VAT RATE SHOCKS AND INFLATION: A THEORETICAL AND EMPIRICAL ANALYSIS FOR GREECE

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ABSTRACT

This paper evaluates the effectiveness of Value Added Tax (VAT) reductions as a tool to mitigate inflation in Greece, combining empirical evidence with structural macroeconomic analysis. First, the estimation of a small-scale structural vector autoregression (SVAR) model reveals that temporary VAT reductions exert a statistically insignificant effect on inflation. Nevertheless, when VAT reductions are accompanied by enhancements in product market competition, the disinflationary effects become both significant and persistent. Second, the results from a Dynamic Stochastic General Equilibrium (DSGE) model calibrated to the Greek economy indicate that the short-run pass-through of VAT cuts to consumer prices is partial, ranging between 19% and 25% in the short term. This pass-through is highly influenced by structural factors and the persistence of policy interventions. Notably, permanent VAT cuts generate nearly twice the inflation pass-through compared to temporary ones. The disinflationary impact is also stronger in economies with more competitive product markets, where firms are more likely to transmit cost reductions to prices. Conversely, in economies characterised by relatively high nominal rigidities or limited domestic input use, the inflation response to VAT reductions is diminished. Overall, the results of the study demonstrate the significance of structural conditions in determining the inflationary outcomes of VAT-based fiscal measures.

Keywords: VAT reduction; inflation; fiscal policy; tax rate pass-through; SVAR; DSGE; Greece

JEL classification: C32; E31; E62; H20; O52

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ΜΕΤΑΒΟΛΕΣ ΤΟΥ ΦΠΑ ΚΑΙ ΠΛΗΘΩΡΙΣΜΟΣ: ΜΙΑ ΕΜΠΕΙΡΙΚΗ ΚΑΙ ΘΕΩΡΗΤΙΚΗ ΑΝΑΛΥΣΗ ΓΙΑ ΤΗΝ ΕΛΛΗΝΙΚΗ ΟΙΚΟΝΟΜΙΑ

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ΠΕΡΙΛΗΨΗ

Η παρούσα μελέτη διερευνά την αποτελεσματικότητα των μειώσεων του Φόρου Προστιθέμενης Αξίας (ΦΠΑ) ως εργαλείου περιορισμού του πληθωρισμού στην ελληνική οικονομία, συνδυάζοντας την εμπειρική τεκμηρίωση με τη διαρθρωτική μακροοικονομική ανάλυση. Τα αποτελέσματα που προκύπτουν από τη χρήση ενός μικρής κλίμακας διαρθρωτικού αυτοπαλίνδρομου διανυσματικού υποδείγματος (SVAR) υποδηλώνουν ότι οι προσωρινές μειώσεις του ΦΠΑ έχουν στατιστικά μη σημαντική επίδραση στον πληθωρισμό. Ωστόσο, όταν οι μειώσεις του ΦΠΑ συνοδεύονται από πολιτικές που ενισχύουν τον ανταγωνισμό στην αγορά προϊόντων, οι αποπληθωριστικές επιδράσεις καθίστανται σημαντικές και διατηρήσιμες. Παράλληλα, τα αποτελέσματα από ένα δυναμικό στοχαστικό υπόδειγμα γενικής ισορροπίας (DSGE), το οποίο διαμετρείται για την ελληνική οικονομία, δείχνουν ότι η μετακύλιση των μειώσεων του ΦΠΑ στις τιμές καταναλωτή βραχυπρόθεσμα είναι μερική και εκτιμάται μεταξύ 19% και 25%. Ο βαθμός μετακύλισης επηρεάζεται από διαρθρωτικούς παράγοντες, καθώς και από τη διάρκεια της εφαρμογής του μέτρου. Οι μόνιμες μειώσεις του ΦΠΑ σχεδόν διπλασιάζουν τη μετακύλιση στις τιμές σε σύγκριση με τις προσωρινές. Οι αποπληθωριστικές επιδράσεις είναι επίσης ισχυρότερες σε οικονομίες με πιο ανταγωνιστικές αγορές, όπου οι επιχειρήσεις είναι πιο πρόθυμες να μετακυλίσουν τις μειώσεις κόστους στις τιμές. Αντιθέτως, σε οικονομίες που χαρακτηρίζονται από υψηλό βαθμό δυσκαμψιών ή περιορισμένη χρήση εγχώριων εισροών, οι επιδράσεις στον πληθωρισμό από μειώσεις του ΦΠΑ είναι ασθενέστερες. Συνολικά, τα ευρήματα της μελέτης αναδεικνύουν το ρόλο των διαρθρωτικών και θεσμικών χαρακτηριστικών στον τρόπο με τον οποίο οι μεταβολές του ΦΠΑ επηρεάζουν τον πληθωρισμό.

ΜΗ ΤΕΧΝΙΚΗ ΣΥΝΟΨΗ

Η πρόταση για προσωρινή και στοχευμένη μείωση του συντελεστή Φόρου Προστιθέμενης Αξίας (ΦΠΑ) σε ορισμένες κατηγορίες βασικών αγαθών, όπως τρόφιμα και ενέργεια, επανήλθε στο προσκήνιο τα τελευταία χρόνια ως μέτρο πολιτικής έναντι του κύματος πληθωριστικών πιέσεων και υιοθετήθηκε από αρκετές χώρες της ευρωζώνης. Οι πιέσεις αυτές απορρέουν κυρίως από την αύξηση του κόστους της ενέργειας και των πρώτων υλών, καθώς και από διαταράξεις στην εφοδιαστική αλυσίδα, κυρίως λόγω του πολέμου στην Ουκρανία. Όπως προκύπτει από τη σχετική βιβλιογραφία, η αποτελεσματικότητα μιας μείωσης του ΦΠΑ στον περιορισμό του πληθωρισμού παραμένει αντικείμενο συζήτησης, καθώς εξαρτάται κυρίως από τα διαρθρωτικά και θεσμικά χαρακτηριστικά των οικονομιών, όπως είναι για παράδειγμα ο βαθμός ανταγωνισμού στις αγορές προϊόντος και εργασίας, καθώς και τις στρατηγικές τιμολόγησης των επιχειρήσεων.

Με βάση τα παραπάνω, η παρούσα μελέτη εξετάζει τις επιδράσεις μιας προσωρινής μείωσης του ΦΠΑ στον πληθωρισμό στην Ελλάδα, τόσο από θεωρητική όσο και από εμπειρική σκοπιά, ακολουθώντας την εξής μεθοδολογική προσέγγιση. Αρχικά, χρησιμοποιείται ένα διαρθρωτικό αυτοπαλίνδρομο διανυσματικό υπόδειγμα (SVAR) με στόχο να διερευνηθούν οι επιδράσεις μιας μείωσης του ΦΠΑ στον πληθωρισμό, καθώς και ο ρόλος βασικών διαθρωτικών παραγόντων, όπως ο βαθμός ανταγωνισμού στην αγορά προϊόντος, στη μετακύλιση της μείωσης του ΦΠΑ στις τιμές. Στη συνέχεια, χρησιμοποιείται ένα δυναμικό στοχαστικό υπόδειγμα γενικής ισορροπίας (DSGE model), το οποίο διαμετρείται για την ελληνική οικονομία, προκειμένου να εξεταστούν οι μακροοικονομικές επιδράσεις από μια μείωση του ΦΠΑ. Η ανάλυση εστιάζει στη μετακύλιση της εν λόγω μείωσης στις τιμές καταναλωτή και στο ρόλο των διαρθρωτικών και θεσμικών χαρακτηριστικών, όπως ο βαθμός ανταγωνισμού στην αγορά προϊόντος και οι δυσκαμψίες στις τιμές και τους μισθούς, στη διαμόρφωση των διαύλων μετάδοσης της εν λόγω φορολογικής παρέμβασης στην οικονομική δραστηριότητα.

Τα αποτελέσματα της μελέτης δείχνουν ότι η αποτελεσματικότητα μιας μεμονωμένης μείωσης του ΦΠΑ ως μέτρου περιορισμού του πληθωρισμού στην ελληνική οικονομία είναι περιορισμένη βραχυπρόθεσμα, καθώς η μετακύλισή της στις τελικές τιμές καταναλωτή είναι μόνο μερική. Αντιθέτως, διαπιστώνεται σημαντική και διατηρήσιμη αποκλιμάκωση του πληθωρισμού όταν η μείωση του ΦΠΑ συνοδεύεται από διαρθρωτικά μέτρα που ενισχύουν τον ανταγωνισμό στις αγορές προϊόντων και υπηρεσιών.

Παράλληλα, τα αποτελέσματα της ανάλυσης υποδηλώνουν ότι η επίδραση της μείωσης του ΦΠΑ στις τιμές εξαρτάται σε μεγάλο βαθμό από τη διάρκεια της εφαρμογής του μέτρου. Οι μόνιμες μειώσεις ΦΠΑ είναι πιο αποτελεσματικές από τις προσωρινές, καθώς ενισχύουν την αξιοπιστία της οικονομικής πολιτικής και επηρεάζουν θετικά τις προσδοκίες των νοικοκυριών και των επιχειρήσεων. Εκτιμάται ότι μια μόνιμη μείωση του ΦΠΑ σχεδόν διπλασιάζει τη μετακύλιση στις τιμές σε σύγκριση με μια προσωρινή μείωση. Αντιθέτως, σε οικονομίες με υψηλό βαθμό δυσκαμψιών στις τιμές και τους μισθούς ή με περιορισμένη χρήση εγχώριων εισροών στην παραγωγική διαδικασία, η αποτελεσματικότητα της μείωσης του ΦΠΑ στον περιορισμό των πληθωριστικών πιέσεων είναι ασθενέστερη.

