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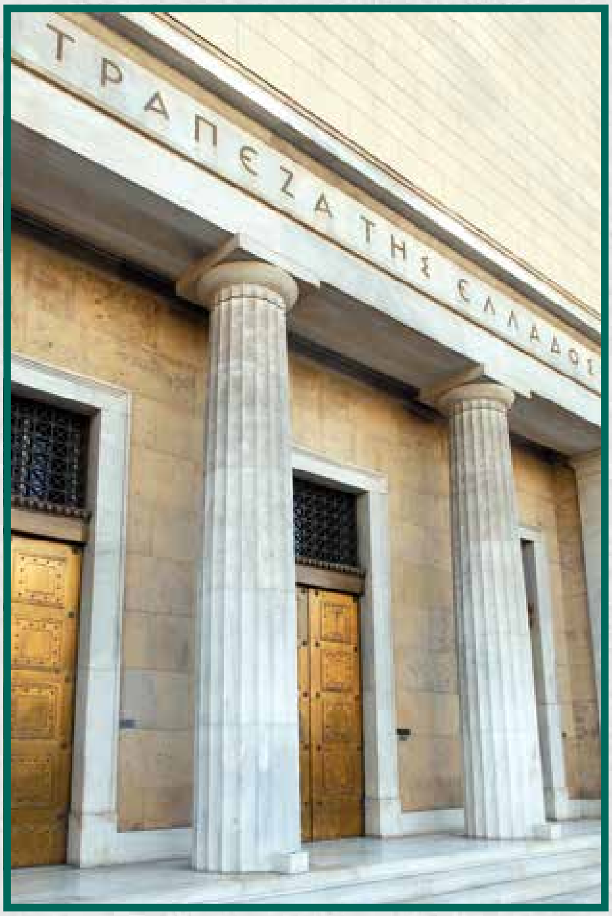

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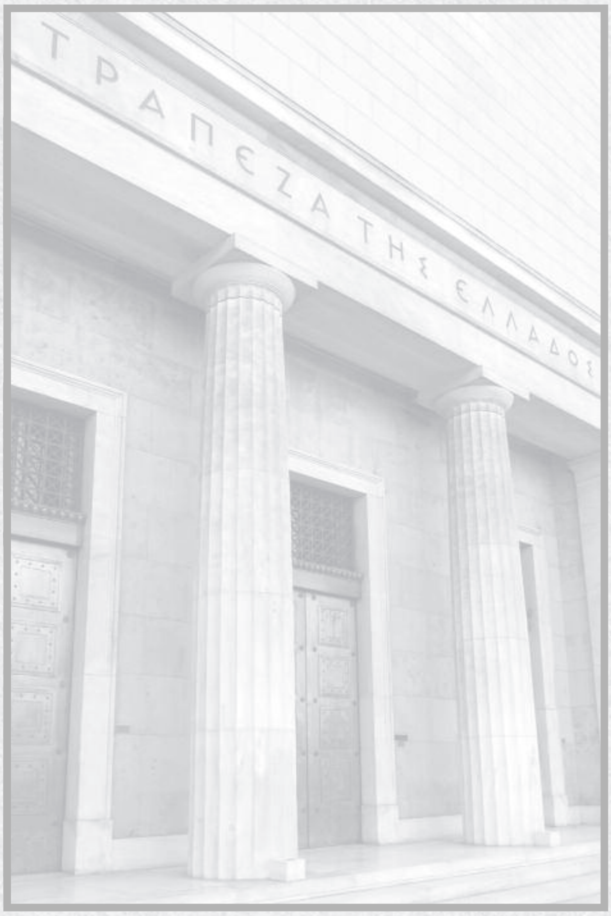

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BANK OF GREECE
21, E. Venizelos Avenue
GR-102 50 Athens

www.bankofgreece.gr

Economic Analysis and Research Department – Secretariat
Tel. +30 210 320 2393

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CONTENTS

EFFECTS OF A SOVEREIGN CREDIT RATING UPGRADE TO INVESTMENT GRADE ON THE GREEK ECONOMY

Marianthi Anastasatou
Bank of Greece, Economic Analysis and Research Department

Hiona Balfoussia
Bank of Greece, Economic Analysis and Research Department

Zacharias Bragoudakis
Bank of Greece, Economic Analysis and Research Department

Dimitris Malliaropulos
Bank of Greece, Economic Analysis and Research Department,
and University of Piraeus, Department of Banking and Financial Management

Petros Migiakis
Bank of Greece, Economic Analysis and Research Department

Dimitris Papageorgiou
Bank of Greece, Economic Analysis and Research Department

Pavlos Petroulas
Bank of Greece, Economic Analysis and Research Department

ABSTRACT

The paper investigates the potential effects of a sovereign credit rating upgrade to investment grade on the trajectory of the Greek economy. A cross-country empirical analysis of past upgrades suggests that an economy's upgrade to investment grade is associated with a reduction in sovereign bond yields and spreads by about 70 basis points. In the long run, such an upgrade boosts real GDP and reduces GDP volatility by 2.5% and 0.48%, respectively. Furthermore, the findings derived from a dynamic factor model indicate that an upgrade to investment grade is expected to reduce Greek sovereign bond yields and pass through to the Greek banking sector by reducing its funding costs and narrowing the spread between Greek and euro area bank bonds. Subsequently, a DSGE model featuring a rich financial sector, calibrated to the Greek economy, is employed to trace the dynamic responses of key financial and real variables to an upgrade to investment grade. The model suggests that an upgrade to investment grade that reduces bank funding costs has a positive impact on the real and financial sectors of the Greek economy in both the short and the long run. Finally, counterfactual experiments illustrate that a sovereign credit rating upgrade to investment grade has a stabilising effect on both the banking sector and the real economy in the face of adverse shocks.

Keywords: credit ratings; investment grade threshold; cost of funding; GDP growth; economic resilience

JEL classification: E37; E43; E44; G11; G12; G21

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Μαριάνθη Αναστασάτου
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

Χιόνα Μπαλφούσια
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

Ζαχαρίας Μπραγουδάκης
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

Δημήτρης Μαλλιαρόπουλος
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών,
και Πανεπιστήμιο Πειραιώς, Τμήμα Χρηματοοικονομικής και Τραπεζικής Διοικητικής

Πέτρος Μηγιάκης
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

Δημήτρης Παπαγεωργίου
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

Παύλος Πέτρουλας
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

ΠΕΡΙΛΗΨΗ

Η μελέτη εξετάζει τις δυνητικές επιδράσεις μιας αναβάθμισης της κρατικής πιστοληπτικής αξιολόγησης της Ελλάδος στην επενδυτική κατηγορία για την ελληνική οικονομία. Αρχικά, παρουσιάζεται εμπειρική διερεύνηση, χρησιμοποιώντας ένα μεγάλο δείγμα οικονομιών, τόσο αναπτυσσόμενων όσο και ανεπτυγμένων, ορισμένες εκ των οποίων αναβαθμίστηκαν στο διάστημα 2000-2022. Εκτιμάται ότι η αναβάθμιση στην επενδυτική κατηγορία επιφέρει μια μόνιμη μείωση των αποδόσεων των κρατικών ομολόγων κατά περίπου 70 μονάδες βάσης, την περίοδο 3 μήνες πριν έως και 3 μήνες μετά την αναβάθμιση, καθώς και σημαντικές μακροοικονομικές επιδράσεις, όπως αύξηση του πραγματικού ΑΕΠ, σε βάθος χρόνου, κατά 2,5% και μείωση της μεταβλητότητάς του κατά 0,48%. Στη συνέχεια, η μελέτη εξετάζει τις δυνητικές επιδράσεις μιας αναβάθμισης στην επενδυτική κατηγορία για την ελληνική οικονομία. Αρχικά, εκτιμάται η μείωση του κόστους χρηματοδότησης για το Ελληνικό Δημόσιο που αναμένεται ως συνέπεια της αναβάθμισης, με τη χρήση υποδειγμάτων καμπύλης αποδόσεων. Κατόπιν, διερευνώνται οι δυνητικές επιδράσεις της εν λόγω μείωσης στον πραγματικό και στο χρηματοπιστωτικό τομέα της ελληνικής οικονομίας στο πλαίσιο ενός δυναμικού στοχαστικού υποδείγματος γενικής ισορροπίας. Στόχος είναι η ανίχνευση και κατανόηση των μηχανισμών μετάδοσης της θετικής αυτής διαταραχής στην πραγματική οικονομία και τον τραπεζικό τομέα, καθώς και η ποσοτική προσέγγιση των αναμενόμενων επιδράσεων μέσω προσομοιώσεων του υποδείγματος. Σύμφωνα με τα ευρήματα της προσομοίωσης στο πλαίσιο του υποδείγματος, μια αναβάθμιση του Ελληνικού Δημοσίου στην επενδυτική κατηγορία οδηγεί σε μόνιμη αύξηση του επιπέδου των βασικών οικονομικών και χρηματοπιστωτικών μεγεθών. Μακροπρόθεσμα, το επίπεδο του πραγματικού ΑΕΠ αυξάνεται και ενισχύονται τα τραπεζικά κεφάλαια και οι πιστώσεις. Επιπρόσθετα, επιδρά σταθεροποιητικά τόσο στον τραπεζικό τομέα όσο και στην πραγματική οικονομία.

EFFECTS OF A SOVEREIGN CREDIT RATING UPGRADE TO INVESTMENT GRADE ON THE GREEK ECONOMY*

Marianthi Anastasatou
Bank of Greece, Economic Analysis and Research Department

Hiona Balfoussia
Bank of Greece, Economic Analysis and Research Department

Zacharias Bragoudakis
Bank of Greece, Economic Analysis and Research Department

Dimitris Malliaropulos
Bank of Greece, Economic Analysis and Research Department,
and University of Piraeus, Department of Banking and Financial Management

Petros Migiakis
Bank of Greece, Economic Analysis and Research Department

Dimitris Papageorgiou
Bank of Greece, Economic Analysis and Research Department

Pavlos Petroulas
Bank of Greece, Economic Analysis and Research Department

1 INTRODUCTION

With the exception of the pandemic downturn, the Greek economy has been growing at a fast pace in recent years, recording increases in investment and exports, as well as a sharp decline in the ratio of public debt to GDP. This marked progress has been reflected in declining sovereign spreads and a steadily improving sovereign credit rating. The eager anticipation of Greece's sovereign credit rating upgrade to investment grade raises the question of whether such an upgrade may itself have an effect on the trajectory of the Greek economy.

While the impact of sovereign credit ratings on the pricing of securities is well established in the literature, their macroeconomic impact has received less attention. Even scarcer is academic research that specifically explores the possible implications of a sovereign credit rating upgrade from non-investment grade to investment grade status. This study attempts to explore the implications of an upgrade of the Greek economy to investment grade, motivated by the change of the economy's sovereign credit rating outlook to positive by S&P in April 2023 and seen from that point in time.[1]

The remainder of the paper is structured as follows: Section 2 offers a brief review of the literature. Section 3 presents cross-country evidence regarding the impact of an economy's upgrade to investment grade on sovereign bond yields and spreads, as well as on equities, using generalised method of moments (GMM) estimations. Section 4 focuses on the potential impact of such an upgrade on the Greek economy. First, we employ a dynamic factor model to estimate the credit risk component of 10-year Greek government bonds and, ultimately, to gauge the effect of an upgrade on the funding costs of the sovereign and the banks. Subsequently, we use a dynamic stochastic general equilibrium model with a rich financial sector to provide a quantitative and qualitative assessment of the effects of the sovereign credit rat-

* 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 This study was completed in July 2023. The cut-off date for the data employed in the econometric analysis is 15.6.2023.

ing upgrade to investment grade on key financial and real variables. Finally, we perform counterfactual experiments to examine the possible impact of the upgrade on the resilience of the Greek economy. Section 5 presents our conclusions.

2 A BRIEF LITERATURE REVIEW

2.1 REAL EFFECTS OF A SOVEREIGN CREDIT RATING UPGRADE

The growth rate of GDP responds to changes in sovereign credit ratings via the interest rate or cost of funding channel and the capital flows channel. Regarding the former, sovereign credit rating upgrades directly affect the cost of funding of the government and are also associated with a decline in corporate bond yields and bank lending rates, which lowers the cost of capital for the whole economy. This lower cost transforms some of the investment projects which had a negative net present value (NPV) before the upgrade into projects with a positive NPV, thus leading to an increase in private investment and, therefore, output. Furthermore, lower interest rates, coupled with a decline in perceived country risk, also prompt an increase in the supply of credit, which further boosts output growth. Improved investor confidence, as a result of a rating upgrade, also works in the same direction.

Empirical evidence on the real effects of sovereign credit rating upgrades is limited. In a study of 103 countries over the period 1982-2012, a one-notch rating upgrade is estimated to lead to an increase of 0.6 percentage points (pps) in the subsequent five-year average annual growth rates of the re-rated countries, while the corresponding impact is 1.7 pps when the rating is close to the investment-grade threshold (Chen et al. 2016). Similarly, private investment growth increases by 4.5 pps in the year of the upgrade and by 3.2 pps in the following year, while the coefficient is insignificant for the subsequent years and for the cases where upgrades cross the investment grade – though the latter finding is probably due to the very small fraction of such cases (Chen et al. 2013).

Turning to the second channel, sovereign rating changes also impact capital flows, including FDI flows, as they mitigate the information asymmetry between foreign and domestic agents, thus improving the upgraded economy's access to international capital markets. In a panel study of emerging market economies, a one-notch rating upgrade results in an increase in FDI (as a percentage of GDP) of about 0.33%, or of 2.38% when moving from a speculative to an investment grade (Emara and El Said 2021). Cai et al. (2018) examine this relation in a panel of OECD countries and report similar findings, with the exception of a small subset of countries, including Greece, though the inclusion of the Greek sovereign debt crisis in the sample may be a confounding factor. Finally, significant causality effects run from sovereign ratings to measures of economic risk (Athari et al. 2021).

2.2 FINANCIAL EFFECTS OF A SOVEREIGN CREDIT RATING UPGRADE

Sovereign credit ratings remain a significant determinant of the corporate credit ratings of domestic firms (see e.g. Ferri et al. 2001; Borensztein et al. 2013; Cheikh et al. 2021; Wang and Xie 2022), despite the fact that credit rating agencies have gradually allowed for exceptions to their standing policy of never rating a corporation above the sovereign (the "country ceiling"). However, it has been found that the degree of spillover from sovereign to corporate rating is larger for downgrades than for upgrades (Borensztein et al. 2013). Specifically, it is reported that a two-notch upgrade of the sovereign rating would lead to an increase in the corporate rating by one notch.

Consistent with this rationale, it has been found, as aforementioned, that sovereign credit ratings or other measures of sovereign risk affect corporate spreads and the likelihood of corporate bond issuance (see e.g. Eichengreen and Mody 2000; Bedendo and Colla 2015; Bevilaqua et al. 2020). Also, several studies document the close association between credit risk premia in sovereign bonds and sovereign credit ratings (see e.g. Malliaropulos and Migiakis 2018; El-Shaggi and von Schweinitz 2018). As such, a possible channel of transmission of sovereign credit rating changes to the economy works through the cost of corporate funding. In particular, on balance, the long-run pass-through of sovereign yields to corporate yields is around one-to-one, while it is larger for financial firms compared to non-financial firms (Li et al. 2023). Finally, there is evidence of reinforcing dynamics between yields, sovereign and bank ratings (Gibson et al. 2017), whereby a 1-notch change in the sovereign rating may, in the long run, lead to a 2.5-notch change in that same variable, a change in spreads of around 3 pps and a 2-notch change in bank ratings.

The investment-grade (IG) threshold is important for financial entities, due to its role in financial regulation[2] and its use by large institutional investors in their portfolio allocation mandates (see e.g. Ellul et al. 2011; Falato et al. 2021; Baghai et al. 2023). Thus, several papers have argued that there exists a "cliff effect" across the IG threshold for the pricing of debt in bond and credit markets, which increases the risk premia paid by downgraded entities beyond what would be explained by the size of the downgrade (see e.g. Jaramillo and Tejada 2011) and amplifies the effects of shocks on non-IG assets (see, among others, Cantor and Packer 1996; Acharya and Steffen 2020; Bevilaqua et al. 2020). Moreover, Jaramillo and Tejada (2011) show that a rating change to below (or above) the IG threshold adds (or deducts, respectively) 35 basis points (bps) to the bond yields of affected sovereigns, on top of what is explained by standard rating changes. In this respect, given the importance of the IG threshold for regulatory purposes, recent studies highlight the financial stability risks stemming from a potential wave of downgrades of IG assets to non-IG status (see Altman and Heine 2020; Chodorow-Reich et al. 2021).

Finally, an extensive body of literature has examined stock price reactions to credit rating announcements (see e.g. Griffin and Sanvicente 1982; Holthausen and Leftwich 1986; Hand et al. 1992; Goh and Ederington 1999; Jorion et al. 2005; Even-Tov and Ozel 2021). Using mostly monthly or multi-day announcement windows, this body of research shows that, on balance, credit rating downgrades often reveal new information and lead to significant stock price reactions, but upgrades do not. This could be an indication that usually markets have already incorporated information about upgrades by the time of their announcement.

