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MACROECONOMIC EFFECTS OF SHOCKS TO IMPORT AND SERVICES SECTOR PRICES

Dimitris Papageorgiou
Economic Analysis and Research Department

ABSTRACT

This paper investigates the macroeconomic implications of inflationary shocks that originate from the import and services sectors. The set-up is a medium-scale Dynamic Stochastic General Equilibrium (DSGE) model calibrated for the Greek economy. The results suggest that a temporary increase in import price inflation adversely affects economic activity and drives up domestic inflation. The largest output losses occur in the medium term, since in the short term the adverse effects are dampened by the presence of price rigidities and an import substitution effect that induces expenditure to switch towards domestically produced goods. Additionally, the findings suggest that a temporary increase in the price of the services sector exerts strong inflationary pressures and negatively affects economic activity. Finally, the results show that inflation persistence matters for the effects on the macroeconomy. The more persistent inflation is in imports and the services sector, the larger the output losses.

Keywords: import prices; services sector prices; consumer prices; inflation; Greece

JEL classification: E31; E27; F41; O52

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ΜΑΚΡΟΟΙΚΟΝΟΜΙΚΕΣ ΕΠΙΔΡΑΣΕΙΣ ΑΠΟ ΔΙΑΤΑΡΑΧΕΣ ΣΤΙΣ ΤΙΜΕΣ ΤΩΝ ΕΙΣΑΓΩΓΩΝ ΚΑΙ ΤΟΥ ΤΟΜΕΑ ΤΩΝ ΥΠΗΡΕΣΙΩΝ

Δημήτρης Παπαγεωργίου
Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

ΠΕΡΙΛΗΨΗ

Το παρόν άρθρο διερευνά τις μακροοικονομικές επιδράσεις που προκύπτουν από αυξήσεις στις τιμές των εισαγωγών και του τομέα των υπηρεσιών. Η εκτίμηση των επιδράσεων γίνεται με τη χρήση ενός Δυναμικού Στοχαστικού Υποδείγματος Γενικής Ισορροπίας (Dynamic Stochastic General Equilibrium model), το οποίο διαμετρείται για την ελληνική οικονομία.

Τα αποτελέσματα υποδεικνύουν ότι μια προσωρινή αύξηση του πληθωρισμού των τιμών των εισαγωγών επηρεάζει αρνητικά την οικονομική δραστηριότητα και αυξάνει τον εγχώριο πληθωρισμό. Όσον αφορά το βαθμό μετακύλισης στις εγχώριες τιμές, εκτιμάται ότι μια αύξηση του πληθωρισμού του δείκτη τιμών εισαγωγών κατά 1 ποσοστιαία μονάδα (ποσ. μον.) οδηγεί σε αύξηση του πληθωρισμού του Δείκτη Τιμών Καταναλωτή και του αποπληθωριστή του ΑΕΠ κατά 0,147 και 0,1 ποσ. μον. αντίστοιχα. Οι μεγαλύτερες απώλειες του ΑΕΠ παρατηρούνται μεσοπρόθεσμα, καθώς βραχυπρόθεσμα οι δυσμενείς επιπτώσεις μετριάζονται από (α) την ακαμψία των εγχώριων τιμών και (β) τη μερική υποκατάσταση των εισαγωγών από εγχωρίως παραγόμενα αγαθά. Επιπλέον, τα ευρήματα υποδεικνύουν ότι ο βαθμός εμμονής της αύξησης των τιμών των εισαγωγών είναι καθοριστικής σημασίας για τις μακροοικονομικές επιπτώσεις. Όσο πιο επίμονος είναι ο πληθωρισμός των τιμών των εισαγωγών, τόσο μεγαλύτερες είναι οι απώλειες του ΑΕΠ μεσοπρόθεσμα. Ενδεικτικά αναφέρεται ότι μια προσωρινή αύξηση του πληθωρισμού των τιμών των εισαγωγών κατά 1 ποσ. μον. μειώνει το πραγματικό ΑΕΠ κατά 0,02% και 0,06% μετά από τέσσερα και οκτώ τρίμηνα αντίστοιχα. Η διατήρηση του πληθωρισμού των τιμών των εισαγωγών κατά ένα επιπλέον τρίμηνο, σε σχέση με το βασικό σενάριο, προκαλεί πρόσθετη σωρευτική απώλεια του πραγματικού ΑΕΠ ίση με περίπου 0,14% κατά τα δύο πρώτα έτη.

Επιπρόσθετα, τα αποτελέσματα επισημαίνουν ότι μια προσωρινή αύξηση στις τιμές του τομέα των υπηρεσιών ασκεί ισχυρές πληθωριστικές πιέσεις και επηρεάζει αρνητικά την οικονομική δραστηριότητα. Για παράδειγμα, μια προσωρινή αύξηση του πληθωρισμού στον τομέα των υπηρεσιών κατά 1 ποσ. μον. μειώνει το πραγματικό ΑΕΠ και τις ιδιωτικές επενδύσεις κατά περίπου 0,19% και 0,87% αντίστοιχα μετά από τέσσερα τρίμηνα. Η αύξηση της εμμονής του πληθωρισμού στον τομέα των υπηρεσιών ενισχύει τις αρνητικές επιπτώσεις στην οικονομική δραστηριότητα. Ενδεικτικά, η διατήρηση του πληθωρισμού στον τομέα των υπηρεσιών κατά ένα επιπλέον τρίμηνο, σε σχέση με το βασικό σενάριο, οδηγεί σε πρόσθετη σωρευτική απώλεια του πραγματικού ΑΕΠ ίση με 0,49% κατά τα δύο πρώτα έτη.