Το γενικό συμπέρασμα της μελέτης είναι ότι η μείωση του ΦΠΑ, από μόνη της, δεν επαρκεί ως εργαλείο για την αποκλιμάκωση των πληθωριστικών πιέσεων στην ελληνική οικονομία, καθώς η αποτελεσματικότητά της εξαρτάται σε μεγάλο βαθμό από το ευρύτερο θεσμικό και διαρθρωτικό περιβάλλον. Η αξιοποίηση του ΦΠΑ ως αποτελεσματικού μέσου αποπληθωριστικής παρέμβασης προϋποθέτει την ένταξή του σε ένα ευρύτερο πλαίσιο οικονομικής πολιτικής, το οποίο περιλαμβάνει συμπληρωματικές διαρθρωτικές παρεμβάσεις. Οι παρεμβάσεις αυτές θα

πρέπει να στοχεύουν στην ενίσχυση του ανταγωνισμού στις αγορές προϊόντων και υπηρεσιών και στη μείωση των στρεβλώσεων στην οικονομία, προκειμένου να ενισχυθεί η μετακύλιση των μέτρων φορολογικής πολιτικής στις τιμές καταναλωτή.

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I INTRODUCTION

The proposal for a temporary and targeted reduction of the Value Added Tax (VAT) rate on certain categories of goods (such as basic foodstuffs and energy) has recently come to the fore in response to a surge in inflation, which, in turn, is the result of rising energy and commodity prices, as well as supply bottlenecks mainly due to the Russo-Ukrainian war.

In the European Union, Spain was the first country to adopt temporary VAT rate cuts on basic foodstuffs[1] and energy[2] as part of a strategy to contain recent inflationary pressures (after the end of 2021). The initial plan was for these temporary tax rate reductions to expire by the end of 2023, with the possibility of extension depending on inflation trends and broader economic conditions. After this, similar policy measures were adopted by other euro area economies, including Germany, France, Belgium, Italy and Portugal, with regard to both basic goods and energy. In the case of Greece, since the end of the pandemic, the authorities have implemented targeted interventions to address increased energy prices. However, they have largely maintained VAT rates at the elevated levels introduced during the economic adjustment period, in order to achieve the necessary fiscal adjustment.[3]

As demonstrated by the relevant empirical literature, the effectiveness of a VAT reduction in containing inflation remains a subject of debate, as it is contingent on several factors. According to Blundell (2009), who analyses the 2009 temporary VAT rate cuts in the UK, the impact on inflation is limited, as these tax cuts boost real income and demand, which, in turn, fuel inflation. At the same time, several studies assess the impact of VAT cuts on a more disaggregated level, that is, on specific goods and services markets.[4] These studies indicate that the pass-through of VAT rate cuts to retail prices varies significantly across different markets and is influenced by market structure (e.g. firm size), the degree of competition, pricing strategies, the penetration of e-commerce and e-shopping in households' purchases and the extent of product diversification.[5] These findings emphasise the broader view that the effectiveness of VAT cuts in reducing inflation is not uniform across economies or sectors, but rather contingent on deeper structural and institutional features. In this context, the transmission of exogenous shocks —including fiscal measures such as VAT cuts— to inflation is heavily influenced by country-specific structural and institutional characteristics. These include, for example, the

* The views expressed in this article are of the authors and do not necessarily reflect those of the Bank of Greece. The authors are responsible for any errors or omissions.

1 VAT was cut from 4% to 0% for certain products such as bread, milk, cheese, fruit, vegetables and cereals and from 10% to 5% for meat and fish.

2 For example, VAT on electricity was reduced from 21% to 5% to mitigate the impact of high energy prices on households and businesses.

3 It should be noted that, during the pandemic, Greece introduced several income support measures and benefits, as well as temporary tax exemptions, which aimed to sustain consumers' purchasing power. In this context, Greece reduced VAT on electricity and natural gas from 13% to 6%, and on the catering sector from 24% to 13% (for a detailed description of relevant fiscal measures, see previous Bank of Greece Annual Reports, Section "Institutional framework and fiscal reforms"). The country's limited interventions in the period following the outbreak of the Russo-Ukrainian war included VAT rate cuts for inputs used in livestock production and agriculture (feed, fertilisers, etc.), and an extension of the exemptions in force (in the form of a reduced VAT rate) for specific sectors (such as non-alcoholic beverages, transport and gyms, real estate).

4 Depending on the data format and the structure of the markets under examination, alternative empirical methods of analysis mainly involve the use of structural vector autoregression, as well as the use of panel data models. Markets where the effects of VAT rate cuts have been studied, include: (i) hairdressing (Kosonen 2015), (ii) film (Moral and Gómez-Antonio 2020), (iii) catering (Harju and Kosonen 2014), and (iv) food and beverages (Benzarti et al. 2024; De Amores Hernandes et al. 2023 and Fuest et al. 2025). In addition, artificial intelligence technologies are lately being used to exploit electronic transaction data in real time (see Forteza et al. 2024).

5 For example, see Hindriks and Serse (2019) as well as Copestake and Bellon (2022).

degree of product market competition, labour market rigidities, firms' pricing behaviour and the interplay between policy persistence and private sector expectations.[6]

To illustrate this point, consider a temporary reduction in the VAT rate. The immediate effect on inflation is a decline in the price level, as the lower tax rate directly reduces consumer prices. Nevertheless, this initial disinflationary impact may be partially offset by subsequent demand-side dynamics. Specifically, the implementation of this measure produces a positive income effect, thereby strengthening households' purchasing power and stimulating consumption. Furthermore, given the temporary nature of the tax reduction, consumers may choose to postpone future consumption in favour of the present, thereby generating an intertemporal substitution effect that would serve to further boost short-run demand and inflationary pressures.

From a supply-side perspective, the impact of a reduction in VAT is determined by its interplay with firms' marginal costs. Under perfect competition, broad-based VAT rate cuts —including those affecting the cost of production inputs— are expected to reduce production costs, enhance firms' productive capacity and eventually lead to higher output and lower prices. In contrast, under imperfect competition[7] (e.g. oligopolistic or monopolistic market structures), a decline in production costs, along with a reduction in consumer prices (due to a decrease in the VAT rate), has the potential to result in elevated profit margins for firms, with minimal consequences for production. In such environments, the pass-through of VAT rate cuts to retail prices may be incomplete and inflation may prove more persistent, thereby reducing the effectiveness of this policy measure. Ultimately, the net effect on inflation is contingent upon the interaction between pricing behaviour, market structure and the strength of demand and supply-side responses.

In this context, the objective of the present paper is to investigate the implications of a reduction in VAT rates on inflation in Greece, from both a theoretical and an empirical perspective. In order to address this issue, the following approach is adopted. First, a small-scale structural vector autoregression (SVAR) model is employed to analyse the key factors influencing the pass-through of a VAT reduction to inflation. These factors include the degree of product market competition and monetary policy reactions, and the evaluation of their role in shaping observed inflation dynamics. Second, a Dynamic Stochastic General Equilibrium (DSGE) model calibrated to the Greek economy is used to examine the macroeconomic effects of consumption tax rate cuts. The analysis focuses on the pass-through to consumer prices and the role of structural and policy-related factors —such as market competition, price and wage rigidities, and policy persistence— in shaping the transmission mechanism.

The paper relates and contributes to two strands of literature. The first is the empirical examination of the effectiveness of VAT reductions in containing inflation. While existing research in this area predominantly relies on disaggregated data to estimate the impact of VAT changes on prices, this paper makes a novel contribution by providing macro-level estimates using a SVAR approach. The second strand relates to the general equilibrium effects of VAT changes. To the best of our knowledge, there is limited evidence regarding the quantification of the pass-through of VAT cuts to inflation within a general equilibrium setting, accounting for the structural and policy determinants.[8] Our paper bridges these two strands. It offers a unified framework to assess the broader macroeconomic implications of

6 See Galí and Gertler (1999), Blanchard and Giavazzi (2003), Fabiani et al. (2006), Christiano et al. (2005), as well as Blanchard and Galí (2007) and the references in footnote 5.

7 Under conditions of monopolistic competition, undertakings determine the level of production and —given the aggregate demand— the price, whereas under oligopolistic competition, they determine the production level, while prices are linked to the strategies of the other firms in the oligopoly sector.

8 See Voigts (2016), who finds that the VAT pass-through to inflation depends on the modelling specification of consumption and VAT taxes. There are several studies that examine the impact of consumption taxes on output using a similar framework (see, e.g. Forni et al. 2009 and Coenen et al. 2008).

VAT reductions. Finally, our paper contributes to the body of literature that empirically examines the pass-through of VAT changes in the Greek economy.[9]

The results of the empirical analysis reveal that the direct impact of a VAT cut on inflation is limited and statistically insignificant at the macro level. This suggests that this measure is not very effective in the short term. By contrast, a significant and sustained fall in inflation is observed in response to increased market competitiveness, as reflected by a reduction in aggregate markups. This indicates that enhanced market competition strengthens the pass-through of VAT reductions to consumer prices. Robustness checks using local projections confirm these findings, showing that improvements in market competition result in long-term reductions in inflation. Further confirmation comes from a scenario analysis, which shows that the effectiveness of VAT cuts in reducing inflation depends critically on the degree of competition in goods and services markets. VAT cuts only result in meaningful disinflation when accompanied by structural reforms that reduce markups, highlighting the interplay between fiscal policy and market structure.

Moreover, the results from the DSGE model suggest that a temporary consumption tax rate cut reduces inflation and boosts output in the short term. However, the pass-through to inflation is only partial, with estimates ranging between 19% and 25% in the first year following implementation, figures that lie at the lower end of the empirical estimates. The analysis further reveals that structural and policy-related factors critically influence the magnitude of the inflation response. Notably, a permanent tax cut nearly doubles the short-term pass-through, underscoring the importance of policy credibility and expectations in the design of fiscal interventions. The inflationary impact of the tax cut is also found to be stronger in more competitive economies, consistent with the findings from the empirical analysis. Moreover, the disinflationary effect of the tax cut is more muted in economies where firms adjust prices infrequently, as nominal rigidities delay the transmission of cost changes to consumer prices. The pass-through is larger in economies with more flexible labour markets, where wages adjust more rapidly to shocks, thereby amplifying the impact on marginal costs and prices. Finally, the disinflationary impact is more pronounced in economies with stronger home bias in input sourcing, highlighting the importance of production structure and supply-chain configuration in shaping fiscal transmission.