3 CROSS-COUNTRY EMPIRICAL ANALYSIS

3.1 PREVIOUS CASES OF SOVEREIGN CREDIT RATING UPGRADES TO INVESTMENT GRADE

In the recent past, there have been several rating upgrades to investment grade. Using a large database for 77 economies worldwide, spanning the period from 1.1.2000 to 15.6.2023, we have identified 16 cases of upgrades to investment grade in the (foreign currency) credit ratings assigned by S&P, Moody's and Fitch to sovereigns previously belonging to non-investment grade. These are shown in Table 1, ordered from the most recent to the oldest one.

Table 1 shows that, in most cases, an upgrade to the IG category is preceded by a change in the outlook of the credit rating to positive. The average time lag between an outlook change to positive and an upgrade is about 8 months.[3]

2 For the application of the investment-grade threshold in the monetary policy framework, see Bindseil et al. (2017); for the capital adequacy framework, see Altman et al. (2002).

3 With the exception of Panama's upgrade. This case is treated as an exception because, after Fitch changed its outlook to positive, in early 2008, the turbulence in financial markets escalated and may have resulted in a reluctance of the rating agencies to proceed to an upgrade, amid the unfolding global financial crisis. Also, the three rating agencies examined herein had all downgraded Portugal to non-investment grade during the euro area debt crisis period; however, as DBRS had sustained a sovereign credit rating within the IG category for Portugal, we do not include this country among the ones listed in Table 1.

Table 1 Precedents of upgrades of sovereign credit ratings to investment grade

Country	Date of upgrade to IG	Date of positive outlook	Rating agency
Croatia	22/3/2019	21/9/2018	S&P
Cyprus	14/9/2018	15/9/2017	S&P
Hungary	20/5/2016	22/5/2015	Fitch
Philippines	27/3/2013	-	Fitch
Turkey	5/11/2012	-	Fitch
Uruguay	3/4/2012	-	S&P
Indonesia	15/12/2011	-	Fitch
Panama	23/3/2010	29/1/2008	Fitch
Brazil	30/4/2008	16/5/2007	S&P
Romania	6/10/2006	7/6/2006	Moody’s
India	22/6/2004	16/10/2003	Fitch
Bulgaria	4/6/2004	24/7/2003	S&P
Russia	18/10/2003	28/7/2003	Moody’s
Slovakia	30/10/2001	9/11/2000	S&P
Mexico	3/7/2000	2/2/2000	Moody’s

Source: Refinitiv.
Note: The date of the upgrade to investment grade (IG) is the date on which the first of the three major rating agencies (namely, Fitch, Moody’s and S&P) upgraded the economy in question to investment grade.

Exceptions to the rule that an IG upgrade is preceded by a change in the outlook of the sovereign to positive are mostly related to emerging markets in the aftermath of the global financial crisis; emerging market economies (EMEs) were noted during the turbulence as an exception to the developments in the world economy. In fact, they were considered to be net winners of the global financial crisis. As a result, despite the downgrade cycle of that period, in the case of EMEs rating agencies proceeded to upgrades, although with a slight delay in comparison to the improvements in emerging market countries’ fundamentals. Finally, the last column of Table 1 shows the credit rating agency that first assigned an IG rating to the sovereign of interest.

Using the information provided in Table 1, we can then gauge the evolution of various financial indicators around the event of the IG upgrade. In particular, we have re-based sovereign bond yields and spreads and equity market returns, so that they take the value of 100 at the base date, i.e. 3 months before the upgrade of the sovereign rating to the IG category. In this way, we construct indices which are then rolled on, up until 3 months after the upgrade, and reflect the percentage point change in each indicator at t+3m vis-à-vis its value at the base date (i.e. t-3m).

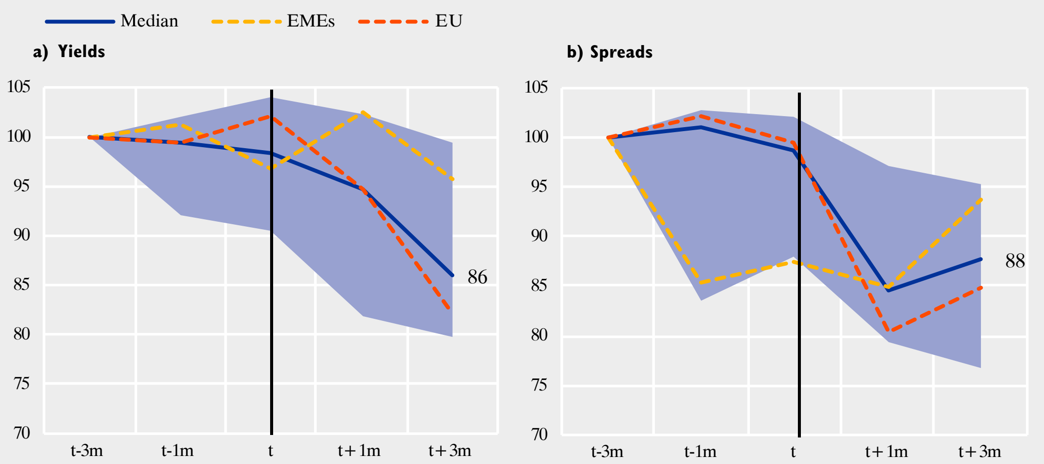
Chart 1 below illustrates the developments in sovereign bond yields for a period of 3 months before (i.e. from t minus 3 months) and 3 months after (i.e. up to t plus 3 months) the upgrade.[4] Panel (a) illustrates the level of yields, at each point in time, relative to their value at the beginning of the examination period. Panel (b) illustrates the same developments, when gauged through the yield differentials between the countries that were upgraded and a benchmark country (i.e. Germany for euro area and EU sovereigns and the US for all other countries).

Chart 1 shows that, 3 months after the upgrade, yields and spreads experience a similar movement: yields decline by 14% compared to their initial level (3 months before the

4 Sovereign bond yield data were available for Brazil, Bulgaria, Croatia, Cyprus, Hungary, the Philippines, Indonesia, India and Turkey.

Chart 1 Evolution of sovereign bond yields and spreads around the time of the investment grade upgrade

(yield/spread at t-3m=100)



Sources: LSEG, Refinitiv (data); Bank of Greece (calculations).
Notes: The lines show the evolution of sovereign bond yields (panel a) and spreads (panel b) vis-à-vis benchmark bonds, re-based at their level three months (t-3m=100) before the upgrade of the sovereign credit rating to investment grade. The solid blue line is the median of the re-based series and the light blue shaded area is their interquartile range (75th-25th percentile). The dashed red line is the median of the series for bonds from European Union (EU) countries and the dashed orange line the corresponding median for emerging markets (EMEs). The vertical black line indicates the timing (t) of the sovereign credit rating upgrade to investment grade.

upgrade), while spreads decline by 12%. This means that, for a sovereign with a yield of 7% and a spread over the benchmark of 500 bps, the upgrade is expected to be associated with a reduction of 100 bps in its yield and of about 60 bps in its spread. This reduction is measured as the overall evolution during the 6-month window applied; however, according to the precedents we have examined, the larger part of the fall in spreads is expected to come about in the 3 months following the upgrade.

Nevertheless, this observation involves some degree of heterogeneity: the coloured lines in the two panels of Chart 1 show the movements of yields and spreads in different groups of countries that have experienced an IG upgrade. The dashed red line in both panels corresponds to the median of European countries and the orange line to the median of emerging market economies (EMEs). The picture in both panels is uniform: European spreads and yields decline relatively more than those of EMEs.

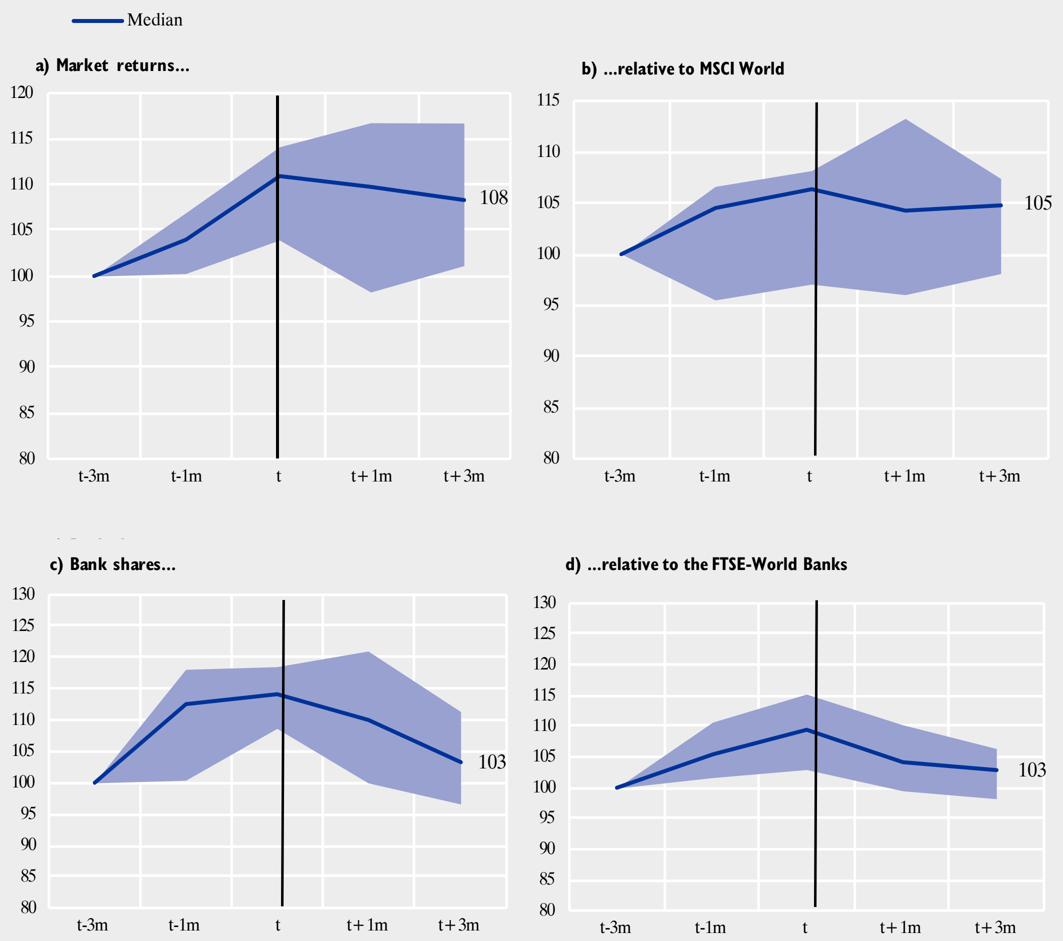
For equity markets, we construct two types of indicators.[5] The first one measures the level of the stock market price index at each point in time, against its level at the base date. We use both the general price index of each country's stock market and the country's banking index. The second group of measures intends to extract information about the returns of these indices in excess of those of indices capturing world developments. In particular, at the base date (t-3 months), the country-specific general index is taken as a ratio to the MSCI World index, and the corresponding banking index is taken as a ratio to the FTSE World Banks index, which captures share price developments in the banking sector worldwide. Then, these ratios are rolled over for the subsequent periods. Chart 2 below illustrates the findings.

Chart 2 shows that share prices, as measured by the general stock market indices of the countries in our sample, rise significantly in the period preceding the IG upgrade: the general stock market indices rise by about 11 pps

5 Data availability restricts the analysis for equity markets to the following economies: Brazil, Bulgaria, Croatia, Cyprus, Hungary, India (excluding banks), Indonesia, Mexico, the Philippines, Romania, Slovakia and Turkey.

Chart 2 Stock market developments around the time of IG upgrades

(stock index at t-3m=100)



Sources: LSEG, Refinitiv (data); Bank of Greece (calculations).
Notes: The panels show the evolution of share price indices, re-based at their level three months (t-3m=100) before an upgrade of the sovereign credit rating to investment grade. The blue line is the median of the re-based series and the light blue area is their interquartile range (75th-25th percentile). Panels a) and b) show developments in the equity markets of selected countries around the time of the IG upgrade, while panels c) and d) correspond to developments in bank share prices. Panels a) and c) show the level of the general and banking sector stock market indices at each time t, relative to their level three months before the IG upgrade (i.e. index=$P_\tau/P_{\tau\text{-}3m}$, where τ={t-3m, t-1m, t=0, t+1m, t+3m; t=day of IG upgrade}). Panels b) and d) show the same developments for the general and banking sector indices relative to MSCI World and FTSE-World Banks, respectively.

before the upgrade and smooth down by about 3 pps three months after that. Overall, in the period spanning from 3 months before to 3 months after the IG upgrade, the general stock market indices rise by about 8%. Relative to world stock market developments, this rise is somewhat lower: in the three months preceding the upgrade, the stock market rises by 6 pps above the MSCI World, while this development is smoothed down by 1 pp in the three months after achieving the IG status. Nevertheless, the median excess return of the stock markets in economies upgraded to the IG category vis-à-vis the world market is 5% in the 6-month period around the event.

The share prices of the banking sector in upgraded countries outperform their peers elsewhere. In particular, the statistics indicate that the share prices of banks in countries upgraded to IG rise by 3% vis-à-vis the global banking sector in the period from 3 months before to 3 months after the upgrade. This is an important finding, as it may indicate that Greek banks will face more favourable conditions in raising equity capital after the upgrade of the Greek sovereign rating to investment grade.

3.2 DYNAMIC PANEL GMM ESTIMATES

Effects on sovereign bond yields

The next step in our analysis is to formally estimate the effects of an upgrade to investment grade on the yields and spreads of sovereign bonds. In this sub-section we make use of a large dataset of 77 countries' bond yields and ratings, augmented by the inclusion of the annual percentage changes in their foreign exchange rates against the US dollar and of a proxy for global monetary policy.[6] Data are in daily frequency and cover the period from 1.1.2000 to 15.6.2023. The estimated equation is the following:

$$r_{it}=\alpha_i+\beta_1 c_{it}+\beta_2 EFFR_t+\beta_3 \%\Delta FX_{it} + \beta_4 I_{it}^{t\text{-}3m,t+3m}+e_{it} \quad (1)$$

where:

r_{it} is the yield on the ten-year bond of country i=1, 2,...N, at each point in time t=1, 2,...T;

c_{it} is the rating of country i (at each point in time t);

$EFFR_t$ is the effective Fed funds rate at each point in time t;

$\%\Delta FX_{it}$ is the annual rate of return of the exchange rate of the currency of country i against the US dollar (1 USD/FX), with positive values denoting depreciations and negative values appreciations of the currency;

$I_{it}^{t\text{-}3m,t+3m}$ is an index taking the value of 1 in the period 3 months before and 3 months after an upgrade across the IG threshold for the country that has been upgraded and 0 in all other cases (i.e. countries and periods).[7]

The variable of interest here is obviously the index $I_{it}^{t\text{-}3m,t+3m}$. Since, however, the literature has established the existence of monetary policy effects globally, we also insert the effective Fed funds rate (EFFR) to control for global monetary policy effects. Ratings and the dynamics of foreign exchange rates are introduced in order to capture country-specific effects that are not adequately captured by the fixed effects also included in the model. Finally, due to the need to address data properties whose roots in many cases exceed the unity threshold of non-stationarity, the estimation of the above equation has been done using Dynamic Least Squares, i.e. a cointegration technique for heterogeneous panels.

Table 2 reports the results. From the estimation of equation (1), we conclude that the upgrade to investment grade deducts about 52 basis points from the 10-year bond yield of the sovereign which achieved this upgrade during the 6-month period around the event of the upgrade (coefficient β_4). Note that this finding comes on top of the effects captured by the other variables in the setup, which include positive effects stemming from the proxy of global monetary policy conditions, as well as country-specific developments captured by ratings and the depreciation of the currency (reflected in positive values of the variable $\%\Delta FX_{it}$). Among them are the reduction effects exercised by the smaller value of the rating variable due to the upgrade; this deducts another 19 basis points (coefficient β_1). All in all, the IG upgrade is expected to deduct about 70 basis points from the 10-year bond yields of the upgraded sovereign during the quarter before and after the event.

6 The setup is based on the one employed in Malliaropulos and Migiakis (2023).
7 For this variable we have examined alternative definitions as well, such as a variable that spans a period 6 months before up to 6 months after the upgrade or one that marks the upgrade only after the rating is upgraded by two rating agencies to the IG. Our results do not change significantly.

Table 2 Estimates of the effects of an IG upgrade on sovereign bond yields

β_1: Ratings	β_2: Effective FFR	β_3: Foreign exchange	β_4: IG threshold
0.197*** (0.014)	0.327*** (0.009)	0.021*** (0.001)	-0.520*** (0.207)
Adjusted R-squared	J-B	ADF z-stat	LLC t-stat
66.9%	16579k [0.000]	-14.652 [0.000]	-12.598 [0.000]

Notes: The above cointegration setup is estimated using Dynamic Least Squares with leads and lags selected according to the AIC. Long-run variances and cross-section fixed effects are included in the estimation. Asterisks (***, ** and *) denote significance (at 1%, 5% and 10%, respectively). Figures in parentheses are standard errors and those in brackets are p-values.

Effects on economic activity

Next, we examine the effects that a rating upgrade has on the growth rate of real GDP. To do so, we again draw on previous experience, based on data for about 85 economies worldwide. Data are at an annual frequency for the period from 2000 to 2020.[8] The dynamic panel GMM setup estimated is of the following form:

$$\Delta Y_{it} = \varrho \Delta Y_{it\text{-}1} + \beta \Delta X_{it} + \gamma IG_{it} + F_t + e_{it} \qquad (2)$$

where:

Y is one of the following variables: real GDP growth, GDP volatility and fiscal balance;

X is the vector of regressors, including the IG-upgrade dummy;

F is an index controlling for specific years/periods effects (i.e. period fixed effects).

