk channel through which sovereign default risk is transmitted to the real economy.

Finally, the model includes a number of nominal and real frictions, such as habit formation in consumption, investment adjustment costs and variable capital utilisation, which have been empirically identified as playing an important role in the transmission of structural shocks. Overall, the model captures well the key features of a typical small open economy of the euro area and, thus, provides a parameterised general equilibrium model suitable for policy simulations.

4.2 METHODOLOGY AND POLICY EXPERIMENTS

The approach to assessing the effects of inflationary shocks stemming from the import sector is summarised as follows: First, the model economy is parameterised to represent a typical small open economy within the euro area.[16] Regarding the degree of real wage rigidity, two scenarios are considered. In the first scenario, it is assumed that the economy exhibits a relatively high degree of real wage rigidity. In the second, the economy has a low degree of rigidity, where real wages are primarily driven by changes in the marginal productivity of labour.[17] Thus, the two economies differ only in their degree of wage rigidity. Then, in order to investigate the effects of an increase in the prices of imported intermediate goods, a temporary cost-push shock is introduced that increases import price inflation by 1 percentage point (pp). The calibration of the magnitude and persistence of the shock is indicative, aimed at drawing conclusions on the sensitivity of macroeconomic variables to changes in import prices and comparing the dynamic responses under alternative scenarios. Given that the shock is temporary, all macroeconomic variables will gradually converge to their initial levels. The experiments are performed under perfect foresight, which means that households and firms fully anticipate the future transition paths of the exogenous variables.

4.3 TRANSMISSION MECHANISM OF AN IMPORTED INFLATIONARY SHOCK TO THE DOMESTIC ECONOMY

Chart 6 shows the dynamic effects derived from the model for selected macroeconomic variables. All variables are expressed in percentage deviations from their steady state, except for inflation rates and profit shares, which are expressed as percentage point changes. First, we discuss the channels through

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16 The values of the structural parameters are set as in Papageorgiou and Vourvachaki (2017) and Papageorgiou (2014).
17 For the economy with a high degree of real wage rigidities, n equals 0.97, as estimated for the euro area countries in Albonico et al. (2019). For the economy with the lower degree of wage rigidities, the value of this parameter is set to be equal to 0.3.

which the imported inflation shock is transmitted to the domestic economy and then we examine the importance of real wage rigidities under the alternative scenarios. The propagation mechanism of the exogenous inflationary shock is as follows:

The first order effect of an increase in the price of imported intermediate goods is the rise in the production cost of domestically produced consumption and investment goods. This prompts firms to raise domestic prices, resulting in an increase in domestic inflation, as well as to reduce output and labour costs. At the same time, rising prices cause a negative income effect on households, adversely affecting demand for consumption and investment. However, the negative impact on economic activity initially appears to be limited for the following reasons:

First, only a fraction of firms can adjust their prices immediately due to Calvo price rigidities. As a result, the pass-through of import prices to domestic prices occurs gradually, dampening the responses of the macroeconomic variables on impact. Second, the increase in the price of imported intermediate goods generates an import substitution effect, which mitigates the impact on output and inflation. Specifically, the imported intermediate goods are more expensive in the short term, leading firms and households to substitute imported with domestically produced intermediate goods, thereby increasing demand for domestic consumption and investment goods, both tradable and non-tradable. In particular, the higher the elasticity of substitution between imported and domestically produced goods, the stronger the substitution effect and the more resilient the economy to changes in import prices. Third, as households expect lower future incomes, they substitute future for today's consumption and investment (intertemporal substitution effect). As depicted in Chart 6, the net effect on real GDP on impact is marginally negative due to increased demand for domestically produced goods, which exerts upward pressures on labour demand and, eventually, wage rates. This leads

firms to partially pass through the increase in import prices to the domestic prices in response to elevated production costs, which, in turn, increases their profits and raises inflationary pressures.

In the following periods of transition, as more firms adjust their prices upwards, the pass-through of import prices to domestic prices increases and adversely affects demand for consumption, investment and exports. At the same time, as discussed below, real wage rigidities prevent firms from absorbing part of the increased production costs through a reduction in labour costs, resulting in further inflationary pressures and a decrease in employment.

