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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.

INFLATION DYNAMICS AND THE ROLE OF DOMESTIC FACTORS*

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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-

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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.

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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.
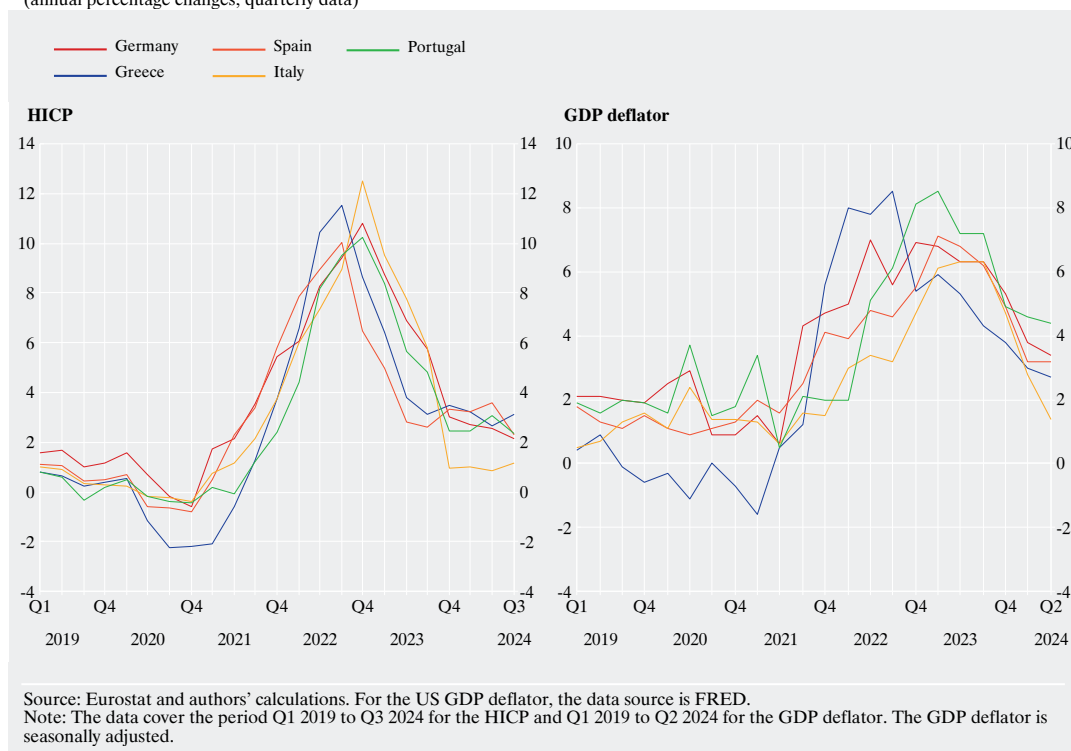
More specifically, as Chart 1 illustrates, the evolution of the HICP reveals notable differences in the pace of acceleration, the timing and level of the peaks, and the subsequent deceleration across countries. For instance, Germany and Spain experienced a rapid inflation surge starting in mid-2021, 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:

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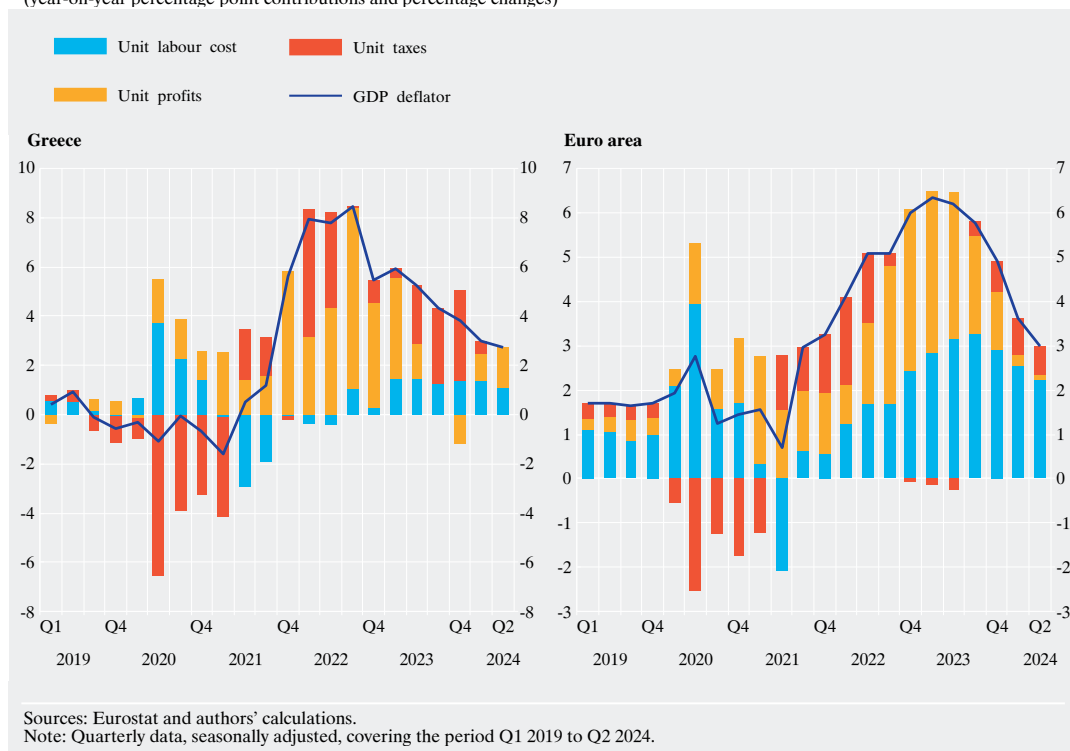
or, equivalently,

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

Chart 2 depicts the contribution of the above-mentioned 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.

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

- 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
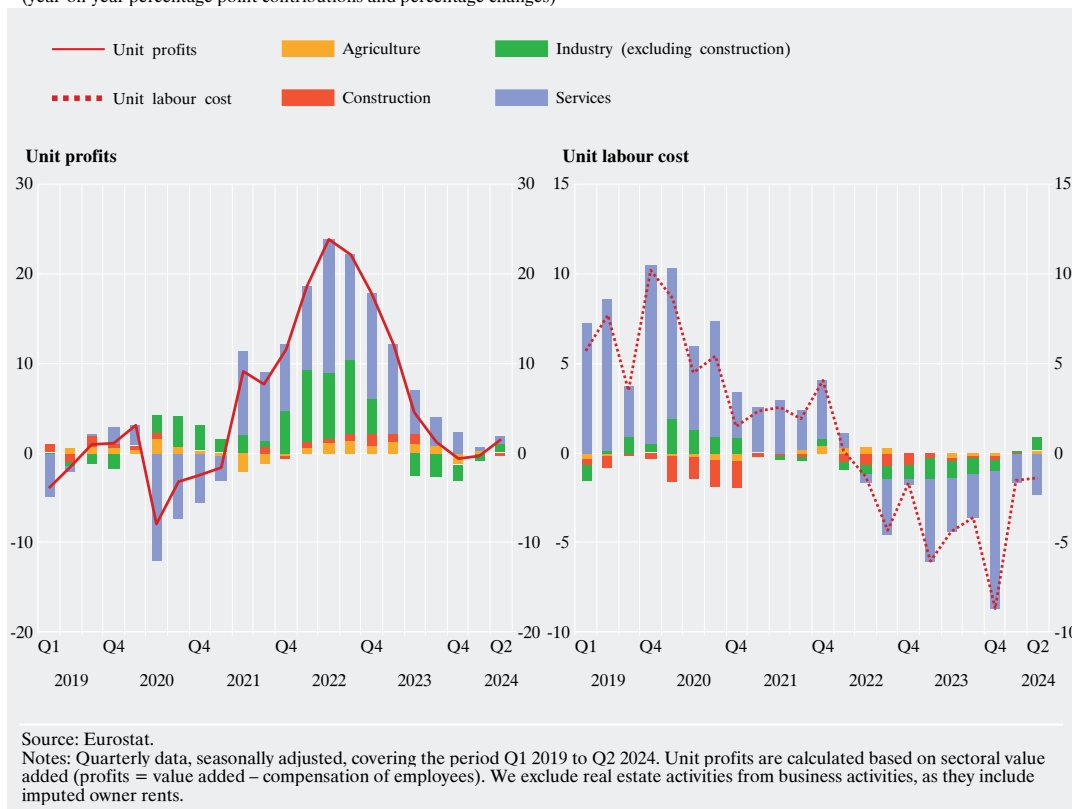
returning to positive territory (1 pp). However, the largest contribution to the GDP deflator came from unit taxes (2.7 pps).[10] In the first two quarters of 2024, inflation continued to gradually de-escalate to 2.9%, with unit profits making the largest contribution (1.4 pps), followed by unit labour 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

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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)

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

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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.

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]

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-

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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)
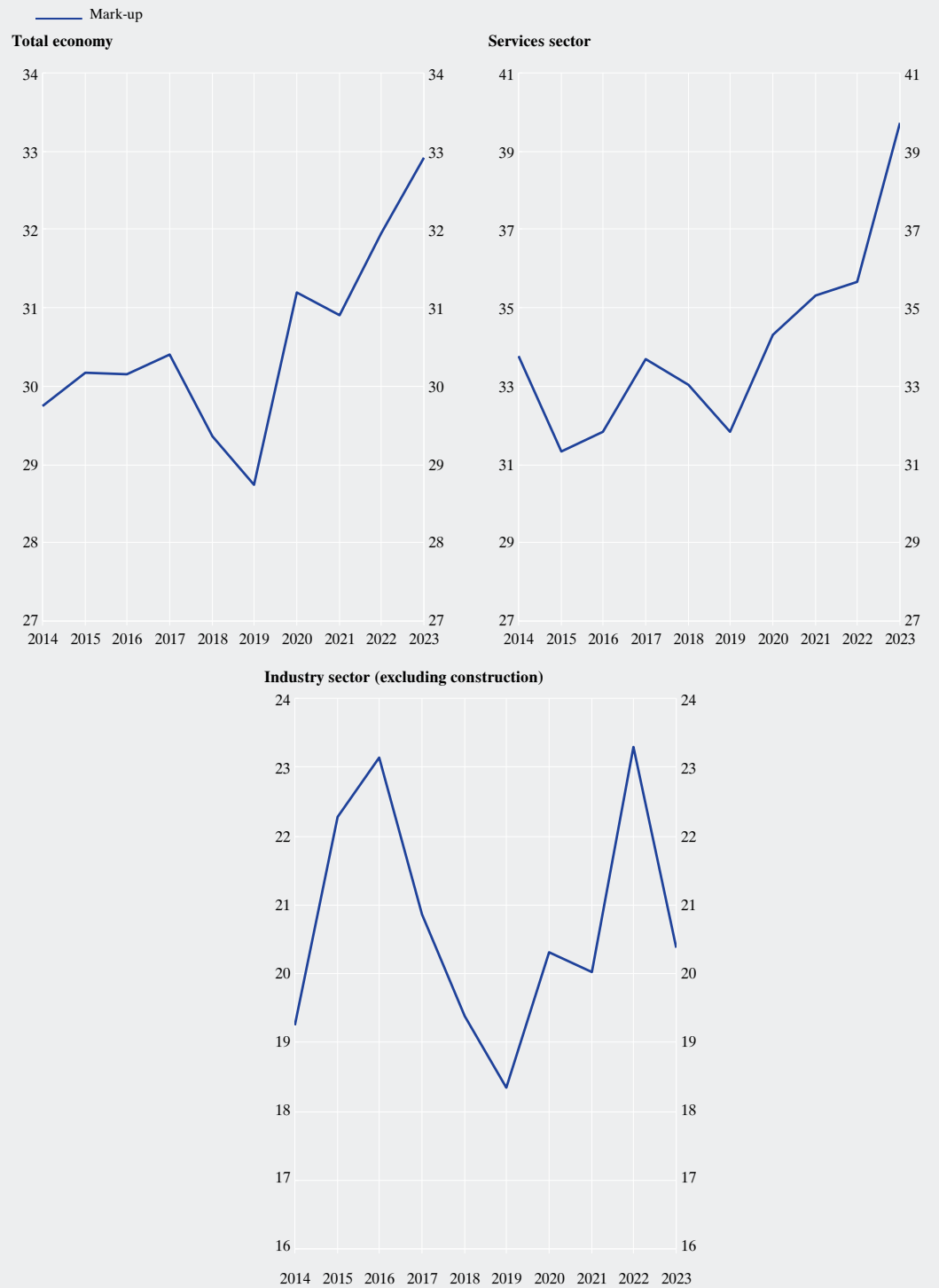
Sources: Eurostat and authors' calculations.
Notes: Annual data covering the period 2014 to 2023. Total economy includes total business activities excluding real estate activities, as the latter include imputed owner rents. In addition, we exclude public administration and defence, and compulsory social 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.
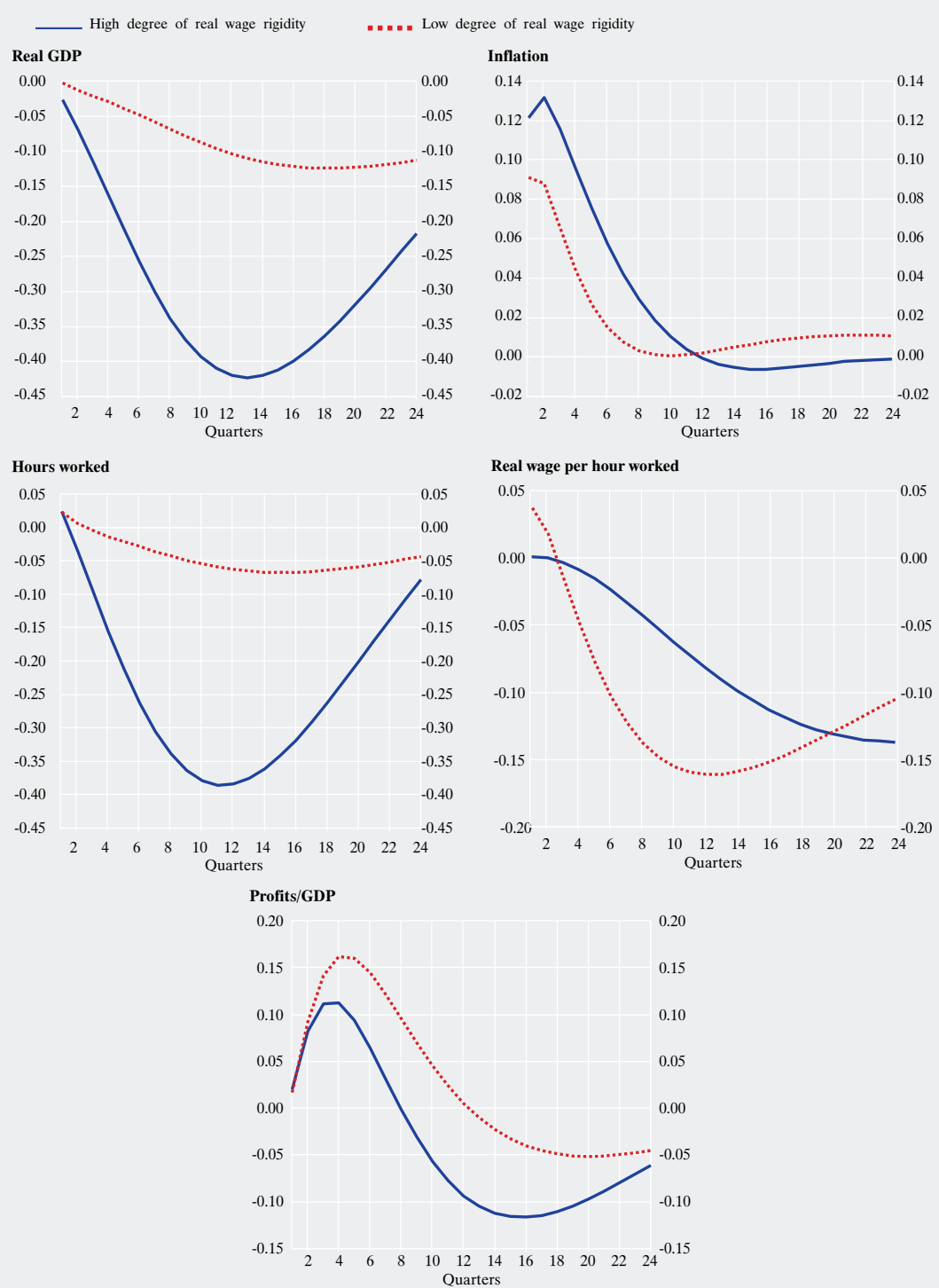
Specifically, in the economy that exhibits high real wage rigidities, the labour market adjusts more slowly in response to the import price shock, as firms cannot promptly adjust labour costs to offset rising production costs. As a result, they gradually pass these costs on to domestic final prices, 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

Chart 6 Effects of an increase in import prices and the role of wage rigidities

(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%.

THE MEASUREMENT OF INTERNATIONAL INVESTMENT THROUGH FDI STATISTICS: STRUCTURE AND RESULTS OF THE BANK OF GREECE'S ANNUAL FOREIGN DIRECT INVESTMENT SURVEY

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ABSTRACT

The purpose of this article is to describe the methodology, the statistical process and the results obtained from the annual Foreign Direct Investment (FDI) survey conducted by the Bank of Greece. First, we make extensive reference to the OECD Benchmark Definition of Foreign Direct Investment (BMD4), which provides full and detailed guidance on the coverage and compilation of FDI statistics. After defining what FDI statistics include and illustrating the ownership structure of a multinational enterprise group under the Benchmark Definition, the analysis focuses on the instructions of BMD4 for the compilation and presentation of aggregated as well as detailed FDI statistics by partner country and by economic activity. Next, we outline the content and the structure of the survey's questionnaires and the statistical process followed for the compilation of FDI statistics. Finally, we present the results obtained from the FDI survey at the level of stocks by partner country and by economic activity, as well as the main economies that ultimately control investments in Greece and the intermediate chains they use.