The variable of interest IG_{it}, namely the IG upgrade, is constructed so that it captures the new state of the economy as belonging to investment grade. In particular, for economies upgraded to IG from non-IG by at least one of the three major rating agencies, the variable takes the value of 1 for the year of the upgrade and the years thereafter and 0 in all other cases (i.e. years and countries). For the estimation of the above setup, we use Arellano-Bond estimators to remove moving average (MA) components. Alternative setups (including system GMM and dynamic panel FE models) have been examined, but their properties have been found to be inferior to the AB-DPD model used herein. Table 3 reports the results of the estimations.

Table 3 Estimates of the effects of an IG upgrade on real GDP

	ϱ	β
Real GDP growth	0.684*** (0.002)	0.801*** (0.137)
GDP volatility	0.161*** (0.007)	-0.403*** (0.001)

Notes: The above dynamic panel data setups are based on Arellano-Bond estimators, with errors robust for serial correlation and cross-section heterogeneity (White period coefficient covariance and cross-section clusters). Long-run variances and cross-section fixed effects are included in the setup. Instruments used in the estimations, apart from the dependent variable's lagged values, are: (for the real GDP growth equation) changes in the current account balance, changes in the fiscal balance, changes in broad money supply, an index variable capturing the status of the currency as a global reserve, the average ranking of the country in governance indicators, history of default, GDP volatility and period fixed effects. In the equation of GDP volatility, we also add interest expenses, while for the fiscal balance, on top of the previous instruments, we also add debt-to-GDP ratios. Asterisks (***, ** and *) denote significance (at 1%, 5% and 10%, respectively).

Our estimates reported in Table 3 suggest that, following the IG upgrade, countries that have been upgraded are expected to have:

(a) 0.8 pps higher real GDP growth rates;

and

(b) 0.4 pps lower GDP volatility;

8 The data source is Fitch Ratings. The full dataset covers 117 sovereigns, although data adequate for our purposes are available for 85 countries.

Given that the setup includes an autoregressive term (coefficient: ϱ), we may infer the anticipated long-run effects from the above estimates by the formula: $\frac{\beta}{1-\varrho}$. In this regard, the long-run effects of the IG upgrade are expected to be a 2.5% higher GDP level and a 0.48% lower GDP volatility level. Thus, according to these results, the IG upgrade is expected to have economically significant effects, pushing up economic activity and enhancing the resilience of the upgraded economy. On the other hand, our sample includes a large number of emerging market economies, for which the effects of upgrades to IG may be particularly strong. Hence, these estimates should be interpreted as an upper bound.

4 IMPACT OF A SOVEREIGN CREDIT RATING UPGRADE TO INVESTMENT GRADE ON THE GREEK ECONOMY

4.1 IMPACT ON THE COST OF FUNDING

In general, cross-country differences in the cost of sovereign funding reflect differences in the monetary policy outlook, uncertainty about future short-term interest rates and credit risk. Since there is a common monetary policy in the euro area, differences in sovereign bond yields between member countries should largely reflect differences in the credit risk of sovereigns. We have estimated the credit risk component of 10-year Greek government bonds using a dynamic factor model for defaultable sovereign bonds along with the respective credit risk components of Italian and Portuguese government bonds.[9]

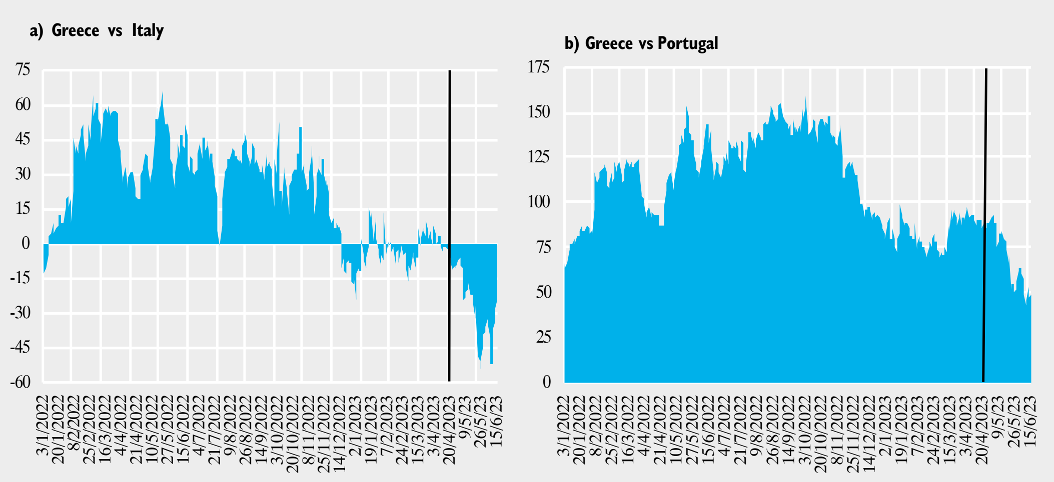
As shown in Chart 3, from the date of the announcement of the positive outlook by S&P[10] to the end of our sample period, the risk

9 The model is a time-varying affine term structure model (a Dynamic Nelson-Siegel model; for the methodology, see Diebold and Li 2006). The technique used for decomposing interest rates is based on Bauer and Rudebusch (2020). We chose Italy and Portugal for comparison because both countries are IG, but they are the ones closest to the rating of Greece.

10 On 21 April 2023, S&P changed the outlook of Greece's sovereign rating to positive from stable; with a rating standing at BB+ at the time, i.e. just one notch below investment grade, this development signalled that an upgrade of Greece's sovereign rating was very likely in the next 12-18 months, according to the rating agency's definition.

Chart 3 Sovereign bond yields: differences in credit risk components

(basis points)



Source: Bank of Greece (econometric model).
Notes: The credit risk components for each country have been estimated from an affine term structure model (of the dynamic Nelson Siegel type), that allows the decomposition of their sovereign bond yields into an expectations component, a term premium and a credit risk premium. The blue areas show the ratio of the credit risk component of the Greek 10-year sovereign bond to the credit risk components of Italy (panel a) and Portugal (panel b). The black lines mark 21 April 2023, when the rating agency S&P revised its outlook on Greece to positive, signalling a probable upgrade to investment grade.

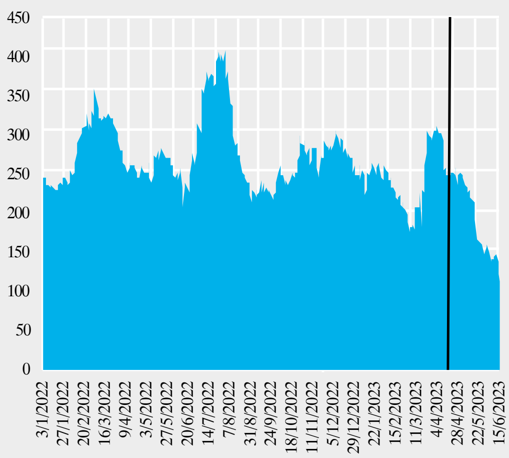
premia demanded by investors for holding Greek sovereign bonds decreased by about 30 bps relative to the credit risk components of other euro area sovereign bonds, such as the Italian and the Portuguese ones. This development explains the largest part of the 40 bps reduction in Greek sovereign bond yields in the same period.[11] Thus, the credit risk differential of Greek sovereign bonds vis-à-vis Italian ones has remained steadily negative (standing at -25 bps on 15.6.2023) since S&P's announcement of a positive outlook for the sovereign rating on Greece, despite the fact that throughout this period Italy was rated in the IG category, whereas at the time Greece was not.[12] So, the negative default risk differential may indicate that investors discount the high likelihood of an upgrade of Greece to IG in the near future.

At the same time, the comparison of the credit risk premia on Greek sovereign bonds to those on Portuguese bonds[13] indicates that, despite the discounting of a likely upgrade, there may still be room for further compression of funding costs for the Greek State. In particular, the credit risk differential between the two countries' sovereign bonds stands at +55 bps at the end of our sample period (on 15.6.2023). Based on the findings reported in Section 2, which indicate that the IG upgrade is associated with an overall reduction in yields of about 70 bps, in the case of an actual upgrade of Greece, a further compression of the credit risk component may be anticipated, which could lead to an additional yield reduction of up to 40 bps. Such a hypothetical development would still leave a positive spread of at least 15 bps, *ceteris paribus*, in the credit risk component of Greek government bonds vis-à-vis those of Portuguese bonds.

The effect of an upgrade of the Greek sovereign to the IG category is expected to pass through to the cost of funding of Greek banks both directly and indirectly. The indirect channel is related to the fact that, in all previous cases, an upgrade of the Greek sovereign credit rating has been followed by an upgrade of Greek banks' ratings. So, an upgrade of Greece's sovereign rating to IG is expected to enable future upgrades of Greek banks to IG.[14] The direct channel is related to how bonds are priced in the market: since sovereign bonds are benchmarks for pricing all other bonds with exposure to the same economy, a significant change (i.e. either a rise or a decline) in the yields of sovereign bonds passes through to corporate and bank bonds.

Chart 4 Yield differentials of senior bank bonds: Greek vs EA banks

(basis points)



Sources: LSEG, Refinitiv.
Notes: The blue area illustrates the differential (spread) of the weighted average yield on Greek bank bonds vis-à-vis the yield on the iBoxx index for senior BBB-rated bank bonds denominated in euro and with a residual maturity of five to seven years. The black line marks 21 April 2023, when the rating agency S&P revised its outlook on Greece to positive, signalling a probable upgrade to investment grade.

Chart 4 illustrates the yield differential between senior bonds issued by Greek banks and those issued by euro area banks with similar characteristics, except for their rating. As shown in Chart 4, the reduction of risk premia

11 Another 10 bps reduction in yields is associated with lower term premia.
12 Italy is rated by Fitch and S&P at BBB and by Moody's at Baa3.
13 Portugal is rated by Fitch and S&P at BBB+ and by Moody's at Baa2.
14 On 15.6.2023, the highest issuer-default ratings of Eurobank and National Bank of Greece assigned by Fitch, Moody's and S&P stood at BB-, i.e. 3 notches below the IG threshold; Alpha Bank's issuer-default rating stood at B+ (4 notches below IG) and Piraeus Bank's at B (5 notches below IG).

in Greek sovereign bonds after S&P changed Greece's sovereign rating outlook to positive has been reflected in and amplified by the movements of Greek bank bond yields: their spread over euro area bank bonds belonging to investment grade has come down by about 140 basis points. At the end of our sample period, this spread stood at around 115 basis points.

Extending the sample period until the beginning of September, we observe that in anticipation of an upgrade to the IG category the risk premia on Greek sovereign bonds declined by more than 50 basis points vis-à-vis the credit risk components of comparable euro area sovereign bonds with an IG rating. Thus, as indicated above, the overall decline in the credit risk premia of Greek sovereign bonds in anticipation of an IG upgrade stood close to the 70 bps reduction in sovereign bond yields observed in previous cases of IG upgrades, as documented in Section 2. Turning to the likely impact of an IG upgrade on bank bonds, since S&P announced the positive outlook for the Greek sovereign rating, yields on senior bonds issued by Greek banks have been reduced by more than 150 basis points relative to those of euro area peers with an IG rating. Furthermore, an upgrade of Greece's sovereign credit rating to the IG category is expected to be followed by rating upgrades of Greek banks. In turn, rating upgrades of Greek banks would, in all likelihood, lead to a further compression of their funding costs compared with those of euro area banks with an IG rating. All in all, the assumption that the already observed reduction of Greek banks' yields will be permanent seems plausible.

4.2 THE GENERAL EQUILIBRIUM EFFECTS OF A RATING UPGRADE

Methodology

This subsection provides a quantitative and qualitative assessment of the effects of a sovereign credit rating upgrade to investment grade in the context of a dynamic stochastic general equilibrium (DSGE) model. The model has a fully developed micro-founded private sector, as well as a detailed financial sector featuring bank intermediation, banking capital regulations and multiple agency problems, including household, firm and bank default in equilibrium.[15] It is, thus, rich in terms of the interactions between the real and financial sectors, and suitable for examining the transmission channels at play following a positive shock, such as an IG upgrade.

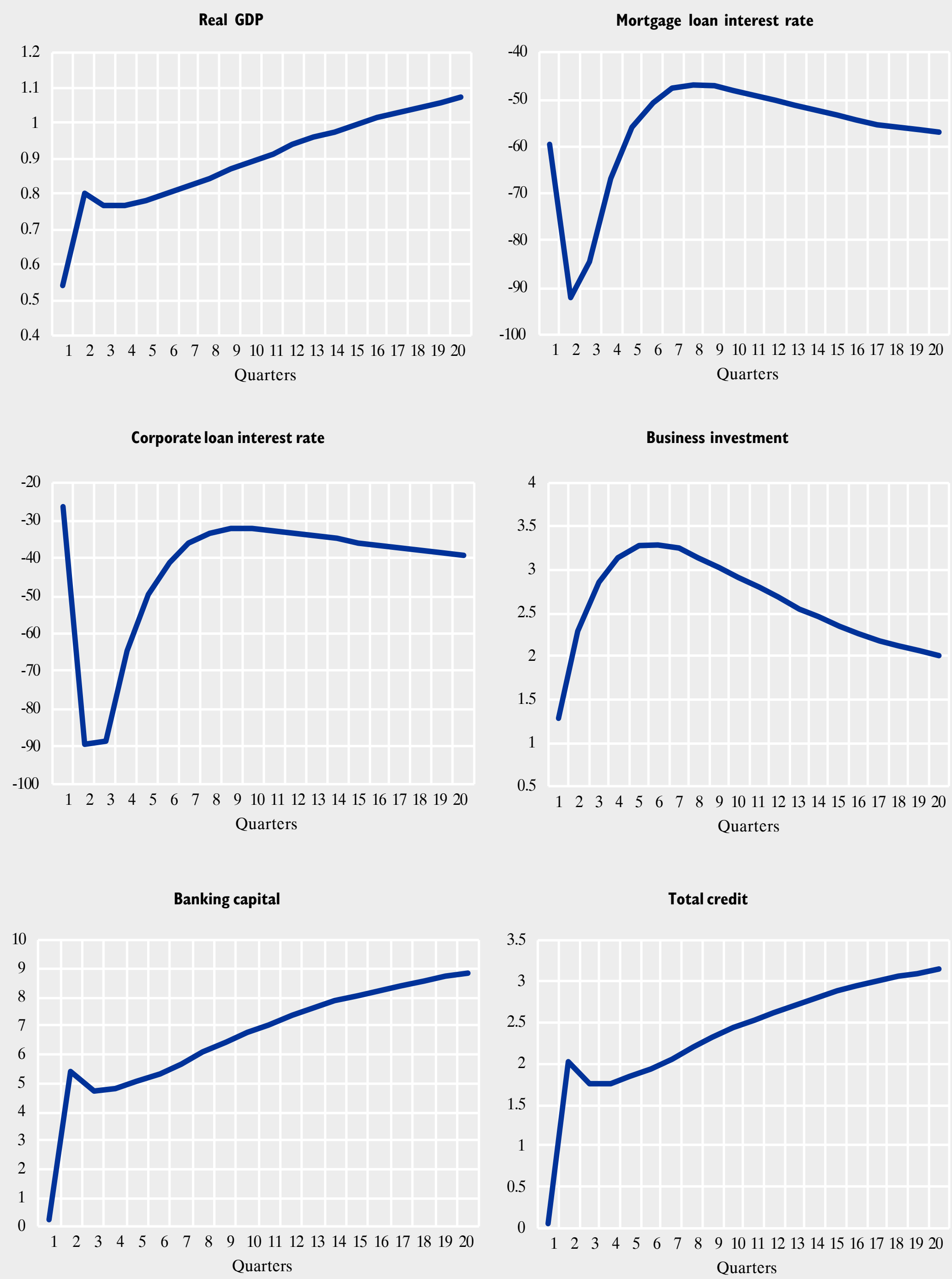
The approach adopted is as follows: First, the model is calibrated at a quarterly frequency to capture the key characteristics of the real and financial sectors of the Greek economy.[16] Then, drawing on the results of subsection 4.1, we simulate a rating upgrade shock as a permanent reduction in the bank funding costs by 100 basis points and report the dynamic responses of key real and financial variables. Additionally, we perform counterfactual experiments to examine whether a rating upgrade insulates the economy against exogenous shocks and prevents excessive volatility in the real and financial sectors of the economy. To this aim, we compare the dynamic responses following an exogenous shock in the benchmark calibrated economy (pre-rating upgrade economy) to those in an economy with lower funding costs (post-rating upgrade economy).

Dynamic responses to a rating upgrade shock

Chart 5 shows the dynamic responses of key financial and real variables to a rating upgrade shock over the first 20 quarters following the shock. The shock is transmitted from the financial sector to the real economy via the funding and bank capital channels. First, a rating upgrade reduces banks' funding costs, thus allowing them to reduce the lending rates they charge for mortgage and corporate loans and to increase credit supply (bank funding channel). In turn, households and firms increase their demand for investment and consumption, thereby prompting a rise in the prices of housing and physical capital. Given that, in the model, these assets constitute collateral against

15 For a detailed description of the model, see Clerc et al. (2015).
16 The calibration procedure for the Greek economy follows the work of Balfoussia and Papageorgiou (2016) and Balfoussia et al. (2019).