The rest of the paper is organised as follows: Section 2 presents the empirical model and the main empirical estimates. Section 3 describes the theoretical model and presents the main results from the simulations, while Section 4 concludes.

2 EMPIRICAL MODEL

We employ standard empirical analysis in the area as adopted by numerous articles (Afonso et al. 2009; Caldara and Kamps 2008; Alesina et al. 2012) that assess the implications of fiscal shocks on aggregate inflation. Our analysis uses a simplified VAR model based on quarterly Greek data from 2000q1 to 2024q1. The chosen period covers key milestones affecting the domestic economy: Greece's entry into the EMU in 2001, the sovereign debt crisis in 2010 and the subsequent economic crisis, the pandemic and, to a lesser extent, the impact of the war in Ukraine.

The general specification is as follows:

$$Y_t = A_0 + \sum_{i=1}^{p} A_i Y_{t-i} + \sum_{j=1}^{q} B_j X_{t-j} + e_t \quad (1)$$

where Y_t denotes the vector of endogenous variables and X_t denotes the vector of exogenous variables of our VAR model for the Greek economy, while p and q denote lag structure (up to 4 lags utilised).

In our analysis, we keep a small number of endogenous quarterly variables $Y_t=(\pi_t, y_t, mu_t)$,

9 See Dimitrakopoulou et al. (2024).

where π_t denotes the annualised inflation (y-o-y) derived from the HICP index[10] and y_t is the annualised real GDP growth rate of the Greek economy (y-o-y) and mu_t the total economy's markup constructed as in Papageorgiou and Rizos (2024).[11] In our set of exogenous variables, we have included variables of interest denoted with the vector $X_t=(r_t, \tau_t)$, where r_t denotes the quarterly average of the 3-month Euribor and, with a view to portraying fiscal shocks, τ_t denotes the applied statutory VAT rate extrapolated to a quarterly frequency (incorporated up to 4 lags).[12]

In the light of the Ordinary Least Squares (OLS) Vector Autoregressive (VAR) model, this study undertakes an evaluation of the repercussions of a VAT rate reduction and its subsequent transmission to inflation within the Greek economy. To this end, a simplified Cholesky decomposition is employed, under the assumption of a sequence of shocks initiated by the VAT rate reduction in question and propagating to markup, growth and inflation. The impulse responses of inflation and output to a VAT statutory tax rate and markup shock are presented in the panels of Chart 1.

As demonstrated in the left-hand side panels of Chart 1, the impact of a VAT rate reduction is projected[13] to reduce the overall inflation rate. However, these projections appear to be statistically insignificant at 95% significance level.[14] A similar response is exhibited in the case of real output growth to a VAT cut shock.[15] In the case of a negative markup shock (right-hand side panels of Chart 1), an improvement in competition (as expressed by the decline in markup by 1 standard deviation) has a negative and statistically significant effect on inflation in the medium run, i.e. after 5-6 quarters. The estimated adverse effect on output is also found to be insignificant at the 95% level of significance.[16]

As a robustness test, the local projection variant of impulse responses (Jordà 2005) is employed, following the same model specification (see Chart A1 of the Appendix).[17] The estimated effects of changes to statutory VAT rates on inflation are found to be negligible and these effects are observed to dissipate rapidly, thereby verifying that the impact of a VAT cut on inflation is at best limited in the case of the Greek economy. A similar VAT cut is also shown to have a muted effect on output. Conversely, a reduction in markup, indicative of enhanced competition, has been found to produce statistically significant disinflationary effects at the 95% confidence level after a period of six to seven quarters. This finding signifies that enhancing competition results in a decline in inflation in the medium term (see Chart A1 of the Appendix). However, the responses of output to enhanced competition have not been determined to be statistically significant.

2.1 CONDITIONS UNDER WHICH A VAT RATE SHOCK COULD BE TRANSMITTED TO INFLATION: THE ROLE OF MARKET COMPETITION

A small number of additional scenarios are simulated on the basis of the estimated VAR model to provide a more precise understanding of the factors that can lead to an improvement in the effectiveness of VAT reductions in terms

10 Quarterly data on y-o-y inflation is defined as $\pi_t = \frac{a_t - a_{t-4}}{a_{t-4}}$, where a_t is the 3-month average of the HICP index published by ELSTAT. This approximation is very close to the 12-month annualised inflation rate published monthly by the Hellenic Statistical Authority (ELSTAT).

11 A rough proxy for quarterly price markups for the total economy has been constructed using non-financial transactions data from Eurostat. Markups are defined as the ratio of the net operating surplus and mixed income to total input costs. Total input costs are proxied as the sum of intermediate consumption and consumption of fixed capital.

12 Our estimation is based on a limited number of restrictions imposed on the elements of matrix coefficient B_j, as denoted in the Appendix (Table A1).

13 Assuming symmetry of response between a positive and a negative shock. Similar analysis at the 90% leads to similar conclusions findings.

14 There have been similar findings, when, instead of the statutory VAT rate, we used a proxy of the implied VAT rate, defined as the VAT revenues divided by private consumption adjusted for the VAR revenues and seasonally adjusted (STL seasonal adjustment).

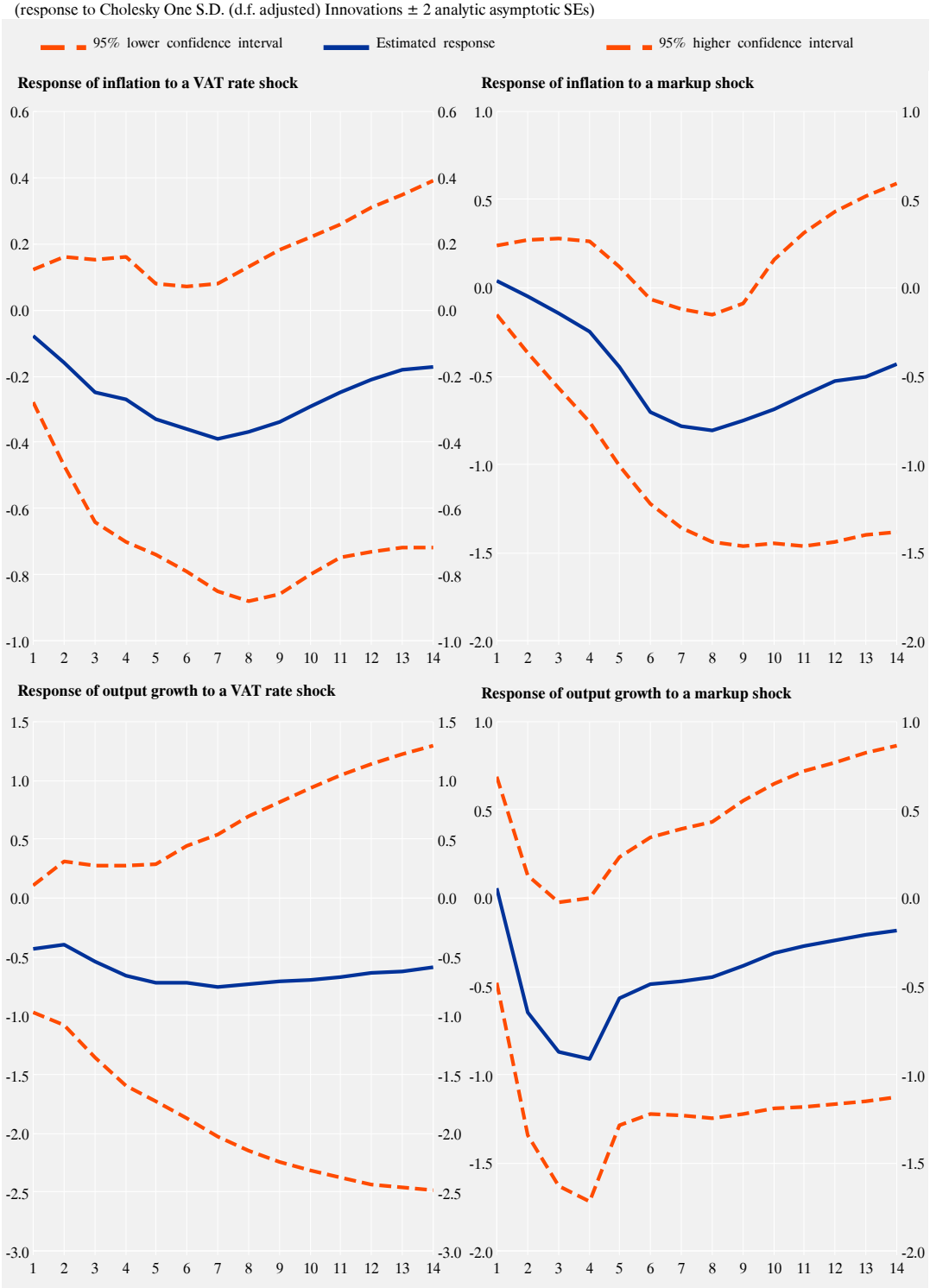
15 According to Kneller et al. (1999), as well as Rapanos and Kaplanoglou (2014), the change in VAT rates does not by itself affect the factors of the production function through substitution effects and does not affect saving and investment decisions or businesses' competitiveness through exports.

16 It should also be noted that, given the aggregate level of data, the observed impact on output is the result of multiple factors, e.g. type of competition, product market differentiation, size of markets, barriers to entry and exit, linkages with external environment, etc.