Η ΜΕΤΡΗΣΗ ΤΩΝ ΔΙΕΘΝΩΝ ΕΠΕΝΔΥΣΕΩΝ ΜΕΣΩ ΤΩΝ ΣΤΑΤΙΣΤΙΚΩΝ ΞΑΕ: ΔΙΑΡΘΡΩΣΗ ΚΑΙ ΑΠΟΤΕΛΕΣΜΑΤΑ ΤΗΣ ΕΤΗΣΙΑΣ ΕΡΕΥΝΑΣ ΞΕΝΩΝ ΑΜΕΣΩΝ ΕΠΕΝΔΥΣΕΩΝ ΤΗΣ ΤΡΑΠΕΖΑΣ ΤΗΣ ΕΛΛΑΔΟΣ

Στυλιανή Μπέλλη
Τράπεζα της Ελλάδος, Διεύθυνση Στατιστικής

Νικόλαος Χαριτάκης
Τράπεζα της Ελλάδος, Διεύθυνση Στατιστικής

ΠΕΡΙΛΗΨΗ

Σκοπός του παρόντος άρθρου είναι να περιγράψει τη μεθοδολογία, τη στατιστική διαδικασία και τα αποτελέσματα που προκύπτουν από την ετήσια έρευνα Ξένων Άμεσων Επενδύσεων (ΞΑΕ) που διεξάγεται από την Τράπεζα της Ελλάδος. Αρχικά γίνεται εκτενής αναφορά στο εγχειρίδιο του ΟΟΣΑ για τον Ορισμό Αναφοράς ΞΑΕ (Benchmark Definition of Foreign Direct Investment – BMD4), το οποίο θέτει τα παγκόσμια πρότυπα για την κατάρτιση των στατιστικών ΞΑΕ, συμπεριλαμβανομένων των βασικών εννοιών και ορισμών, των επιμέρους κατηγοριών και μεθόδων εκτίμησης των ΞΑΕ, της δομής ιδιοκτησίας πολυεθνικών ομίλων και, τέλος, της κατάρτισης στατιστικών ΞΑΕ ανά χώρα προέλευσης και υποδοχής, και ανά κλάδο οικονομικής δραστηριότητας της επιχείρησης άμεσης επένδυσης. Στη συνέχεια, παρουσιάζεται αναλυτικά το περιεχόμενο των ερωτηματολογίων της ετήσιας έρευνας και η στατιστική διαδικασία κατάρτισης των στατιστικών ΞΑΕ από την Τράπεζα της Ελλάδος με βάση τις συστάσεις του εγχειριδίου του ΟΟΣΑ. Συγκεκριμένα, γίνεται αναφορά στον καθορισμό του πληθυσμού των αναγγελλόντων (FDI population frame), στο περιεχόμενο των ερωτηματολογίων (survey structure) και στα μέτρα που λαμβάνονται για τον περιορισμό είτε της συνολικής μη ανταπόκρισης από τις στατιστικές μονάδες (unit non-response) είτε της μη ανταπόκρισης σε επιμέρους αιτούμενα στατιστικά στοιχεία (item non-response), καθώς και στους ελέγχους που διενεργούνται ως προς τη συνέπεια μεταξύ ροών και αποθεμάτων ΞΑΕ. Τέλος, παρουσιάζονται τα αποτελέσματα που προκύπτουν από την έρευνα ΞΑΕ σε επίπεδο αποθεμάτων ανά χώρα και ανά κλάδο οικονομικής δραστηριότητας, οι κυριότερες οικονομίες που ελέγχουν τελικά τις επενδύσεις στην Ελλάδα και οι ενδιάμεσες αλυσίδες που χρησιμοποιούν.

THE MEASUREMENT OF INTERNATIONAL INVESTMENT THROUGH FDI STATISTICS: STRUCTURE AND RESULTS OF THE BANK OF GREECE'S ANNUAL FOREIGN DIRECT INVESTMENT SURVEY*

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1 INTRODUCTION

Foreign Direct Investment (FDI) is a key element in the rapidly evolving international economic integration. It acts as a means of creating direct, stable and long-term links between economies, which, under the right conditions, can enhance business development and contribute to improving the competitiveness of both the host economy and the economy of origin of the investment. At the same time, through the activities of multinational enterprises, FDI forms the backbone of many global value chains by connecting and organising production between countries and is an important channel for the cross-border exchange of capital, goods and services and knowledge. Therefore, reliable and high-quality FDI statistics are essential for policy making and for monitoring globalisation.

The collection and compilation of FDI statistics is based on the statistical surveys conducted by the National Central Banks according to the statistical methodology defined by the OECD. Already in the 1980s, the OECD had adopted a "Benchmark Definition of Foreign Direct Investment", which provided a comprehensive set of rules to improve the statistical measures of foreign direct investment. Since then, as the financing structures of multinational enterprises have continued to evolve in an increasingly globalised market and as statistical measures have had to adapt to changing economic and financial realities, in 2008 the OECD developed the fourth edition of the Benchmark Definition of Foreign Direct Investment (BMD4),[1] which is now the global standard for FDI statistics. This edition is fully compatible with the underlying concepts and definitions of the International Monetary Fund's sixth edition of the Balance of Payments and International Investment Position Manual (BPM6).[2] The implementation of the BMD4 guidelines significantly improves the quality of FDI statistics by providing more meaningful criteria for measuring FDI and allowing FDI statistics to enlighten the analysis of global value chains and, more generally, globalisation. This is why the conduct of foreign direct investment statistical surveys aiming at the proper application of international standards is an important task for the statistical community.

Within the above context, the purpose of this article is to describe the methodology, the statistical process and the results obtained from the annual FDI survey conducted by the Bank of Greece. First, we refer extensively to the OECD Benchmark Definition of FDI, which sets the global standards for the compilation of FDI statistics, including the basic concepts and definitions, the sub-categories of FDI, the estimation methods, the ownership structure of multinational groups and, finally, the compilation of FDI statistics by country of origin and host country and by branch of economic activity of the direct investment enterprise. We then provide a detailed presentation of the content of the questionnaires and the statistical process for preparing the annual FDI survey conducted by the Bank of Greece, based on the recommendations of the OECD manual. Specifically, we refer to the definition of the population of the FDI survey respondents (FDI population frame), we outline the content of the survey questionnaires (survey structure) and the meas-

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ures taken to limit non-response from the statistical units (unit non-response) and non-response to individual requested statistics (item non-response), as well as the controls performed for consistency between flows and stocks of FDI. Finally, the results obtained from the FDI survey are presented at the level of stocks by country and by economic activity sector.

2 DESCRIPTION OF THE OECD BENCHMARK DEFINITION OF FOREIGN DIRECT INVESTMENT

2.1 FDI DEFINITION

According to the fourth edition of the OECD Benchmark Definition of Foreign Direct Investment (BMD4), FDI is defined as the establishment of a lasting interest in and the exertion of a significant degree of influence over the management of an enterprise resident in one economy by an investor resident in another economy. The ownership of 10% or more of the voting power in an enterprise is evidence of such a relationship.

An entity's residence is attributed to the economic territory with which it has the strongest connection, in other words its centre of predominant economic interest.

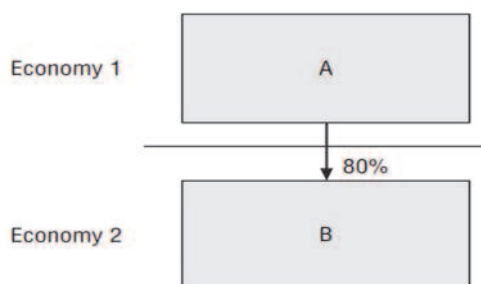### 2.2 FRAMEWORK FOR DIRECT INVESTMENT RELATIONSHIPS (FDIR)

The FDIR defines FDI relationships and the population of direct investors and direct investment enterprises to be included in FDI statistics. According to the FDIR, the FDI population enterprises are classified into subsidiaries, associates, fellow enterprises and branches. The FDIR also identifies cases that are not related to FDI.
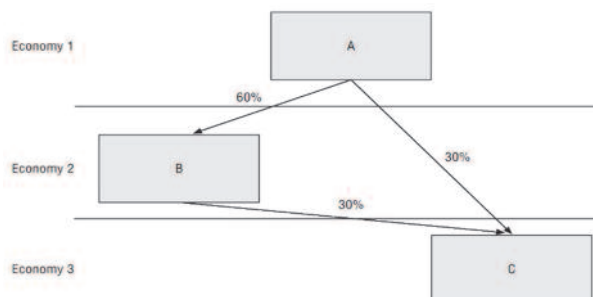
2.2.1 Subsidiaries

A subsidiary in FDI is an enterprise in which:

(a) an investor owns more than 50% of its voting power and, therefore, has control over the enterprise. In Figure 1, enterprise B is a subsidiary of enterprise A;
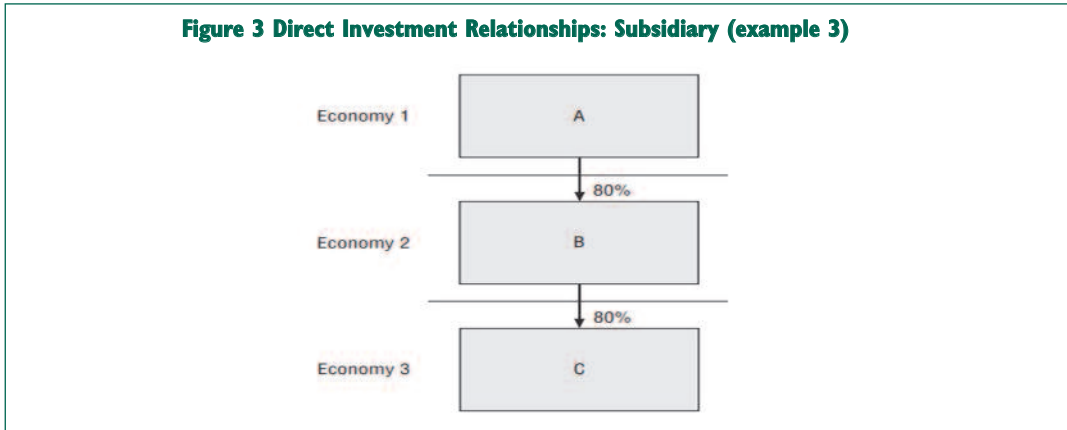

Figure 1 Direct Investment Relationships: Subsidiary (example 1)

Figure 2 Direct Investment Relationships: Subsidiary (example 2)

Figure 3 Direct Investment Relationships: Subsidiary (example 3)

(b) an investor and its subsidiaries combined own more than 50% of the voting power. In Figures 2 and 3 above, enterprise C is a subsidiary of enterprise A.

2.2.2 Associates

An associate in FDI is an enterprise in which:

(a) an investor owns at least 10% and no more than 50% of its voting power. In Figure 4, enterprise B is an associate of enterprise A;

(b) an investor and its subsidiaries combined own at least 10% but not more than 50% of its voting power. In Figures 5 and 6 below, enterprise C is an associate of enterprise A;

Figure 4 Direct Investment Relationships: Associate (example 1)
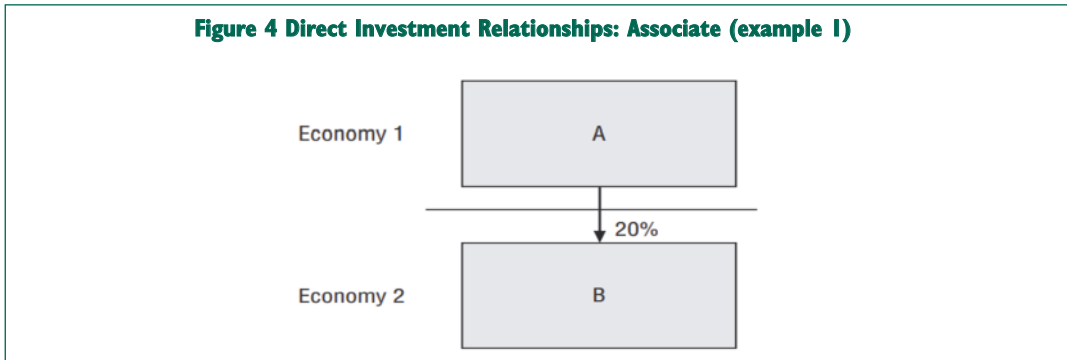
Figure 5 Direct Investment Relationships: Associate (example 2)
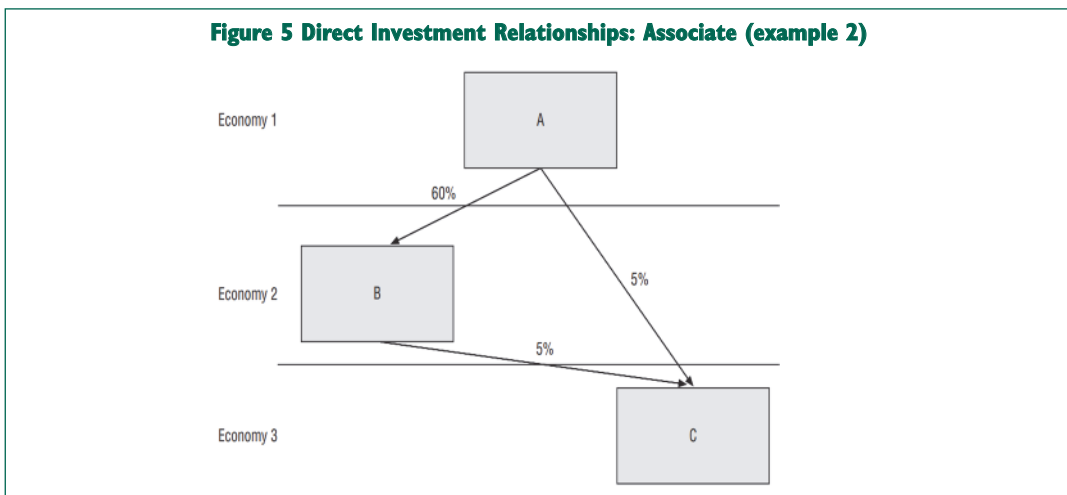
Figure 6 Direct Investment Relationships: Associate (example 3)

Economy 1 — A

80%

Economy 2 — B

40%

Economy 3 — C
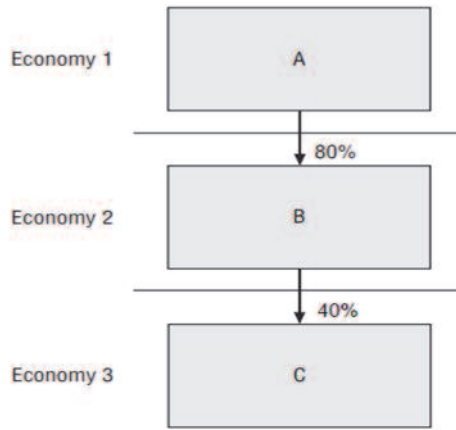
Figure 7 Direct Investment Relationships: Associate (example 4)

Economy 1 — A

30%

Economy 2 — B

60%   30%

Economy 3 — C   30%   D
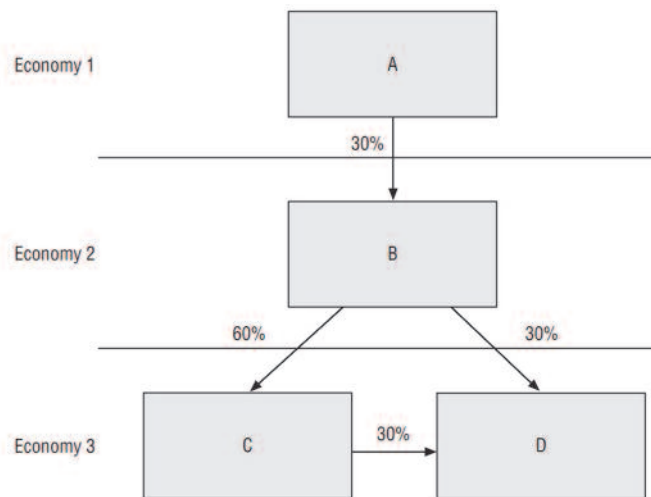
Figure 8 Direct Investment Relationships: Associate (example 5)

Economy 1 — A

40%

Economy 2 — B

80%

Economy 3 — C
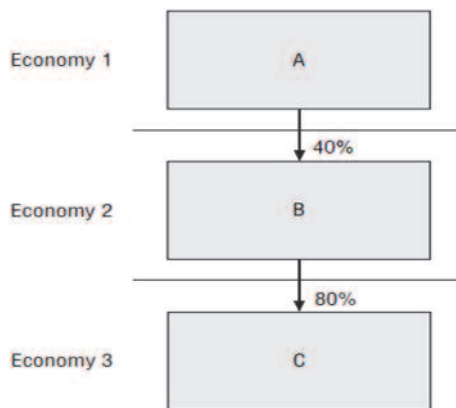
(c) an associate of the investor, either as an individual or in combination with its subsidiaries, owns more than 50% of its voting power. In Figures 7 and 8 above, enterprises D and C are associates of enterprise A.

2.2.3 Fellow enterprises

Fellows are enterprises that are not related to each other by holding 10% or more of the voting power in one another, but are directly or indirectly influenced by the same entity (they have a "common parent"). In Figure 9 below, B and C are fellow enterprises.

foreign company in the country of establishment.