Chart 5 Dynamic responses to a rating upgrade shock



Source: Authors' own estimations.
Note: All variables are expressed as percentage deviations from the initial steady state, except for the (annualised) lending rates, which are expressed in changes in basis points.

Table 4 Effects of a rating upgrade shock

Quarters	1	4	8	12	20	Long-run
Real GDP	0.54	0.77	0.85	0.94	1.10	1.30
Business investment	1.28	3.14	3.15	2.67	1.95	1.60
Housing investment	0.67	1.78	2.61	3.37	4.28	3.15
Banking capital	0.24	4.80	6.10	7.36	9.00	11.10
Total credit	0.06	1.77	2.19	2.63	3.15	4.16

Source: Authors' own estimations.
Note: All variables are expressed as percentage deviations from the initial steady state.

which loans have been pledged, this increase in asset prices leads to reduced rates of default for both mortgages and business loans. As a result, bank equity also increases, and, thus, so does the supply of loans, boosting economic activity (bank capital channel). Moreover, the average default of banks decreases and further reduces deposit funding costs and lending rates. It is notable that lending rates fall by less than the initial decline in banks' funding costs, resulting in higher bank profitability and net worth. Consequently, there is a second-round increase in asset prices, which also lowers default rates among borrowers and increases credit supply. This, in turn, further boosts economic activity.

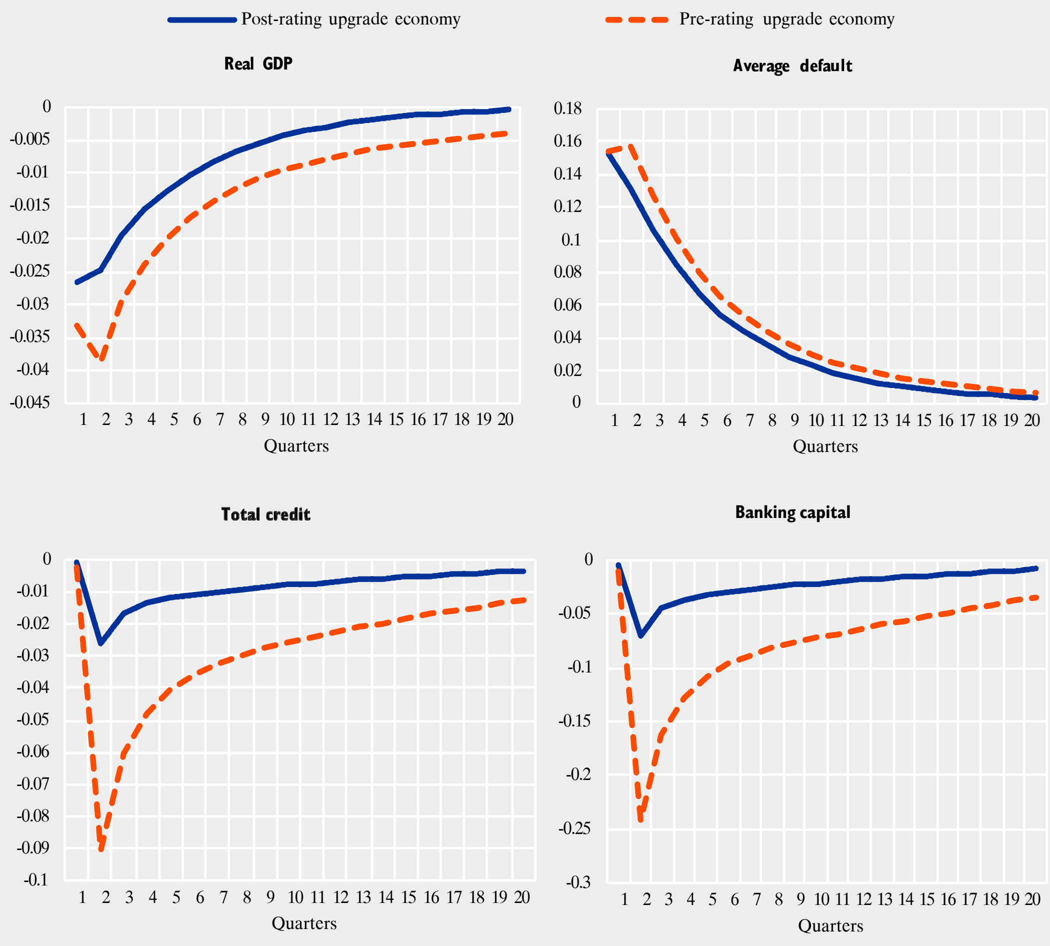
Table 4 summarises the main quantitative results of the rating upgrade shock. The level of real GDP increases by 0.94% after 12 quarters (3 years) following the shock. This translates into an average contribution to the real GDP growth rate of around 0.31 pps per year over the first 3 years after the upgrade. The levels of real business and housing investment increase by 2.67% and 3.37%, respectively, over the first 12 quarters. The levels of total credit and banking capital increase by 2.63% and 7.36%, respectively, over the same period.

As the positive shock of an IG upgrade is assumed to be permanent, it causes the economy to gradually move to a new steady-state equilibrium, i.e. it has permanent long-run effects. In the new long-run equilibrium, the levels of real GDP, business investment and housing investment increase by 1.3%, 1.6% and 3.15%, respectively. Total credit supply and banking capital increase by 4.6% and 11.1%, respectively. It should be noted that the total impact of an IG upgrade on the Greek economy could be even higher, as positive effects may also come about through other channels not incorporated in this analysis, for example via improved consumer confidence and increased FDI flows, *inter alia*.

Resilience gains from a rating upgrade to investment grade

In this section, we use the model to perform counterfactual experiments to examine whether a rating upgrade of the Greek economy would insulate it against exogenous shocks and prevent excessive volatility in the real and financial sectors of the economy. Chart 6 shows one such experiment, namely the dynamic responses to a one standard deviation negative bank risk shock in the benchmark calibrated economy (pre-rating upgrade economy) and in an economy with lower funding costs (post-rating upgrade economy). As can be seen, in the economy which enjoys lower funding costs due to the IG upgrade, there is a shorter and milder contraction of output compared to the benchmark economy. This reflects the fact that the shock has a smaller impact on banking capital and the default rate of banks, thus resulting in a much lower fall in credit supply. Similar results are obtained when we examine alternative exogenous shocks. In conclusion,

Chart 6 Effects of a bank risk shock



Source: Authors' own estimations.
Note: All variables are expressed as percentage deviations from the initial steady state, except for the average default, which is expressed in percentage point changes.

our counterfactual experiments indicate that a sovereign credit rating upgrade to investment grade strengthens the resilience of the real and financial sectors of the economy and prevents excessive volatility caused by exogenous shocks.

5 CONCLUSIONS

In conclusion, we employ a battery of approaches to explore the implications of a sovereign credit rating upgrade to investment grade for the Greek economy. Drawing on cross-country data, we provide empirical evidence that an upgrade is likely to be associated with a permanent reduction in the sovereign spread and a rise in the stock market. It is estimated that government bond yields decline by about 70 bps in connection to an upgrade to investment grade. These gains are expected to pass through to the cost of funding of Greek banks, both directly and indirectly, allowing Greece's further convergence to the euro area average. Moreover, based on previous cases of sovereign upgrades to investment grade, we find that real GDP is expected to rise by up to 2.5% in the long run. Additionally, we employ a DSGE model of the Greek economy with a rich financial sector to examine the transmission channels at play following an upgrade. We study the dynamic responses of key real and financial variables and find that an upgrade has permanent positive effects, as the economy moves to a new steady state. Finally, counterfactual experiments illustrate that a sovereign credit rating upgrade to investment grade has a stabilising impact on both the banking sector and the real economy. It follows that there is a need for sound fiscal policies and reforms, which will help maintain the current investment grade rating and hopefully achieve further credit rating upgrades that could yield additional potential gains for the Greek economy.

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TECHNICAL APPENDIX

COMPONENTS OF SOVEREIGN BOND YIELDS

In the literature on the term structure of interest rates, the relationship between the nominal yield of a bond and the expected interest rates for the period spanning the term to maturity of the bond is given as follows:

$$y_t(\tau) = \frac{1}{\tau}\int_0^{\tau} f_t(u)du \qquad \text{(A.1)}$$

In equation (A.1), y_t is the yield of a zero-coupon bond with a term to maturity of τ years, and f_t stands for the forward rate. The integral, spanning the period until the maturity of the zero-coupon bond discounted for the number of years (i.e. $^1/_\tau$), simply denotes that the nominal bond yield is the average of forward rates. So, in the absence of credit risk, this relationship associates the observed bond yield, after isolating pricing factors such as coupon payments or accrued interest, to the market's expectations about interest rates for each year up until the year in which the bond will mature. This equation will provide the (average) sensitivity of nominal bond yields, across the yield curves, to the (average) expected forward rates for the term to maturity of the bond. The most prominent way to fit the equation in the data is using the Nelson-Siegel yield curve model in the forward rates:

$$f_t(\tau) = \beta_1 + \beta_2 e^{-\lambda\tau} + \beta_3 \lambda e^{-\lambda\tau} \qquad \text{(A.2)}$$

which fits the yield curve model to the observed yields, per maturity segment, based on three latent factors (β_1, β_2 and β_3) and a limiting parameter (λ). Nevertheless, the affine term structure literature has been documented (Duffee 2002) to fail in efficiently forecasting zero-coupon risk-free bond yields, and the estimation of the above equation in the standard setup will leave a large deterministic residual. The residual will be the (average) term premia, reflecting factors such as uncertainty about future monetary policy and market liquidity.

Again, however, Duffee (2002) argues that the risk compensation cannot be independent from interest rate volatility, a condition inducing some kind of dynamics in the latent factor model of the yield curve. At this point, Diebold and Li (2006) argue that the extant, at the time, models of the term structure of interest rates inadequately forecast bond yields out of sample. On this basis, they introduced the dynamic-factor model shown below:

$$f_t(\tau) = \beta_{1t} + \beta_{2t} e^{-\lambda_t\tau} + \beta_{3t} \lambda_t e^{-\lambda_t\tau} \qquad \text{(A.3)}$$

which then provides the solution of the yield curve, based on three dynamic factors (i.e. β_{1t}, β_{2t} and β_{3t}) and a decay parameter (λ_t):

$$y_t(\tau) = \beta_{1t} + \beta_{2t}\left(\frac{1-e^{-\lambda_t\tau}}{\lambda_t\tau}\right) + \beta_{3t}\left(\frac{1-e^{-\lambda_t\tau}}{\lambda_t\tau} - e^{-\lambda_t\tau}\right) \qquad \text{(A.4)}$$

So, first we make use of the model above to capture the dynamic factors of the yield curve from risk-free zero-coupon bond yields and forward rates. Thus, on the one hand, equation (A.4) provides the *expectations parameter* of bond yields, i.e. their component which is associated to the expected short-term rates for the period until the maturity of each bond. On the other hand, the difference between the implied nominal bond yield $y_t(\tau)$ and the implied forward rate for the same maturity segment [i.e. $f_t(\tau)$] provides the measure of the premium for risks *à la* Duffee (2002). Since, until now, we work with AAA-rated bonds only, this premium cannot be explained by credit risk. In fact, previous studies (see, among others, Cochrane and Piazzesi 2005 and Adrian et al. 2013) associate it to higher uncertainty over future short-term rates, market liquidity etc., along higher terms to maturity; thus, this parameter captures the *term premium* of bond yields.

Now, employing the same model for defaultable bonds complicates things, with regard to the decoupling of the expectations parameter from the parameter that is associated with risks, as the origins of the latter could not be straightforwardly associated with the uncertainty over the level of short-term rates in the future. It would also reflect views about the level of credit risk of the underlying sovereign bond issuer. However, studies on the pricing of sovereign risk in bond markets associate the level of the credit risk premium in sovereign bond yields to the sovereign credit ratings (e.g. El-Shaggi and von Schweinitz 2018). In this strand of the literature, Malliaropulos and Migiakis (2018) associate bond yields to expected short-term rates and credit risk, as follows:

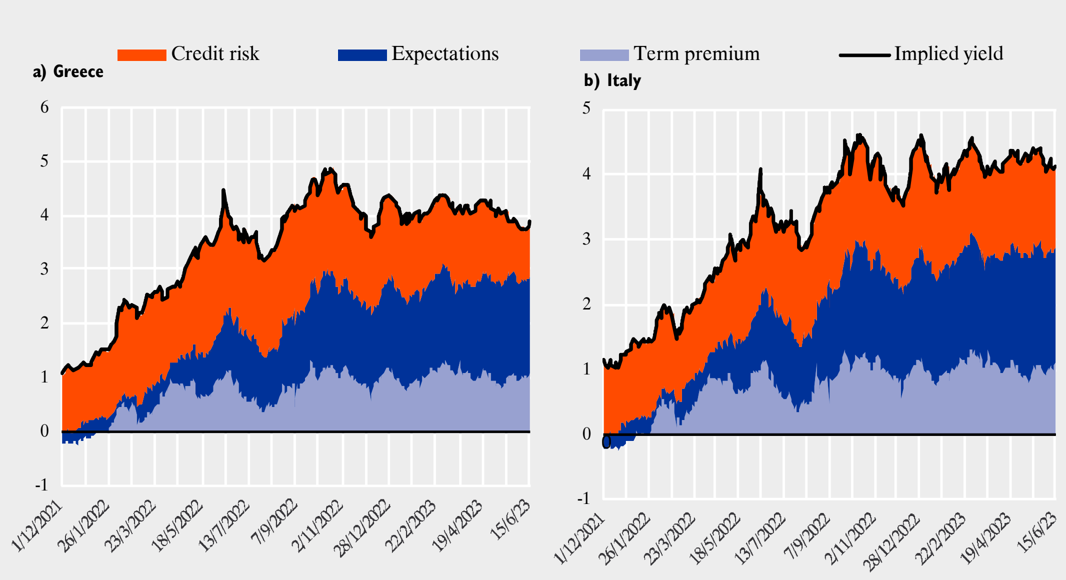
$$y_t^d(\tau) - y_t(\tau) = E_t\left[e^{\frac{1}{n}\cdot\int_0^\tau r_0(u)du}\cdot\left(e^{\frac{1}{n}\cdot\int_0^\tau (s(u)+x(u))du}-1\right)\right] \quad \text{(A.5)}$$

where $y_t^d(\tau)$ is the yield of the defaultable bond (and $y_t(\tau)$ that of the risk-free one), E_t is the expectations operator for the information set available until time t, r_0 is the base rate (set by the central bank), s is the default risk premium and x is the currency risk premium. Now, the function $\int_0^\tau r_0(u)du$ can be shown to be equivalent to $\int_0^\tau f_\tau(u)du$, from equation (A.1), with the addition of a term premium.

At the same time, if the sovereign under examination has the same monetary policy authority with another one, as is the case for euro area sovereigns, then the expectations about short-term rates, i.e. the parameter $E_t\left(e^{\frac{1}{n}\cdot\int_0^\tau r_0(u)du}\right)$ in equation (A.5), should be uniform for both, say, Greek and Italian sovereign bonds. Additionally, in this case, equation (A.5) is simplified, as there is no currency risk premium. So, for euro area countries, this model decomposes sovereign bond yields into the parameters measured by the yield curve models for default-free bonds (i.e. the *expectations component* and the *term premium*) with the addition of a component reflecting *credit risk*. Chart A1 illustrates these components for Greek and Italian sovereign bonds with a ten-year term to maturity:

Chart A1 Components of ten-year sovereign bond yields

(%)



Source: Bank of Greece (econometric model).

Chart A1 shows that the differences in sovereign bond yields between Greece and Italy originate from the different level of the credit risk premium. Finally, again following Malliaropulos and Migiakis (2018), credit risk premia are linked to sovereign credit ratings; as a result, the movements of the differential of the credit risk components of Greece vis-à-vis Italy should mainly reflect market views about potential upcoming changes in the gap between the credit ratings of the two countries. Interestingly, as shown in panel (a) of Chart 3 in the main text, the differential of the credit risk components turned negative at around the time when S&P changed the outlook of the sovereign credit rating it assigned to Greece to positive, on 21 April 2023.

THE DISTRIBUTIONAL IMPACT OF FISCAL MEASURES TO COMPENSATE FOR CONSUMER INFLATION IN GREECE IN 2022

Maria Flevotomou
Bank of Greece, Economic Analysis and Research Department

ABSTRACT

This paper analyses the distributional implications of consumer inflation in Greece and of the fiscal measures adopted to cushion its adverse impact on households in 2022. The analysis employs the tax-benefit microsimulation model for the European Union (EUROMOD) to study how inflation, income support measures, as well as measures aimed at containing prices affected households' purchasing power and welfare across the income distribution. The study confirms that the purchasing power of lower-income households was more severely affected by the 2022 inflation surge than that of higher-income households, resulting in the so-called inflation gap. The unequal impact of inflation was further magnified by the high shares of consumption in the income of the poorer, resulting in a welfare loss differential of 9.2 percentage points between the bottom and the top income decile. The adverse distributional impact of the inflationary shock was largely offset by government policies, with a welfare loss of only 2.9% remaining for the population as a whole. Fiscal measures were shown to close the inflation gap and mitigated the welfare loss differential between the poor and the rich to just 0.7 percentage points. Price measures were dominant vis-à-vis their income counterparts in compensating for welfare losses across the income distribution and, most interestingly, had a significant progressive impact largely driven by the electricity subsidy, as the support provided was inversely related to consumption. However, given that they were not as well-targeted to low-income households, they were relatively cost-inefficient when compared with income measures. Nonetheless, the efficiency advantage of income measures may be severely undermined in the presence of extensive tax evasion, which points not only to the need for a careful design of targeted measures, but also to complementarities with structural reforms fighting tax evasion.