Εν κατακλείδι, τα ευρήματα δείχνουν ότι αν συνεχιστεί ο παρατηρούμενος πληθωρισμός στις τιμές των εισαγωγών στην Ελλάδα, είναι πιθανόν να ωθήσει τις εγχώριες επιχειρήσεις να μετακυλίσουν το υψηλότερο κόστος στις τιμές καταναλωτή προκειμένου να προστατεύσουν τα περιθώρια κέρδους τους, προκαλώντας περαιτέρω πληθωριστικές πιέσεις. Ενώ οι αρνητικές επιπτώσεις στη μακροοικονομία φαίνεται να είναι περιορισμένες βραχυπρόθεσμα, ο επίμονος πληθωρισμός των τιμών των εισαγωγών ενδέχεται να καταστήσει αναγκαία την υιοθέτηση πολιτικών που θα θέσουν υπό έλεγχο τις εγχώριες πληθωριστικές πιέσεις μεσοπρόθεσμα. Μια ακόμη μεγάλη πρόκληση για την ελληνική οικονομία αποτελεί ο περιορισμός των αυξανόμενων πληθωριστικών πιέσεων σε τομείς που χαρακτηρίζονται από έλλειψη ανταγωνισμού, όπως συμβαίνει με τον τομέα των υπηρεσιών, ώστε να αποφευχθεί η επιβράδυνση της τρέχουσας οικονομικής ανάκαμψης.

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Dimitris Papageorgiou
Economic Analysis and Research Department

1 INTRODUCTION

Global inflation has been rising since early 2021, as most economies have started to recover from the COVID-19 pandemic. The rising inflation can be largely attributed to the following two factors. The first factor is the sharp rise in energy prices observed since the beginning of 2021. The pandemic induced a significant cycle in oil prices, which fell during 2020 and recovered to their pre-pandemic levels at the beginning of 2021, generating strong base effects in energy inflation. The second factor is the reallocation in the consumption basket of households. After the outbreak of the pandemic there was a collapse in demand for services, as well as a strong increase in demand for goods. The former led to downward price pressures in the services sector during the pandemic, followed by strong base effects in prices after the re-opening of the economies. The latter created shortages in raw materials used in the production process, thereby leading to higher input prices and supply-side disruptions.[1]

Against this background, the aim of this paper is to investigate the macroeconomic effects of inflationary cost-push shocks that originate from the import and services sectors for the Greek economy in the context of a Dynamic Stochastic General Equilibrium (DSGE) model. To account for the uncertainty surrounding the persistence of the inflation drivers, the analysis also considers the implications from different degrees of persistence of the inflationary shocks.

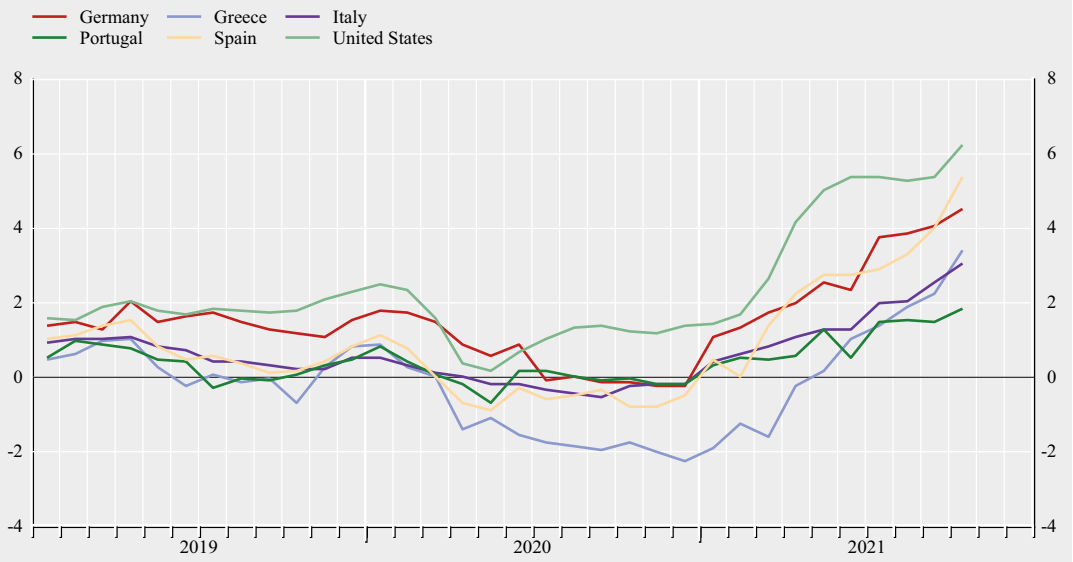
As is evident in most advanced economies, the Consumer Price Index (CPI) in Greece has increased since mid-2021 (see Chart 1). I am particularly interested in examining the effects of higher import price inflation on the Greek economy, as Greece is among the euro area countries that have displayed the highest increases in the import price index of goods and services, as well as in the import price index in industry since the beginning of 2021; see Charts 2 and 3 for the evolution of the respective import price indices for selected euro area countries.[2] At the same time, the imported goods that are used in the production process account for a large fraction of total imports in Greece (see Chart 4). To the extent that rising import prices drive up input costs, firms are likely to pass on some of these costs to output prices. As Chart 5 illustrates, input prices in the manufacturing sector have been rising since mid-2020 and reached a record high in October 2021. The rise in input prices was accompanied by an increase in output prices. The gap between input and output prices has widened since mid-2020, indicating that firms absorbed part of the higher input costs in their profit margins over that period. At the same time, the manufacturing Purchasing Managers' Index (PMI), which measures the performance of the manufacturing sector, has been rising since May 2020, reflecting the high demand for goods during the pandemic. This was followed by a rise in CPI inflation in goods that has been on an upward trend since March 2021, indicating a pass-through of higher input prices to consumer prices (see Chart 6). In an environment of rising input prices and demand for goods, it is likely that firms will seek to protect their margins in the future, thereby inducing a stronger pass-through of higher input prices to final consumer prices.[3]

Regarding recent developments in the services sector, activity expanded significantly follow-

1 See Lane (2021) and Schnabel (2021) for a discussion regarding the inflation dynamics during the pandemic.
2 Greece has exhibited the highest increase in the import price index of goods and services throughout the euro area since the beginning of 2021. Greece, Lithuania and the Netherlands are the countries with the highest increases in the import price index in industry.
3 Bobeica et al. (2019) show that it is more likely that higher costs will be passed on to output prices in periods of high demand and inflation.