17 Assuming symmetry of response between a positive and a negative shock.

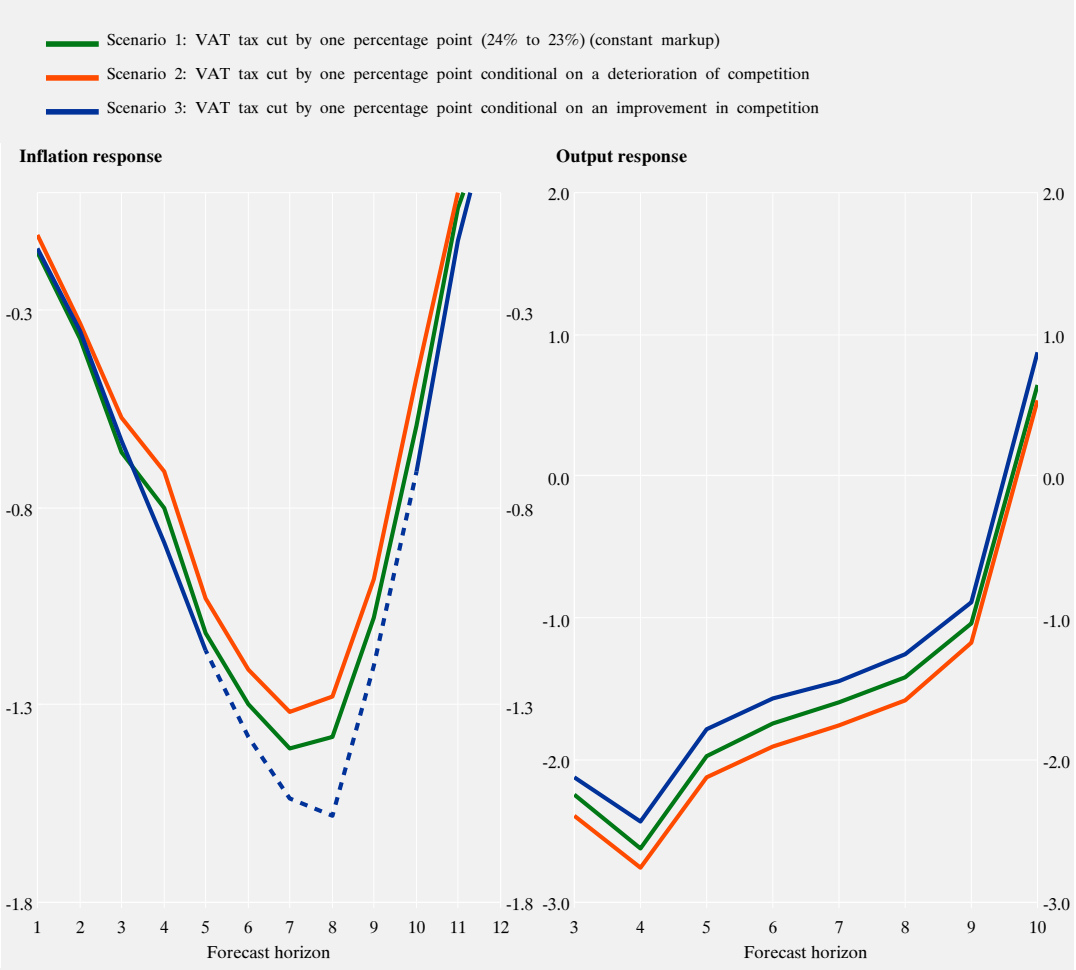
Chart 1 Impulse response functions of inflation and growth to a negative shock to the statutory VAT rate and to markup (improvement in competition)

(response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 analytic asymptotic SEs)



Source: Authors' estimations and Bank of Greece.

Chart 2 Scenario analysis: estimated inflation and output response based on the VAR model (eq. 1) under Scenarios 1, 2 and 3 (see note below for details)



Sources: Authors' estimations and Bank of Greece. The dashed lines denote statistical significance at 95%.
Note: Scenario 1 portrays a decline in inflation (pass-through) resulting from a temporary reduction by one percentage point in the VAT statutory rate. Scenario 2 is defined as Scenario 1 plus a trend increase in markup (i.e. less competition in products and services) to historic highs and Scenario 3 is defined as Scenario 1 plus a trend decline in markup to historic lows after the Greek crisis (more competition in products and services).

of their pass-through to inflation. A reduction in the VAT rate as a measure to combat high inflation is also influenced by the structural characteristics and functioning of goods and services markets. It is evident that an increase in competition, coupled with the removal of structural impediments to competition, tends to facilitate the transmission of VAT rate reductions to inflation, thereby increasing their impact. In the event of an increase in structural impediments (leading to an increase in markups), which constitutes a deterioration in competitive conditions, fiscal interventions through VAT are more likely to be reversed and short-lived.

We portray the role of imperfect competition in the pass-through of VAT rate changes to inflation using three scenarios (see Chart A2 of the Appendix). In the first scenario, the markup remains constant at the level observed in 2024q1, while the statutory VAT rate is temporarily reduced by one percentage point from 24% to 23% as of 2024q3, returning to 24% by

2026q1. In the second scenario, a similar fiscal shock is assumed, accompanied by a gradual increase in the markup, with the aim of reaching the high markup levels observed in the Greek economy immediately after the adoption of the euro (see Scenario 2 in Chart A2 of the Appendix).

In the third scenario, a similar fiscal policy shock is postulated together with a linear decline in the markup, with the aim of achieving the reduced markup levels that were observed during the Greek sovereign crisis, when the markup reached unprecedented lows in 2018 (see Scenario 3 in Chart A2 of the Appendix). The simulated estimates of all three scenarios express deviations from a common baseline scenario, where all variables remain constant to the last observation (ceteris paribus).

As shown in Chart 2, the improvement in competition and the removal of structural impediments to greater competition, as assumed in Scenario 3, are estimated to improve the pass-through of VAT reductions to inflation and prolong their impact, as the estimated effect becomes statistically significant for a number of quarters after the assumed reduction in the VAT rate to 23%. In the event of an increase in structural impediments (i.e. markups) leading to a deterioration in competition, the impact of fiscal policy interventions through VAT reductions on inflation is estimated to be muted, as the assumed reduction in VAT rates does not have a statistically significant impact on inflation (at the 95% significance level). Finally, as regards the response of output, Chart 3 shows that there is no discernible difference between the three scenarios in terms of output, as the response of output is not statistically significant throughout the assumed forecast horizon.

3 CONSUMPTION TAX RATE PASS-THROUGH: A GENERAL EQUILIBRIUM APPROACH

In this section we employ a DSGE model to analyse the macroeconomic effects of a reduction in the consumption tax rate, with a particular focus on its effectiveness in curbing inflationary pressures. The analysis proceeds in three main steps.

First, we examine the dynamic responses of a temporary cut in the consumption tax rate to explore the transmission mechanisms and identify the main propagation channels through which the shock affects key macroeconomic variables. Second, we quantify the pass-through of the consumption tax rate cut to price inflation, measuring the extent to which the reduction in the tax rate translates into lower prices. This measure provides a benchmark for assessing the short-term effectiveness of the policy in mitigating inflation. Third, we explore, through comparative simulations, a set of structural and policy-related factors that may influence the pass-through magnitude to identify the conditions under which consumption tax reductions are more or less likely to generate substantial disinflationary effects.

3.1 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.[18]

In particular, the domestic economy is modelled as a standard 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-

18 For details on the main features of the model, see Papageorgiou and Vourvachaki (2017) and Papageorgiou (2014).

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.[19]

As regards 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.

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 Eurozone and, thus, provides a parameterised general equilibrium model suitable for policy simulations.

3.2 METHODOLOGY AND POLICY EXPERIMENTS

The approach to assess the effects of reductions in the consumption tax rate is sum-

19 For more details, see also Hall (2005), Blanchard and Galí (2007) and Papageorgiou (2014).

marised as follows: First, the model is calibrated at a quarterly frequency, meaning that specific values are assigned to the structural parameters and exogenous policy instruments to reflect the key features of the Greek economy.[20] The fiscal policy instruments equal their average values in the data over the period 2019-2021 to reflect fiscal conditions prior to the inflationary pressures that emerged in mid-2022 in Greece. Then, in order to investigate the effects of a reduction in the consumption tax rate, a temporary fiscal policy shock is introduced that reduces the consumption tax rate for a period of 12 quarters (3 years). The implementation period is chosen so as to reflect the typical duration of temporary fiscal measures adopted by many euro area countries in response to recent inflationary pressures.[21] The magnitude of the reduction is calibrated so that consumption tax revenues as a share of steady state GDP decline by 1 percentage point (p.p.) during the implementation period. After the three-year period, the tax rate gradually returns to its initial level, following a smooth adjustment path. Given that the shock is temporary, all macroeconomic variables will gradually converge to their initial levels.

The first part of the analysis focuses on the propagation mechanism of this shock. The objective is to understand how a temporary reduction in the consumption tax rate affects key macroeconomic variables. This experiment will serve as the baseline scenario. In the second part, the pass-through of the consumption tax cut to inflation is quantified. The degree of pass-through captures the extent to which changes in the consumption tax rate are transmitted to consumer prices, providing a concise measure of the policy's effectiveness in mitigating inflationary pressures.

In the third part, we explore how structural and policy-related factors influence the degree of pass-through. To this end, the baseline model economy is compared to alternative model configurations that vary in the following dimensions:

(i) Higher product market competition, to assess how firms' pricing power and tax responsiveness shape inflation dynamics.

(ii) Lower price adjustment frequency, testing whether nominal rigidities delay or weaken the transmission of tax changes to prices.

(iii) Reduced real wage rigidities, to evaluate how labour market flexibility alters the inflationary effects of tax policy.

(iv) Permanent (vs. temporary) tax cuts, to evaluate the role of policy persistence in shaping expectations and inflation.

(v) Stronger home bias in production (lower substitutability between domestic and imported intermediate inputs), to examine how reduced input substitution affects domestic price sensitivity to tax changes.