2.2.5 Investment relationships that do not fall under FDI

The following relationships are not part of FDI statistics:

(a) An enterprise in which the investor owns less than 10% of the voting power, in the absence of an indirect participation that would make it a subsidiary or an associate, is considered not to be influenced by the investor

Figure 9 Direct Investment Relationships: Fellow enterprises
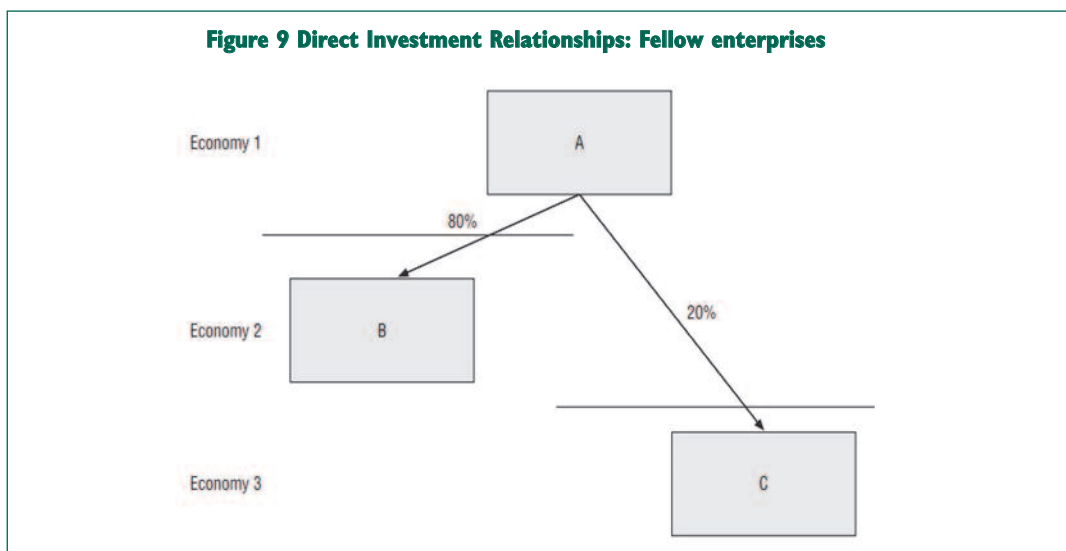
If a resident direct investor A has a direct investment in a non-resident enterprise C, as well as a resident subsidiary enterprise B, then B is not a foreign affiliate[3] of A (since they are in the same economy), but B and C are fellow enterprises under the FDIR and any transactions and positions between them are relevant for foreign direct investment and are included in the FDI statistics.

2.2.4 Branches

Branches are included in FDI statistics. A branch is defined as a local unit of economic exploitation of a foreign company not constituting a separate legal entity and carrying out directly all or some of the activities of the

and therefore does not fall within the scope of FDI.

(b) An associate of an enterprise associated to the investor is not influenced by this investor and is not FDI related under the FDIR. Note that the Participation Multiplication Method[4] does not apply. In Figure 10 below, C is not connected to A through a direct investment relationship, even though the multiplication of intermediate participation rates (30% X 40% = 12%) is greater than 10%.

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3 Affiliated enterprises are enterprises in a direct investment relationship.
4 The Participation Multiplication Method (PMM) includes in direct investment all enterprises in which an investor has voting equity participation of at least 10%. The calculation of the participation percentage is based on a straight multiplication and summation of direct and indirect participation percentages.

Figure 10 Investment relationships outside FDI

Economy 1	A
	↓ 40%
Economy 2	B
	↓ 30%
Economy 3	C
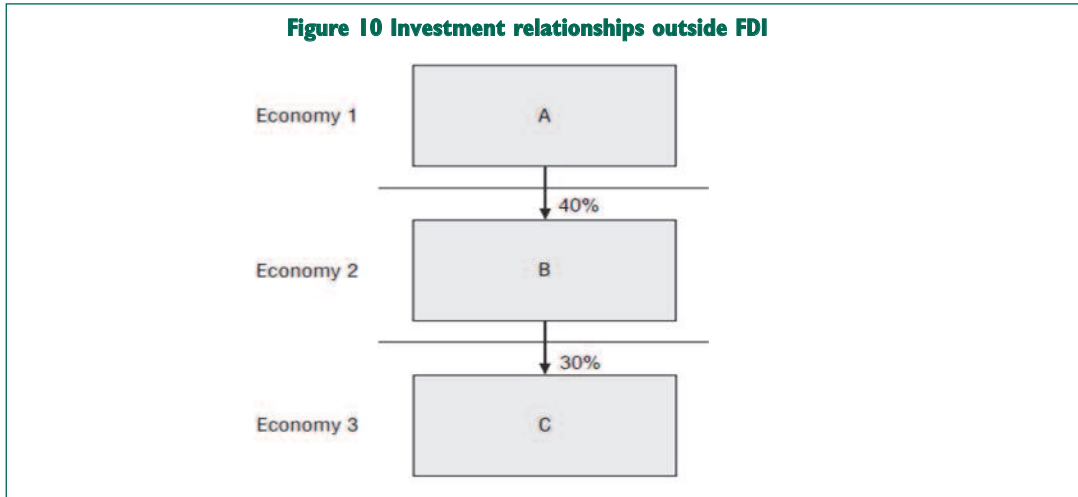
2.3 STRUCTURE OF A MULTINATIONAL ENTERPRISE GROUP AND FDI RELATIONSHIPS

Using all the above definitions, Figure 11 shows the structure of a Multinational Enterprise Group (MNE) and illustrates the various relationships between the entities involved in a direct investment relationship.[5]

Each of the boxes represents a different entity. The arrows show the direction of ownership and the percentages that accompany them show the share of equity held by the direct investor.

5 OECD (2015), *Measuring International Investment by Multinational Enterprises. Implementation of the OECD's Benchmark Definition of Foreign Direct Investment*, 4th edition.

Figure 11 Multinational Enterprise Group and FDI relationships
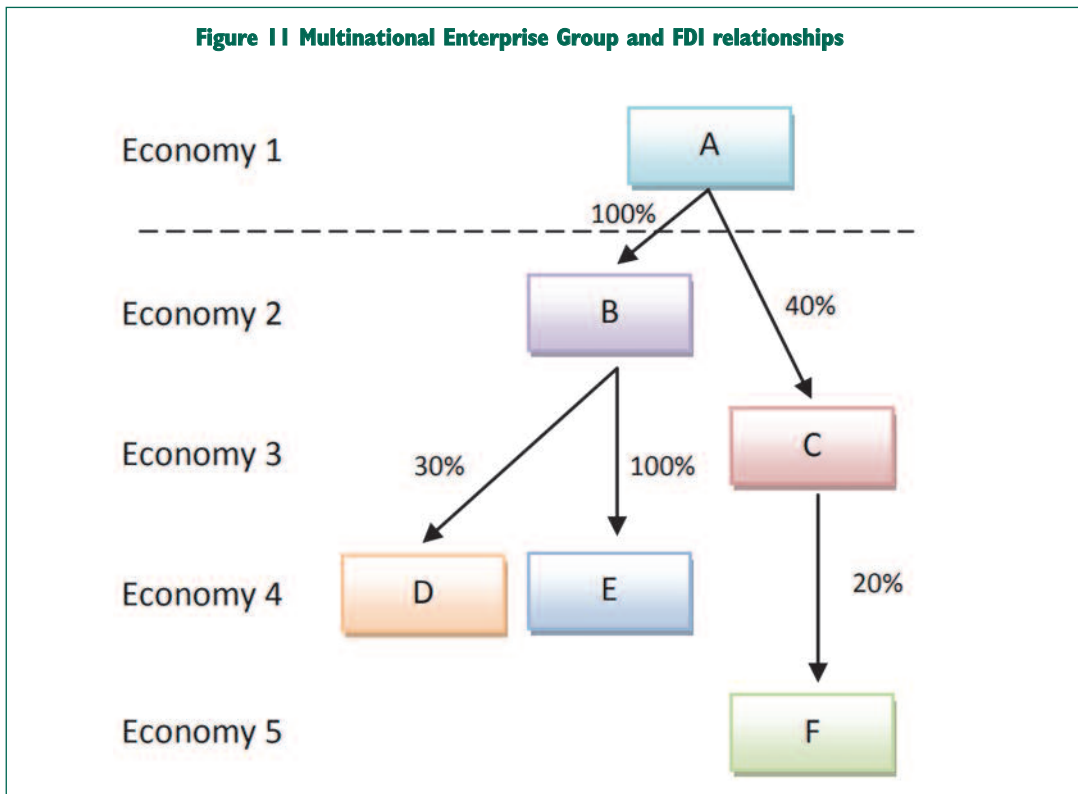
Entity A is a direct investor in two direct investment enterprises: B and C. A is said to have a direct ownership interest in B and C and is called a parent; B and C are called affiliates of A. A controls B (subsidiary) because it owns more than 50% of the voting equity in B, but A only has influence on C (associate) because it owns 50% or less of the voting equity in C. While a parent is usually a business enterprise, it can be any institutional unit, such as an individual, a government, a non-profit institution, or a trust. In contrast, affiliates must be business entities – either corporations or quasi-corporations. A quasi-corporation is an unincorporated business that operates as if it is separate from its parent, such as a branch.

B and C are also parents. D and E are affiliates of B and they are also affiliates of A through A's control of B. Similarly, F is an affiliate of C. However, it is not an affiliate of A as the ownership tie between F and A is considered to be too weak – A only has influence on C, which, in turn, only has influence on F. A is said to have an indirect ownership interest in D and E.

There is no direct investment equity relationship between B and C because neither one owns any voting power in the other. However, they are called fellow enterprises and they are in a direct investment relationship because they are controlled by the same direct investor. Any transactions between them are relevant to direct investment and included in FDI statistics because such transactions are likely to result from the influence that A has on the operations of both entities. There are other examples of fellow enterprises in the Figure, including D and C, D and E, and E and C. However, F is not a fellow of any other entity in Figure 11, as it does not have a direct investor in common with any of the other entities.

Entity A is the ultimate controlling parent (UCP) of affiliates B, D, and E. A is also the UCP of C if no other single entity owns a majority share of C. The UCP is found by moving up the ownership chain from the immedi-ate investor until an entity that is not con-trolled – that is, owned by more than 50% – by any other entity is reached. Entity C is the UCP of F assuming that no other direct investor owns a majority share of F because C is not controlled by A. Economy 1, the country of res-idence for entity A, is the ultimate investing country (UIC) for affiliates B, C, D and E. Economy 3 is the UIC of affiliate F.

To recap, for Economy 1, the entities covered by FDI statistics are A, B, C, D and E. The same applies to Economies 2, 3 and 4. For Economy 5, the entities of interest to FDI sta-tistics are F and C.

2.4 FDI COMPONENTS AND ACCOUNTS

The main financial instrument components of FDI are equity and debt instruments. Owner-ship of equity is usually evidenced by shares, stocks, participations, depositary receipts or similar documents. Equity also includes rein-vested earnings. Debt instruments include debt securities, loans, trade credits and deposits, except for investments in derivatives. Invest-ment in real estate is included in direct invest-ment, as part of cross-border acquisition of assets.

FDI accounts cover all cross-border transac-tions and positions between entities in a for-eign direct investment relationship: (a) FDI financial flows, which cover equity and debt transactions between related parties in a spe-cific time period; (b) FDI income, which rep-resents the return on equity and debt invest-ment to the immediate investor in the refer-ence period; and (c) FDI positions, which reflect the value of accumulated direct invest-ment at the end of the reference period – also referred to as FDI stocks.

2.5 SUPPLEMENTARY INTERNATIONAL RECOMMEN-DATIONS CONCERNING THE COVERAGE OF FDI STATISTICS

To clarify the transactions and entities included in direct investment, BMD4 makes

additional recommendations. The first of these is to exclude all debt between financial intermediaries, such as banks, from direct investment. In the past, permanent debt, defined as debt representing an enduring interest, was included in direct investment, while all other debt was excluded because it was more strongly associated with the role of corporations as financial intermediaries than with their direct investment relationship. However, BDM4 recognised that there were practical difficulties in estimating permanent debt and made a change to exclude all debt between financial intermediaries from FDI.

Another change brought about by BMD4 was the extension of the coverage of FDI to include investments to and from Collective Investment Institutions (CIIs). CIIs include entities such as mutual funds, private equity funds and hedge funds. A CII can be either a direct investment enterprise, if an investor acquires at least 10% of the voting power of the CII, or a direct investor, if the CII acquires at least 10% of the voting power of a foreign enterprise. Investments to and from CIIs are therefore included in direct investment if the FDI criteria are met; however, this phenomenon needs further monitoring as the nature and motivations for direct investment by CIIs may differ from those of multinational enterprises (MNEs). It should be noted that the recommendations of the ECB for the compilation of balance of payments statistics propose the statistical classification of CIIs only as direct investors and not as direct investment enterprises. That is, all investments in the equity of investment enterprises should be treated as portfolio investments and not as direct investment, while investments by investment enterprises can be considered a direct investment if they meet the 10% voting power criterion.[6]

Finally, the BMD4 clarifies that non-profit institutions can be direct investors. They cannot, however, be direct investment enterprises because their non-profit status does not allow them to be a source of income or other financial gain for the units that establish, control or finance them. Examples of non-profit institutions that could be considered as direct investors include non-profit colleges, universities or hospitals that acquire voting rights in a foreign business.

2.6 PRESENTATION OF FDI STATISTICS ACCORDING TO THE ASSET/LIABILITY PRINCIPLE

In addition to the definition of FDI and the framework of FDI relationships, the OECD also provides recommendations on how to compile and present aggregated and detailed FDI statistics by partner country and by economic activity of the direct investment enterprise.

At the aggregate level, BMD4 is aligned with the recommendations of the International Monetary Fund's Balance of Payments and International Investment Position manual (BPM6) for recording FDI statistics according to the "asset/liability principle". This recommendation makes the FDI statistics included in the balance of payments (BOP) and international investment position (IIP) accounts more comparable to other macroeconomic statistics. In addition, the specific presentation of aggregated FDI statistics allows balance of payments analysis, such as examining the impact of FDI on a country's current account balance.

Under the asset/liability principle, FDI statistics are presented according to whether the investment relates to an asset or a liability for the country compiling the data. For example, a country's assets include equity investments and loans from both parents and subsidiaries located in that country to their foreign affiliates, because these investments are claims they have on assets in foreign countries. Similarly, the reporting country's liabilities include equity investments and loans of foreign parents and subsidiaries to affiliates resident in that country, because these investments represent claims that foreigners have on assets in the reporting country. The presentation of FDI according to

6 ECB (2023), "EU Balance of Payments and International Investment Position statistical sources and methods – 'B.o.p. and i.i.p. e-book' ", October.

the asset/liability principle does not, however, show the direction of influence of the direct investment; this is achieved by the presentation based on the "directional principle", which is explained further below.

2.7 PRESENTATION OF FDI STATISTICS ACCORDING TO THE DIRECTIONAL PRINCIPLE

To record detailed FDI statistics by partner country and by economic activity sector, the BMD4 and BPM6 manuals recommend the use of the directional principle, which shows the direction and degree of influence of foreign direct investment. The directional principle is considered as the most appropriate way of compiling FDI statistics for understanding and analysing foreign direct investment and the actions of multinational enterprises.

According to the directional principle, direct investment flows and positions are presented according to the direction of the investment for the reporting economy – either outward or inward. Thus, for a given country, all flows and positions of parent entities resident in that economy are shown under outward investment, and all flows and positions of affiliates resident in that economy are shown under inward investment.

Table 1 shows the building blocks used to construct the presentation of FDI positions according to the asset/liability principle as well as according to the directional principle.

Under the asset/liability presentation, the asset side includes assets of both resident parent companies and resident affiliates, while the liability side includes all liabilities of resident parents and resident affiliates. In contrast, the outward investment position consists only of positions of resident parents, and the inward investment side consists only of positions of resident affiliates.

The second difference is in the treatment of reverse investment, which occurs when an affiliate invests in its parent. Under the directional presentation, reverse investment is subtracted to derive the amount of total outward or inward investment of the reporting country. So, if a resident parent borrows money from one of its foreign affiliates, this is subtracted when calculating the reporting country's outward investment, because it reduces the amount of funds that country's parents have invested in their foreign affiliates. Similarly, if a resident affiliate lends money to its foreign parent, this amount is subtracted when calculating inward investment, because it reduces the funds that the foreign parent has invested in that country. In contrast, under the asset/liability presentation, all assets and all liabilities are simply added up.

Table 1 Asset/liability presentation vs directional presentation of FDI positions

FDI ASSETS	FDI LIABILITIES
equal	*equal*
Resident parents' equity in and lending to foreign affiliates	Foreign parents' equity in and lending to resident affiliates
plus	*plus*
Resident affiliates' equity in and lending to foreign parents	Foreign affiliates' equity in and lending to resident parents
OUTWARD FDI	**INWARD FDI**
equal	*equal*
Resident parents' equity in and lending to foreign affiliates	Foreign parents' equity in and lending to residents affiliates
minus	*minus*
Foreign affiliates' equity in and lending to resident parents (reverse investment)	Resident affiliates' equity in and lending to foreign parents (reverse investment)

Finally, it should be noted that reverse investment in equity is rare, therefore the difference between the two presentations primarily arises from differences in the treatment of reverse investment in debt instruments.