Chart 1 CPI

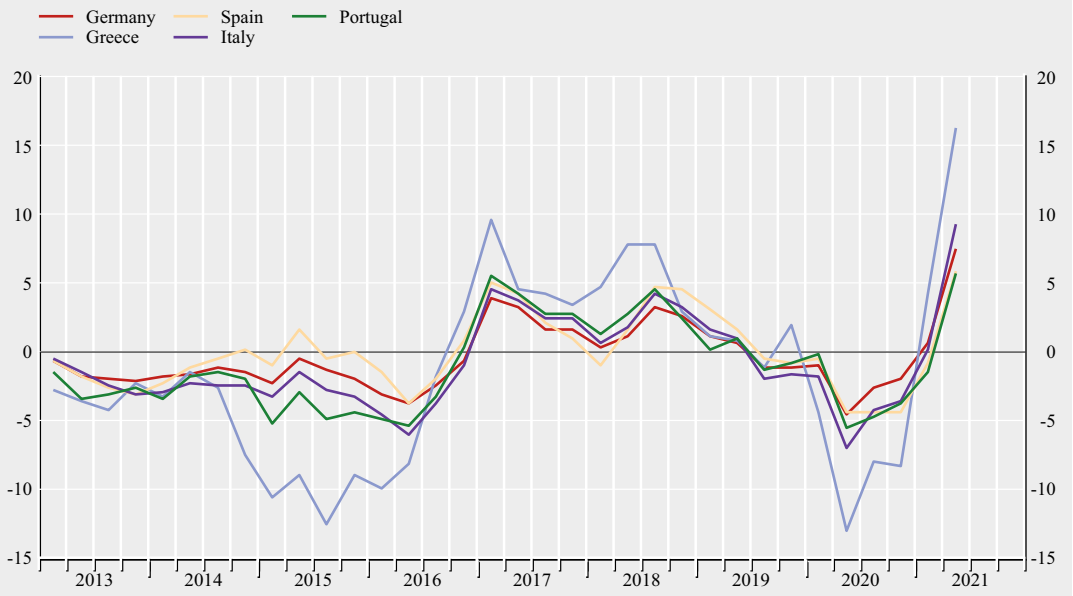
(annual % changes, monthly data)



Source: OECD.Stat.

Chart 2 Import price index of goods and services

(annual % changes, quarterly data)

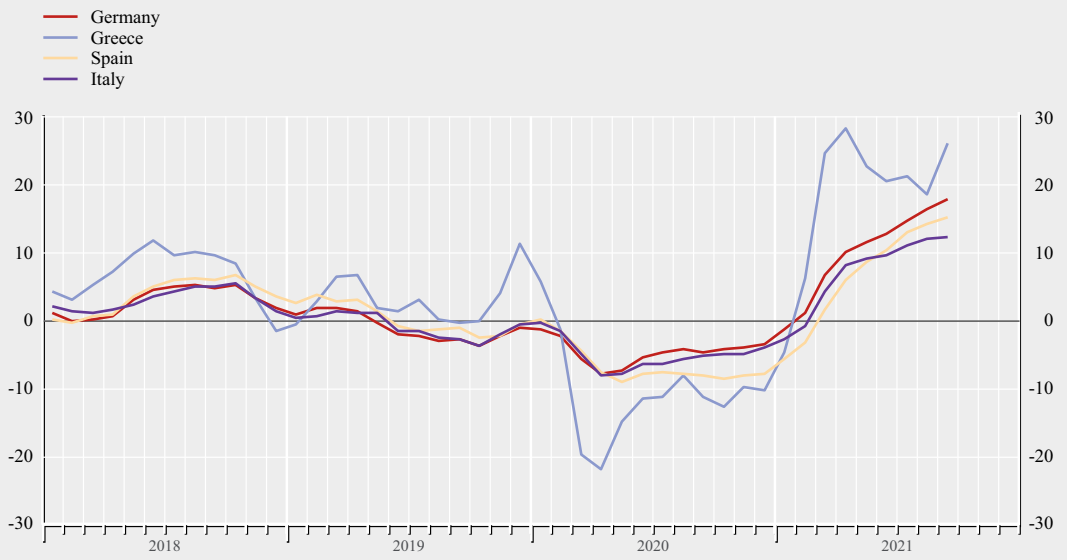


Source: Eurostat.

ing the easing of the pandemic-related restrictions. As Chart 7 illustrates, the confidence indicator in the services sector rose to 40.5 in October 2021, i.e. its highest value since Sep-

Chart 3 Import price index in industry

(annual % changes, monthly data)



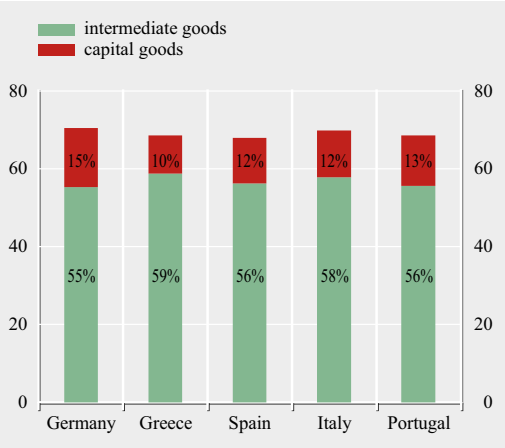
Source: Eurostat.

tember 2001. While pricing pressures in the services sector were muted until May 2021 due to the presence of strict containment measures, the relatively high markups and the lack of competition in the services sector in Greece, combined with rising demand, raise concerns about stronger inflationary pressures in the future.[4]