The selection of structural and policy-related factors for the sensitivity analysis is grounded in both theoretical considerations and empirical findings regarding the transmission of consumption tax changes. First, the degree of product market competition is known to influence the pricing behaviour of firms and the extent to which cost shocks are passed on to consumers. In more competitive markets, firms operate under tighter margins and price adjustments are more sensitive to cost shocks, including those induced by fiscal policy (see Lombardo 2002 and Fabiani et al. 2006). Second, the frequency of price adjustments determines the responsiveness of inflation to tax shocks. In models with Calvo frictions, more frequent price adjustments allow firms to update prices more rapidly, enhancing the short-run effectiveness of tax-based disinflationary policies. Third, lower wage rigidities facilitate faster adjustment in labour costs, thereby affecting the overall inflation response. Fourth, the persistence of the tax change alters agents' expectations and intertemporal decision-making. A persistent reduction

20 The values of the structural parameters are set as in Papageorgiou and Vourvachaki (2017) and Papageorgiou (2014).
21 See, e.g., Ferdinandusse and Delgado-Téllez (2024).

in the consumption tax rate may exert stronger effects on price-setting behaviour and consumption smoothing, as it is perceived to change the long-run relative price of consumption (see, e.g., Coenen et al. 2012). Finally, we consider the role of home bias in production, proxied as a lower substitutability between domestic and imported intermediate inputs. A stronger home bias implies that firms rely more heavily on domestically-produced intermediates. This channel is particularly relevant in small open economies, where the elasticity of substitution between domestic and imported inputs can significantly shape the transmission of both fiscal and external shocks (see, e.g., Burstein et al. 2003 and Corsetti et al. 2008).

All policy experiments are conducted under the assumption of perfect foresight, implying that households and firms fully anticipate the future paths of the fiscal shock.

3.3 TRANSITION DYNAMICS OF A TEMPORARY REDUCTION IN THE CONSUMPTION TAX RATE

Chart 3 displays the dynamic responses of selected macroeconomic variables to the fiscal policy shock, as derived from the model. All variables are expressed in percentage deviations from their steady state, except for the inflation rate, which is shown in percentage point changes. The propagation mechanism of the consumption tax shock is as follows:

The temporary reduction in the consumption tax rate increases households' disposable income, generating both a positive income effect and an intertemporal substitution effect in favour of higher current consumption. As a result, private consumption rises, stimulating aggregate demand and leading to an expansion of output in the short run. The lower consumption tax rate also reduces the relative price of consumption goods compared to investment goods, thereby lowering the relative price of capital. This weakens incentives to reallocate resources toward investment, leading to a decline in private investment. At the same time, employment increases, while real wages decline. The reduction in real wages compresses firms' real marginal costs, leading to an increase in labour demand, thereby allowing firms to decrease domestic prices. Consequently, domestic inflation falls. In turn, the decline in domestic prices improves the economy's terms of trade, stimulating a rise in exports, which further increases output. In the following periods of transition, as the consumption tax rate returns to its initial level, all variables gradually converge to their initial steady state.

3.4 PASS-THROUGH TO INFLATION

To quantify the inflationary impact of the consumption tax rate cut, we compute the cumulative present value pass-through to domestic prices. This measure captures the extent to which changes in the consumption tax rate are transmitted to domestic prices, by comparing the cumulative present value of inflation responses to the cumulative change in the consumption tax rate over a defined horizon. In particular, the cumulative present value pass-through T years after a change in the tax rate on consumption is defined as:

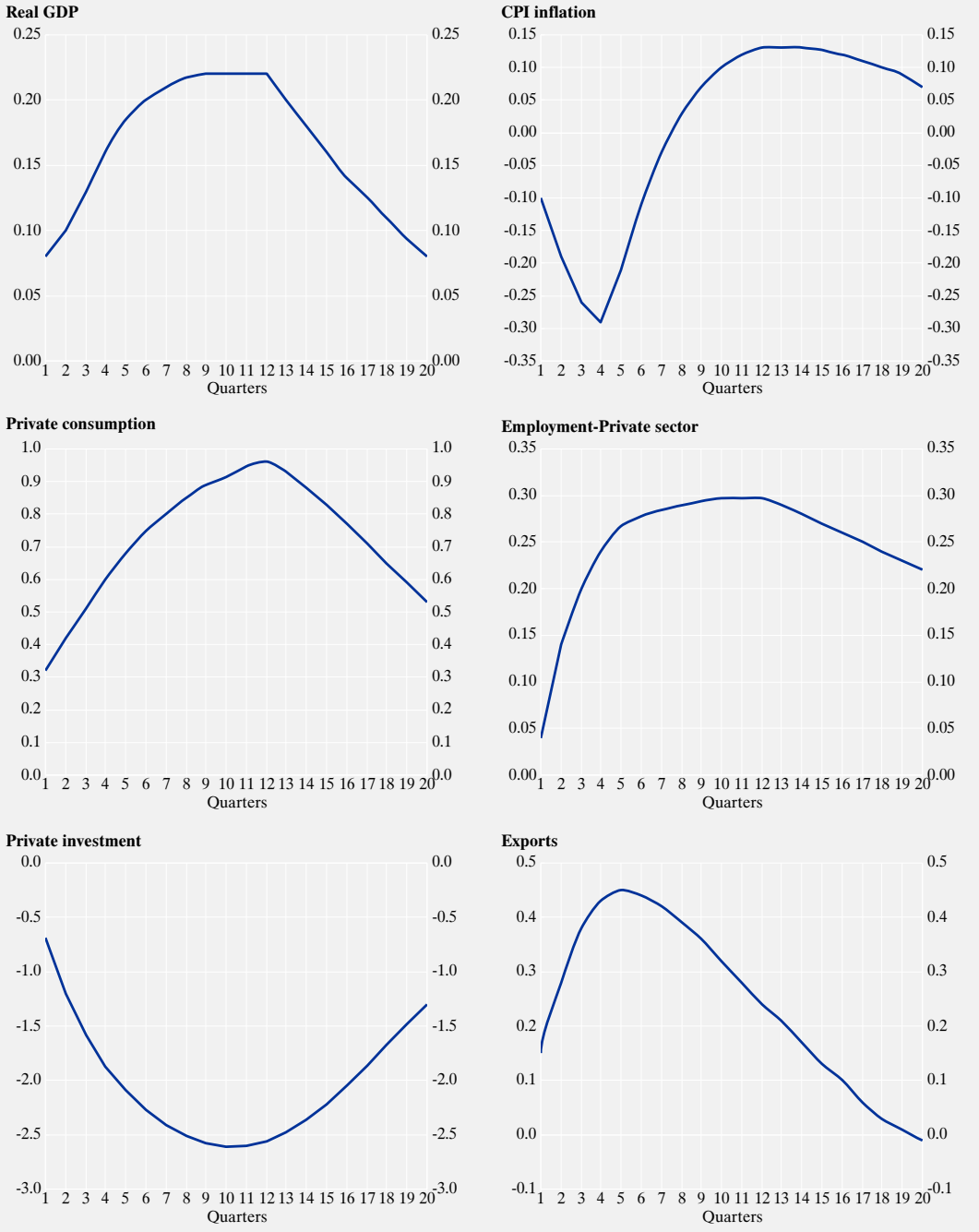
$$\varphi_t = \frac{\sum_{t=0}^{T}\left(\prod_{j=0}^{t}\left(R_{t+j}\right)^{-1}\right)\Delta CPI_{t+j}}{\sum_{t=0}^{T}\left(\prod_{j=0}^{t}\left(R_{t+j}\right)^{-1}\right)\Delta \tau^{c}_{t+j}} \qquad (2)$$

where ΔCPI_{t+j} and $\Delta \tau^{c}_{t+j}$ are, respectively, the level changes in CPI inflation and the consumption tax rate compared with their steady-state values and R_{t+j} is the model-based nominal return on government bonds, which is used as the discount rate.

The results indicate that the pass-through is partial, with the cumulative present value pass-through ranging between 25% and 19% during the first four quarters following the shock (see top left panel in Chart 4). This implies that, over the short term, approximately 19% to 25% of the reduction in the tax rate is reflected in lower consumer prices. The incomplete pass-through is in line with the findings of the empirical model under the baseline scenario and reflects the presence of nominal and real rigidities in the model, such as sticky prices and

Chart 3 Dynamic responses to a temporary reduction in the consumption tax rate

(%)