2.8 CHOOSING BETWEEN THE TWO PRESENTATIONS OF FDI STATISTICS

For economic analysts who have to choose between the two ways of presenting FDI statistics, one might say that the recording of aggregated FDI statistics on the basis of assets/liabilities is recommended, because it makes FDI statistics consistent with other macroeconomic statistics in general and with the treatment of other functional categories of investment in BOP/IIP statistics.[7] The asset/liability approach facilitates macroeconomic analyses, such as examining the composition and size of a country's liabilities and assets to assess its vulnerability to crises. By providing consistent information on the composition and size of assets and liabilities by functional category of investment (for example, direct investment or portfolio investment) and by instrument (for example, equity or debt), a country's IIP provides important insights into how vulnerable its economy is to external market conditions. For example, assessing the share of

total debt liabilities in direct investment is important because the returns to creditors in direct investment depend on the performance of the debtor, as there is a lasting interest between the creditor and the debtor. In contrast, the returns to creditors on debt liabilities in portfolio investment do not depend on the performance of the debtor but are required even if the debtor is in difficulty, and, hence, pose a greater risk to the economy.

Presenting FDI statistics on an asset/liability basis may be appropriate for macroeconomic analyses, but it is less suitable for studying the nature and motivations of foreign direct investment. For example, this approach is less useful for identifying the countries of origin of the direct investment in a particular reporting country or for assessing the access to particular foreign markets by its direct investors. The presentation of FDI statistics based on the direction of investment seems more appropriate for this type of analysis and this is why the international manuals recommend the presentation of detailed FDI statistics by economic activity and by partner country on a directional basis. As already explained, the statistics shown

7 There are five categories of investment in BOP/IIP statistics: direct investment, portfolio investment, foreign exchange, financial derivatives and other investment consisting mainly of loans and deposits.

Chart 1 Comparison of FDI stocks presented under the asset/liability and the directional principle

(EUR millions)
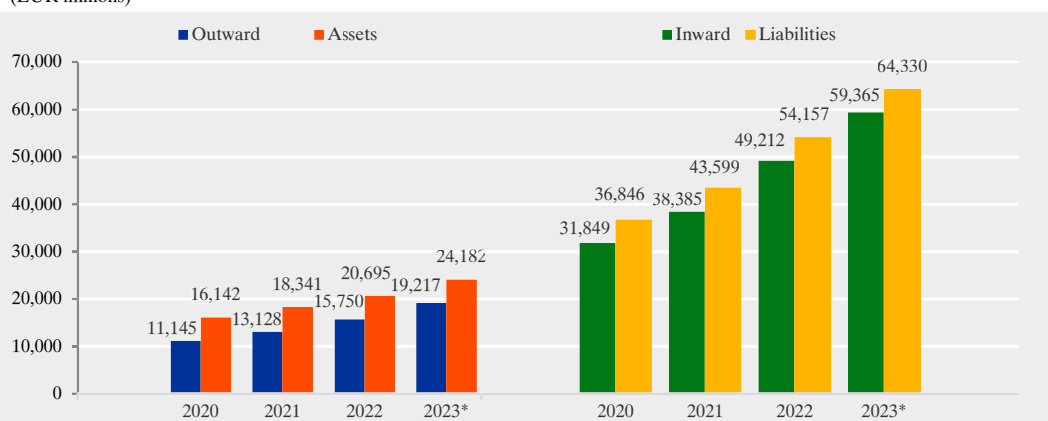
Source: Bank of Greece.
* Provisional data.

on a directional basis classify direct investment either as outward investment, where a direct investor in the reference economy has an outward investment, or as inward investment, where a foreign direct investor has an investment in an affiliate located in the reference economy (inward).

The two different presentations of FDI statistics have an impact on the statistical data. Aggregate FDI statistics based on the asset/liability principle are always higher than those based on the directional principle, because reverse investments are not subtracted as they are in the statistics on a directional basis. The size of the difference between the two sets of statistics depends on the amount of reverse investment. Furthermore, the extension of the directional principle to fellow enterprises introduced in BMD4 (and described in the next sub-section) reinforces the differences between the two principles (see Chart 1).

2.9 EXTENDED DIRECTIONAL PRINCIPLE

In order to further improve statistics on a directional basis – which measure more accurately the degree and the direction of influence of the investment – the international recommendations propose to extend the directional principle to relations between fellow enterprises.

In the past, the statistical standards required that FDI assets of a resident fellow enterprise in a fellow enterprise abroad should be recorded as outward investment and its FDI liabilities as inward investment, which is, in

practice, still followed by many countries. However, this treatment does not accurately reflect the direction and the degree of influence of resident and non-resident direct investors in the reference economy. For example, a resident company does not achieve any influence over a fellow non-resident company by granting a loan to it – the influence remains with their common parent, which ultimately controls the transactions of the fellow enterprises. In order to reflect this influence, the latest BMD4 standards provide that the recording of flows and stocks between fellow enterprises in a reference economy depends on the residence of the Ultimate Controlling Parent (UCP) of the fellow enterprises. If the UCP is a resident of the reference economy, FDI flows and stocks should be recorded as outward FDI and, vice versa, if the common parent is not a resident of the reference economy, FDI flows and stocks should be recorded as inward FDI.

This treatment applies to both equity investments and loans between fellows. However, as equity investments are rare, it is debt that has the largest impact on FDI statistics (see Table 2).

If the UCP of the fellow enterprise is a resident of the reference economy, then loans to and from the fellow enterprise are treated as outward investment. Any loan from the fellow company to a fellow company abroad is treated as an increase in outward investment from the reference economy because it represents an increase in the influence that a resident direct investor (the UCP) has in the

Table 2 Recording of loans between fellows on a directional basis

		Residence of the Ultimate Controlling Parent (UCP)	
		UCP is resident	UCP is not resident
Direction of the loan	Resident fellow enterprise makes a loan	Increase in outward investment (outward)	Decrease in inward investment (inward)
	Resident fellow enterprise receives a loan	Decrease in outward investment (outward)	Increase in inward investment (inward)

Table 3 Greek FDI stocks recorded under the asset/liability principle and the directional principle

(in EUR millions)

Reference year	By principle and type of capital	Asset/Liability principle			Directional principle — Direct investment abroad						
		Direct investment assets	Direct investment liabilities	Direct investment net	Total	Equity capital of resident direct investors in direct investment enterprises abroad (and resident fellow enterprises if UCP is resident) — Net	Assets	Liabilities	Debt instruments of resident direct investors in direct investment enterprises abroad (and resident fellow enterprises if UCP is resident) — Net	Assets	Liabilities
		(1)=(6)+(9) +(14)+(17)	(2)=(7)+(10) +(13)+(16)	(3)=(1)-(2)	(4)=(5)+(8)	(5)=(6)-(7)	(6)	(7)	(8)=(9)-(10)	(9)	(10)
2021		18.341	43.599	-25.258	13.128	14.785	14.872	87	-1.657	1.491	3.148
2022		20.695	54.157	-33.462	15.750	16.459	16.564	105	-710	1.494	2.204
2023		24.182	64.330	-40.148	19.217	19.429	19.434	5	-212	1.874	2.087

Reference year	By principle and type of capital	Directional principle — Direct investment in Greece							Direct investment net
		Total	Equity capital of non-resident direct investors abroad in resident direct investment enterprises (and resident fellow enterprises if UCP is non-resident) — Net	Liabilities	Assets	Debt instruments of non-resident direct investors abroad in resident direct investment enterprises (and resident fellow enterprises if UCP is non-resident) — Net	Liabilities	Assets	
		(11)=(12)+(15)	(12)=(13)-(14)	(13)	(14)	(15)=(16)-(17)	(16)	(17)	(18)= (4)-(11)=(3)
2021		38.385	34.806	34.810	4	3.579	5.554	1.975	-25.258
2022		49.212	44.398	44.402	4	4.814	7.446	2.633	-33.462
2023		59.365	54.564	54.569	5	4.801	7.670	2.869	-40.148

Source: Bank of Greece.

direct investment enterprise of another economy. Likewise, if the fellow enterprise takes a loan, this reduces outward direct investment, just as it would if the UCP had taken a loan, because such an investment reduces the total amount invested by the resident direct investor (the UCP) abroad.

The recording of transactions between fellow enterprises in the assets/liability presentation differs from that according to the directional principle. In the asset/liability presentation, all equity and debt investments made by resident fellow companies are recorded as assets and all equity and debt investments received by resident fellow companies are recorded as liabilities. The direction of influence is not relevant.

2.10 SPECIFIC RECOMMENDATIONS FOR THE VALUATION OF STOCKS AND FLOWS IN FDI STATISTICS

The BMD4 and BPM6 manuals recommend market value as an appropriate valuation method for stocks and flows of direct investment. Market value places all assets at current prices. However, it is difficult to produce market values for FDI stocks because the equity capital of many direct investment enterprises is not listed on the stock market. Often the only information available to those compiling FDI statistics is the book value of the firm's capital, which is available on the books of either the direct investor or the direct investment enterprise. Therefore, it is necessary to estimate market values for unlisted shares. The BMD4 and BPM6 man-

uals make specific recommendations for the calculation of market values of FDI stocks in order to make market values statistics more widely available and more comparable across countries.

Six methods are recognised for approximating the market value of unlisted equity: (a) recent transaction price; (b) own funds at book value (OFBV); (c) market capitalisation method; (d) net asset value (NAV); (e) present value; and (f) apportioning global value. However, it appears that of these six recommended methods, only the first three are retained in the draft texts of the current BMD4 review process.

Under the recent transaction price method, given that there may be occasional buying and selling of unlisted shares, the price of a recent transaction (within the previous year) may be used to estimate the market value of a firm's capital. In general, recent trading prices can be a good indicator of current market values as long as conditions remain unchanged. As time passes after the transaction and conditions change, recent transaction prices become increasingly misleading.

The method of own funds at book value (OFBV) involves the valuation of a business at the value shown in its books in accordance with International Accounting Standards (IAS). OFBV are based on the direct investment firm's books and appear on its balance sheet as equity. The definition of OFBV contains the paid-up capital, all types of reserves and the net value of undistributed profits and losses (including the result for the current year). The more frequent the revaluation of assets and liabilities, the closer the approximation to market values. Data that are not reassessed for several years can be a poor reflection of market value. International Accounting Standards require that most assets be revalued on an annual basis. On the other hand, IAS do not recognise some intangible assets and therefore OFBV are almost always less than the company's capitalisation. Also, the direct invest-

ment enterprise may not keep books in accordance with IAS, but may follow national generally accepted accounting principles (GAAP) and, therefore, the closeness of national GAAP to IAS should be considered to determine whether the OFBV method is appropriate for approximating market value.

The market capitalisation method calculates the ratio of market capitalisation to OFBV for a group of comparable companies and then applies this ratio to the direct investment enterprise's OFBV in order to approximate market value. In general, this method estimates market value well. However, there should be a deep enough capital market to develop a country-specific ratio. Separate ratios should also be developed for different sectors of the economy. Finally, this method can introduce bilateral asymmetries if the countries compiling the statistics use different proportions.

In Greece, FDI positions are valued at market value for listed shares, whereas unlisted equity is valued using the OFBV concept. As regards the valuation of listed shares, the market capitalisation value of the direct investment enterprise is obtained from the Centralised Securities Database (CSDB) using the International Securities Identification Number (ISIN). Then, the data collected in the context of FDI statistics are cross-checked with the assets/liabilities listed equity collected in the context of the compilation of portfolio investment statistics (Securities Holdings Statistics by Sector – SHSS), ensuring a coverage of more than 95% for 2022 and 2023. Additionally, inward listed equity is cross-checked with the voting rights of shareholders of companies listed on the ATHEX markets. This information originates from disclosures made by the listed companies based on information received from their shareholders.

Unlisted equity is valued using the OFBV concept (as a proxy for market value), with the book value obtained from the books of the direct investment enterprise. It is the sum of

paid-up capital, all types of reserves identified as equity, cumulated reinvested earnings and cumulated retained holding gains or losses included in own funds. Of the 330 largest FDI enterprises in Greece, which account for about 90% of total inward FDI, about 75% use International Accounting Standards/International Financial Reporting Standards (IAS/IFRS) and the remaining use National (Greek) Accounting Standards (NAS). While there are some differences between IAS/IFRS and NAS, entities are allowed by law to predominantly rely on international standards for guidance. Therefore, to a significant extent, there is a convergence between Greek and international standards. However, the valuation of unlisted stocks using the OFBV concept may distort the market value and there are cases where the cost of acquiring a direct investment enterprise differs significantly from the OFBV.

3 THE ANNUAL FOREIGN DIRECT INVESTMENT SURVEY OF THE BANK OF GREECE

The annual FDI survey carried out by the Bank of Greece is a census survey and, therefore, no sampling is applied. All reporting companies, residents in Greece are expected to report the FDI outstanding amounts concerning them, regardless of the amount involved. This information is used to compile statistical data concerning FDI, while it also contributes to the compilation of the country's International Investment Position, Balance of Payments and National Accounts, as well as to the update of the European register of multinational enterprises (EuroGroups Register - EGR).

3.1 STRUCTURE AND CONTENT OF THE QUESTION-NAIRE OF THE ANNUAL FDI SURVEY

The structure of the questionnaire of the annual FDI survey is divided into 9 subcategories:

(a) General information and metadata on the respondent. The general information collected concerns identification information (Tax Registration Number, General Commercial Register (GEMI) Number, and Name), contact information and metadata on the respondent (economic sector, main economic activity sector code, ISIN, if listed on a stock exchange, and flag, if it concerns a Special Purpose Entity).

(b) Group and ultimate investor information. The information collected concerns the group's main economic activity, the sector code and the final investor, which is defined as the entity (individual, household or company) that has control over the reporting entity (owns more than 50% of the voting shares) and is at the top of the chain (not controlled by another entity). It is noted that if the reporting company in Greece is not controlled by another entity, then the company in Greece is considered as the ultimate investor. These data are used to compile foreign direct investment statistics in Greece by country of ultimate investor at the level of stocks (inward FDI stocks by ultimate investing economy).

(c) Details of direct investors (DI). The information collected concerns the entities that participate (directly or indirectly, including through domestic intermediate enterprises) in the respondent's equity and with which the respondent is linked through a direct investment relationship (it is a subsidiary, affiliate or fellow company) or the details of the head office, if the respondent is a branch of a foreign company.

(d) Financial details of the respondent. In the event that a foreign direct investor participates directly in the respondent's equity, data are collected from the financial statements (balance sheet and profit and loss statement) of the respondent and, in addition, the amount of reinvested earnings of the respondent is calculated. Since a direct investment enterprise is, by definition, subject to control or influence by a direct investor or investors, the decision to retain and reinvest profits in the firm represents an investment decision on the part of the direct investor, which is recorded statistically in the sense of reinvested earnings.

(e) Details of direct investment enterprises (DIE). The information collected concerns the companies in which the reporting entity participates (directly or indirectly, including through domestic intermediate companies) and with which the reporting entity is connected through a direct investment relationship (they are subsidiaries, affiliates or fellow companies), as well as foreign branches.

(f) Financial data of direct investment enterprises. Similarly to sub-category (d), data are collected from the financial statements (balance sheet and profit and loss account). In addition, the amount of reinvested earnings is calculated for each of the foreign direct investment enterprises in which the respondent directly participates, including foreign branches.

(g) Financial data of foreign branches.

(h) Ultimate Host Economy. Information regarding the ultimate host economy is collected when the foreign direct investment enterprise is a holding company or a special purpose entity (SPE) and does not represent the final destination of the investment. Given that such entities, i.e. holding companies and SPEs, do not make a real contribution to the economies that host them, data are collected on the first productive business (first operating unit) and the countries where they are located below in the chain, in order to reallocate the outward FDI stock and capture the final destination of the residents' investments abroad (compilation of outward FDI stocks by ultimate host economy). Data are currently collected on a voluntary basis.

(i) Claims and liabilities in debt instruments against non-residents. The data collected concern the respondent's positions in debt instruments relating to trade credits, loans, securities and other debt instruments vis-à-vis foreign direct investors (see item (c) above), direct investment enterprises (see item (e) above) and fellow enterprises of the respondent.

The determination of the structure and content of the FDI questionnaire is a dynamic process, which adapts to changes imposed by the updates of international standards and guidelines or regulations of international organisations.

3.2 THE STATISTICAL PROCESS OF COLLECTING AND COMPILING FDI STATISTICS

The statistical process of collecting direct investment data through the annual FDI Survey consists of four stages: (a) defining the FDI population frame, which includes entities residing in Greece known to have a direct investment relationship with a non-resident, either as a direct investor or as a direct investment company; (b) collection of data through the Bank of Greece Internet Reporting Information System (IRIS); (c) consistency check between FDI flows and stocks; and (d) compilation and publication of FDI data.