The set-up I employ is a small open economy medium-scale DSGE model that incorporates two sectors of production, namely a tradable and a non-tradable sector. The latter is used as a proxy for the services sector. There are two types of domestic firms. The first type produces final non-tradable goods under perfect competition using as inputs domestic non-tradable and tradable intermediate goods, as well as imported tradable intermediate goods. The second type of firms consists of monopolistically competitive firms that produce tradable and non-tradable intermediate goods, as well as importing firms that import intermediate goods from abroad, which are then supplied as inputs to the final goods firms. Firms in the tradable and the non-tradable sector, as well as importing firms set prices according to the Calvo-type scheme with partial indexation and prices are equal to a markup over the marginal

Chart 4 Imports of intermediate and capital goods (2017-2021)

(% of total)

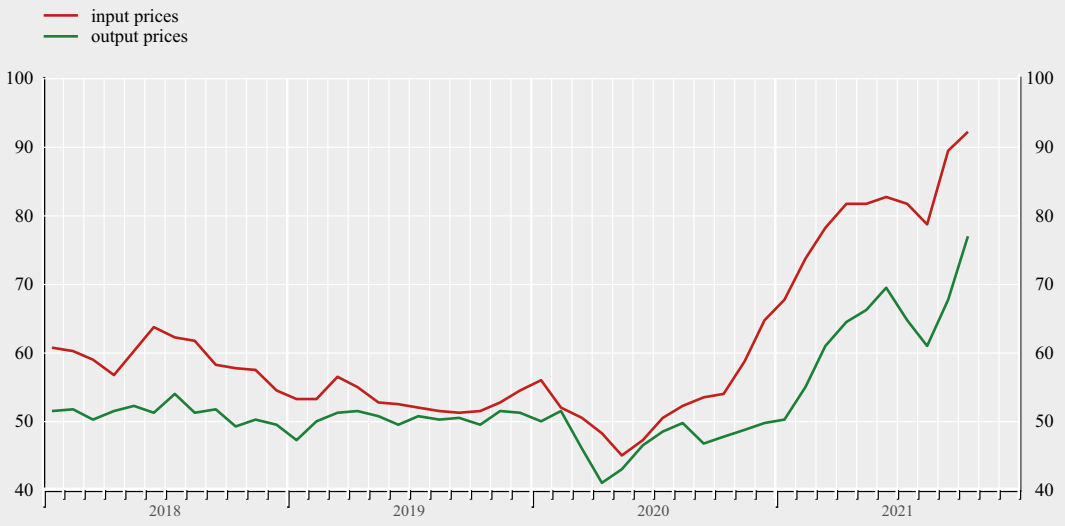


Sources: Eurostat and author's calculations.

4 See e.g. the study by Thum-Thysen and Canton (2015) that provides estimates of markups in the services sector for the EU countries.

Chart 5 Input and output prices in manufacturing

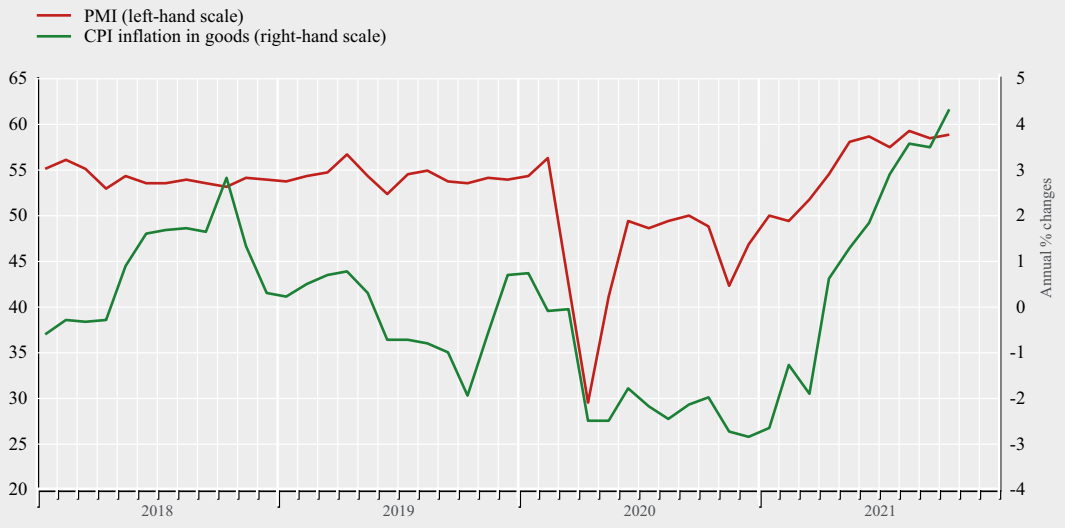
(monthly data)



Source: Markit.

Chart 6 PMI and CPI inflation in goods

(monthly data)



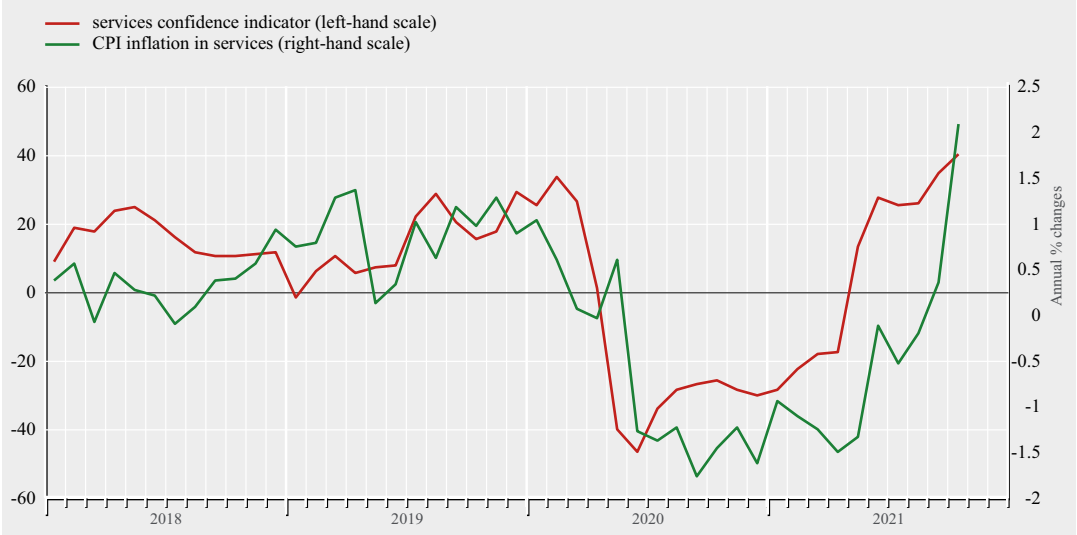
Sources: For PMI: Markit. For CPI: OECD.Stat.