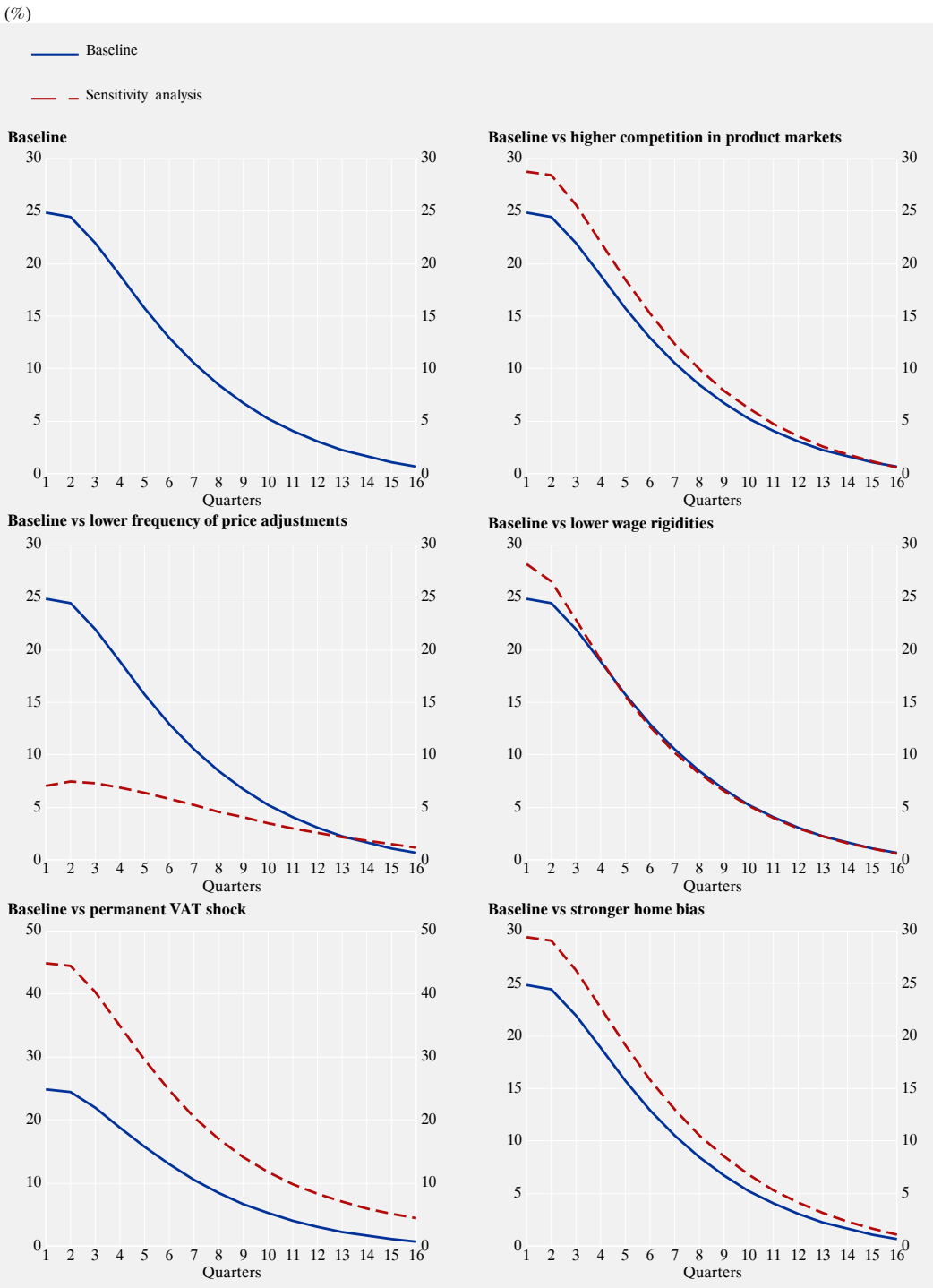


Source: Authors' estimations.
Note: All variables are expressed as percentage deviations from the steady state, with the exception of inflation, which is annualised and expressed in percentage point changes.

wage rigidities, which dampen the response of inflation to changes in tax policy.

There is limited evidence regarding the consumption tax rate pass-through to inflation in

Chart 4 Cumulative pass-through to inflation



Source: Authors' estimations.

the context of DSGE models.[22] Nevertheless, the dynamic responses of the macroeconomic

22 See Voigts (2016), who finds that the VAT pass-through to inflation depends on the modelling specification of consumption and VAT taxes.

variables are in line with previous studies that examine the general equilibrium effects of fiscal shocks using a similar framework (see, e.g., Forni et al. 2009; Coenen et al. 2008 and Kilponen et al. 2019). Compared to empirical estimates, the model-implied pass-through lies on the lower end of the spectrum. Most empirical studies, however, focus on sector-specific or product-level data, often examining the pass-through of value-added taxes to retail prices. These studies frequently report pass-through rates in the range of 30% to 100% in the short run, depending on the market structure, product type and timing of the tax change.[23] Unlike the empirical studies, the present analysis focuses on the aggregate macroeconomic effects of a broad-based consumption tax cut, rather than the micro-level adjustment of specific prices. This macro perspective captures general equilibrium effects and, unlike VAT, the consumption tax modelled here applies to a broader tax base, including all categories of private consumption, rather than a subset of goods and services.

3.5 STRUCTURAL AND POLICY DETERMINANTS OF THE CONSUMPTION TAX RATE PASS-THROUGH TO INFLATION

In this section, we conduct a series of sensitivity analyses to assess the robustness of the baseline results and shed light on the policy and structural factors that influence the transmission of consumption tax rate changes to inflation. These experiments isolate the role of key factors related to market structure, nominal and real rigidities, shock persistence and production openness, all of which may shape the extent to which tax changes are passed through to consumer prices. The results are illustrated in Chart 4.[24]

First, we consider the role of product market competition. Under a higher degree of product market competition (i.e. lower steady-state markups), prices are set closer to marginal cost, limiting firms' ability to absorb the effects of tax changes within their pricing margins. As a result, when the consumption tax is reduced and marginal costs fall, this change is fully reflected in prices, leading to a higher pass-through. While the differences are quantitatively modest, the results highlight how market power affects the responsiveness of inflation to tax changes: the disinflationary effect of the tax cut is stronger in more competitive economies, where lower markups increase the sensitivity of prices to tax rate changes.

Second, we examine the impact of nominal price rigidities by varying the frequency of price adjustments. When firms adjust prices less frequently —modelled through a higher Calvo parameter— the short-run pass-through of the consumption tax cut to inflation is significantly reduced. Infrequent price updating implies that only a fraction of firms can adjust their prices in response to the tax shock, leading to gradual and incomplete price adjustment at the aggregate level. In contrast, with more flexible pricing, a larger share of firms responds contemporaneously, allowing the tax cut to exert a stronger disinflationary effect. Consequently, the disinflationary effect of the tax cut is more muted in economies where firms adjust prices infrequently, as nominal rigidities delay the transmission of cost changes to final consumer prices. These findings are consistent with previous studies that emphasise the role of nominal rigidities in shaping the transmission of fiscal policy.

Third, we explore the implications of real wage rigidities for tax pass-through. When wages are more flexible, this enhances the responsiveness of inflation to tax changes. In this case, real wages adjust more rapidly in response to changes in labour demand and marginal costs, allowing firms to align their pricing more closely with tax-induced cost shifts. By contrast, when wages are rigid, firms face higher labour costs and the extent to which a tax cut lowers marginal costs is diminished, leading to a smaller price adjustment. This mechanism is in line with the broader macroeconomic liter-

23 See, for instance, Benedek et al. (2020) and Benzarti et al. (2020).
24 Table A2 in the Appendix summarises the values of the parameters used in the policy experiments.

ature highlighting the importance of labour market flexibility in macroeconomic adjustment (Christiano et al. 2005 and Smets and Wouters 2007). Thus, the pass-through to inflation is larger in economies with more flexible labour markets, as real wages adjust more rapidly to shocks, amplifying the impact on marginal costs and prices.

Fourth, we analyse the effect of the persistence of the tax shock. The results indicate that a permanent reduction in the consumption tax rate leads to a substantially higher pass-through than a temporary one, with the short-run pass-through rising to 35-45% in the first four quarters, nearly twice the level observed under a transitory shock. This amplification reflects the role of forward-looking behaviour: permanent tax cuts induce stronger responses in both consumption and prices. Firms respond to the sustained decline in marginal costs by implementing more pronounced price reductions, while households engage in stronger intertemporal substitution. As a result, the pass-through is significantly larger when tax changes are perceived as permanent. These findings are consistent with the fiscal policy literature emphasising the importance of expectations, credibility and the temporal structure of policy in shaping macroeconomic outcomes (see Leeper et al. 2010 and Coenen et al. 2013).

Finally, we consider the role of international input substitutability, by conducting a sensitivity analysis with respect to the elasticity of substitution between domestic and imported intermediate goods used in production. A lower elasticity implies stronger home bias, meaning firms rely more heavily on domestic intermediates. In this case, the reduction in real marginal costs is larger, as firms cannot easily substitute domestic with imported inputs, resulting in a stronger pass-through of the consumption tax cut to consumer prices. Conversely, when imported inputs are easily substitutable, firms can reallocate production toward foreign inputs, dampening the effect of the tax reduction. Hence, the inflationary effect of the tax cut is more pronounced in economies with stronger home bias in the use of domestic inputs in production. These results highlight the importance of production structure and input sourcing in shaping fiscal transmission, consistent with the findings of Burstein et al. (2003) and Corsetti et al. (2008).

In sum, the results suggest that the degree of tax pass-through is influenced not only by the tax instrument itself but also by key structural features of the economy, including market power, nominal and real rigidities, the persistence of policy interventions and the degree of openness in production. Understanding the interaction among these elements is crucial for the design of effective, tax-based inflation control strategies.

4 CONCLUSIONS

This paper investigates the effectiveness of VAT cuts in mitigating inflation in Greece through both empirical (SVAR) and theoretical (DSGE) approaches.

The empirical findings reveal that the direct impact of a VAT reduction on inflation is limited and statistically insignificant at the aggregate level. This suggests that there are modest short-term disinflationary effects under existing product market conditions. However, a significant and sustained fall in inflation is observed when VAT cuts are accompanied by improvements in product market competition.

The results from the DSGE model further demonstrate that the pass-through of consumption tax cuts to prices is partial (ranging from 19% to 25% in the short run) and highly dependent on structural and policy-related factors, such as market competition, labour market flexibility and the persistence of the policy intervention. Permanent tax cuts can nearly double the inflation pass-through relative to temporary measures, emphasising the role of policy credibility and forward-looking expectations in shaping macroeconomic outcomes. Moreover, the disinflationary effects of consumption tax cuts are amplified in more com-

petitive economies, where cost reductions are more readily transmitted to consumer prices. Conversely, in economies with high nominal rigidities or limited use of domestic inputs in production, the disinflationary effects are considerably muted.

Taken together, these findings suggest that reductions in the VAT rate alone may be insufficient as a tool for combatting inflation in Greece, as their effectiveness depends heavily on the country-specific institutional and structural context. Policy makers aiming to use consumption tax adjustments as a disinflationary instrument should therefore consider complementary reforms —particularly those that enhance competition and reduce structural rigidities— in order to maximise the transmission of tax changes to consumer prices. Future research could explore sector-specific VAT pass-through dynamics or the interaction between tax policy and monetary-fiscal coordination.

REFERENCES

Afonso, A. and R.M. Sousa (2009), "The macroeconomic effects of fiscal policy", ECB, Working Paper No. 991, January.

Alesina, A., C. Favero and F. Giavazzi (2012), "The output effect of fiscal consolidations", NBER, Working Paper No. 18336, August.

Benedek, D., R.A. de Mooij, M. Keen and P. Wingender (2020), "Varieties of VAT pass through", *International Tax and Public Finance*, 27(4), 890-930, August.

Benzarti, Y., D. Carloni, J. Harju and T. Kosonen (2020), "What goes up may not come down: asymmetric incidence of value-added taxes", *Journal of Political Economy*, 128(12), 4438-4474, December.

Benzarti, Y., S. Garriga and D. Tortarolo (2024), "Can VAT cuts and anti-profiteering measures dampen the effects of food price inflation?", NBER, Working Paper No. 32241, March.