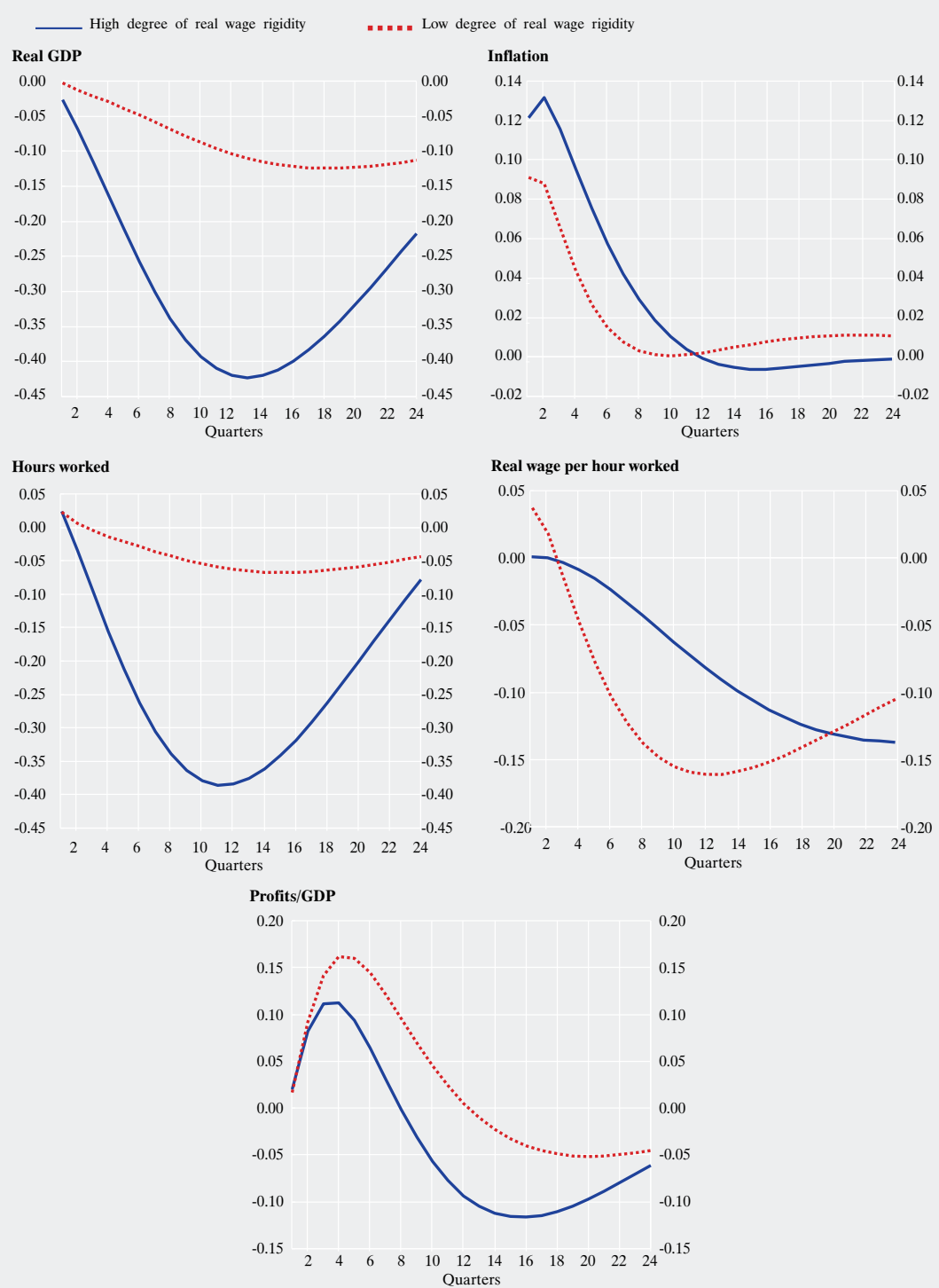## 4.4 DYNAMIC EFFECTS OF AN INCREASE IN IMPORT INFLATION UNDER WAGE RIGIDITIES

Regarding the role of real wage rigidities in the propagation mechanism following an increase in import prices, the results from the comparison of the two economies suggest that a higher degree of real wage rigidity leads to stronger and more persistent inflationary pressures and a greater negative impact on economic activity.

Specifically, in the economy that exhibits high real wage rigidities, the labour market adjusts more slowly in response to the import price shock, as firms cannot promptly adjust labour costs to offset rising production costs. As a result, they gradually pass these costs on to domestic final prices, creating persistent inflationary pressures and an increase in the profit shares. At the same time, in order to manage labour costs, firms reduce labour demand, resulting in lower employment and output. In turn, the lower demand for labour adversely affects the income of households, further suppressing domestic demand and deepening the economic downturn.