cost. The incorporation of different production sectors in the model allows examining the implications of sector-specific shocks, namely shocks to the tradable, non-tradable and import sectors.

The results suggest that a rise in import price inflation negatively affects economic activity and leads to an increase in domestic prices. The implied pass-through to domestic CPI and GDP deflator inflation resulting from a 1 per-

Chart 7 Confidence indicator and CPI inflation in services

(monthly data)



Sources: For the services confidence indicator: European Commission, Business and consumer surveys. For CPI: OECD.Stat.

centage point (pp) change in import price inflation is 0.147 pp and 0.1 pp, respectively, which is in the range of estimates found in the relevant literature. The largest losses in output occur in the medium term, since in the short term the adverse effects are dampened by the presence of price rigidities and an import substitution effect that induces expenditure to switch towards domestically produced goods. The findings further suggest that the persistence of the rise in the price of imports matters for the adverse effects on economic activity in the medium term. The higher the persistence of import price inflation, the larger the output losses in the medium term. By way of illustration, a temporary increase of 1 pp in import price inflation reduces output by 0.02% and 0.06% after four and eight quarters, respectively. An increase in the persistence of import price inflation by one more quarter relative to the baseline scenario produces an additional cumulative loss in output equal to around 0.14% over the first two years after the shock and reaches a value of 0.28% over the first three years. Furthermore, the findings point out that an increase in the price of the non-tradable sector has an adverse effect on economic activity. For instance, a 1 pp increase in the inflation of the non-tradable sector decreases real GDP and private investment by around 0.19% and 0.87%, respectively, after four quarters. An increase in inflation persistence amplifies the negative effects on economic activity. For example, an increase in inflation persistence in the non-tradable sector by one more quarter results in an additional cumulative loss in output equal to 0.49% over the first two years after the shock.

To the best of my knowledge, this is the first paper that studies the effects of import price inflation for Greece in a general equilibrium framework. However, this is not only a country study, since it contributes to the literature that investigates the relationship between prices and exchange rates in the context of DSGE models. Corsetti and Dedola (2005), Corsetti et al. (2008), Choudhri and Hakura (2015) and Ortega and Osbat (2020) find that the exchange rate pass-through to import and hence consumer prices is incomplete and its degree depends on the nature of the shock that drives the exchange rate. Shocks to the exchange rate itself and monetary policy

shocks seem to have the largest impact on import and consumer prices.[5] There is also a large number of studies that provide empirical evidence on the impact of exchange rate and import price changes on consumer prices. Among many others, Ortega and Osbat (2020) provide recent estimates regarding the exchange rate pass-through to import and consumer prices for the euro area economies. They show that the pass-through to import prices is much larger than that to consumer prices and varies substantially across countries.[6] The paper also contributes to the literature that examines the effects of changes in the price of the services sector.[7] Papageorgiou and Vourvachaki (2017) examine the effects of structural reforms that enhance competition in the non-tradable sector for Greece. The present analysis differs in that the focus is on the investigation of inflationary pressures arising from the non-tradable sector.

The rest of the paper is organised as follows. Section 2 describes the theoretical model. Section 3 presents the main results. Section 4 concludes.

2 DESCRIPTION OF THE THEORETICAL MODEL

The model I use 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, but also includes some features that are important to adapt the model to Greece.[8]

In particular, the domestic economy is modelled as a 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 participate 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.

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 wages can deviate from the marginal product of labour due to labour unions' bargaining power. 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 domestically and in the rest of world (recorded as exports), while firms in the non-tradable sector sell their output only domestically. There are also importing firms that import intermediate goods from abroad 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.

5 See also Finn (2000) and Balke and Brown (2018) for the effects of energy price shocks in DSGE models.
6 Campa and Goldberg (2005) provide empirical evidence regarding the exchange rate pass-through to import prices in OECD countries. See Burstein and Gopinath (2014) for a review of the theoretical and empirical work on the relationship between prices and exchange rates.
7 See e.g. Forni et al. (2010).
8 For details of the main features of the model, see Papageorgiou and Vourvachaki (2017) and Papageorgiou (2014).

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 the Greek economy and thus provides a parameterised general equilibrium model suitable for policy simulations.