Blanchard, O. and J. Galí, (2007), "Real wage rigidities and the new Keynesian model", *Journal of Money, Credit and Banking*, 39, Supplement 1, 35-65, February.

Blanchard, O. and F. Giavazzi (2003), "Macroeconomic effects of regulation and deregulation in goods and labor markets", *The Quarterly Journal of Economics*, 118(3), 879-907, August.

Blundell, R. (2009), "Assessing the temporary VAT cut policy in the UK", *Fiscal Studies*, 30(1), 31-38, March.

Burstein, A.T., J.C. Neves and S. Rebelo (2003), "Distribution costs and real exchange rate dynamics during exchange-rate-based stabilizations", *Journal of Monetary Economics*, 50(6), 1189-1214, September.

Caldara, D. and C. Kamps (2008), "What are the effects of fiscal policy shocks? A VAR-based comparative analysis", ECB, Working Paper No. 877, March.

Christiano, L.J., M. Eichenbaum and C.L. Evans (2005), "Nominal rigidities and the dynamic effects of a shock to monetary policy", *Journal of Political Economy*, 113(1), 1-45, February.

Coenen, G., C.J. Erceg, C. Freedman, D. Furceri, M. Kumhof, R. Lalonde, D. Laxton, J. Lindé, A. Mourougane, D. Muir, S. Mursula, C. de Resende, J. Roberts, W. Roeger, S. Snudden, M. Trabandt and J. in't Veld (2012), "Effects of fiscal stimulus in structural models", *American Economic Journal: Macroeconomics*, 4(1), 22-68, January.

Coenen, G., M. Mohr and R. Straub (2008), "Fiscal consolidation in the euro area: long-run benefits and short-run costs", *Economic Modelling*, 25(5), 912-932, September.

Coenen, G., R. Straub and M. Trabandt (2013), "Gauging the effects of fiscal stimulus packages in the euro area", *Journal of Economic Dynamics and Control*, 37(2), 367-386, February.

Copestake, A. and M. Bellon (2022), "Supply and demand determinants of heterogeneous VAT pass-through", Social Science Research Network (SSRN), doi.org/10.2139/ssrn.4207882.

Corsetti, G., L. Dedola and S. Leduc (2008), "International risk sharing and the transmission of productivity shocks", *The Review of Economic Studies*, 75(2), 443-473, April.

De Amores Hernandez, A., S. Barrios, R. Speitmann and D. Stoehlker (2023), "Price effects of temporary VAT rate cuts: evidence from Spanish supermarkets", European Commission, JRC132542.

Dimitrakopoulou, L., C. Genakos, T. Kampouris and S. Papadokonstantaki (2024), "VAT pass-through and competition: evidence from the Greek islands", *International Journal of Industrial Organization*, 97, 103110, December.

Fabiani, S., M. Druant, I. Hernando, C. Kwapil, B. Landau, C. Loupias, F. Martins, T. Mathä, R. Sabbatini, H. Stahl and A. Stokman (2006), "What firms' surveys tell us about price-setting behavior in the euro area", *International Journal of Central Banking*, 2(3), September.

Ferdinandusse, M. and M. Delgado-Téllez (2024), "Fiscal policy measures in response to the energy and inflation shock and climate change", ECB, *Economic Bulletin*, Issue 1/2024.

Forni, L., L. Monteforte and L. Sessa (2009), "The general equilibrium effects of fiscal policy: estimates for the Euro area", *Journal of Public Economics*, 93(3-4), 559-585, April.

Forteza, N., E. Prades and M. Roca (2024), "Analysing the VAT cut pass-through in Spain using web-scraped supermarket data and machine learning", Banco de España, Documentos de Trabajo No. 2417, May.
Fuest, C., F. Neumeier and D. Stöhlker (2025), "The pass-through of temporary VAT rate cuts: evidence from German supermarket retail", *International Tax and Public Finance*, 32(1), 51-97, February.
Galí, J. and M. Gertler (1999), "Inflation dynamics: a structural econometric analysis", *Journal of Monetary Economics*, 44(2), 195-222, October.
Hall, R.E. (2005), "Employment fluctuations with equilibrium wage stickiness", *American Economic Review*, 95(1), 50-65, March.
Harju, J. and T. Kosonen (2014), "The inefficiency of reduced VAT rates: evidence from restaurant industry", Government Institute for Economic Research, 18 July.
Hindriks, J. and V. Serse (2019), "Heterogeneity in the tax pass-through to spirit retail prices: evidence from Belgium", *Journal of Public Economics*, 176(C), 142-160, August.
Jordà, Ò. (2005), "Estimation and inference of impulse responses by local projections", *American Economic Review*, 95(1), 161-182, March.
Kilponen, J., M. Pisani, S. Schmidt, V. Corbo, T. Hledik, J. Hollmayr, S. Hurtado, P. Júlio, D. Kulikov, M. Lemoine, M. Lozej, H. Lundvall, J.R. Maria, B. Micallef, D. Papageorgiou, J. Rysanek, D. Sideris, C. Thomas and G. de Walque (2019), "Comparing fiscal consolidation multipliers across models in Europe", *International Journal of Central Banking*, 15(3), 285-320, September.
Kneller, R., M.F. Bleaney and N. Gemmell (1999), "Fiscal policy and growth: evidence from OECD countries", *Journal of Public Economics*, 74(2), 171-190, November.
Kosonen, T. (2015), "More and cheaper haircuts after VAT cut? On the efficiency and incidence of service sector consumption taxes", *Journal of Public Economics*, 131, 87-100, November.
Leeper, E.M., T.B. Walker and S.-C.S. Yang (2010), "Government investment and fiscal stimulus", *Journal of Monetary Economics*, 57(8), 1000-1012, November.
Lombardo, G. (2002), "Imperfect competition, monetary policy and welfare in a currency area", Economic Research Centre of the Deutsche Bundesbank, Discussion Paper No. 21/02, August.
Moral Arce, I. and M. Gómez-Antonio (2020), "Una evaluación sobre los efectos de una reducción del tipo de gravamen del IVA para los bienes y servicios culturales", Instituto de Estudios Fiscales, Papeles de trabajo del Instituto de Estudios Fiscales No 4, Serie Economía, 1-44.
Papageorgiou, D. (2014), "BoGGEM: a dynamic stochastic general equilibrium model for policy simulations", Bank of Greece, Working Paper No. 182, May.
Papageorgiou, D. and A. Rizos (2024), "Inflation dynamics and the role of domestic factors", Bank of Greece, *Economic Bulletin*, 60, 7-26, December.
Papageorgiou, D. and E. Vourvachaki (2017), "Macroeconomic effects of structural reforms and fiscal consolidations: trade-offs and complementarities", *European Journal of Political Economy*, 48, 54-73, June.
Rapanos, V.Th. and G. Kaplanoglou (2014), "Φορολογία και οικονομική ανάπτυξη. Η περίπτωση της Ελλάδας" ["Taxation and economic growth: the case of Greece"], in M. Masourakis and C.Vl. Gortsos (eds.), *Ανταγωνιστικότητα για ανάπτυξη: Προτάσεις πολιτικής* [*Competitiveness for growth: policy proposals*], 609-638, Hellenic Bank Association [in Greek].
Smets, F. and R. Wouters (2007), "Shocks and frictions in US business cycles: a Bayesian DSGE approach", *American Economic Review*, 97(3), 586-606, June.
Voigts, S. (2016), "VAT multipliers and pass-through dynamics", SFB 649, Discussion Paper No. 2016-026, Humboldt University Berlin, Collaborative Research Center 649: Economic Risk.

APPENDIX

Table A1 Vector autoregression estimates

Sample (adjusted): 2001Q1 2024Q1

Included observations: 93 after adjustments
Restrictions: @VEC(L1) = "NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA",
@VEC(L2) = "NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA",
@VEC(L3) = "NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA",
@VEC(L4) = "NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA, NA, NA, 0, NA"
Iterated GLS convergence achieved after 6 iterations
Standard errors in parentheses and t-statistics in square brackets

	YT	PT_GR	MARKUP	STA_VAT
YT(-1)	0.529483 (0.1025) [5.16590]	0.047964 (0.03794) [1.26414]	-0.000217 (0.0004) [-0.54429]	0 –
YT(-2)	0.096392 (0.11741) [0.82102]	-0.00685 (0.04343) [-0.15772]	0.000253 (0.00047) [0.53927]	0 –
YT(-3)	-0.0209 (0.11562) [-0.18077]	0.004088 (0.04278) [0.09557]	[0.09557] (0.00046) [-0.36984]	0 –
YT(-4)	0.18847 (0.09889) [1.90590]	0.019879 (0.03657) [0.54355]	-0.000104 (0.0004) [-0.26059]	0 –
PT_GR(-1)	-0.522328 (0.28068) [-1.86095]	1.086396 (0.10383) [10.4635]	0.001555 (0.00113) [1.38039]	0 –
PT_GR(-2)	0.599941 (0.42138) [1.42376]	-0.155758 (0.15583) [-0.99954]	-0.001656 (0.00171) [-0.96803]	0 –
PT_GR(-3)	-0.347318 (0.42997) [-0.80777]	-0.421763 (0.15901) [-2.65248]	0.001208 (0.00175) [0.69235]	0 –
PT_GR(-4)	-0.045614 (0.298) [-0.15307]	0.137518 (0.11028) [1.24704]	-0.000924 (0.00118) [-0.78422]	0 –
MARKUP(-1)	12.89953 (26.5863) [0.48519]	7.159973 (9.84971) [0.72692]	0.820462 (0.09993) [8.21027]	0 –
MARKUP(-2)	21.98775 (31.7695) [0.69210]	0.693854 (11.7518) [0.05904]	0.021079 (0.12759) [0.16521]	0 –
MARKUP(-3)	8.437219 (31.6484) [0.26659]	-0.333966 (11.7084) [-0.02852]	0.332615 (0.12649) [2.62957]	0 –
MARKUP(-4)	-5.364481 (25.6125) [-0.20945]	10.99148 (9.48821) [1.15844]	-0.219792 (0.0966) [-2.27518]	0 –
STA_VAT(-1)	1.60226 (0.59929) [2.67358]	0.193709 (0.22487) [0.86142]	0 –	0.893084 (0.10099) [8.84303]
STA_VAT(-2)	-0.055079 (0.79942) [-0.06890]	-0.017447 (0.29999) [-0.05816]	0 –	0.012219 (0.13747) [0.08888]
STA_VAT(-3)	-0.131815 (0.79814) [-0.16515]	-0.075369 (0.29951) [-0.25164]	0 –	0.006911 (0.13744) [0.05029]
STA_VAT(-4)	-0.714838 (0.65289) [-1.09489]	0.222809 (0.24489) [0.90984]	0 –	0.02823 (0.09877) [0.28580]
C	-29.21883 (20.8429) [-1.40186]	-14.02434 (7.80403) [-1.79707]	0.01676 (0.01094) [1.53183]	1.498063 (0.54958) [2.72584]
EURIBOR3M	-0.030943 (0.27991) [-0.11055]	0.04221 (0.10374) [0.40689]	0.000909 (0.00113) [0.80440]	-0.088142 (0.03827) [-2.30300]

Source: Authors' estimations.
Notes: The above restrictions are operational and specific to the specification of the model. The above specification treats all input variables as endogenous (to produce impulse response functions) but with the assumed restrictions on statutory value added tax aimed to treat this variable as an exogenous variable.