Keywords: inflation; fiscal policy; distributional effect; welfare effect; EUROMOD

JEL classification: D12; D31; D60; E31; H20; I30

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Η ΑΝΑΔΙΑΝΕΜΗΤΙΚΗ ΕΠΙΔΡΑΣΗ ΤΩΝ ΔΗΜΟΣΙΟΝΟΜΙΚΩΝ ΜΕΤΡΩΝ ΓΙΑ ΤΗΝ ΑΝΤΙΜΕΤΩΠΙΣΗ ΤΟΥ ΠΛΗΘΩΡΙΣΜΟΥ ΣΤΗΝ ΕΛΛΑΔΑ ΤΟ 2022

Μαρία Φλεβοτόμου
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

ΠΕΡΙΛΗΨΗ

Στην παρούσα μελέτη αναλύονται οι αναδιανεμητικές επιδράσεις του πληθωρισμού και των δημοσιονομικών μέτρων που υιοθετήθηκαν για την άμβλυνση των δυσμενών επιπτώσεών του στα νοικοκυριά στην Ελλάδα το 2022. Η ανάλυση χρησιμοποιεί το υπόδειγμα μικροπροσομοίωσης φόρων-παροχών της Ευρωπαϊκής Ένωσης (EUROMOD) για να μελετήσει πώς ο πληθωρισμός, τα μέτρα στήριξης του εισοδήματος των νοικοκυριών, καθώς και τα μέτρα που στόχευαν στη συγκράτηση των τιμών, επηρέασαν την αγοραστική δύναμη και την ευημερία των νοικοκυριών σε όλο το εύρος της κατανομής του εισοδήματος. Η μελέτη επιβεβαιώνει ότι η αγοραστική δύναμη των νοικοκυριών με χαμηλότερο εισόδημα επηρεάστηκε περισσότερο από την άνοδο του πληθωρισμού το 2022 σε σχέση με εκείνη των νοικοκυριών με υψηλότερο εισόδημα, γεγονός που οδήγησε στο λεγόμενο “χάσμα πληθωρισμού”. Ο άνισος αντίκτυπος του πληθωρισμού ενισχύθηκε περαιτέρω από τα υψηλά μερίδια της κατανάλωσης στο εισόδημα των φτωχότερων, με αποτέλεσμα να προκύψει ένα χάσμα ως προς τις απώλειες κοινωνικής ευημερίας μεταξύ του κατώτατου και του ανώτατου εισοδηματικού δεκατημορίου της τάξεως των 9,2 ποσοστιαίων μονάδων. Η αρνητική αναδιανεμητική επίδραση της πληθωριστικής διαταραχής αντισταθμίστηκε σε μεγάλο βαθμό από τα μέτρα στήριξης που υιοθετήθηκαν, τα οποία περιόρισαν τις απώλειες σε όρους κοινωνικής ευημερίας σε μόλις 2,9% για τον πληθυσμό συνολικά. Επιπλέον, τα δημοσιονομικά μέτρα εξάλειψαν το χάσμα πληθωρισμού και μείωσαν το χάσμα απωλειών κοινωνικής ευημερίας μεταξύ φτωχών και πλουσίων σε μόλις 0,7 της ποσοστιαίας μονάδας. Τα μέτρα που στόχευαν στη συγκράτηση των τιμών κυριάρχησαν έναντι των μέτρων στήριξης του εισοδήματος των νοικοκυριών ως προς την αντιστάθμιση των απωλειών ευημερίας σε όλη την κατανομή του εισοδήματος. Είχαν δε προοδευτική αναδιανεμητική επίδραση, που οφείλεται κυρίως στην επιδότηση της κατανάλωσης ηλεκτρικής ενέργειας, καθώς η παρεχόμενη στήριξη ήταν αντιστρόφως ανάλογη της κατανάλωσης. Ωστόσο, επειδή δεν ήταν εξίσου στοχευμένα στα νοικοκυριά με χαμηλό εισόδημα, ήταν από οικονομικής απόψεως λιγότερο αποδοτικά σε σχέση με τα μέτρα στήριξης του εισοδήματος. Εντούτοις, το σχετικό πλεονέκτημα αποτελεσματικότητας των εισοδηματικών μέτρων μπορεί να υπονομευθεί σοβαρά υπό συνθήκες εκτεταμένης φοροδιαφυγής, γεγονός που αναδεικνύει την ανάγκη όχι μόνο για προσεκτικό σχεδιασμό των στοχευμένων μέτρων, αλλά και για συμπληρωματικότητά τους με διαρθρωτικές μεταρρυθμίσεις για την καταπολέμηση της φοροδιαφυγής.

THE DISTRIBUTIONAL IMPACT OF FISCAL MEASURES TO COMPENSATE FOR CONSUMER INFLATION IN GREECE IN 2022*

Maria Flevotomou
Bank of Greece, Economic Analysis and Research Department

1 INTRODUCTION

The inflation crisis, which started in 2021 due to the pandemic-related global supply bottlenecks, escalated in 2022 with Russia's invasion of Ukraine, as high worldwide energy dependency on Russia pushed further upwards the prices of fuels and, subsequently, of other products as well. Euro area inflation rose from 2.6% in 2021 to 8.4% in 2022, whereas in Greece the respective rates were 0.6% and 9.3%.

Rising inflation weighs on households' real income, eroding their purchasing power. Moreover, inflation has negative distributional effects, as it disproportionately affects lower-income households. On the one hand, the latter have a higher propensity to consume and, in some cases, even spend more than they earn. Furthermore, they are often credit constrained, so rising prices may ultimately contain their consumption.[1] On the other hand, food and energy products, which have experienced the largest price increases in recent years, have a larger share in the consumption basket of lower-income households.[2]

The above has put pressure on fiscal policy to contain the welfare losses associated with the inflationary shock and support the most vulnerable citizens, not only in order to stimulate consumption and growth, but also to maintain social cohesion by mitigating the adverse distributional effects of inflation.

This article aims to analyse the impact of inflation on household disposable income and assess how the latter was affected by the fiscal measures targeting households in Greece in 2022, focusing in particular on distributional effects. It is organised as follows: Section 2 offers a description, as well as a classification by type and target group, of the fiscal measures adopted in Greece in response to the energy crisis, along with the associated costs and financing sources. Section 3 introduces the data and methodology employed, which is centered around EUROMOD, the tax-benefit microsimulation model for EU countries. Section 4 presents the empirical results from two complementary points of view: the impact on real disposable income – or household purchasing power – and the impact on household consumption welfare. It also explores what drove the estimated changes in inequality by looking at the contributions of the inflationary shock, the associated fiscal support, as well as other factors. Finally, the efficiency of the different types of inflation compensation measures is assessed by weighing their inequality-reducing impact against their fiscal cost. Section 5 concludes.

In brief, we find that the purchasing power of lower-income households was more severely affected by the 2022 inflation surge in Greece than that of high-income households. Fiscal measures significantly contributed to closing the inflation gap and mitigating the resulting welfare differential. Whereas price measures were dominant compared to income measures in compensating for welfares losses across the income distribution, they were relatively cost-inefficient in containing the adverse inequality impact of inflation due to their less targeted nature. Nonetheless, the efficiency advantage of income measures needs to be addressed in the light of extensive tax evasion in Greece.

2 FISCAL MEASURES IN GREECE

In Greece, the fiscal interventions to address the energy crisis were sizeable compared to its

* This paper draws on the results for Greece included in the analysis of six euro area countries in Amores et al. (2023). The views expressed in this article are of the author and do not necessarily reflect those of the Bank of Greece. The author is responsible for any errors or omissions.

1 See Charalampakis et al. (2022).

2 See Villani and Vidal Lorda (2022).

euro area peers, amounting to 0.5%, 5.0% and 1.1% of GDP in 2021, 2022 and 2023, respectively, against euro area support amounting to 0.2%, 1.9% and 1.8% of GDP in the respective years. [3] It should be noted, however, that most of the interventions in response to the energy crisis were financed by revenues from the Energy Transition Fund (ETF)[4], reducing the budgetary cost of support measures in Greece to 0.1%, 2.2% and 0.0% of GDP in 2021, 2022 and 2023, respectively.

Inflation compensation measures (ICMs) were first introduced in 2021. They involved subsidies on electricity consumption (amounting to EUR 490 million), as well as extraordinary direct financial support to households. The latter involved one-off lump-sum transfers to low-paid pensioners, disabled people and the uninsured elderly, an increase in the heating allowance and the payment of double the amount of the minimum guaranteed income in December (totalling EUR 384 million).

With the escalation of the inflation crisis due to the Ukraine war in 2022, the fiscal support package was substantially expanded. Its composition strongly favoured price measures, such as subsidies, which accounted for 84% of measures (see Chart 1).

In particular, out of a total fiscal package of EUR 10.4 billion, subsidies on electricity and gas consumption amounted to EUR 7.7 billion, a significant part of which targeted enterprises. Table A2 in the Appendix contains an exhaustive list of the ICMs and associated costs in Greece in 2022 by type of measure (price, income and other).

Subsidies for household electricity consumption were effectively progressive, as they were inversely related to electricity consumption (see Table A3 in the Appendix). The subsidy rate varied throughout the year depending on the evolution of electricity prices. Households benefitting from the so-called social residential tariff received more generous support.

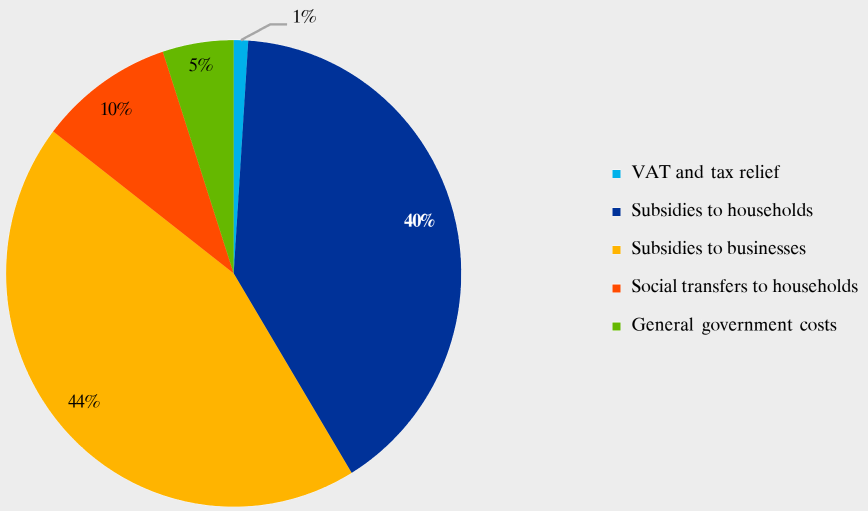
In contrast, for household natural gas consumption, a flat subsidy rate applied (EUR 20 per MWh from January to June 2022, except for April 2022, when it was EUR 40 per MWh). The Public Gas Corporation (DEPA) also provided a subsidy throughout the year. Lastly, flat-rate subsidies were provided for diesel (12 cents per litre) and for heating oil (20 cents per litre).

Other price measures concerned fiscal support to farmers, including a refund of excise duties on diesel and a reduction in the VAT rate on fertilisers and animal feed (from 13% to 6%). In addition, the "Power pass" programme involved a one-off 60% refund of the increase in electricity bills between December 2021 and May 2022 for households' primary residence, with eligibility based on a net family income in 2020 of up to EUR 45,000 and a maximum ceiling of EUR 600. Finally, the "Fuel pass" programme included two lump-sum payments in 2022, through either a bank payment or a dedicated digital debit card. In May 2022, eligibility criteria included a family taxable income of less than EUR 30,000; car owners received EUR 45 on a digital debit card or EUR 40 in a bank account. In August/September 2022, eligibility criteria included a family taxable income of less than EUR 30,000 (with expanded income criteria for each additional member, and up to a ceiling of EUR 45,000); car owners received EUR 80 on a digital debit card or EUR 65 in a bank account. Subsidy amounts were lower for motorcycle owners and higher for island residents.

Regarding income support to vulnerable households, there were two main fiscal support packages, which were disbursed in April and December 2022. As in 2021, they targeted low-paid pensioners, the uninsured elderly receiving OPEKA (Organisation of Welfare Benefits and Social Solidarity) benefits and recipients

3 See Checherita-Westphal and Dorrucci (2023).
4 The Energy Transition Fund (ETF) was established in 2021 (Law 4855/2021) to fund a variety of subsidies for electricity, natural gas, heating oil and transport fuels. A breakdown of its revenues is presented in Table A1 in the Appendix.

Chart 1 Estimated composition of inflation compensation measures in 2022



Source: Author's own calculations based on General Accounting Office estimates.

of disability benefits. More specifically, the support provided included payments of EUR 200 in April 2022 and EUR 250 in December 2022 to (a) pensioners with a monthly income of up to EUR 600 and EUR 800, respectively, (b) the uninsured elderly receiving OPEKA benefits and (c) beneficiaries of disability benefits. Moreover, beneficiaries received double the amount of the minimum guaranteed income and one-and-a-half times the amount of the OPEKA child benefit in April 2022 and December 2022. The long-term unemployed received support of EUR 250 in December 2022. Finally, there was a further increase in the heating allowance. The total cost of these measures amounted to around EUR 1 billion and accounted for 9% of the total fiscal package.

Fiscal support for the energy crisis was largely withdrawn in 2023, totalling EUR 2.5 billion, all of which was budget neutral.

The present analysis focuses on income and price measures affecting households in 2022, i.e. it examines a subset of the overall fiscal support package. It covers 100% of the income measures and 98.5% of the price measures affecting households (see Table A2 in the Appendix for details and validations of our results against government cost estimates).

3 DATA AND METHODOLOGY

EUROMOD

The distributional effects were estimated using EUROMOD[5], a tax-benefit microsimulation model of the European Union, currently developed and maintained by the Joint Research Centre of the European Commission. EUROMOD enables the analysis, in a comparable manner, of the effects of taxes and benefits on household incomes for individual countries and the EU as a whole.

The distinguishing feature of microsimulation models is that they operate at the individual

5 Version I.4.113. For more information on the EUROMOD model, see https://euromod-web.jrc.ec.europa.eu/ as well as Sutherland and Figari (2013).

level, i.e. they take into account diverse circumstances and characteristics of the population of interest (Citro and Hanushek 1991) contained in micro datasets providing information on different sources of income (gross earnings, pensions and social transfers), household composition and individual socioeconomic characteristics. This allows the effects of public policy to be studied along the income distribution and across its various population segments.

EUROMOD is a static microsimulation model. Static microsimulation models typically impute income tax or other liabilities and the receipt of social security and other benefits by applying the rules for eligibility or liability to individuals and households (Harding 1996). In replicating current or hypothetical institutional frameworks, static models assume away behavioural responses on the part of micro agents. Their key purpose has, hence, traditionally been to show the "morning after" impact of a policy change.

Looking at the EU energy crisis of 2022, when the price surge was sudden and mostly driven by the increase in food and energy costs, this assumption can be rationalised considering the unexpected nature of the shock and the limited ability of households to switch away from necessity goods. Recent literature[6] analysing demand responses to the inflationary shock supports this assumption. More generally, there seems to be some evidence that the total distributional impact of (relatively small) tax and benefit policy changes is close to their direct effect.[7]

Data

EUROMOD by default uses the EU statistics on income and living conditions (EU-SILC[8]) survey as input data. EU-SILC provides a yearly cross-sectional survey of households with regard to income, poverty, social exclusion and living conditions that is standardised across all EU Member States.

The present analysis employs the EU SILC 2020 wave for the simulation of income support ICMs. For Greece, this is effectively a representative sample of the population containing information on 32,832 individuals in 15,086 households.

The EU-SILC 2020 wave reports income information for the year 2019. As such, the income reference year of the micro dataset does not correspond to the years relevant for the distributional analysis of inflation compensation measures in 2022. Therefore, adjustments, in the form of updating 2019 gross incomes, had to be implemented so that the latter reflect nominal levels in the base year 2021 and the analysed year 2022. This so-called uprating exercise is implemented by income source per simulated year within EUROMOD, based on information obtained from other data sources. The data are typically taken from Eurostat or provided by the statistical offices of the Member States, government authorities or national central banks.

Table A4 in the Appendix sets out the assumptions underlying the uprating mechanism from 2021 to 2022 in the case of Greece,[9] breaking down household disposable income in its basic sub-components. Two highlights from Table A4 include: (a) the differential wage growth applied to private and public sector employment, as civil servant wages had been frozen since 2012, while for private employees an annual wage growth of 1.8% was imputed on the basis of the 2023 Q3 national accounts data available at the time of analysis; and (b) the pension freeze applicable from 2016 (Law 4387/2016).

The 2021 and 2022 income distributions were, hence, artificially created in the basic EUROMOD functionality, enabling the simulation of inflation compensation measures targeting household incomes.

6 See Sologon et al. (2022).
7 See Barrios et al. (2019).
8 For more details on EU-SILC, see Eurostat's EU statistics on income and living conditions.
9 The Joint Research Centre of the European Commission publishes annual country reports that describe in more detail the uprating exercise, policy changes and the institutional set-up of each EU country (EUROMOD Country Reports).