3 METHODOLOGY AND POLICY EXPERIMENTS

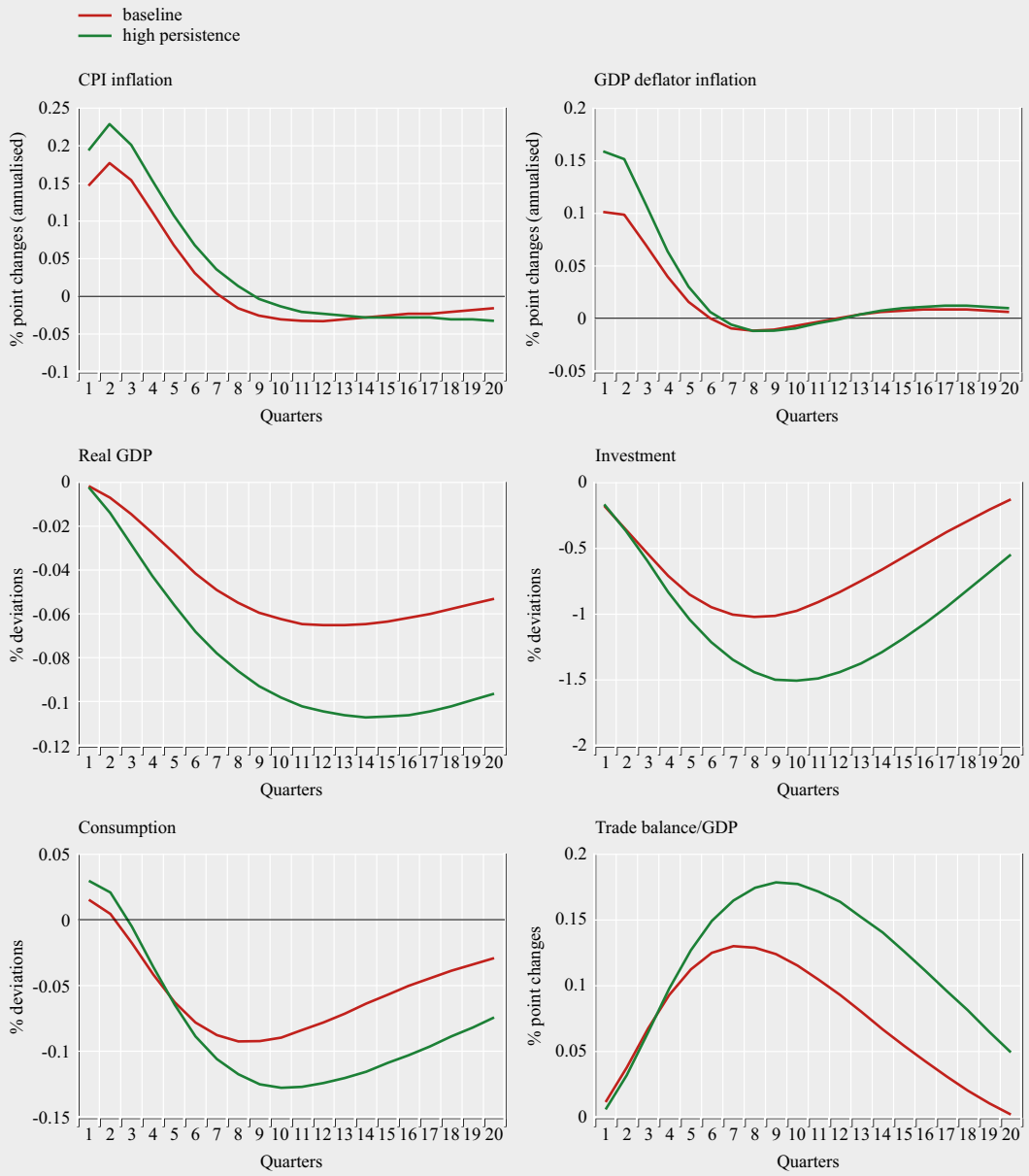
The approach to assessing the impact of inflationary shocks on the import and services sectors is summarised as follows: First, the model is calibrated for the Greek economy at a quarterly frequency. The values of the structural parameters are set as in Papageorgiou and Vourvachaki (2017) and Papageorgiou (2014). The exogenous fiscal policy instruments are set equal to their average values in the data over the period 2017-19. The main source of data is Eurostat. Then, in order to investigate the effects of an increase in the prices of the import and services sectors, I perform the following sets of experiments: (i) a temporary cost-push shock (i.e. a markup shock) to the import sector that increases the inflation rate of imports by 1 pp on impact; and (ii) a temporary cost-push shock (i.e. a markup shock) to the non-tradable (services) sector that increases the inflation rate of this sector by 1 pp on impact. To account for the uncertainty surrounding the persistence of the inflation drivers and the current inflation outlook, I implement these experiments for different degrees of persistence of the inflationary shocks. In the "baseline scenario", the persistence of the shocks is set so that the respective inflation rates gradually return to their initial levels after four quarters. In the "high persistence scenario", the persistence of the shocks is set so that the respective inflation rates gradually return to their initial levels after five quarters. The experiments are performed under perfect foresight, which means that households and firms fully anticipate the future transition paths of the exogenous variables.

3.1 EFFECTS OF AN INCREASE IN THE PRICE OF IMPORTS

Chart 8 shows the effects of the shock in the import prices of intermediate goods in the baseline and the high persistence scenario. All variables are expressed in percentage deviations from their steady state, except for the inflation rates and the trade balance-to-GDP ratio that are expressed as percentage point changes.

Regarding the propagation mechanism following an increase in import prices under the baseline scenario, a rise in the production costs of domestically produced final consumption and investment tradable goods is observed, which in turn triggers an increase in the respective prices. As a result, the domestic CPI, which is a weighted sum of the price index of domestic tradable and non-tradable con-

Chart 8 Dynamic effects of an increase in the price of imports



Source: Author's estimations.
Note: All variables are expressed in percentage deviations from the steady state, except for CPI inflation, GDP deflator inflation and the trade balance-to-GDP ratio that are expressed in percentage point changes.

sumption goods, rises. The estimated pass-through to domestic CPI inflation is equal to 0.147 pp at the impact period.[9] The pass-through to GDP deflator inflation is 0.1 pp on impact. Inflation in the domestic tradable and non-tradable intermediate goods sectors mimics the path of GDP deflator inflation, and

9 The pass-through to the domestic inflation rates is computed as the percentage point change in the respective inflation rate that results from a change of 1 pp in import price inflation.

the pass-through to the inflation rates of these sectors is about 0.088 pp. These results are consistent with previous findings in the relevant literature. For instance, Ortega and Osbat (2020) using a DSGE model calibrated for the euro area find that an increase of around 4 pp in import prices is followed by an increase of approximately 0.5 pp in consumer prices.[10]