Table A1 Vector autoregression estimates

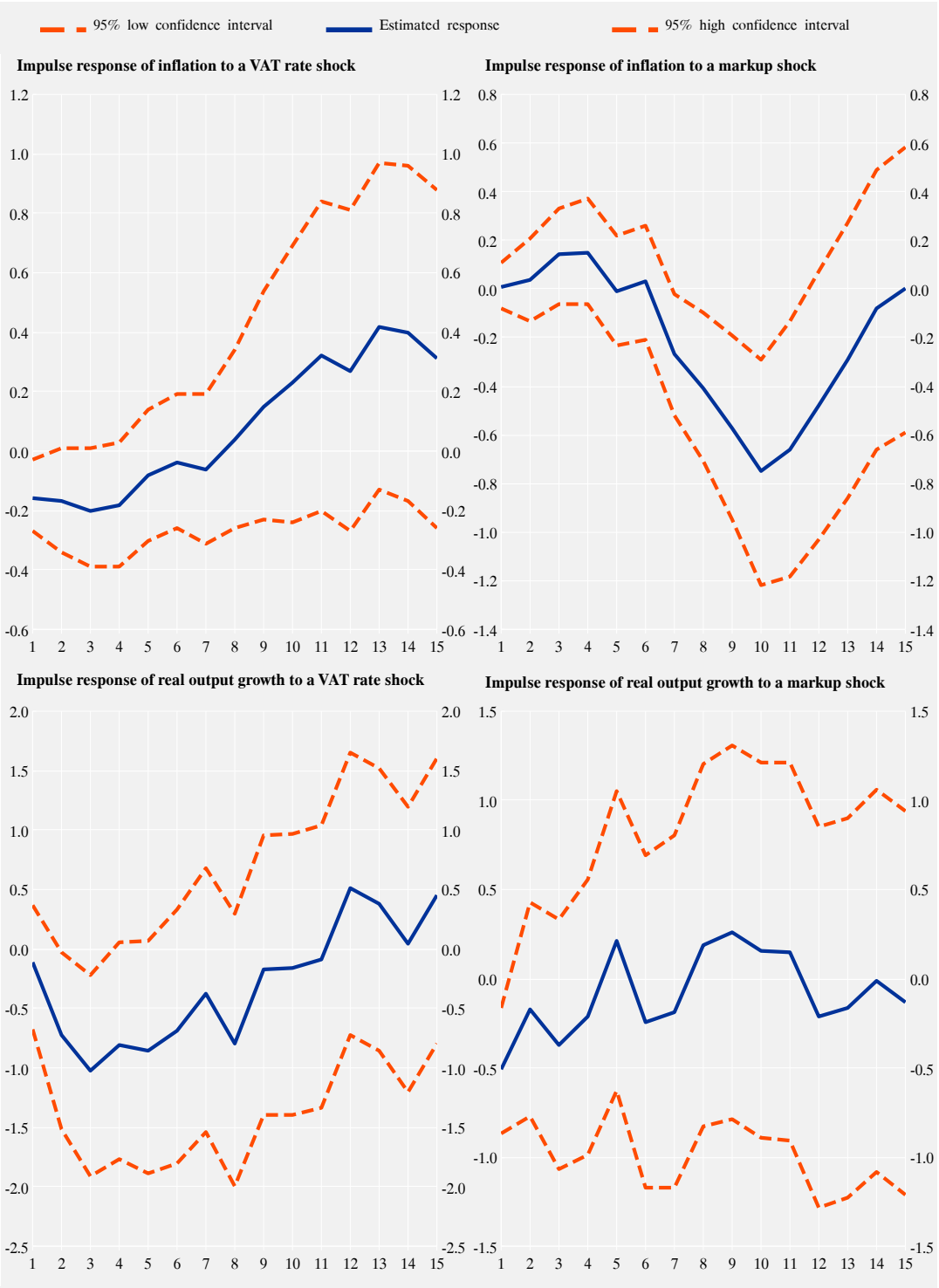
(continued)

R-squared	0.57617	0.835484	0.962604	0.970627
Sum sq. resids	509.0602	70.00788	0.008905	16.58047
Mean dependent	4.173903	2.684043	0.412138	21.5914
S.D. dependent	3.613225	2.150677	0.050875	2.47701
Determinant resid covariance		0.000152		
Log likelihood		-79.1481		
Akaike information criterion		2.906411		
Schwarz criterion		4.431417		
Number of coefficients		56		
Number of restrictions		16		

Source: Authors' estimations.
Notes: The above restrictions are operational and specific to the specification of the model. The above specification treats all input variables as endogenous (to produce impulse response functions) but with the assumed restrictions on statutory value added tax aimed to treat this variable as an exogenous variable.

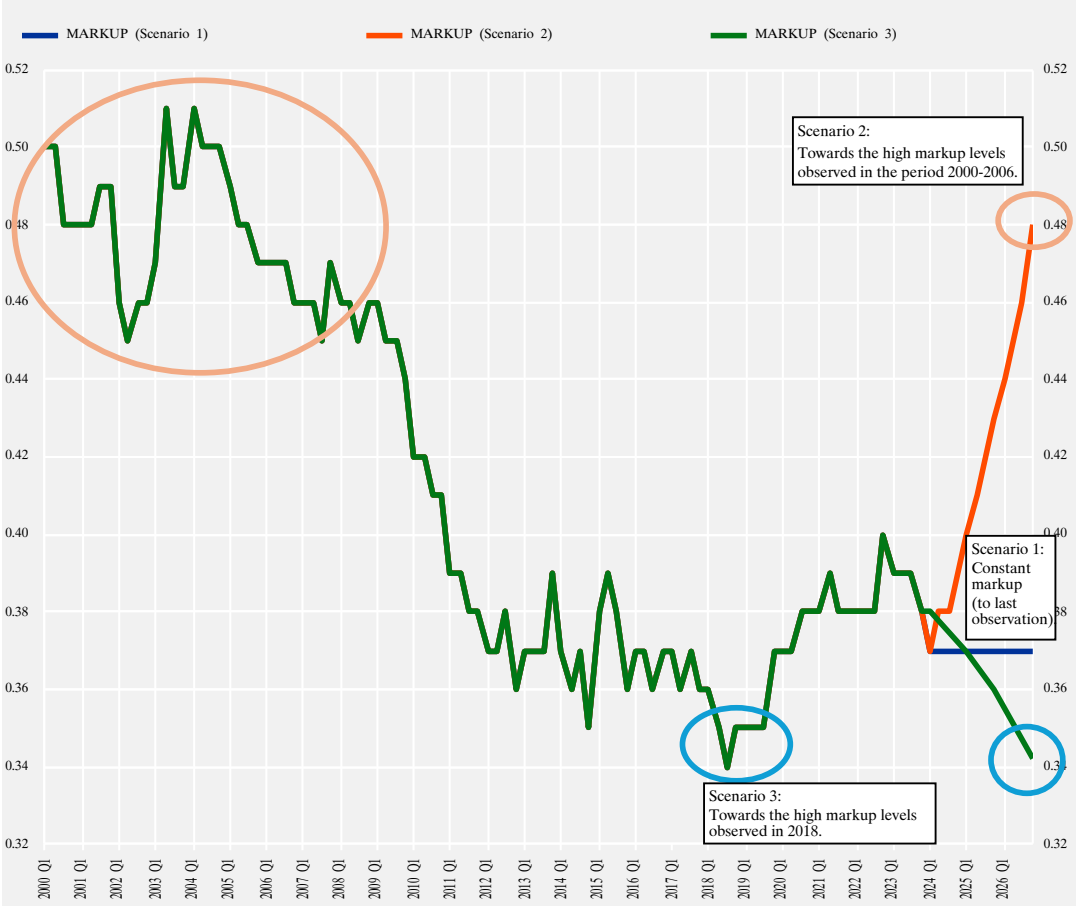
Chart A1 Local projections: impulse response function of inflation and growth to a negative shock to the statutory VAT rate and to markup (improvement in competition)

(response to Cholesky One S.D. Innovations 95.0% marginal confidence bands)



Source: Authors' estimations.

Chart A2 Graphical representation of markup evolution in the case of Scenarios 1, 2 and 3



Source: Authors' estimations.

Table A2 Calibrated parameters and sensitivity analysis

Parameter	Baseline calibration	Sensitivity analysis
Markups (domestic non-tradables)	1.463	1.263
Markups (domestic tradables)	1.352	1.152
Calvo parameters	0.75	0.90
Degree of real wage rigidity	0.70	0.20
Elasticity of substitution between foreign and domestically-produced tradable consumption goods	3.351	2.5
Elasticity of substitution between foreign and domestically-produced tradable investment goods	6.352	2.5