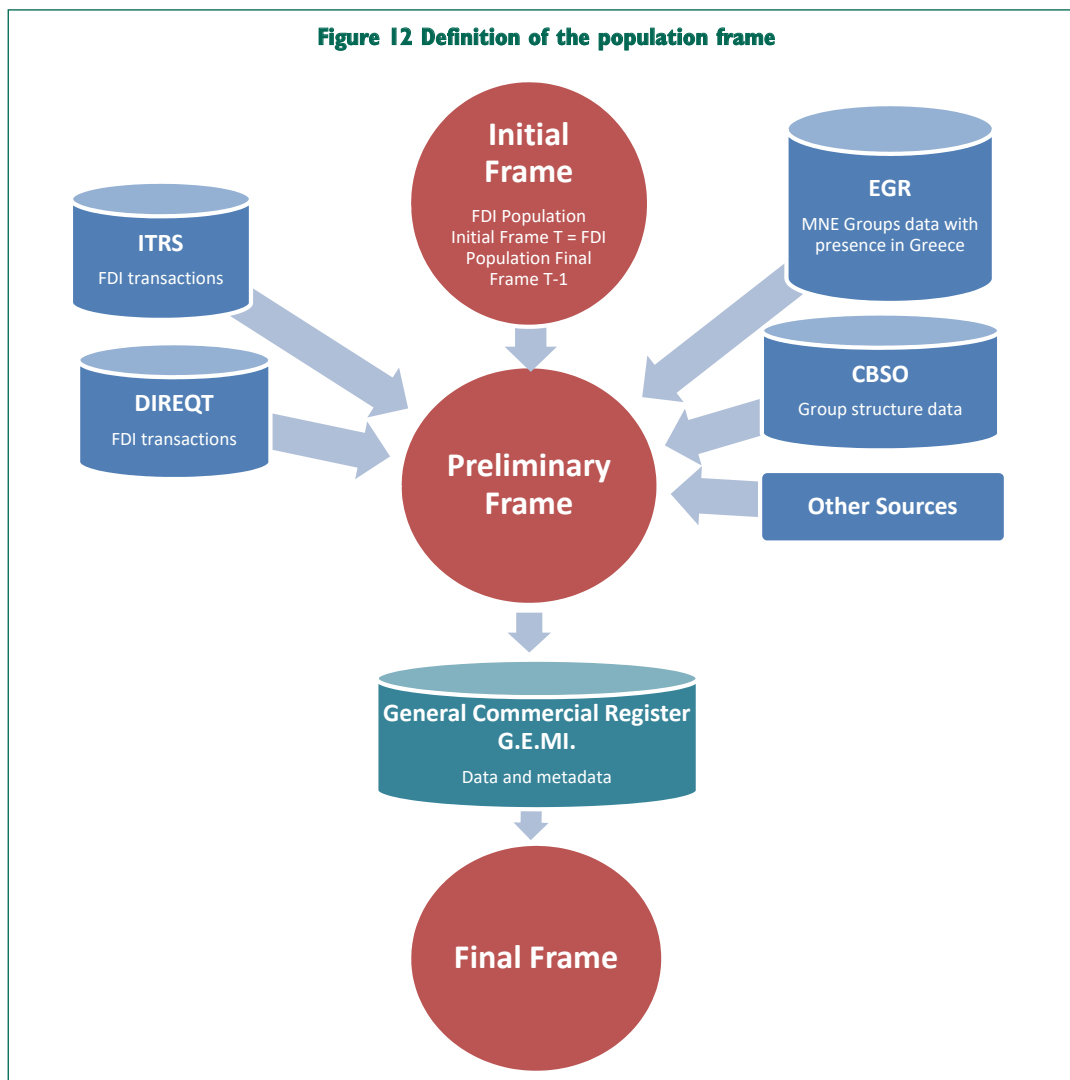### 3.2.1 Definition of the population frame

The methodology followed to define the population of respondents who are expected to submit data to the FDI survey for the reference year T is as follows:

First, the initial frame of respondents for the reference year T (initial frame) is determined. The initial population of respondents for reference year T is equal to the final population of respondents of the previous reference year T-1.

Next, the preliminary frame of respondents for the reference year T (preliminary frame) is determined. In this phase, the initial frame for reference year T is expanded to include data from the following available sources:

- ITRS: enterprises involved in FDI transactions reported on a monthly basis through the International Transactions Reporting System (ITRS) for the preparation of the balance of payments.

- DIREQT: companies that report on their own account monthly foreign trade data

Figure 12 Definition of the population frame

```
                    ┌─────────────┐
                    │   Initial   │
                    │    Frame    │
                    │ FDI Population
                    │ Initial Frame T = FDI
                    │ Population Final
                    │  Frame T-1  │
                    └─────────────┘
┌──────────┐                          ┌──────────┐
│  ITRS    │                          │   EGR    │
│ FDI      │                          │ MNE Groups data with
│ transactions                        │ presence in Greece
└──────────┘                          └──────────┘
┌──────────┐       ┌──────────────┐   ┌──────────┐
│ DIREQT   │       │ Preliminary  │   │  CBSO    │
│ FDI      │ ───►  │   Frame      │   │ Group structure data
│ transactions     │              │   └──────────┘
└──────────┘       └──────────────┘   ┌──────────┐
                                      │ Other Sources
                                      └──────────┘
                    ┌──────────────┐
                    │ General Commercial Register
                    │    G.E.MI.    │
                    │ Data and metadata
                    └──────────────┘
                    ┌──────────────┐
                    │ Final Frame  │
                    └──────────────┘
```

through the Direct Reporting System of the Bank of Greece for the preparation of the balance of payments.

- EGR: data from the EuroGroups Register, which contains financial information and data on the structure of multinational groups with economic interests in Europe. The data obtained from the EuroGroups Register cover all the companies of multinational groups (including branches) operating in Greece. It is noted that multinational groups are classified according to the country of establishment of the ultimate controlling institutional unit (UCI) of the group and form the statistical population of

the Inward FATS (foreign affiliates statistics) survey, if the ultimate controlling institutional unit is established in a country abroad, or of the Outward FATS survey, if the ultimate controlling institutional unit is established in Greece. The production cycle of the EGR register is annual.

- CBSO: Data from the annual financial statements of companies in the non-financial sector in Greece collected by the Bank of Greece and including, among other things, data on the structure of groups.

- Other sources: published information from other sources (media, announcements in the

General Commercial Register (GEMI), announcements of changes in the voting rights of shareholders of companies with shares traded on the ATHEX markets, etc.).

It is noted that the "key" used to connect the data from all the above sources is the tax registration number.

- GEMI: For all the entities of the population frame expanded as explained above, publicly disclosed company information is obtained, based on the cooperation achieved between the Bank of Greece and GEMI, which relates to metadata such as: name, legal form, main economic activity, address, contact information, as well as the active/inactive status as at 31 December of reference year T, on the basis of which all businesses that have definitely been dissolved are excluded from the reporting frame.

With the addition of data from GEMI, the final frame of respondents for reference year T (final frame) is established and notifications are then sent to respondents for the submission of data to the FDI survey through the IRIS information system of the Bank of Greece. For the reference year 2023, the final frame included 8,037 enterprises.

3.2.2 Collection of data through the IRIS system of the Bank of Greece

FDI survey data are collected electronically through the IRIS system of the Bank of Greece, where FDI survey questionnaires are submitted. The process of validating the submitted data is divided into two phases:

Phase 1: Automated file validation phase
The electronic data collection system incorporates validation rules for the automated processing of the submitted file, which includes: (a) basic checking of technical aspects of the received file (file type, expected number of columns, alphanumeric/numeric character format, etc.) and not of the content; (b) error checking of responses to mandatory elements,

including for miscoding. The automated validation phase ensures the completeness of the submitted data and eliminates item non-response. For each submission, a proof of submission is provided to the respondent, which includes all the submitted data and the result of their automated processing. In case one or more validation rules are not satisfied, respondents are requested to correct the errors and resubmit the file.

Phase 2: Data quality validation phase
The automated file validation phase is followed by content validation. This is performed by the statistical analyst through non-automated inspection and/or, if necessary, processing of the received file, using all available sources, as well as a comparison with previous years' data. The minimisation of non-response from the reporting units (unit non-response) is also very important. Respondents who are included in the population frame of the FDI Survey but either did not submit an FDI record or the record they submitted did not pass the automated validation process, receive a compliance notice. Large companies are also notified by direct calls. In addition to the comprehensive guidelines and data collection system that significantly help respondents to ensure complete and accurate reporting, special attention is paid to the monitoring of large units, which make up the bulk of total FDI. Around 330 reporting units account for 90% of total inward FDI in Greece, as shown in Chart 2,

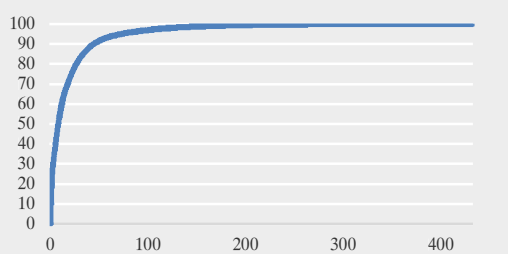**Chart 2 Cumulative distribution of inward FDI stock (2023)**

(y-axis: % of total inward FDI stock; x-axis: number of respondents)
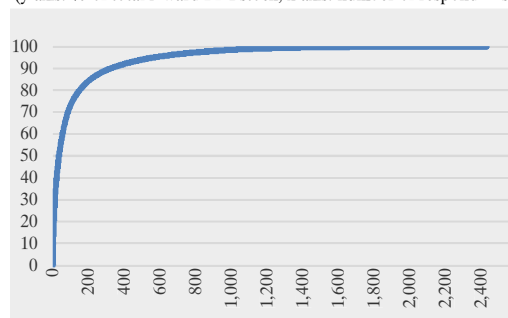
Source: Bank of Greece.
Note: Provisional data.

Chart 3 Cumulative distribution of outward FDI stock (2023)

(y-axis: % of total outward FDI stock; x-axis: number of respondents)

Source: Bank of Greece.
Note: Provisional data.

Table 4 Consistency between FDI stocks and flows

|	
FDI Positions (at the beginning of the reference year)	
FDI Flows	
Revaluations	*of which:* revaluations due to exchange rate effects
	of which: revaluations due to price changes
Other volume changes	*of which:* write-offs and cancellations
	of which: reclassifications
FDI Positions (at the end of the reference year)	

and around 80 reporting units account for 95% of total outward FDI in Greece, as shown in Chart 3.

3.2.3 Consistency check between FDI stocks and flows

Changes in FDI stocks are classified into three categories: (a) FDI transactions in the balance of payments; (b) price changes; and (c) other volume changes (see Table 4).

The change in FDI stocks between the beginning and the end of the reference year is compared with the FDI transactions recorded in the balance of payments during the reference year, at the VAT level. This process is important for harmonising flows/stocks, as discrep-

ancies may arise that are not due to valuation differences and/or other volume changes and that lead to corrections/revisions at the level of FDI flows or positions.

When conflicting information is received from different sources and the correct information cannot be determined, direct contacts are initiated with the respondents, providing feedback, along with a corresponding request for correction and resubmission of the data.

The above process of collecting data through the IRIS system of the Bank of Greece, after defining the FDI population frame, checking the correctness of the submitted data and checking the consistency between FDI flows and stocks is summarised in Figure 13.

Figure 13 The statistical process of collecting data through the annual FDI Survey
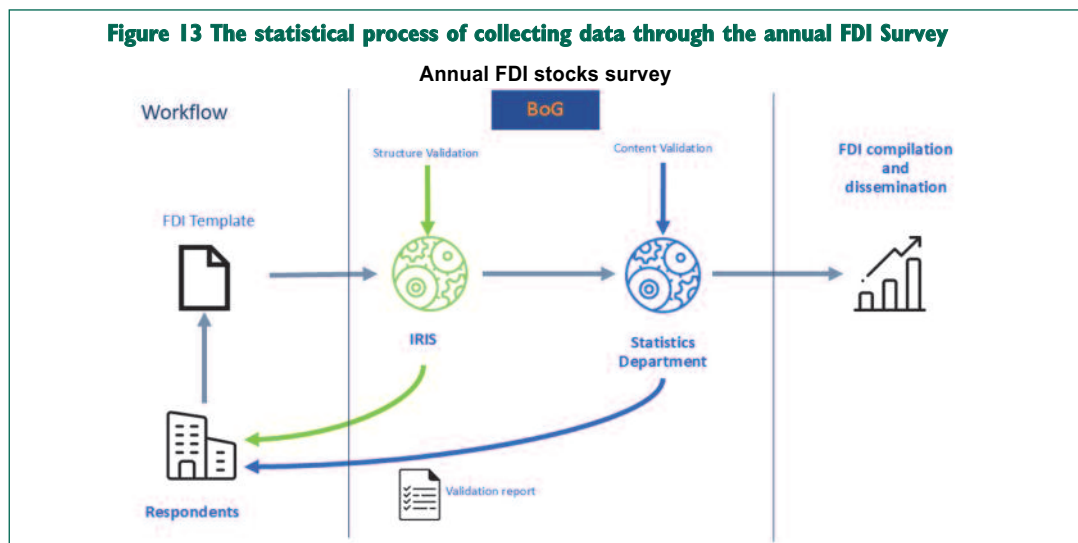
3.3 THE RESULTS OF THE ANNUAL FDI SURVEY FOR 2023

Foreign direct investment statistics (inward or outward FDI) provide a measure of Greece's integration into the global economy. In Greece, the net external position in direct investment has been negative since 2016. Greece receives larger amounts of foreign direct investment than it invests abroad. At the end of 2023, the stock of foreign direct investment in Greece reached EUR 59,365 million, while the stock of Greek direct investment (DI) abroad was EUR 19,217 million (see Chart 4).

Almost 80% of total FDI stocks in Greece is concentrated in services (56% at the end of 2023) and private purchase and sale of real estate/real estate activities (23%).[8] Stocks of Greek DI abroad are primarily directed to enterprises in the services sector (EUR 13 billion), with financial and insurance activities accounting for two-thirds of such stocks (see Chart 5).[9]

Direct investment in Greece originates from, in descending order, Luxembourg, Germany, Cyprus and the Netherlands (which all, except Germany, see a lot of capital transit due to their tax attractiveness), followed by Switzerland, Italy and the United Kingdom (see Chart 6).

The main sectors of economic activity attracting investments from Luxembourg include Financial and insurance activities, Real estate activities and Information and communication. FDI from Germany is mainly directed to Information and communication, Transportation and storage and Wholesale and retail trade. Investments from Cyprus are channelled to various activities such as Manufacturing, Arts, entertainment and recreation, Electricity, gas, steam and air conditioning supply and Real estate activities. Finally, direct investment from

8 FDI in real estate activities does not include investments in Real Estate Investment Companies (REIC). These are considered investments in investment fund shares and therefore are recorded under the Portfolio Investment functional category.
9 The FDI classification by economic activity is based on the activity of the immediate direct investment enterprise.
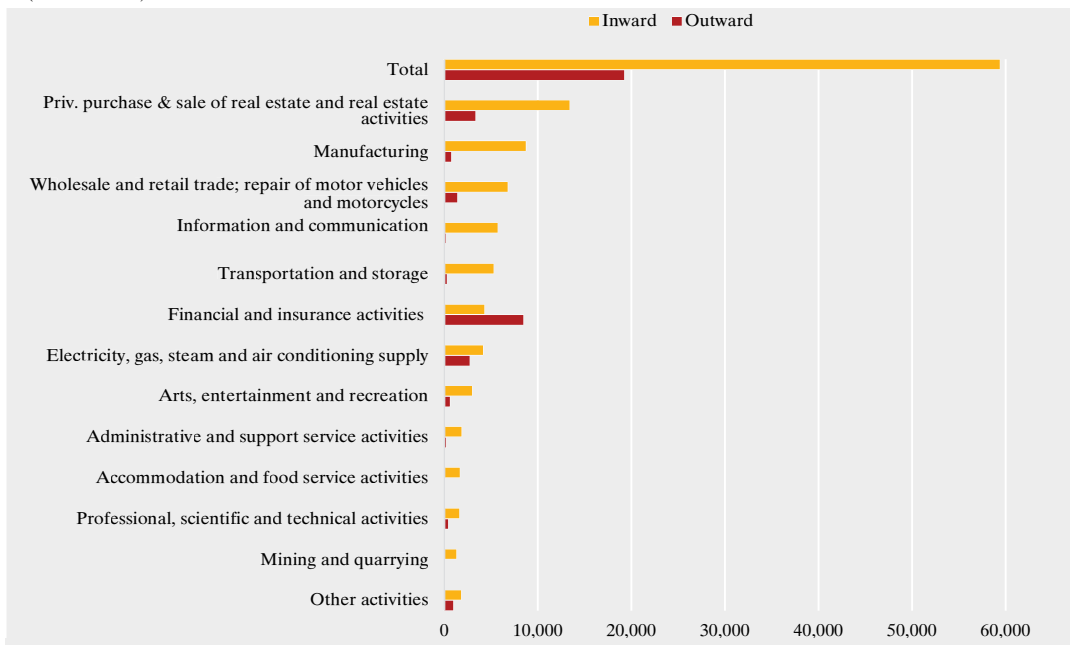