For the simulation of price measures, an extended functionality of EUROMOD is used, namely the Indirect Tax Tool (ITT). The ITT relies on data from the Household Budget Survey (HBS), which contains information on household expenditure on goods and services. In particular, the ITT draws on the harmonised HBS, which is essentially a collection of the national HBSs carried out by Eurostat every five years. This is because HBSs, being national surveys designed with the main purpose of calculating weights for the consumer price index, leave leeway for each EU country to decide upon other objectives, methodology or even frequency of the survey. Although there have been continuous efforts to make the data comparable across countries and over time, differences remain. Microdata harmonised by Eurostat are available every five years, the latest coming from the 2010, 2015 and 2020 waves.

In the present analysis, the harmonised HBS is matched with the EU-SILC from the same year to obtain an internally consistent dataset with income and consumption data. At the time of drafting, consolidated EU-SILC and HBS microdata were only available for the 2010 wave of the HBS. The consolidation was implemented by means of a semi-parametric procedure developed by Akoğuz et al. (2020). This procedure combines the estimation of Engel curves used in earlier studies (such as Decoster et al. 2010) with matching techniques. It consists of three main steps. First, a common set of relevant covariates is identified in the source and recipient datasets. Second, in the source dataset, consumption goods are aggregated into 20 macro-categories and expressed in terms of consumption shares of income. These aggregated consumption shares are regressed against the set of covariates identified in the first step. Third, the estimated coefficients are used to construct fitted shares of consumption in both the source and the recipient datasets (i.e. in each of these datasets, 20 fitted consumption shares will be constructed for any household, based on the regression model above). A Mahalanobis distance metric is used to find the closest match between any household in the source and recipient datasets. Once households from the recipient (EU-SILC) and source (HBS) datasets are matched, the consumption shares of the full consumption basket from the latter are imputed to the former.

Given the above, we explored to what extent household consumption expenditure has changed since 2010. The HBS provides information on household consumption expenditure across twelve categories defined by consumption purpose, following the UN Statistical Commission's Classification of Individual Consumption According to Purpose (COICOP).

Chart 2 depicts the evolution, across the latest three HBS waves, of the expenditure share in Greece of the five COICOP categories making up the largest part of total consumption expenditure in 2010. The expenditure shares remained broadly stable across all three waves, with relative differences being most noticeable in "food and non-alcoholic beverages" and "housing, water, electricity, gas and other fuels", but still reaching up to 5% at most.

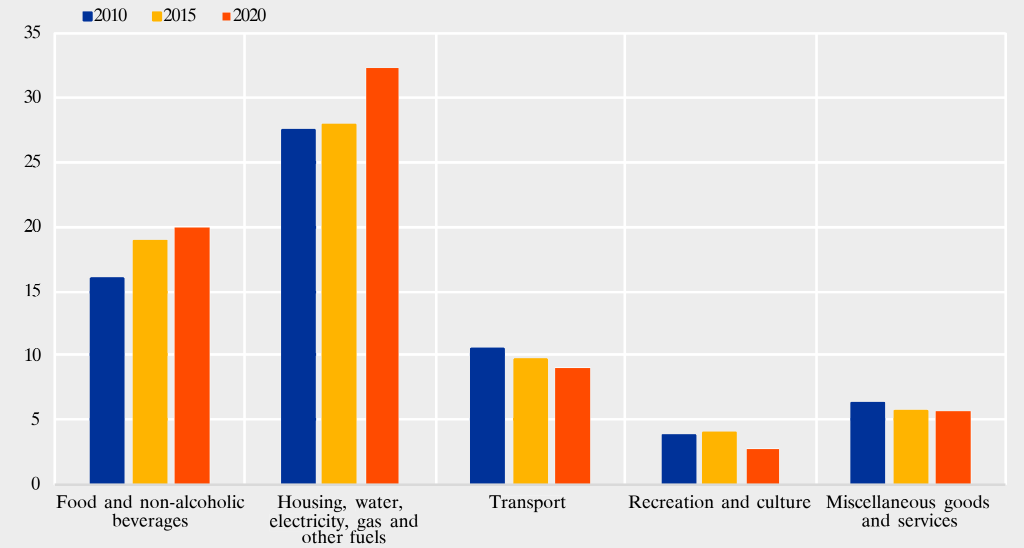
Moreover, as expenditure on energy goods is particularly relevant for our analysis, we explored the extent to which expenditure on electricity, gas and other fuels has changed by income quintile across the three more recent HBS waves.

Chart 3 shows that the share of expenditure on energy goods in Greece has increased for all income quintiles since 2010, the increase ranging from 1.7 percentage points (pps) for the top income quintile to 2.7 pps for the bottom. Across all waves, households with lower income spend a larger portion of their budget on energy compared to higher incomes.

Overall, there are changes in household expenditure patterns since 2010, but of relatively small magnitude. We may hence have some degree of confidence that the use of the 2010 HBS data to approximate current household

Chart 2 Share of top five COICOP categories in total consumption expenditure (2010-2020)

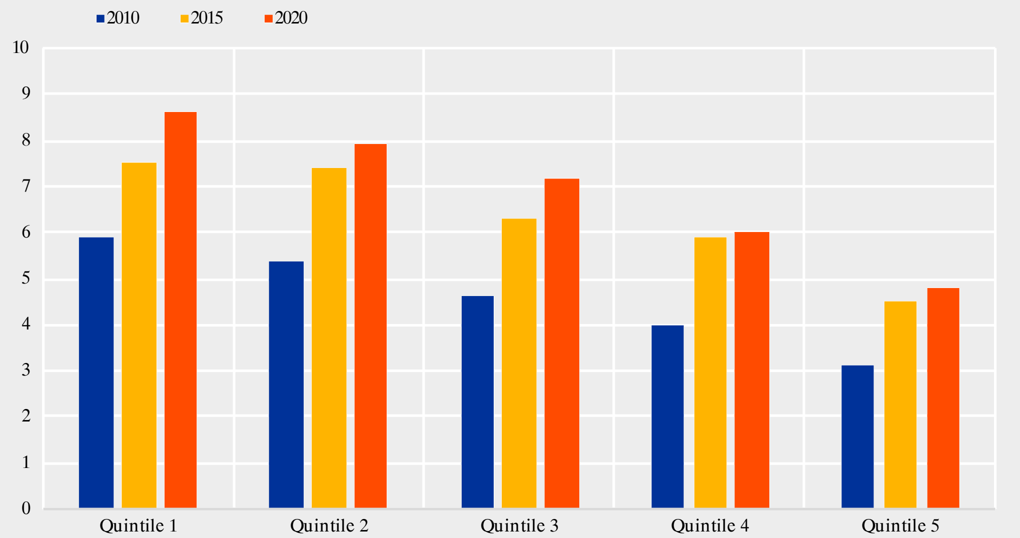
(%)



Source: Author's own calculations based on Eurostat's 2010, 2015 and 2020 HBS waves.

Chart 3 Share of expenditure on electricity, gas and other fuels in total consumption expenditure of each quintile (2010-2020)

(%)



Source: Author's own calculations based on Eurostat's 2010, 2015 and 2020 HBS waves.

consumption preferences and assess the impact of price measures in 2022 should not significantly bias results.

Counterfactual analysis

Inflation compensation measures (ICMs) on both the income and the price side are assessed by means of counterfactual analysis, building on two extended functionalities of EUROMOD.

First, we employ the *Policy Effects Tool (PET)* in order to isolate the impact of income ICMs from other factors driving household disposable income changes in 2022.

The PET tool isolates policy effects from other changes in the income distribution by assessing household disposable incomes under the actual system and a counterfactual system, keeping household characteristics and market incomes constant. Furthermore, to adjust for changes in nominal income levels over time, the monetary parameters of the tax-benefit system are adjusted with a factor α, which reflects benchmark indexation. There are two predefined choices for benchmark indexation: $\alpha = 1$ (custom), in which case the effect of policy changes is calculated simply in nominal terms; and $\alpha =$ CPI, in which case the effect of policy changes is calculated in real terms on the basis of Eurostat's Harmonised Index of Consumer Prices (HICP) along with other series of uprating indices.

Formally, let $d_t(p_t, y_t)$ denote the function calculating at time t household disposable income on the basis of household market income y and monetary parameters p reflecting the structure of the tax-benefit system (e.g. tax rates, benefit eligibility rules). Then, policy effects from $t=2021$ to $t=2022$, PE_{2022}, are calculated as follows:

$$PE_{2022} = \frac{1}{\alpha} * d_{2022}(p_{2022}, \alpha y_{2021}) - d_{2021}(p_{2021}, y_{2021})$$

Technically, instead of scaling monetary policy parameters, the tool scales monetary input variables (market incomes, expenditure and assets) with the factor α and monetary output variables with the factor $1/\alpha$.

Using the PET tool, we employ a novel methodology in order to break down the total change in household disposable income from 2021 to 2022 into three components:

(a) the nominal adjustment of income, that is how disposable income grows on account of "market income" growth, i.e. due to wage growth and pension revaluation. This is effectively what explains the change in household disposable income once policy effects have been accounted for. Using the above notational convention, this is estimated in nominal terms (α=1) as:

$$d_{2022}(p_{2022}, y_{2022}) - d_{2021}(p_{2021}, y_{2021}) - PE_{2022}$$

(b) gains arising from income support ICMs estimated as:

$$PE_{2022} - PE^{C}_{2022}$$

where PE^{C}_{2022} stands for policy effects in a counterfactual 2022 tax and benefit system, with no income ICMs.

(c) the impact of other income support measures, estimated as PE^{C}_{2022}.

Second, we used another extended functionality of EUROMOD, the *ITT extension*, to account for price measures such as price caps, price subsidies and discounts, and VAT reductions. Using the ITT extension, we simulate household spending under the 2021 and 2022 actual systems, i.e. the 2021 baseline, which considers household expenditure in 2021 (exp_{2021}) given the direct and indirect tax and benefit rules in place at that time, and the 2022 reform system, which considers household expenditure in 2022 (exp_{2022}) given the actual inflation increase and the discretionary price measures introduced by the government. Given our assumption of full pass-through, comparing household spending across these two systems gives us an estimate of the effective rates of inflation ($\pi = \frac{exp_{2022} - exp_{2021}}{exp_{2021}}$) experienced by households across the income distribution. In addition, we simulate a counterfactual 2022 scenario, where we assume that the discretionary price measures introduced by the government were not implemented. Comparing household spending under the counterfactual 2022 (exp^{c}_{2022}) and the baseline 2021 systems gives us the effective rates of inflation that households would have experienced if the price mitigation measures had not been in place $\pi^c = \frac{exp^c_{2022} - exp_{2021}}{exp_{2021}}$.

4 EMPIRICAL RESULTS

In the light of the above, empirical results are presented from two complementary points of view. First, we look at the impact of the inflationary shock and the associated policy response on real disposable income, or household purchasing power. Second, we focus on household expenditure to measure the impact on household consumption welfare.

We start by comparing changes in total nominal disposable income and consumer inflation by income decile (see Chart 4). This gives a general overview of the effects of the shock and policy interventions, since inflation erodes the real value of both consumption expenditure and savings.

Government price measures have significantly reduced consumer price inflation across the income spectrum, as estimated actual inflation was around 37% lower than in the counterfactual scenario. Moreover, price ICMs have effectively overcompensated for the inflation gap between poorer and richer households,[10] as in the counterfactual scenario inflation would have been higher (by around 2.4 pps) for the poorest than for the richest households, whereas it is estimated that following the policy response the top income decile in fact faces a marginally higher inflation rate than the bottom decile (by 0.3 pps).

This is because, while lower-income households are more strongly affected by energy and food inflation, they also profit to a larger extent from price measures in relative terms. Following the government price measures, the actual inflation rate across households is simulated to be widely equalised, even though price measures are not exclusively targeted at lower-income households, which nonetheless benefit marginally more than their richer counterparts.

Disposable income increased by 2% on average in 2022, only partly compensating for higher consumer prices.[11] Disposable income growth is inversely related to income, ranging from 1.4% for the ninth income decile to 4.8% for the bottom income decile. This pattern stems from the evolution of income growth as the combined result of income ICMs, nominal uprating and other government measures affecting household disposable income.

In particular, given that income support measures in response to the crisis predominantly targeted lower-income households that are more vulnerable to inflation, they are progressive in nature, increasing by 4.1% the income of households in the bottom decile, where they contributed almost the entirety (87%) of the overall growth in nominal disposable income. This contribution gradually drops as we move to higher income brackets, reaching about 0.03% for the top decile. Therefore, income ICMs appear to mitigate inflation-induced income inequality and the disproportionate impact on the purchasing power of lower-income households.

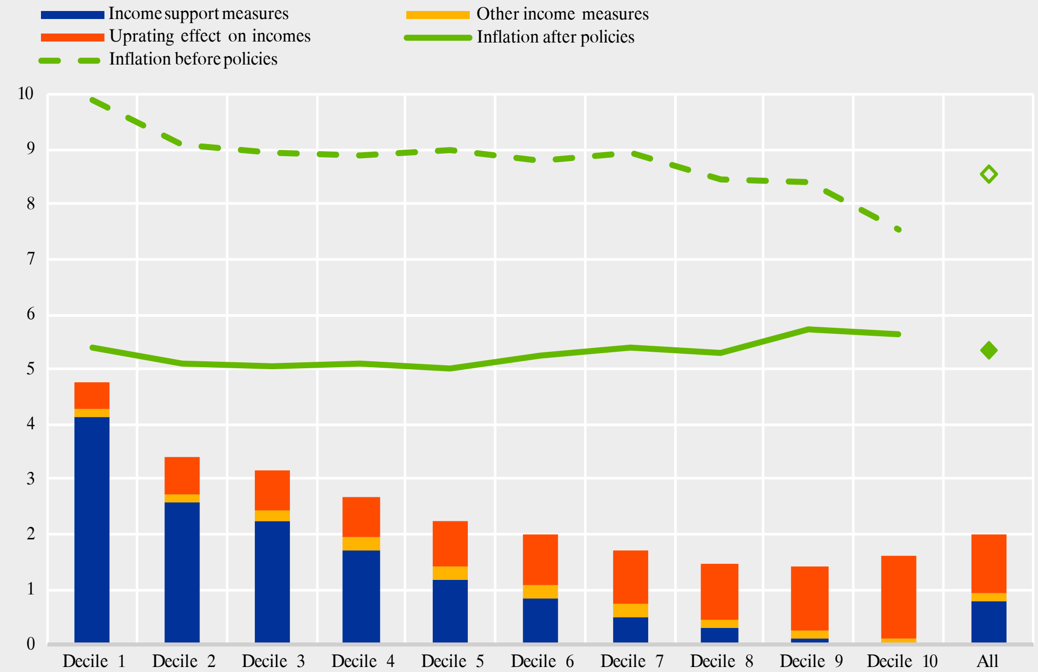
Income from employment often contributes less to the disposable income of poorer households than unemployment or other social benefits. This is what explains the increasing contribution, along the income distribution, of market income uprating to disposable income growth. Furthermore, increases in nominal earnings lead to the so-called "bracket creep", resulting in higher tax rates if tax brackets are

10 The so-called inflation gap refers to the higher inflation faced by poorer households relative to their richer peers. Price increases for energy and – to an even greater extent – food will increase the subjective inflation rate of poorer households more than that of richer households, as these goods account for a larger share of their consumption. At the same time, energy price hikes also strongly affect transportation and discretionary spending (recreation, culture, restaurants and hotels), which have a stronger weight in the consumption baskets of high-income households. See Bobasu et al. (2023) and Battistini et al. (2022).

11 See Bank of Greece (2023), *Annual Report 2022*, Chapter IV, section 5.1.

Chart 4 Distribution of disposable income growth and consumer inflation (2021-2022)

(percentage change in equivalised disposable household income and estimated inflation by decile)



Source: Author's own calculations based on EUROMOD and ITT extension simulations, using EU-SILC and HBS data.
Notes: The bars in the chart show nominal disposable income growth by decile, with the bottom part of the bar, shaded dark blue, showing the contribution of government inflation-related income measures to income growth. The solid line shows the change in decile-specific household consumer expenditure $(exp_{2022}-exp_{2021})/exp_{2021}$, interpreted as consumer inflation. The dashed line shows the inflation rate in a counterfactual scenario without the government price measures, approximated by $(exp_{2022}^{C}-exp_{2021})/exp_{2021}$. Equivalised disposable income is computed by dividing the household's disposable income by the OECD modified equivalence scale, which assigns a weight of one to the first adult of the household and a weight of 0.5 (0.3) to each additional household member over (under) the age of 14.

not adjusted, especially so for lower income groups.[12]

At the same time, government income policies not explicitly linked to the inflation surge – predominantly reduced social security contributions and higher unemployment benefits as a result of the increase in the minimum wage – had a relatively small and equal impact across income groups.

Our second approach jointly evaluates price and income changes by measuring the variation in expenditure – net of any income increase – needed for households to retain their level of consumption welfare, i.e. how much extra money households would need at the inflated prices to afford the same basket of goods as in the baseline scenario.

Accordingly, our results are depicted in Chart 5, which combines the effects of inflation, income growth and government policies on households' welfare across income deciles. This chart may be interpreted as showing the changes in household welfare measured as "compensating variation", assuming a Leontief utility function (i.e. how much money a household would need to spend so as to maintain a given level of utility).