In contrast, in the economy with a low degree of real wage rigidities, where wages are primarily determined by the marginal productivity of labour, firms have greater flexibility to

(percentage deviations from the steady state and percentage point changes)

—— High degree of real wage rigidity ▪▪▪▪ Low degree of real wage rigidity

Real GDP

Inflation

Hours worked

Real wage per hour worked

Profits/GDP

Source: Authors' estimations.
Notes: All variables are expressed as percentage deviations from the steady state, with the exception of the profits-to-GDP ratio and inflation, which are expressed in percentage point changes. Inflation is annualised and calculated using the GDP deflator.

manage rising import costs, by adjusting labour costs downwards. In this case, the labour market adjusts through wage reductions rather than employment cuts, which helps mitigate the negative impact on output. Although the increase in import prices still exerts upward pressure on domestic final prices, the degree of price pass-through and the resulting domestic inflation are lower compared to the economy with high wage rigidities. As illustrated in Chart 6, the responses of real GDP and employment are less severe, while the increase in profits is more pronounced.

5 CONCLUSIONS

This paper investigates the role of domestic factors in shaping inflation dynamics. It employs a DSGE model to examine the macroeconomic effects of a temporary import price shock under varying degrees of real wage rigidity in the labour market. The results suggest that economies with a high degree of real wage rigidity are likely to experience higher and more persistent inflationary pressures than economies with a low degree of real wage rigidity. Real wage rigidities constrain firms from offsetting the higher import costs by reducing labour costs, resulting in a greater pass-through of input costs to final prices, which generates strong and persistent inflation and adversely affects employment and output. In contrast, in economies with low real wage rigidities, firms have more flexibility in managing rising import costs, thereby mitigating

the negative impact on output. Additionally, the paper demonstrates a relatively straightforward methodology to explore the relationship between domestic factors and inflation dynamics, using national accounts data. While the methodology does not allow a causal interpretation, its application to the euro area and Greece suggests that the rise in domestic inflation since 2021 may be largely associated with an increase in profits. Labour costs are also linked to inflationary pressures, though their contribution is relatively smaller than that of profits. In Greece, the increase in profits is primarily associated with the services sector, followed by the industry sector.

Based on the findings, implementing labour market reforms that enable wages to adjust faster to changing economic conditions, while ensuring alignment with labour productivity, could help alleviate inflationary pressures and enhance the economy's resilience to exogenous shocks that increase production costs for firms. Moreover, reforms aimed at enhancing labour productivity and fostering innovation could mitigate the adverse effects of wage rigidity on inflation dynamics by reducing production costs per unit of output. Finally, with respect to the Greek economy, given the persistently high inflation in the services sector, structural reforms aimed at encouraging competitiveness could reduce inflationary pressures by improving productivity and efficiency, as well as by lowering firms' pricing power, thereby mitigating the pass-through of increased production costs to consumer prices.

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APPENDIX

A NUMERICAL EXAMPLE ON THE RELATIONSHIP BETWEEN FIRMS' MARKUP AND PROFIT SHARE

The following numerical example presents a simple exercise where the profit share (as measured by national accounts data) increases even in the case where markups remain constant, when there is an increase in the cost of intermediate inputs used in the production process (e.g. energy). In other words, firms end up with higher profit margins without changing their pricing strategy, i.e. without increasing their markups.

We assume a simple economy, in which the production sector consists of one firm that produces one single output using capital, labour and an intermediate input. To bring the example closer to the recent inflationary shock, we assume that this intermediate input is imported energy. Here, it is crucial to assume that labour and energy exhibit a low degree of substitutability, which is plausible in the short run. Let's consider two consecutive time periods.

In the first period, the cost of all inputs (including energy) is EUR 100. We also assume that the firm pays EUR 70 for labour and the total revenue of the firm (i.e. the value of production) is EUR 200. The markup is assumed to be 30%. Thus, the profit is equal to the markup multiplied by the total input cost, i.e. 30% * 100 = EUR 30. This is equal to the price of the single good produced. Moreover, in this simple setup, GDP, using the income approach, is equal to the sum of profits and wages, i.e. 70 + 30 = EUR 100. Thus, the implied profit share (defined as the ratio of profits to GDP) is equal to 30/100 = 30%.

In the second period, we assume that the cost of energy, which is used as intermediate input in the production process, increases by EUR 50, while the other two remaining inputs (capital and labour) remain constant. Thus, the total input cost is now EUR 150. Wages as well as the mark-up remain constant, i.e. the firm does not change its pricing behaviour. Applying the same markup in the new total input cost, we get the new profits of the firm, i.e. 0.30 * 150 = EUR 45. Thus, the profits (and the price of the single good) increase by EUR 15. Now, the total revenue of the firm increases by the extra profits (EUR 15), plus the additional input costs (EUR 50). Hence, the new total revenue (or the value of production) is equal to EUR 265. Also, the new GDP (using the income approach) is 70 + 45 = EUR 115. Finally, the new profit share (in terms of GDP) is 45/115 = 39%.