Chart 4 Inward, outward and net FDI stocks

(EUR millions)
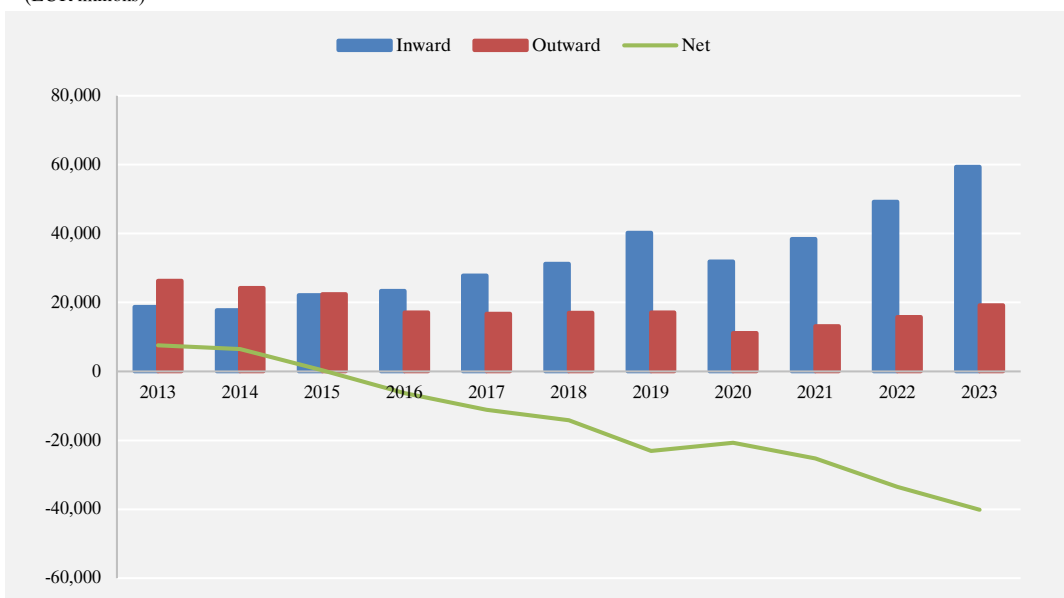
Source: Bank of Greece.
Note: Provisional data for reference year 2023.
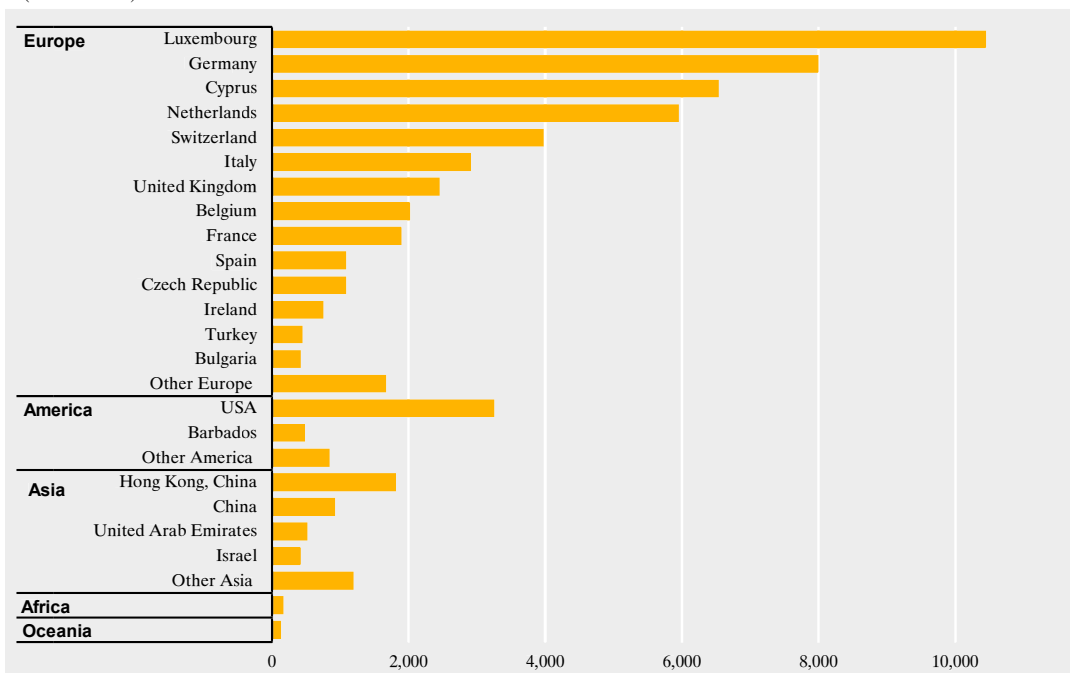
Chart 5 Inward and outward FDI stock by industry (2023)

(EUR millions)

■ Inward ■ Outward

Industry	
Total	
Priv. purchase & sale of real estate and real estate activities	
Manufacturing	
Wholesale and retail trade; repair of motor vehicles and motorcycles	
Information and communication	
Transportation and storage	
Financial and insurance activities	
Electricity, gas, steam and air conditioning supply	
Arts, entertainment and recreation	
Administrative and support service activities	
Accommodation and food service activities	
Professional, scientific and technical activities	
Mining and quarrying	
Other activities	

Source: Bank of Greece.
Note: Provisional data.

Chart 6 Inward FDI stock by country (2023)

(EUR millions)

Europe
- Luxembourg
- Germany
- Cyprus
- Netherlands
- Switzerland
- Italy
- United Kingdom
- Belgium
- France
- Spain
- Czech Republic
- Ireland
- Turkey
- Bulgaria
- Other Europe

America
- USA
- Barbados
- Other America

Asia
- Hong Kong, China
- China
- United Arab Emirates
- Israel
- Other Asia

Africa

Oceania
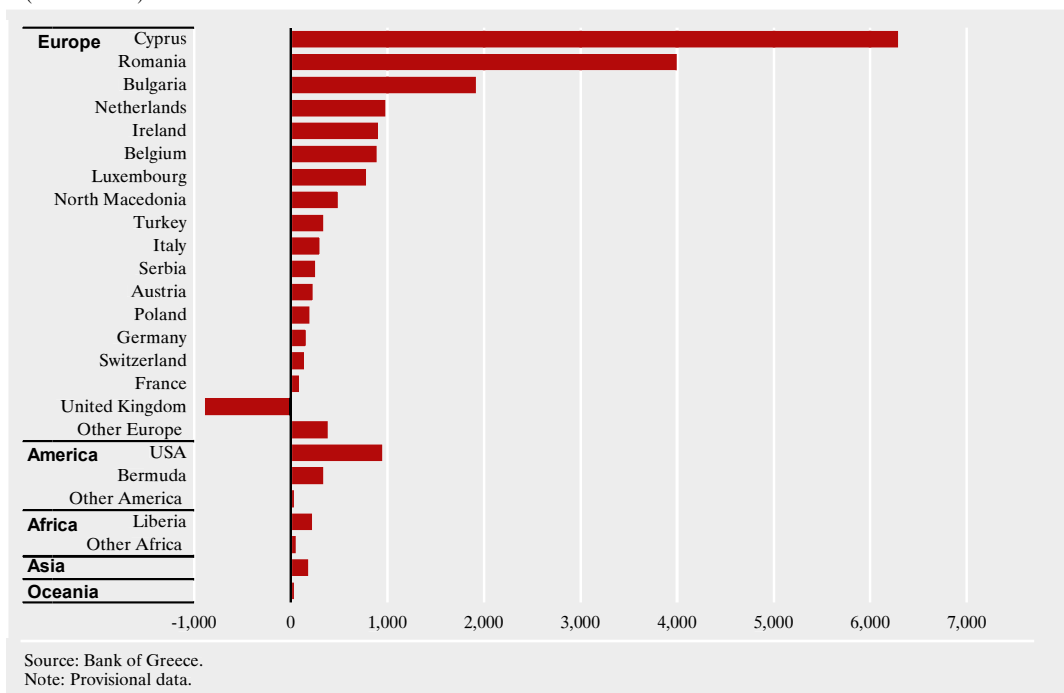
Source: Bank of Greece.
Note: Provisional data.

Chart 7 Outward FDI stock by country (2023)

(EUR millions)

Source: Bank of Greece.
Note: Provisional data.

the Netherlands is concentrated in Mining and quarrying and Manufacturing.

On the outward side, Cyprus, Romania and Bulgaria together hold the largest share (63%) of the total, followed by the Netherlands and Ireland, each with a share of 5% (see Chart 7).

The main sector of economic activity in Cyprus receiving Greek direct investment is Financial and insurance activities. FDI to Romania is mainly directed to Electricity, gas, steam and air conditioning supply activities. Finally, direct investment to Bulgaria is concentrated in Financial and insurance activities.

When allocating inward FDI to the country of residence of the ultimate controlling investor,[10] Greece becomes an inward investor in itself (8% of the total inward FDI) and joins the leading group of investors, as a result of the chain of investment leading back to the Greek economy (a phenomenon called "round tripping") (see Chart 8). The contribution of the large financial centres, i.e. Luxembourg,

Cyprus and the Netherlands, falls from 39% to 15% of total inward FDI, since the United States, Canada, the Czech Republic and Australia direct their investments to Greece through the above countries, which raises the total stock of FDI from the US, Canada, the Czech Republic and Australia invested in Greece from 8% to 23%. Germany, Switzerland, Italy and the United Kingdom do not primarily use intermediate investment chains and their share in total DI in Greece remains about the same (29% as immediate counterparts vs 32% as ultimate investing economies) (see Chart 9).

4   CONCLUSION

Communicating the methodology behind the statistics compiled is a key function of statistics departments and this article tries to

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10 FDI by ultimate investing economy, WTA (winner takes it all) approach. WTA identifies the entity that controls the direct investment enterprise (DIE) using the concept of the ultimate controlling institutional unit recommended in FATS statistics.

Chart 8 Inward FDI stock by country: immediate counterpart vs ultimate investing economy (2023)

(EUR millions)

Source: Bank of Greece.
Note: Provisional data.
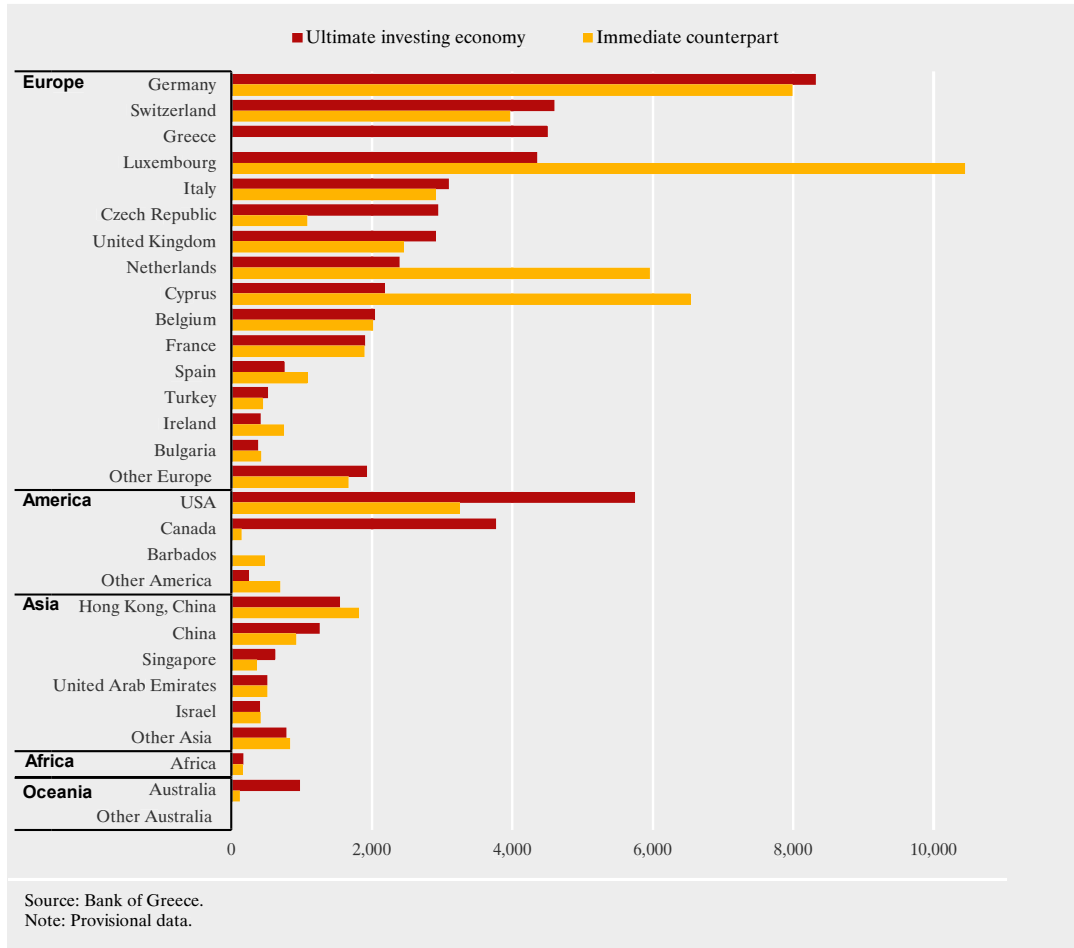
respond to this task by providing some details on issues that are relevant to FDI statistics. These include clarifying the multiple measures of FDI resulting from the presentation of data according to the asset/liability and directional principles. Aggregate statistics are available both in terms of assets/liabilities and on a directional basis. Under the asset/liability principle, financial flows and positions are classified according to whether the direct investment transaction or position is an asset or a liability for the reporting economy. This is in contrast to the directional principle, which classifies financial flows and positions depending on whether the investment is made by a resident direct investor of that economy in a non-resi-

dent direct investment enterprise (outward) or by a non-resident direct investor in a resident direct investment enterprise (inward). Which of these two measures is more appropriate depends on the purpose of the analysis. The asset/liability presentation puts FDI statistics on the same basis as other statistics in the BOP and IIP accounts. The detailed statistics by country and by industry on a directional basis are more meaningful when examining the origin and destination countries of the direct investment and the industries they focus on. The standard series by immediate partner country, which allows for comparability among countries, is the most widely available. Examining the standard series combined with

(inward FDI stock; EUR millions)

Source: Bank of Greece.
Note: Provisional data.
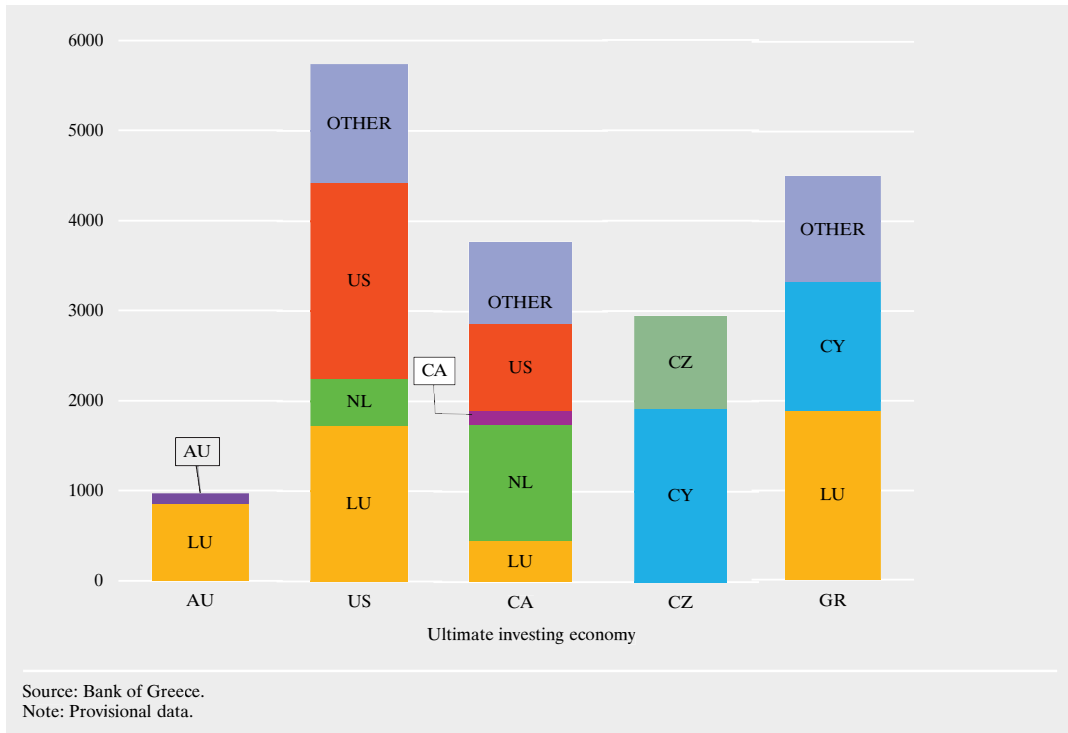
the supplemental series by ultimate investing economy allows for additional insights, such as identifying the residence countries of the investors which ultimately control the invest-ments, as well as the intermediate chains they use. This provides valuable information for policymakers about a country's most significant investing partners.

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FORECASTING POTENTIAL OUTPUT FOR GREECE

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ABSTRACT

This paper presents a description of the current version of the production function methodology used at the Bank of Greece for assessing and forecasting potential output and the output gap. Medium-term projections are also presented: potential output growth is expected to be 1.9%, supported by Total Factor Productivity (TFP) and capital, while the negative demographics are soon to weigh on the productive capacity of the economy. At the end of the projection horizon, most of the potential output growth accrues from TFP, suggesting the need to continue implementing structural reforms. The paper concludes with a brief discussion regarding the complexities of estimating TFP.

ΠΡΟΒΛΕΨΕΙΣ ΔΥΝΗΤΙΚΟΥ ΠΡΟΪΟΝΤΟΣ ΓΙΑ ΤΗΝ ΕΛΛΑΔΑ

Μαριάνθη Αναστασάτου
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

ΠΕΡΙΛΗΨΗ

Το παρόν άρθρο περιγράφει την τρέχουσα μεθοδολογία της συνάρτησης παραγωγής που χρησιμοποιείται στην Τράπεζα της Ελλάδος για την εκτίμηση και την πρόβλεψη του δυνητικού προϊόντος και του παραγωγικού κενού. Παρουσιάζονται επίσης μεσοπρόθεσμες προβλέψεις: η αύξηση του δυνητικού προϊόντος αναμένεται να διαμορφωθεί σε 1,9%, υποστηριζόμενη από τη συνολική παραγωγικότητα των συντελεστών παραγωγής και το κεφάλαιο, ενώ τα αρνητικά δημογραφικά στοιχεία θα επιβαρύνουν σύντομα την παραγωγική ικανότητα της οικονομίας. Στο τέλος του ορίζοντα πρόβλεψης το μεγαλύτερο μέρος της αύξησης του δυνητικού προϊόντος προέρχεται από τη συνολική παραγωγικότητα των συντελεστών παραγωγής, γεγονός που δείχνει την ανάγκη να συνεχιστεί η εφαρμογή διαρθρωτικών μεταρρυθμίσεων. Τέλος, παρουσιάζεται εν συντομία η πολυπλοκότητα της εκτίμησης της συνολικής παραγωγικότητας των συντελεστών παραγωγής.