The green negative bars in Chart 5 show the impact of the inflationary shock on the decile-specific consumption basket, had there been no

12 The magnitude of the bracket creep effect depends on the difference between an individual's effective marginal and average tax rates. Households in the lower half of the income distribution face particularly strong tax progression, with low effective average tax rates but often very high effective marginal tax rates due to a phasing out of transfers.

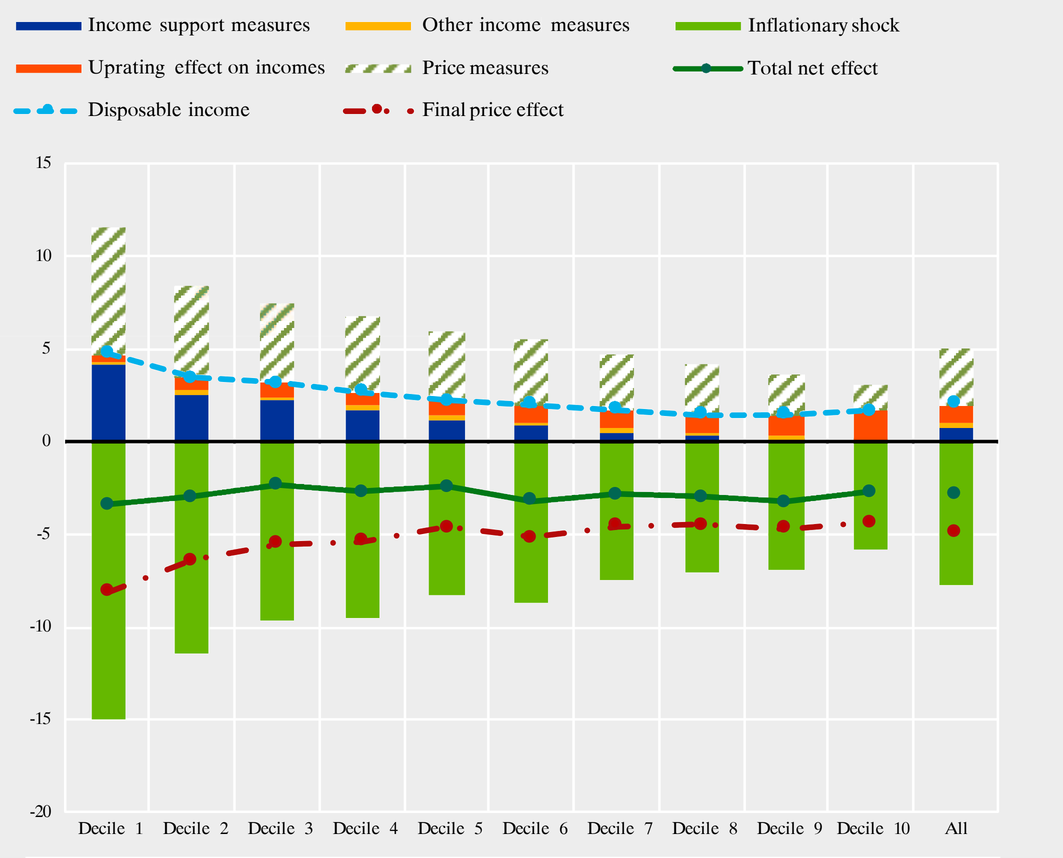
price ICMs, approximated by the increase in household expenditure as a share of household disposable income ($\frac{exp^{c}_{2022} - exp_{2021}}{d_{2021}}$). Since disposable income and expenditure are generally not equal, the impact of a consumer price shock on disposable income does not necessarily coincide with the inflation rate ($\frac{exp^{c}_{2022} - exp_{2021}}{exp_{2021}}$). In particular, since households in the lower income deciles spend more than they earn (implying negative savings), the impact of the increase in expenditure relative to disposable income in the bottom four deciles is larger than the estimated inflation rate.

Positive bars show the positive impact on household purchasing power of (i) market income growth (red bars), (ii) government measures unrelated to the inflationary shock (yellow bars), (iii) income ICMs (blue bars), and (iv) ICMs on the price side (striped green bars). The total net effect (dark green line) is obtained by deducting the final price effect (red dashed line) from the total positive impact of market income growth and government measures (blue dashed line).

As can be seen from Chart 5, ICMs compensated for welfare losses across the income distribution. At the same time, they narrowed down the welfare gap between the poor and the rich: the negative impact of the inflationary shock as a percentage of 2021 household disposable

Chart 5 Price and income effects based on household welfare

(% change as a portion of 2021 equivalised household disposable income, by decile)



Source: Author's own calculations based on EUROMOD and ITT extension simulations, using EU-SILC and HBS data.
Note: Equivalised disposable income is computed by dividing the household's disposable income by the OECD modified equivalence scale, which assigns a weight of one to the first adult of the household and a weight of 0.5 (0.3) to each additional household member over (under) the age of 14.

income, ranged from -3.4% in the bottom decile to -2.7% in the top decile, implying a welfare gap of 0.7 pps. Inflation, if left unaddressed, would disproportionately burden the poor, raising expenditure by as much as 15% for the bottom decile against only 5.8% for the top decile.

As already mentioned, income ICMs increase households' disposable income in a progressive manner, their positive contribution falling with income. Overall, their positive contribution is 0.8% but as high as 4.1% for the lowest income decile.

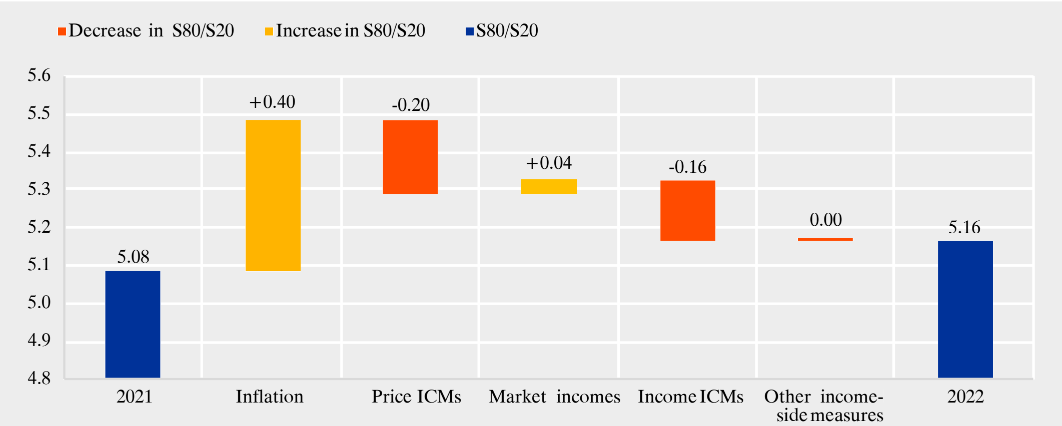
Price ICMs had a dominant effect vis-à-vis income ICMs across all income deciles. Moreover, as already mentioned, they have a progressive character, in that they benefit lower-income households more than their richer counterparts. In fact, it is worth noting that price measures compensated for about half the purchasing power loss in the first income decile, while income measures played a much smaller role. The progressive footprint of price ICMs in Greece is largely due to the design of the electricity subsidy (see Table A3 in the Appendix).

Overall, we may conclude that the adverse distributional impact of the inflationary shock in 2022 was largely offset by government policies, with a welfare loss of only 2.9% remaining for the population as a whole.

The above findings are also reflected in the breakdown of the change in the S80/S20 inequality index (see Chart 6), where we can see that ICMs have made a significant contribution to limiting the inequality-increasing pressures created by the 2022 inflationary shock in Greece. Chart 6 breaks down changes in the quintile share ratio (S80-S20), namely the real disposable income of the top 20% of the income distribution as a share of that of the bottom 20%, calculated on the basis of the welfare measure introduced earlier. In total, our measure of inequality is estimated to have increased by 1.6%. Inflation increased inequality by around 7.9%. Market income growth also had an adverse, yet much milder, inequality impact, increasing the S80/S20 index by 0.8%. Government ICMs on the income and the price side have jointly reduced the S80-S20 ratio by around 7.0%, almost offsetting the inequality footprint of the inflationary shock. Other income side measures, such as reduced social security contributions and higher unemployment benefits, were relatively neutral in reducing inequality.

Chart 6 Breakdown of changes in inequality in Greece (2021-2022)

(changes in the S80/S20 ratio)



Source: Author's own calculations based on EUROMOD and ITT extension simulations, using EU-SILC and HBS data.

Overall, Greece is estimated to have achieved one of the highest inequality reductions amongst its European peers[13] thanks to its rather progressive ICM profile, arising not only from the targeted income measures, but also from the progressive nature of the electricity subsidy paid to households.

The finding that income and price ICMs have both reduced inequality does not mean that they were equally efficient. Given that income measures are typically more targeted at lower-income households, they are generally more efficient at reducing inequality than price measures. Price measures are predominantly untargeted, in that they dampen price increases for all consumers, thus incurring higher fiscal costs compared with their income counterparts.

In particular with regard to Greek ICMs in 2022, it was estimated that an extra 1% of GDP spent on income ICMs increased the adjusted disposable income of the bottom income quintile by four times as much as the same amount spent on price ICMs. This pattern was in fact representative of the euro area.

Additionally, it is not fully clear whether price ICMs achieve their intended objective of containing prices, since the majority are dependent on firms deciding to perfectly pass through the government support to consumer prices. They are, for this reason as well, a relatively inefficient instrument to support the most vulnerable.

Nonetheless, the efficiency of targeted income measures may be undermined in the presence of extensive tax evasion, in which case households underreport their income to the tax authorities so as to be eligible for income support. This caveat is particularly relevant for Greece, yet we need to acknowledge the recent legislative initiatives aiming to contain tax evasion including, among other things, an imputed floor for the taxation of self-employment income and the payment of benefits via a prepaid card. With regard to the latter, beneficiaries should use at least 50% of their allowance in electronic payments and purchases, while the remaining amount may be withdrawn in cash. Incentives are also provided for anyone who chooses not to withdraw the balance, but instead use it in electronic transactions, along the lines of the tax lotteries currently being carried out by the Ministry of Finance.

5 CONCLUDING REMARKS

In 2022, Greece implemented substantial fiscal interventions (amounting to 5.0% of GDP, with a budgetary impact of 2.2% of GDP) to cushion the adverse effects of inflation on the economy and mitigate its adverse distributional impact.

Our analysis makes use of the EUROMOD microsimulation model and its extended functionalities, namely the ITT and PET tools, to assess how inflation and a subset of the above fiscal measures, in particular those targeting households, affected households' purchasing power and welfare across the income distribution.

EUROMOD is a static model, hence it does not account for households' reactions to changes in prices and assumes full pass-through by firms of any increase in production cost or government subsidy. Its scope is limited to government measures directly targeting households. As such, any indirect impact on households arising from government support directed to firms is not assessed.

Given the above, our results confirm earlier empirical findings showing that the purchasing power of lower-income households was more severely affected by the 2022 inflation surge than that of high-income households. The so-called "inflation gap" between the bottom and top income deciles is estimated at 2.4 pps and is mainly attributed to the high share of food

13 See Amores et al (2023).

and energy goods in the consumption basket of low-income households.

The unequal impact of inflation was further magnified by the high shares of consumption in the income of the poorer. Welfare losses, measured as the increase in expenditure as a share of the income required to afford the 2021 basket of goods and services, were as large as 15% for the bottom income decile compared with 5.8% for the top income decile.

Fiscal measures significantly contributed to closing the inflation gap and mitigating the welfare differential.

Price measures (totalling around 3.5 EUR billion) were dominant vis-à-vis their income counterparts in compensating for welfares losses across the income distribution but, perhaps most interestingly, they had a significant progressive impact. Price measures have not only lowered inflation by 37%, but also they have effectively overcompensated for the inflation gap between poorer and richer households, the top income decile facing a higher (by 0.3 pps) inflation rate than the bottom decile. Moreover, they effectively compensated for about half of the welfare loss implied by inflation for the bottom decile, lowering the welfare gap between the bottom and top income deciles to 3.8 pps. These results are largely driven by the progressive character of the electricity subsidy, as the support provided was inversely related to consumption.

Income support measures, totalling around EUR 1 billion, included one-off transfers to vulnerable population groups, increases in the heating allowance and supplements to means-tested benefits. They accounted for 39% of the estimated 2% increase in household disposable income in 2022, which still fell short of the estimated inflation rate. As they targeted low-income groups by design, they were progressive in nature. The income support package effectively mitigated the inflation-induced income inequality, increasing by 4.1% the income of households in the bottom decile, where it contributed almost the entirety (87%) of the overall growth in nominal disposable income. Its contribution gradually dropped towards higher income brackets, reaching about 0.03% for the top decile.

The inequality-reducing impact of price and income ICMs is also reflected in our breakdown of changes in the S80/S20 inequality index in 2021-22. In total, the S80/S20 index is estimated to have increased by 1.6% in 2022. Government ICMs on the income and price sides have reduced the S80/S20 ratio by 3.2% and 3.9%, respectively, largely offsetting the inequality footprint of the inflation and market income growth.

Our analysis reveals a multifaceted picture when looking at the cost efficiency of different types of measures. Fiscal interventions involving price measures, which are not as well-targeted to low-income households as income support measures, imply a high fiscal burden. In particular, it was estimated that given the same amount of expenditure, income measures achieved a quadruple increase in the household disposable income of the bottom decile compared to price measures.

Nonetheless, the relative efficiency of income measures may be severely undermined in the presence of extensive tax evasion, which points not only to the need for a careful design of targeted measures, but also to complementarities with structural reforms fighting tax evasion.

Overall, the policy mix in the fiscal support package should address both efficiency and effectiveness concerns. In parallel, despite its estimated progressive distributional impact, energy-related income support should remain targeted and temporary, should be financed by using the available fiscal space and should be accompanied by energy-saving actions and incentives to reduce energy consumption.

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APPENDIX

Table A1 Breakdown of revenues of the Energy Transition Fund

(EUR millions)

	2021	2022	2023	2024
Total revenues	749	5,782	2,592	1,205
Revenues from windfall profits mechanism (Law 4951/2022, Article 122) – Renewables	0	1,783	555	0
Revenues from renewables (RES special account surplus until June 2022)	0	1,100	0	0
Revenues from CO_2 Emissions Trading System	749	1,026	1,115	1,142
Revenues from public utility services	0	400	60	0
Revenues from levy on producers for the period Oct. 2021-June 2022 (windfall profits)	0	367	-30	0
Revenues from windfall profits mechanism (Law 4951/2022, Article 122) – Lignite, Hydro & Natural Gas	0	1,106	133	0
Revenues from 10-euro levy on natural gas used for electricity production	0	0	128	63
Revenues from solidarity contribution on refineries (in 8 installments, July 2023-February 2024)	0	0	630	0

Table A2 Inflation Compensation Measures (ICMs) in Greece in 2022

(EUR millions)

	Official	Simulated
A. Price Measures	**8,867**	
Refund of Special Diesel Consumption Tax to farmers	76	65
Reduction of VAT on animal feed from 13% to 6%	15	12
Reduction of VAT on agricultural fertilisers from 13% to 6%	15	33
Subsidy for household electricity consumption (funded by ETF revenues)	3,187	
Refund of 60% of the increase in electricity costs for the primary residence of households with an income of up to EUR 45,000 (Power pass)	296	3,441
Subsidy to businesses for electricity consumption (funded by ETF revenues)*	4,171	
Subsidy to households for natural gas consumption (not including DEPA subsidies; funded by ETF revenues)	94	55
Subsidy to businesses for natural gas consumption (funded by ETF revenues)*	246	
Subsidy amounting to 80% of the increase in the cost of agricultural electricity for the period Aug.-Dec. 2021 (funded by ETF revenues)*	33	
Subsidy to farmers for the increased cost of animal feed	50	
Inclusion of animal feed transport in Crete in the Transport Equivalent scheme	8	
Increase in the subsidy for the transport of animal feed to small Aegean islands	4	
Prepaid card for the purchase of motor fuel by households (Fuel Pass)	300	447
Diesel subsidy (12 cents per litre)	217	251
Subsidy to taxi drivers amounting to EUR 200 in April due to increased fuel prices	5	
Farmers' subsidy for the increased cost of fertilisers	60	
Heating oil subsidy (20 cents per litre)	90	93
B. Income Measures	**991**	
Increase in the heating allowance and incentives for replacing natural gas with other forms of fuel	189	3
Support of EUR 200 in April 2022 and EUR 250 in December 2022 to pensioners with a monthly income of up to EUR 600 and EUR 800, respectively	367	280
Support of EUR 200 in April 2022 and EUR 250 in December 2022 to 35,000 uninsured senior citizens receiving OPEKA benefits	15	40
Support of EUR 200 in April 2022 and EUR 250 in December 2022 to 172,000 beneficiaries of disability benefits	65	
Double amount of the minimum guaranteed income paid to 225,000 beneficiaries in April 2022 and December 2022	94	14
OPEKA child benefit payments to 800,000 beneficiaries increased by one and a half in April 2022 and December 2022	243	222
Support of EUR 250 in December 2022 to 100,000 long-term unemployed	18	52
C. Other Measures		
Additional cost of general government operators for electricity and fuel	523	
D. Total ICMs	**10,378**	
with a budgetary impact	4,596	
affecting households	5,405	
simulated	5,341	5,008

* Measures targeting enterprises.