Turing to the impact on the rest of the macroeconomic variables, the presence of price rigidities in domestic markets dampens the responses of the macroeconomic variables in the short run. At the same time, the rise in the price of imported intermediate goods generates an import substitution effect. More specifically, the imported intermediate goods are now more expensive, which leads to expenditure switching towards domestically produced intermediate consumption tradable and non-tradable goods. This effect is amplified by the high home bias in the production of consumption goods. Demand for domestically produced tradable intermediate investment goods also increases. Moreover, higher prices induce a negative wealth effect on households, prompting them to reduce consumption and investment demand. At the same time, since households expect prices to be higher in the future, they substitute future for today's consumption and investment (intertemporal substitution effect). As Chart 8 shows, the net effect on consumption is positive on impact, albeit very small. By contrast, private investment declines in the short run, since there is a low home bias in the production of investment goods and the import substitution effect is weaker. Consequently, the higher price of investment adversely affects demand for investment and capital stock accumulation. The effect on real GDP is marginally negative in the short run. This is driven by the fact that consumption demand is barely affected in the short run, as well as by an improvement in the trade balance due to reduced imports.

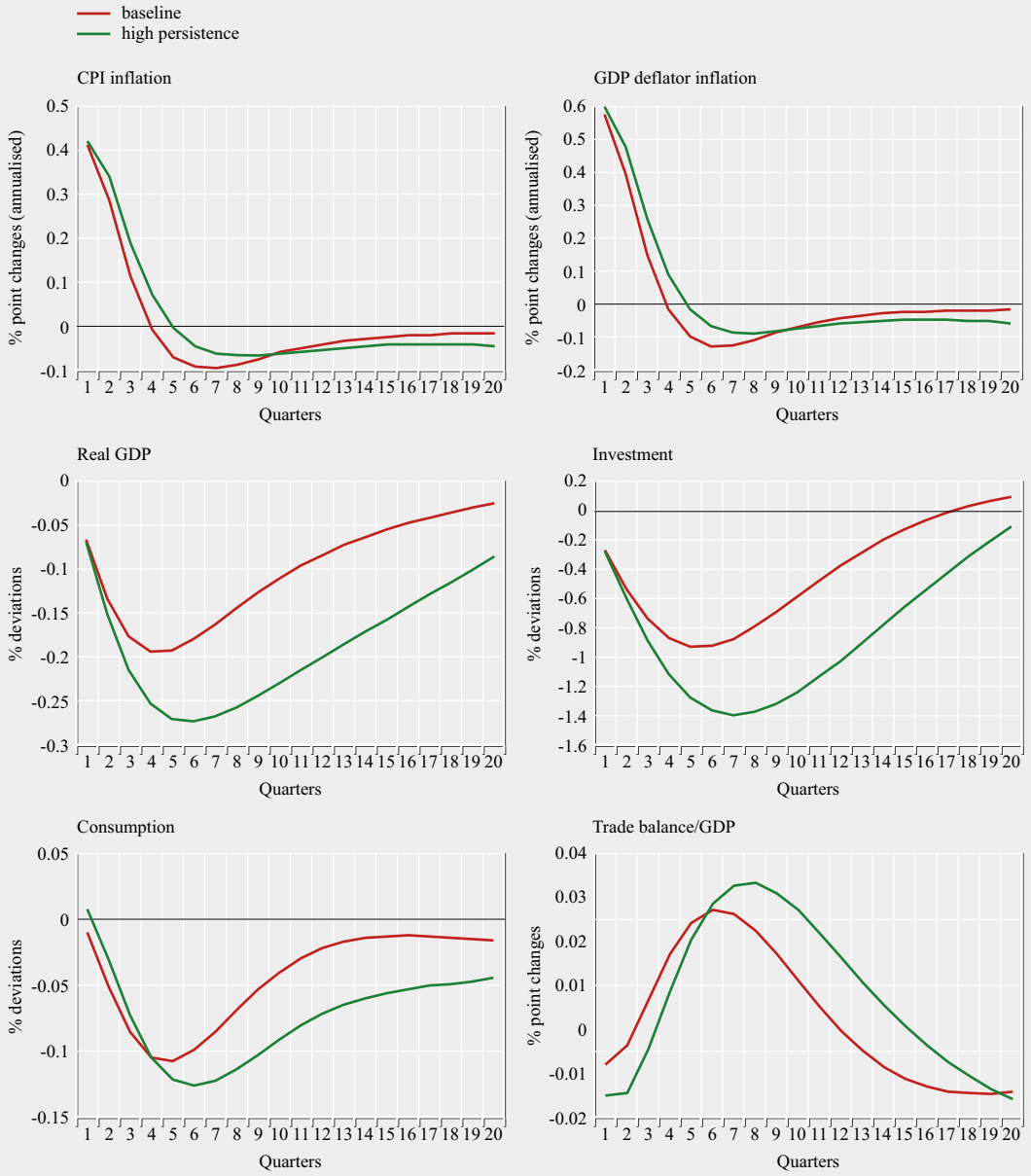
In the following periods of transition, the pass-through of import prices to domestic prices increases and adversely affects demand for consumption and investment. As a result, GDP declines. In particular, real GDP decreases by around 0.02% and 0.06% after four and eight quarters, respectively. The effects are more pronounced in what concerns investment, which declines by around 0.7% and 1% after four and eight quarters, respectively.

In the high persistence scenario, the pass-through to domestic CPI inflation is higher than in the baseline scenario and equal to 0.194 pp. The pass-through to GDP deflator inflation is 0.158 pp. Thus, the more persistent import price inflation is, the higher the pass-through to domestic prices. It should be noted that the increase in the pass-through is stronger for GDP deflator inflation as compared with CPI inflation. This is also reflected in the inflation of the domestic tradable and non-tradable sectors, in which the pass-through is 0.138 pp (0.088 pp in the baseline scenario). This is explained by the fact that intermediate goods firms expect future real marginal costs to be higher than in the baseline scenario and they set higher prices.