FORECASTING POTENTIAL OUTPUT FOR GREECE*

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I INTRODUCTION

Potential output shows the production capacity of an economy, i.e. the maximum level of output that can be achieved given the factors of production, the state of technology and the structure of the economy, without creating pressure on the rate of inflation. It depends on the supply side of an economy and indicates an economy's prospects for long-term sustainable non-inflationary economic growth. It differs from GDP, which shows the actual output produced by an economy at a certain point in time. Potential output is by default a much smoother time series compared to GDP (see Chart 1). During booms, economic activity will rise above potential output and the increased demand will put pressure on prices, while, during recessions, GDP will drop below potential output and inflation will de-escalate; but, on average, GDP will gravitate towards potential output and inflation will tend to stabilise. Over the longer term, actual output is moving alongside potential output and, as a result, potential output is an indicator of the future prospects of an economy.

A concept relevant to potential output is that of the output gap, which is defined as follows:

Output gap = 100*(GDP – potential output)/ potential output

The output gap is a measure of overheating or slack in the economy and, together with potential output, it is a useful indicator for assessing the cyclical position of an economy. Thus, these two indicators are highly relevant to policy making and important for the future stance of monetary and fiscal policies. When the production level is higher than potential output, i.e. when the output gap is positive, the rising level of factor utilisation puts upward pressure on factor costs. The economy overheats, inflation increases and monetary policy needs to be

Chart I GDP and potential output for Greece

(% change)

Sources: ELSTAT and author's estimations.
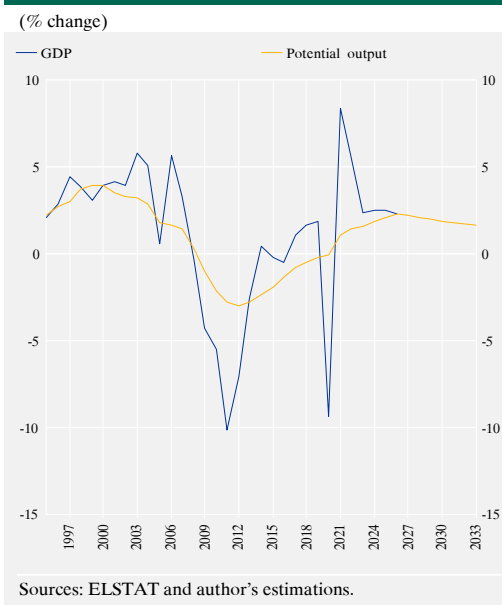
tightened. This will reduce activity and restore price stability. Similarly, potential output is important for conducting fiscal policy, as budget items on both the revenue and the expenditure side depend on activity trends, as well as for assessing the fiscal stance and carrying out debt sustainability analysis. Acknowledging the important information embodied in potential output and output gap estimates, the European Union has formally embraced their use in the fiscal surveillance framework in the context of the Stability and Growth Pact.

Potential output is not directly observable, neither can it be determined with certainty, even with the benefit of hindsight. Thus, estimating potential output and, therefore, the output gap, is surrounded by great uncertainty. There

are several sources of uncertainty. First, the input data are themselves estimates and are subject to revisions when statistical authorities have new or better information. Second, the estimates are affected by model uncertainty or end-point uncertainty. Third, particularly in real time, it is difficult to understand to what extent developments in an economy are driven by cyclical or structural factors. Currently, it is particularly complex to distinguish between the two, given that the global economy has experienced multiple shocks, i.e. the pandemic, the war in Ukraine and the energy crisis, which resulted in large swings in both aggregate supply and demand. In addition, there are ongoing structural developments, such as population ageing, artificial intelligence developments and trade fragmentation that have both long-term consequences for the productive capacity of an economy and potential medium-term effects.

Potential output can be derived using statistical or econometric techniques.[1] In both cases, several assumptions and choices need to be made regarding the level of parameters, specifications, estimation techniques, etc. Moreover, although potential output is by default a smooth series, different types of potential output measures can vary by the degree of sensitivity to short-run fluctuations of activity. The Eurosystem, and thus the Bank of Greece too, use a smooth approach.

2 A PRODUCTION FUNCTION APPROACH

One of the most widely used methodologies for estimating potential output is the production function method. It is an approach used by most of the Eurosystem's National Central Banks (NCBs), but also by international agencies, e.g. the European Commission (D' Auria et al. 2010) and the OECD (Chalaux and Guillemette 2019).

Economy-wide output is assumed to be given by a two-factor Cobb-Douglas production function in capital and labour of the form:

$$Y_t = L_t^{\alpha} K_t^{1-\alpha}\, TFP_t \tag{1}$$

where Y_t is real GDP, L_t is total employment, K_t is the capital stock and TFP_t is total factor productivity. Total factor productivity is a measure of how efficiently labour and capital are used. It is calculated as the share of production growth that cannot be explained by increases in the two inputs. Specifically, it is derived as the Solow residual from equation (1). The coefficient α, which is assumed to have a value between 0 and 1, is the output elasticity of labour, while $(1-\alpha)$ is the output elasticity of capital. The estimation of α is discussed below.

Important properties of the Cobb-Douglas production function are constant returns to scale and diminishing marginal products of the inputs.

In order to estimate potential output, the long-term trend of the two production factors as well as of productivity must be extracted. In other words, one needs to estimate the quantities which accrue after removing the cyclical component from the three variables. Potential output $\overline{Y}$ is:

$$log(\overline{Y}_t) = \alpha\, log(\overline{L}_t) + (1-\alpha)log(K_t) + log(\overline{TFP_t}) \tag{2}$$

where the bar suggests trend variables. Thus, potential output depends on three components:

- Trend employment $(\overline{L}_t)$ is defined as:

  $$\overline{L}_t = \text{Working age population} * \overline{\text{Participation rate}} * (1 - \overline{\text{NAWRU}}), \tag{3}$$

  i.e. the product of working age population, trend participation rate and trend of the non-accelerating wage rate of unemployment (NAWRU). NAWRU is the unemployment rate consistent with stable inflation and is a proxy of the long-run equilib-

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1 For an overview of methods to estimate potential output, see Murray (2014).

rium unemployment. Any excess demand would push the unemployment rate below its equilibrium level, leading workers to demand higher wages, thus putting upward pressure on inflation.

- **Trend total factor productivity** ($\overline{TFP_t}$), which is derived by smoothing out the TFP series.

- **Capital** is the potential use of capital which is equal to the actual capital. So, there is no need to smooth out the series, since the maximum potential output contribution of capital is given by the full utilisation of the existing capital stock.
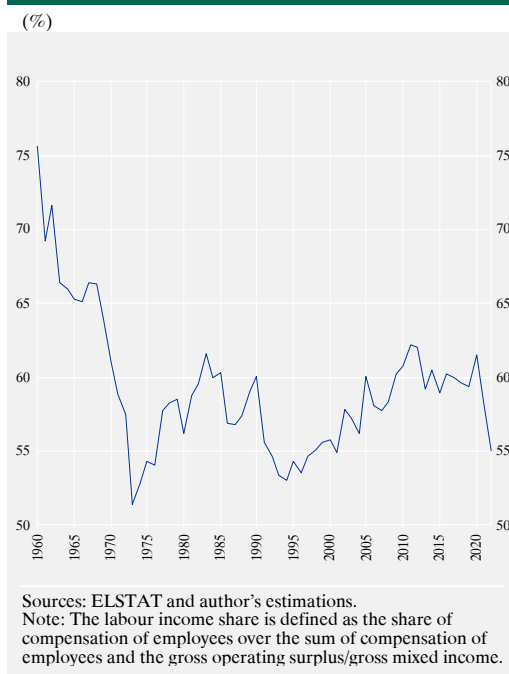
3 CALIBRATION OF THE PRODUCTION FUNCTION FOR GREECE

The model described in Section 2 is calibrated for the Greek economy. Recalibration takes place at irregular frequency to reflect mainly structural changes taking place in the economy.

Labour input is measured in terms of head-count. Labour (and capital) are assumed to be rewarded an amount equal to their marginal revenue products. Thus, the production elasticity of labour, a, is calibrated as the share of labour income. It is estimated as the share of compensation of employees over the sum of compensation of employees and the gross operating surplus/gross mixed income (the latter represents the remuneration of the production factor capital). This share is adjusted to account for the imputed labour income of the self-employed, assuming that the self-employed have the same average wage as employees. This adjustment is important, as the self-employed form a significant part (about 30%) of total employment in Greece. The average labour income share for Greece during the period 1960-2021 is 60% (see Chart 2).

The equilibrium unemployment rate is unobserved and therefore needs to be estimated. The **NAWRU** estimates are based on Phillips curve considerations combined with time series

Chart 2 Labour income share for Greece

(%)

Sources: ELSTAT and author's estimations.
Note: The labour income share is defined as the share of compensation of employees over the sum of compensation of employees and the gross operating surplus/gross mixed income.

techniques. Elmeskov (1993) defines NAWRU as the unemployment rate above which wage inflation accelerates:

$$d^2lnw = -\lambda*(u\text{-}NAWRU), \qquad \lambda>0 \qquad (4)$$

where w is the nominal wage level, u is the actual unemployment rate and d, d^2 and d^3 are the first, second and third difference operators. It follows that a NAWRU can be estimated in terms of wages and unemployment:

$$NAWRU = u\text{-}(du/d^3lnw)*d^2lnw \qquad (5)$$

This definition fit well with the Greek economy until the crisis. However, this relationship suggests that during the crisis the NAWRU had reached unreasonably high levels (see the yellow line in Chart 3). The values remain non-intuitive, even after using a Hodrick-Prescott filter to smooth the time series. Unemployment rates as high as 20% or 25% cannot be perceived as equilibrium values; people will get discouraged and, eventually, will exit the labour force. However, from 2022 onwards, i.e. after the end of the crisis and the pandemic,

Chart 3 Non-accelerating wage rate of unemployment (NAWRU)

(% of labour force)

— Raw   — Adjusted

Source: Author's estimations.
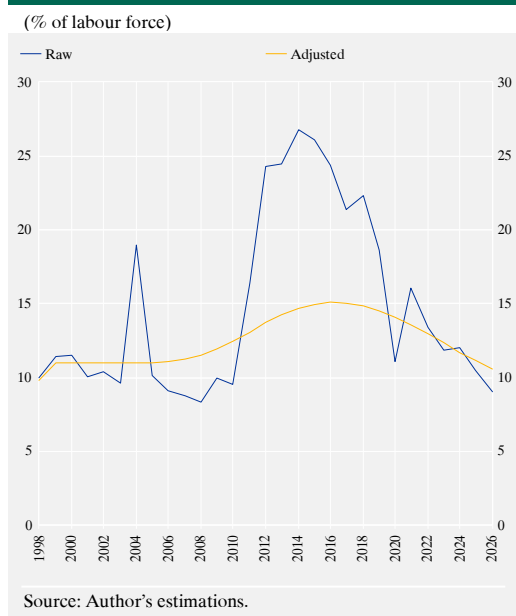
this relationship seems to have been restored in the economy. Note that the estimates of NAWRU for 2024-2026 are based on the June 2024 Bank of Greece projections of the underlying data. Therefore, to reach more intuitive estimates, judgement is used for the crisis period, when the Phillips curve relationship seems to have broken down. Judgement is informed by satellite models available at the Bank of Greece. The series is then filtered to get a smooth NAWRU time series (see the blue line in Chart 3).

For the capital input, data is not available by the Hellenic Statistical Authority and a time series needs to be constructed. The capital stock corresponds to the economy-wide capital stock. It is constructed using the perpetual inventory method, together with an assumption on the initial capital stock. More specifically, the level of capital at the beginning of the estimation period (1960) is assumed to be three times the level of GDP. This is a convention used in empirical studies.[2] Then, the law of motion of the capital stock is:

$$K_t = (1-\delta_t)^*K_{t-1}+I_t \qquad (6)$$

where I_t is investment and δ_t is the depreciation rate. For the period 1960-1994, the depreciation rate is assumed to be 4%. For the period 1995-2021, the depreciation rate is estimated using the share of consumption of fixed capital to GDP from the national accounts. For the forecasting period, the depreciation rate is kept fixed at the level of the last year of actual data (2021).

Finally, the participation rate, the labour force, the NAWRU and the TFP are smoothed with a Hodrick-Prescott filter, in order to eliminate some irregularities of the data.

4 MEDIUM-TERM FORECASTS

Following the calibration, the model is estimated for the Greek economy for the period 1960-2023 and it is used to produce projections for the next ten years.

4.1 END-PERIOD ASSUMPTIONS

In order to forecast potential output for the Greek economy, assumptions about future values and convergence paths need to be made for several variables. It is noted that the convergence paths from the latest data point to the anchor values, i.e. the values towards which a variable will converge at the end of the forecasting horizon are typically smooth.

Projecting the labour component necessitates assumptions/projections to be made for the three relevant variables, namely the evolution of the working age population, the labour force participation rates and the NAWRU. For the working age population (15-74), Eurostat's projections are used.

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2 Derbyshire et al. (2011) calculated at three the average capital-output ratio for EU Member States in 1995. Alternatively, when calculating capital as the ratio of investment over the sum of the GDP growth rate and the depreciation rate ($K_{t-1} = I_t /(g_{GDP}-\delta_t)$), where g_{GDP} is the growth rate of GDP) the average capital-output ratio for Greece for the period 1960-1990 is estimated at three. For an overview of the most important approaches employed in the literature regarding the methods for estimating the initial capital stock, see Berlemann and Wesselhöft (2014).

The **participation rate** continues to be quite different between men and women (see Chart 4). For men, it has been very close to 70%, i.e. it is similar to the euro area (EA) average. For women, the participation rate has been on an upward path over the past twenty years, while significant increases have also occurred in more recent years. In particular, female participation in Greece has been moving closely together with the EA average, although consistently lagging behind by about 10 percentage points. Further increases of participation rates are expected, as policy initiatives have been introduced targeting higher participation especially of women, including child and elderly care reforms to reduce the care burden of women. It is expected that labour force participation rates in Greece at the end of the projection horizon will close the gap to the EA average for men, but only partially for women. So, the relevant anchor is currently a participation rate of 63% (70% for men and 56% for women).

To estimate the **NAWRU** anchor for t+10, i.e. the value towards which the NAWRU will converge 10 years into the future, a linear regression model is utilised. Specifically, the NAWRU is regressed on labour market structural indicators and non-structural indicators to control for persistent macroeconomic shocks.[3] However, the results are not always robust. So, a compromise is reached as described hereafter. For the years 2024-2026, the NAWRU is estimated by equation (5) (using values of unemployment and wages as projected by the Bank of Greece).[4] For the period outside the Broad Macroeconomic Projection Exercise (BMPE) horizon (2027-2033), the NAWRU is assumed to remain constant. Such an assumption is a compromise consistent with the common perception of the NAWRU as a stable long-run level of the unemployment rate.[5] The NAWRU is projected to stand at 10.6% in 2026, which is higher than the estimates of the European Commission, according to which the NAWRU anchor for Greece in 2027 will be 9.1% (Spring 2024 Forecast).[6]

Chart 4 Participation rate in the labour force

(% of population)

Source: Eurostat.
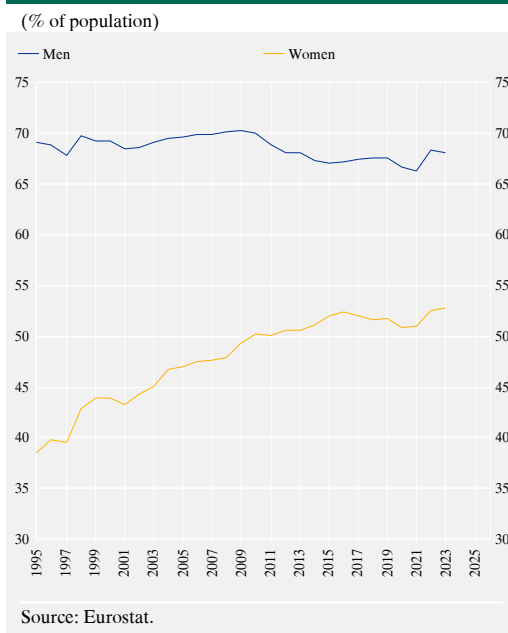
Next, we move on from the labour component to the other components needed in order to estimate potential output, namely capital and TFP. Medium-term forecasts of capital growth are built on the assumption of Greece's convergence to the EA average regarding the path of the **investment-to-GDP** ratio. In particular, a gradual convergence towards the EA average is expected. This implies that the share of investment to GDP will be increasing over the coming years. In practice, this means for Greece that the total investment-to-GDP ratio is projected to converge to 17% by the end of the forecasting period (t+10). This ratio is below the historical average for Greece (19% for 1980-2008), as the post-crisis recovery of residential investment is expected to be partial. It is also below the historical average for the EA (21% for 1995-2022) due to the production structure of the Greek economy, which is relatively more labour intensive compared to the EA.

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3 Such approaches are described in, among others, Gianella et al. (2008), Orlandi (2012) and Heimberger et al. (2017).
4 June 2024 Broad Macroeconomic Projection Exercise (BMPE).
5 It is noted that the smoothed line yields a (marginally) decreasing projection for the whole ten-year period horizon.
6 The European Commission's material related to the estimation of output gaps, including data and projections, is available at the online depository CIRCABC (https://circabc.europa.eu).

Finally, regarding the TFP anchor, i.e. the value of TFP 10 years into the future, it is expected to be around 1%. This level is marginally higher than the historical average estimated by the Bank of Greece (0.9% for the period 1980-2008). It reflects the positive impact of the following factors. First, past structural reforms and planned reforms in the context of the NGEU are expected to have a positive impact on TFP. Second, new investments embody new technologies with higher productivity. The value of the anchor is close to that estimated by the European Commission.[7]

4.2 PROJECTIONS

The results presented here focus on the period 1995-2033. As can be seen in Chart 5, potential output estimates vary between the different phases of the economy throughout the years. In the run-up to the introduction of the euro, the potential output of Greece was increasing at high rates. All factors were contributing, with TFP explaining slightly more of the potential output's growth compared to capital and labour. This booming era was followed by a sharp deterioration during the sovereign debt crisis, when the Greek economy lost cumulatively about 25 percentage points (pps) of its GDP and 20 pps of its potential output. TFP contribution suffered the largest drop, followed by the labour component, while the contribution of capital showed the smallest decline, as capital is by default less responsive to an economy's short-run fluctuations. In recent years, potential output has been recovering – with the only exception being a short-lived interruption during the pandemic.

Looking ahead, potential growth is primarily driven by TFP. This reflects the impact of past reforms, as well as the partial and conservatively estimated impact of selected structural reforms to be implemented in the context of the Recovery and Resilience Facility (RRF). The capital stock makes positive contributions only after 2022 and is gradually gaining pace thereafter, as the impact of the financial crisis and the COVID-19 pandemic fades out, and

Chart 5 Decomposition of potential output

(potential output: %; K, L, TFP: percentage point contributions)

Source: Author's calculations.
Note: K = capital, L = labour, TFP = total factor productivity.
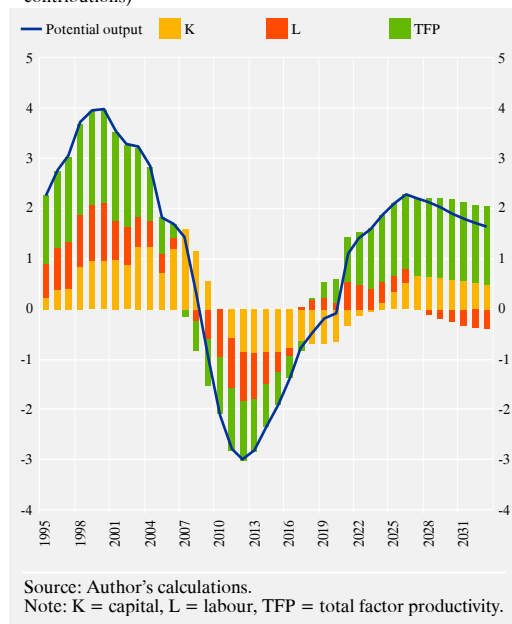
on the back of NGEU support. Trend labour is contributing positively in the short run due to the increasing participation rate and the decreasing NAWRU, which outweigh the negative impact from the shrinking working age population. Its contribution turns negative in 2027, as the impact of negative demographic developments becomes stronger over time. It is noted that the decline in the NAWRU over the extended projection horizon and the increase in the labour force participation rate are supported by past labour market reforms, but also by interventions under the Recovery and Resilience Plan that aim to support reforms of active labour market policies, as well as the upskilling and reskilling of the labour force.

The current estimate of the medium-term growth rate is 1.9%. At the end of the horizon, most of the 1.7% of potential output growth accrues from TFP (1.6 pps), while the contribution of capital is 0.5 pps and the contribution
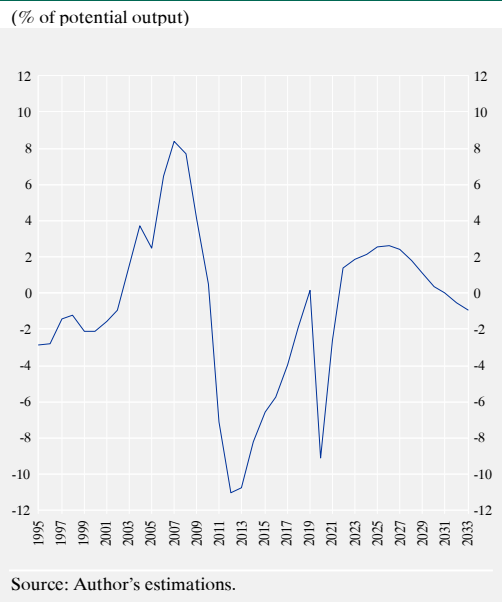
7 According to the 2024 Ageing Report, TFP in Greece is expected to be 0.8% in 2030 and 1.4% in 2040.

of labour is -0.4 pps. Thus, in the outer years, deteriorating demographics almost cancel out the positive impact of capital accumulation. Regarding TFP, earlier studies on the Greek potential output suggested that its contribution in terms of percentage points was of similar magnitude, although the share was smaller due to better demographics of that time resulting in higher overall potential output (see Albani et al. 2010). While it is a common feature for the TFP contribution to be larger than the contributions of capital and labour, Greece stands at the upper side.[8] More specifically, according to the European Commission's 2024 Ageing Report, TFP in Greece explains about 85% of potential output growth in ten years from now, while the euro area average share is 66%. This result implies that a lot of emphasis needs to be put on efforts to enhance TFP, since in the medium term productivity developments are of vital importance for growth.
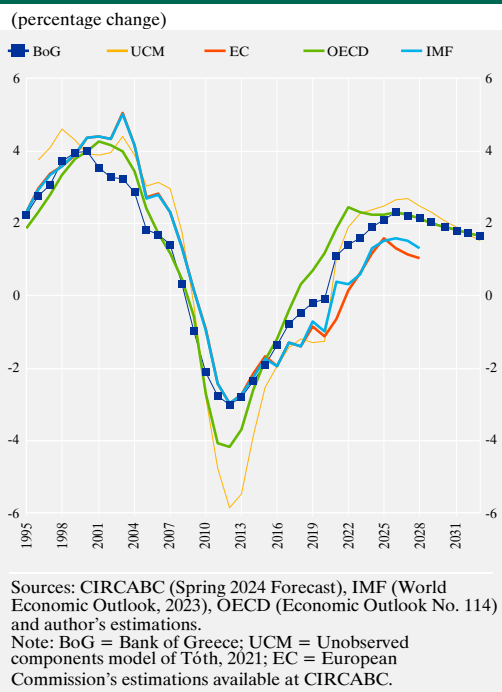
Regarding the output gap, during the first years after the euro accession the Greek economy was growing at high rates and the output gap was both positive and large (see Chart 6). This trend was abruptly interrupted by the debt crisis. The output gap remained negative for a decade, reaching its lowest level in 2013. The subsequent swift recovery of the Greek economy and the rebound of potential growth since 2021 led to the closure of the output gap in 2021 for the first time in a decade. The output gap of the Greek economy is projected to be positive and large throughout the projection horizon, reflecting the recovery of the Greek economy from the decade-long crisis. It follows that the Greek economy is expected to have a negative unemployment gap, i.e. unemployment will be lower than the NAWRU for the coming years and, therefore, there will be upward pressure on wages and prices.

The potential output estimates of the Bank of Greece are close to the ones obtained from the Unobserved Components Model (UCM), developed by the ECB and calibrated by the Bank of Greece for the Greek economy (see Tóth 2021), and the ones from the OECD, but

Chart 6 Output gap

(% of potential output)

Source: Author's estimations.

Chart 7 Potential output

(percentage change)

Sources: CIRCABC (Spring 2024 Forecast), IMF (World Economic Outlook, 2023), OECD (Economic Outlook No. 114) and author's estimations.
Note: BoG = Bank of Greece; UCM = Unobserved components model of Tóth, 2021; EC = European Commission's estimations available at CIRCABC.
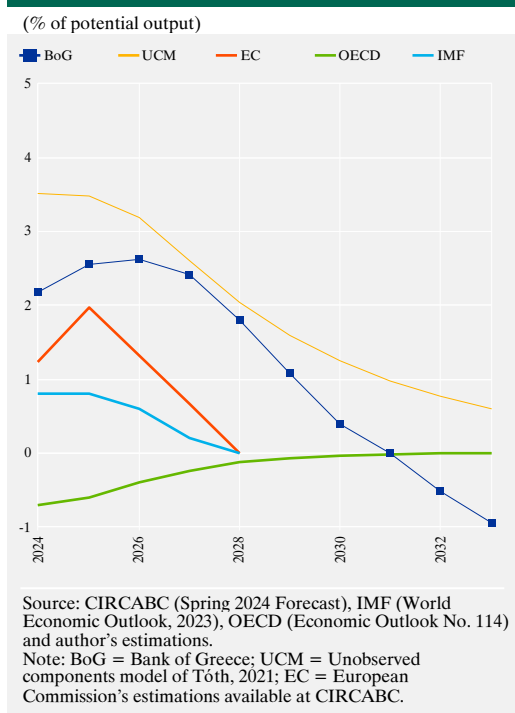
higher than the estimates of the EC and the IMF (see Chart 7). Thus, the model of the Bank of Greece implies an output gap similar

8 See the Spring 2024 Economic Forecast of the European Commission at https://circabc.europa.eu.

Chart 8 Output gap

(% of potential output)

Source: CIRCABC (Spring 2024 Forecast), IMF (World Economic Outlook, 2023), OECD (Economic Outlook No. 114) and author's estimations.
Note: BoG = Bank of Greece; UCM = Unobserved components model of Tóth, 2021; EC = European Commission's estimations available at CIRCABC.

to that estimated by the UCM, but considerably higher compared to the estimates of other institutions (see Chart 8).

5 IN FOCUS: TOTAL FACTOR PRODUCTIVITY AND SOURCES OF BIAS

As already shown, TFP is the main driver of potential output growth in the medium term for Greece but also for the euro area. Hence, it is a very important factor for future growth. For this reason, the present paper includes a special section discussing more thoroughly some specificities surrounding the definition and estimation of TFP.

TFP is strongly correlated with incomes. Indeed, sustainable growth of output per capita can only occur via TFP growth, as shown as early as 1957 by Robert Solow, given that investments in capital and labour have diminishing returns. Currently, the sustainability of growth is further challenged by environmental concerns and ageing societies.

TFP represents the productivity of the whole economy. It is a measure of an economy's ability to generate income from inputs (here, labour and capital) and it is generally thought to reflect the extent to which technology and knowledge are utilised domestically in the production process. If more output can be produced for any given amount of inputs, then the economy is said to have higher TFP. However, TFP in the Cobb-Douglas framework is defined as a residual and, therefore, captures the impact of several other factors. For this reason, TFP has the famous epithet "measure of our ignorance", while Solow (1987) questioned the measurement of productivity with his famous quip "You can see the computer age everywhere but in the productivity statistics".[9]

A first source of the TFP bias is the mismeasurement of capital and labour. One aspect that standard measures of capital and labour do not capture is the quality of these inputs. Workers will produce more economic value added, if they have more years of schooling, better education and training or is healthier. So, enhanced labour skills produce more output. But if labour input is measured by headcount or hours worked, then this increased output will be wrongly attributed to higher TFP. Similarly, investing in capital upgrades the quality of capital stock, thus resulting in higher output for the same amount of inputs. This change will be wrongly attributed to higher TFP.

Moreover, TFP could also be reflecting the impact of different types of capital. In the case of a shift between types of capital with different productivity, e.g. between residential and non-residential, then the average productivity of the total stock of capital will be different. Failing to acknowledge this shift will result in a bias of the TFP estimate. This last case is very relevant for Greece, as housing investment collapsed during the crisis; today, it stands at about one quarter of its pre-crisis value. Thus, new total capital added to the economy, consisting mostly of productive capital, will result

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9 For a witty discussion about the TFP measurement issues see Hulten (2000).

in relatively higher output, and thus higher TFP, compared to the past.

TFP numbers could also be plagued due to intangible assets. Investments in intangibles are often poorly measured in national accounts. This will likely become more important over time with the increasing adoption of artificial intelligence (AI), which requires significant complementary investment in intangible assets. Productivity growth may be underestimated in the early years, when firms and organisations invest in (unmeasured) intangible capital and, later, when the benefits of intangible investments are harvested and (measured) output increases, productivity growth is overestimated. Brynjolfsson et al. (2021) show that adjusting US data for IT-related capital yields a TFP level that is 15.9% higher than official measures by the end of 2017.

Next is the resource allocation within the economy. Firms in an economy differ as to their degree of productivity. If the most productive firms can attract a big share of labour and capital, i.e. if the economy is "allocatively efficient", then an economy's average productivity will be higher. If, instead, a lot of labour and capital is tied up in relatively unproductive firms, the economy is "allocatively inefficient" and TFP will be low. The efficient allocation of capital and labour across firms can be undermined by several factors, from institutional and financial barriers to poorly-designed industrial policies.[10]

TFP is also impacted by international trade. Trade can increase the market share of an economy. This can potentially result in specialisation according to comparative advantages for an economy, offering firms the opportunity to exploit economies of scale. Moreover, in the face of international competition, the relatively more productive firms do better than their unproductive counterparts. A smaller survival rate of less productive firms will raise the productivity level of the whole economy.

Concluding, it is clear that TFP should be interpreted as the joint effect of technical inno-

vation, varying quality of inputs used in production, efficiency gains, economies of scale, and changes in the organisation of production or the wider regulatory environment, shifts in societal attitudes, omitted variables and measurement errors.

6 CONCLUSIONS

This paper provides a description of the current version of the production function methodology used in the Bank of Greece for assessing potential output and output gaps, i.e. the productive capacity and the cyclical position of the Greek economy. Current projections for the next decade are also presented. The paper concludes with a brief discussion regarding the complexities of estimating TFP.

There are many sources of uncertainty involved in the estimation of potential output, including data revisions, methodological choices, forecast assumptions and the difficulty to assess whether developments are due to cyclical or structural factors. Moreover, forecasts inevitably involve expert judgement. Therefore, new data sources, new information about the economy or policy changes, together with developments in the literature, imply that the forecasting methodology needs to be periodically fine-tuned.

Next milestones in the improvement of the forecasting methodology of the Bank of Greece are the use of structural information in the estimation of anchor values for NAWRU and TFP and the use of information about the financial cycle to produce "finance-neutral" output gaps.[11] Structural changes with longer-term implications, such as artificial intelligence, geopolitical changes or climate change, will also need to be included, as their effects will become more relevant over time.

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10 See the IMF's April 2024 Fiscal Monitor on industry policy for innovation. For a discussion of the structural sources of frictions resulting to lower allocative efficiency, see Box 3.1. in World Economic Outlook, April 2024.
11 For a methodology of how to embed information about the financial cycle in potential output estimation, see Borio et al. (2013).

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WORKING PAPERS
(JULY – DECEMBER 2024)

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The dry-bulk shipping market: a small econometric model

Evangelia Kasimati and Nikolaos Veraros

Dry-bulk shipping is of paramount importance for the safe and efficient transportation of goods around the world. This paper introduces a small econometric model describing the main dynamics and interactions within the said sector. In addition, the authors have efficiently integrated the influence of global trade demand on freight rates, addressing a limitation that has persisted in many similar models. They consider that this model could assist market participants to take more educated decisions in chartering and investing.

Monetary policy transmission: the role of banking sector characteristics in the euro area

Georgios Mermelas and Athanasios Tagkalakis

This paper examines the impact of monetary policy shocks on the macroeconomic performance of 20 euro area countries. In doing so, it assesses how variations in the characteristics of the banking system affect the transmission of monetary policy. The main results show that a contractionary monetary policy shock reduces both inflation and retail sales, while increasing the unemployment rate. In contrast, an expansionary monetary policy shock has positive but much milder effects on the economy. Banking systems with higher profitability, risk exposure and lower assets-to-GDP cause a stronger effect of monetary policy on the economy. The main results hold when alternative monetary policy shocks are considered.

Do macroprudential policies make SMEs more-or-less discouraged to apply for a bank loan?

Dimitrios Anastasiou, Fotios Pasiouras, Anastasios Rizos and Artemis Stratopoulou

This paper investigates the effect of macroprudential policies (MAPs) on discouraged small and medium-sized firms (bank borrowers). Employing confidential firm-level survey data for the euro area countries and estimating Probit models, the authors find that several MAPs significantly reduce SMEs' discouragement to apply for a bank loan. The marginal effects are, in most cases, highly significant, while the economic magnitude of implementing financial institutions-targeted MAPs is also considerable. However, this finding is highly dependent on the degree of a firm's credit quality. The authors' results are driven by the demand side; a more stable and better-capitalised banking system could make SMEs less discouraged to apply for a bank loan.

Unpacking commodity price fluctuations: reading the news to understand inflation

Working Paper No. 334
Dimitris Malliaropulos, Evgenia Passari and Filippos Petroulakis

The authors show that text-based indicators of supply and demand disturbances in commodity markets provide distinct information about future inflation movements relative to existing predictors, inflation expectations and survey forecasts. Specifically, they document that demand-side disturbances play a significantly larger role in prediction, because they typically lead to uniform increases in quantities and prices of goods across the consumer basket, resulting in a clear and positive relationship between commodity prices and overall inflation. Supply-side disturbances matter in particular circumstances, for instance during the recent period of the pandemic and geopolitical shocks. In terms of magnitudes, the commodity-specific indicators reduce out-of-sample inflation forecast errors by up to 30 percent. The authors finally apply their indices to the inflation decomposition framework of Blanchard and Bernanke (2023) and corroborate Blanchard and Bernanke's finding that the bulk of pandemic-era inflation can be attributed to commodity supply disruptions, resulting in price increases in goods markets.

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