As in the baseline scenario, there is an import substitution effect. This effect is stronger in the high persistence scenario and produces a higher increase in demand for domestically produced intermediate consumption tradable and non-tradable goods, the production of which exhibits high home bias. As before, households face a negative income effect, forcing them to reduce consumption and investment demand. However, the intertemporal substitution effect for households is stronger since future prices are expected to be higher for a longer period relative to the baseline scenario. As a result, they are more willing to substitute future for current consumption and investment. Eventually, as Chart 8 illustrates, the reduction in demand for consumption and

10 See Chart 18 in Ortega and Osbat (2020). The findings are also in the range of estimates found in the empirical studies. For example, Ortega and Osbat (2020) for the euro area find that an increase of 0.3% in import prices is followed by an increase of 0.04% in consumer prices. Guilloux-Nefussi and Kharroubi (2008) using a panel of OECD countries find that a 1 pp increase in import price inflation produces a rise in CPI inflation of between 0.11 and 0.15 pp.

Chart 9 Dynamic effects of a price increase in the non-tradable sector



Source: Author's estimations.
Note: All variables are expressed in percentage deviations from the steady state, except for CPI inflation, GDP deflator inflation and the trade balance-to-GDP ratio that are expressed in percentage point changes.

investment in the short run is slightly lower than in the baseline scenario and further exerts upward pressures on domestic prices. However, in the following periods of transition the decline in consumption, investment and GDP is much bigger in the high persistence scenario. Real GDP shrinks by around 0.04% and 0.09% after four and eight quarters, respectively (0.02% and 0.06% in the baseline scenario). The present-value cumulative losses in GDP

from the higher persistence of inflation relative to the baseline scenario are 0.14% and 0.28% over the first two and three years, respectively, and around 1.1% in the long run.

3.2 EFFECTS OF HIGHER PRICES IN THE NON-TRADABLE (SERVICES) SECTOR

In this section I examine the macroeconomic effects of an inflationary cost-push shock that raises the price of the non-tradable sector. As in the previous section, the size of the shock is chosen so that the inflation rate in the non-tradable sector increases by 1 pp on impact under the different scenarios regarding the persistence of the shock (baseline and high persistence scenarios). Chart 9 presents the dynamic effects following the shock in the baseline and the high persistence scenario.

The increase in the price of the non-tradable intermediate goods produces a substitution effect that prompts households to substitute non-tradable for tradable goods. At the same time, higher prices in the non-tradable sector exert an upward pressure on the CPI and GDP deflator inflation rates, which increase on impact by 0.41 pp and 0.57 pp, respectively. Thus, the pass-through to the CPI and the GDP deflator is much higher than that of the import price shock. In turn, the rise in domestic prices has an adverse effect on the country's competitiveness, leading to a reduction in demand for exports and a deterioration in the trade balance. The price of investment also increases, leading to a decline in investment demand. Lower aggregate demand forces firms to reduce labour demand, thereby generating downward wage pressures. Consumption demand also decreases since households face a negative income effect, which dominates the intertemporal substitution effect and further dampens aggregate demand on impact. Eventually, the net effect on tradable output is negative, which along with lower non-tradable output implies a reduction in real GDP. In the following periods of transition, consumption, investment and exports continue to decline, ultimately leading to a reduction in real GDP and investment of around 0.2% and 0.87%, respectively, after four quarters.

When the shock to the price of the non-tradable sector is more persistent, the negative effect on real GDP is much stronger than in the baseline scenario over the medium term. This is mainly driven by reduced investment and exports and, to a lesser extent, consumption. Expectations of longer-lasting high prices induce a stronger substitution effect that mitigates the adverse effects on aggregate demand in the short run (households substitute future for current consumption and investment). Real GDP and investment decline by around 0.25% and 1.1%, respectively, after four quarters. The present-value cumulative loss from an increase in the persistence of the inflation rate by one quarter relative to the baseline scenario is 0.49% over the first two years and converges to 1.8% in the long run.

4 CONCLUSIONS

This paper studied the macroeconomic effects of cost-push shocks that increase prices in the import and services sectors. The set-up was a DSGE model calibrated for the Greek economy. Moreover, the analysis considered the implications from different degrees of persistence of the inflationary shocks.

The results suggest that an increase in import price inflation drives up domestic inflation and has an adverse effect on economic activity. The pass-through to CPI and GDP deflator inflation implied by the model is 0.147 pp and 0.1 pp, respectively. The largest output losses occur in the medium term, since in the short term the adverse effects are mitigated by the presence of price rigidities in the domestic market and an import substitution effect that leads to expenditure switching towards domestically produced intermediate goods. The results further suggest that inflation persistence matters for the impact on economic activity. A more persistent rise in import price inflation amplifies the adverse effects on economic

activity and increases the pass-through to domestic prices. Finally, the results indicate that a rise in the price of the services sector induces strong inflationary pressures and negatively affects the macroeconomy.

In summary, the findings point out that if the observed import price inflation in Greece persists, it will likely force domestic firms to pass through higher costs to consumer prices, thereby triggering further inflationary pressures. While the adverse effects on the macroeconomy seem to be subdued in the short run, persistent import price inflation might call for policies to bring domestic inflationary pressures under control in the medium term. A serious challenge for the Greek economy is to rein in the growing inflationary pressures in sectors with high market power, as is the case with the services sector, to avoid dampening its ongoing recovery.

I acknowledge that the import sector incorporated in the model is a stylised one, assuming away a number of features, such as an energy sector, that are typically found to be important for examining the effects of import price shocks on domestic prices (see e.g. Blanchard and Galí 2009). Adding such features would be an interesting extension. Nonetheless, given that the output and inflation effects resulting from the analysis are non-trivial, the findings provide useful insights and help understand the impact of inflationary shocks stemming from the import and services sectors on economic activity.

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