Table A3 Subsidy to households for electricity consumption in 2022

Month	Consumption	Subsidy (in EUR) per MWh
January	0-150 KWh	160
	151-300 KWh	120
February-March	0-150 KWh	150
	151-300 KWh	110
April	0-150 KWh	270
	151-300 KWh	210
May	0-150 KWh	205
	151-300 KWh	160
	300 KWh +	100
June	0-150 KWh	185
	151-300 KWh	140
	300 KWh +	100
July	0+ KWh	200
August	0+ KWh	337
September	0+ KWh	639
October	0-500 KWh	436
	501-1000 KWh	386/436*
	1000 KWh +	336/386*
November	0-500 KWh	238
	501-1000 KWh	188/238*
	1000 KWh +	98/148*
December	0-500 KWh	221
	501-1000 KWh	171/221*
	1000 KWh +	81/131*

* An increased rate applies if electricity consumption is down by at least 15% relative to the previous year.

Table A4 Income uprating 2021-22

(1)+(2)-(3)-(4)	Disposable income	Uprating
(1)	**Original income**	
+	Earnings	
	Employment: civil servants	Wages and salaries per employee; national accounts data
	Employment: public enterprises	Wages and salaries per employee; national accounts data
	Employment: private sector	Wages and salaries per employee; national accounts data
	Self-employment	Wages and salaries per person employed and gross value added by sector; national accounts data
+	Income of children under 16	Wages and salaries per employee; national accounts data
+	Income from rent	0.75 * CPI
+	Private pension	CPI
+	Investment income	Based on housing costs
+	Private transfers received	Wages and salaries per employee; national accounts data
–	Alimony payments	GDP deflator
–	Other maintenance payments	GDP deflator
(2)	**Benefits**	
(2a)	**Pensions**	
+	Main old age pension	Frozen up to 2022
+	Supplementary old age pension	Frozen up to 2022
+	Minor old age pensions	Frozen up to 2022
+	Orphan's pensions	Frozen up to 2022
+	Survivors' pensions	Frozen up to 2022
+	Disability pensions	Frozen up to 2022
(2b)	**Means-tested benefits**	
+	Heating allowance	As announced by government
+	Minor social assistance benefits	Frozen
+	Housing benefits	Based on Social Housing Organisation (OEK) subsidy rates
+	Child benefit, long-term unemployment benefit, birth grant, lump-sum benefit for low-paid pensioners, guaranteed minimum income, housing allowance	Simulated
(2c)	**Non-means-tested benefits**	
+	Non-contributory disability benefits	Based on the severe disability benefit
+	Education allowances for students	Based on the scholarships provided by the State Scholarship Foundation (IKY)
+	Minor family benefits	Frozen
+	Sickness benefits	Wages and salaries per employee; national accounts data
+	Minor unemployment benefits	On the basis of unemployment assistance to the long-term unemployed
+	Maternity benefits	Wages and salaries per employee; national accounts data
+	Unemployment insurance benefit, maternity benefit, parental benefit, lump sum support to vulnerable population groups	Simulated
(3)	**Taxes**	Simulated
(4)	**Social insurance contributions**	Simulated

INTEREST RATE PASS-THROUGH TO DEPOSIT RATES IN GREECE

Evangelia A. Georgiou
Bank of Greece, Economic Analysis and Research Department

ABSTRACT

Deposits of firms and households are the main source of bank funding and, thus, interest rates on deposits have a significant impact on banks' overall funding costs and loan supply, as well as on bank profitability. Since July 2022, when the latest cycle of increases in key ECB interest rates started, deposit rate increases have been rather limited in Greece and the euro area, compared to the corresponding rise in the policy rates, and weaker relative to the previous tightening cycle of 2005-2008.

This article examines the pass-through of ECB policy rate increases to the interest rates on household and corporate deposits in Greece in the light of the fundamental policy and structural changes that have occurred in the Greek banking system since the financial and sovereign debt crisis, as well as due to the pandemic crisis. The empirical results show the relative stickiness of deposit rates for households, compared to those for corporations, especially for term deposits. During the current tightening cycle, overnight deposit rates show a very limited rise – almost zero in the case of households; this development could have been underpinned by the composition of the deposit base of Greek banks, mainly consisting of low-balance household deposits, which are not very sensitive to interest rate changes. Broadly speaking, factors such as the increased supply of deposits to banks, relative to bank lending to the economy, and imperfect competition in the banking system appear to account for a weaker pass-through of policy rate increases to deposit rates. However, overall, we do not find strong evidence that excess liquidity in the banking system has contributed to a weaker pass-through to deposit rates in Greece, which could be related to the fact that the terms and conditions of unconventional monetary policy tools were often adjusted to support the monetary policy stance.

Keywords: monetary policy transmission; deposit rates; loan-to-deposit ratio; bank competition; excess liquidity

JEL classification: E32; E43; E52

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Η ΜΕΤΑΔΟΣΗ ΤΩΝ ΜΕΤΑΒΟΛΩΝ ΤΩΝ ΕΠΙΤΟΚΙΩΝ ΠΟΛΙΤΙΚΗΣ ΣΤΑ ΕΠΙΤΟΚΙΑ ΚΑΤΑΘΕΣΕΩΝ ΣΤΗΝ ΕΛΛΑΔΑ

Ευαγγελία Γεωργίου
Τράπεζα της Ελλάδος, Διεύθυνση Οικονομικής Ανάλυσης και Μελετών

ΠΕΡΙΛΗΨΗ

Οι καταθέσεις των νοικοκυριών και των επιχειρήσεων αντιπροσωπεύουν την κυριότερη πηγή ρευστότητας των τραπεζών και συνεπώς τα επιτόκια των καταθέσεων επηρεάζουν σημαντικά το συνολικό κόστος άντλησης χρηματοδότησης των τραπεζών και την προσφορά δανείων, καθώς και την κερδοφορία τους. Από τον Ιούλιο του 2022, οπότε ξεκίνησε ο τελευταίος κύκλος αυξήσεων των βασικών επιτοκίων της ΕΚΤ, η άνοδος των επιτοκίων καταθέσεων στην Ελλάδα αλλά και στη ζώνη του ευρώ είναι περιορισμένη συγκριτικά με το συνολικό μέγεθος της αύξησης των επιτοκίων πολιτικής και ασθενέστερη σε σχέση με τον προηγούμενο ανοδικό κύκλο των επιτοκίων της περιόδου 2005-2008.

Στο παρόν άρθρο εξετάζεται ο βαθμός μετάδοσης των αυξήσεων των επιτοκίων πολιτικής στα επιτόκια των καταθέσεων των νοικοκυριών και των επιχειρήσεων στην Ελλάδα υπό το πρίσμα των σημαντικών αλλαγών στη διάρθρωση του τραπεζικού συστήματος και στην άσκηση πολιτικής που έλαβαν χώρα ως συνέπεια της χρηματοπιστωτικής κρίσης και της κρίσης χρέους αλλά και λόγω της πανδημίας. Τα εμπειρικά αποτελέσματα επιβεβαιώνουν τη μεγαλύτερη αδράνεια των επιτοκίων καταθέσεων για τα νοικοκυριά σε σχέση με τις επιχειρήσεις, ιδίως στην περίπτωση των προθεσμιακών καταθέσεων. Κατά τον τρέχοντα ανοδικό κύκλο τα επιτόκια καταθέσεων μίας ημέρας (απλού ταμιευτηρίου, τρεχούμενοι λογαριασμοί κ.λπ.) εμφανίζουν πολύ περιορισμένη —μηδενική στην περίπτωση των νοικοκυριών— αύξηση, εξέλιξη που υποβοηθείται από τη σύνθεση της καταθετικής βάσης των ελληνικών τραπεζών κυρίως από καταθέσεις νοικοκυριών χαμηλού ύψους, οι οποίες δεν είναι ιδιαίτερα ευαίσθητες σε μεταβολές των επιτοκίων. Γενικότερα, παράγοντες όπως η αυξημένη διαθεσιμότητα καταθέσεων σε σχέση με το δανεισμό της οικονομίας και ο ατελής ανταγωνισμός στο τραπεζικό σύστημα εκτιμάται ότι επιδρούν ανασταλτικά στο βαθμό μετάδοσης των μεταβολών των επιτοκίων πολιτικής στα επιτόκια καταθέσεων. Ωστόσο, δεν προκύπτουν ισχυρές ενδείξεις ότι η υπερβάλλουσα ρευστότητα στο τραπεζικό σύστημα ως απόρροια των μη συμβατικών μέτρων νομισματικής πολιτικής συνδέεται εν γένει με ασθενέστερη μετάδοση στα επιτόκια καταθέσεων, πιθανόν διότι τα επιτόκια και οι όροι των εν λόγω μέτρων πολιτικής προσαρμόζονταν συχνά ώστε να είναι συμβατά με την κατεύθυνση της νομισματικής πολιτικής.

INTEREST RATE PASS-THROUGH TO DEPOSIT RATES IN GREECE*

Evangelia A. Georgiou
Bank of Greece, Economic Analysis and Research Department

1 INTRODUCTION

The scale and speed of the current monetary policy tightening has been unprecedented since the inception of the monetary union. Faced with a historic surge in inflation, the Eurosystem has increased key ECB interest rates by 450 basis points (bps) since July 2022. Following a holistic approach, it has also adjusted the terms of the targeted longer-term refinancing operations (TLTROs) offered to banks, while proceeding with the contraction of its balance sheet to align it with the restrictive stance of monetary policy.

This policy tightening aimed to affect financing conditions in the euro area, in order to bring demand into line with supply and keep inflation expectations anchored at the Eurosystem inflation target (Lagarde 2022). Assessing the strength of transmission of policy rate adjustments to bank interest rates is of key importance to ensure that policy-induced changes are sufficiently transmitted to the economy and inflationary forces will be curbed effectively. In this transmission process, deposit rates play a central role, as they represent a basic component of banks' funding costs and thus constitute an important determinant of banks' net interest rate margin and profitability.

Monetary policy transmission to the real economy takes place through various transmission channels (interest rates, asset prices, bank lending, risk-taking or the exchange rate). Through the interest rate channel, changes in policy rates affect the short-term money market rates, which in turn influence longer-term rates across the risk-free and sovereign yield curves, thus directly affecting overall financing conditions for the economy. Higher interest rates provide incentives for economic agents to save more today and postpone consumption or investment for the future, thereby exerting a negative impact on current demand and inflation. The bank lending channel refers to the impact of policy changes on the supply of bank loans to the economy, mainly by affecting banks' funding costs and capacity to raise funding from various sources. Bank funding costs arising from the issuance of bank bonds or from borrowing in the interbank market closely follow market rates and directly affect the marginal funding cost of banks. In contrast, funding costs from retail deposits adjust slowly, acting to contain total funding costs during periods of policy tightening (Lane 2022).

The theoretical and empirical literature has identified several factors that drive bank interest rates and spreads and which may affect the transmission of monetary policy (Brissimis and Vlassopoulos 2007). In general, these factors could be broadly classified into the following categories: First, factors related to demand and the macroeconomic environment (such as real GDP growth rate, disposable income, inflation); for example, high income growth could be associated with a higher supply of savings, which may exert downward pressures on deposit rates. Second, factors related to bank-specific characteristics (e.g. operating costs, liquidity and capital adequacy, asset and liability structure). Financial fragmentation recorded during the financial and sovereign debt crisis in the euro area further emphasised the importance of bank characteristics and balance sheet structures in the transmission of monetary policy (Holton and Rodriguez d'Acri 2018; Illes et al. 2019). Third, factors related to the structure of the banking system (e.g. concentration, bank size); according to the "structure-conduct performance" hypothesis, a high degree of concentration and market power of banks can be expected to lead to higher interest rate spreads if it is a manifes-

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

tation of non-competitive pricing behaviour of banks to take advantage of monopolistic profits. This is opposed to the "efficient structure" hypothesis, according to which a high degree of banking concentration could result in lower interest rate spreads due to the dominance of the more efficiently operating banks (Brissimis and Vlassopoulos 2007).

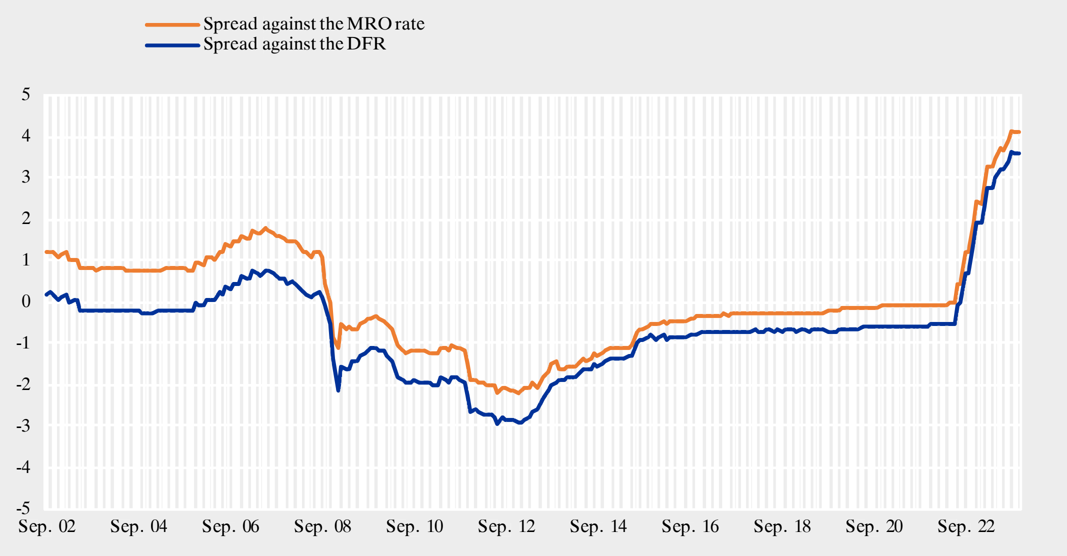
Monetary policy transmission is typically a dynamic process which entails various time lags. However, it has been noted that, in the current tightening cycle, deposit rate pass-through may have been more sluggish and incomplete in both the US and the euro area compared to the past (Byrne and Foster 2023; Messer and Niepmann 2023). For example, high levels of excess liquidity have been considered as a potential factor that may be constraining deposit rate pass-through, allowing banks to react less to the tightening of monetary policy. In this respect, we address two main questions: (1) Is there evidence that the pass-through in deposit rates in Greece is lower in this tightening round? (2) In light of the fundamental policy and structural changes that have occurred in the Greek banking system since the financial and sovereign debt crisis, what could be the main drivers of this development? Rather than providing an exhaustive answer to these questions, we aim to highlight some important aspects that could be relevant for the transmission of monetary policy.

2 IS THE CURRENT DEPOSIT RATE PASS-THROUGH WEAKER THAN BEFORE?

Chart 1 depicts the evolution of the spread between the ECB policy rate (on the main refinancing operations (MRO) or on the deposit facility (DFR)) and the average deposit rate for households in Greece during 2002-2023. At the peak of the sovereign debt crisis, this spread was deeply in negative territory, as deposit rates were kept elevated in an attempt to arrest significant deposit outflows from the banking system; in the following years, this spread gradually moved to zero, as funding constraints in the banking sector eased and policy rates gradually approached their effec-

Chart 1 Spread between the policy rate and the average deposit rate for households (September 2002-November 2023)

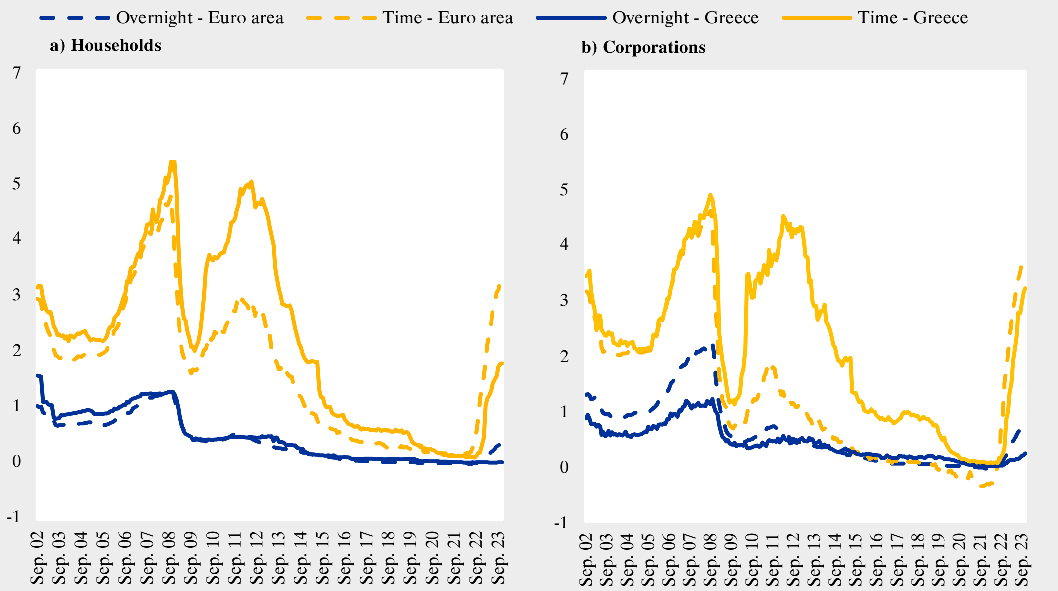
(percentage points)



Sources: ECB and Bank of Greece.

Chart 2 Interest rates on new deposits from households and corporations (Sep. 2002-Nov. 2023)

(%)



Sources: ECB and Bank of Greece.
Note: Time deposit rate refers to the interest rate on deposits with an agreed maturity of up to 1 year.

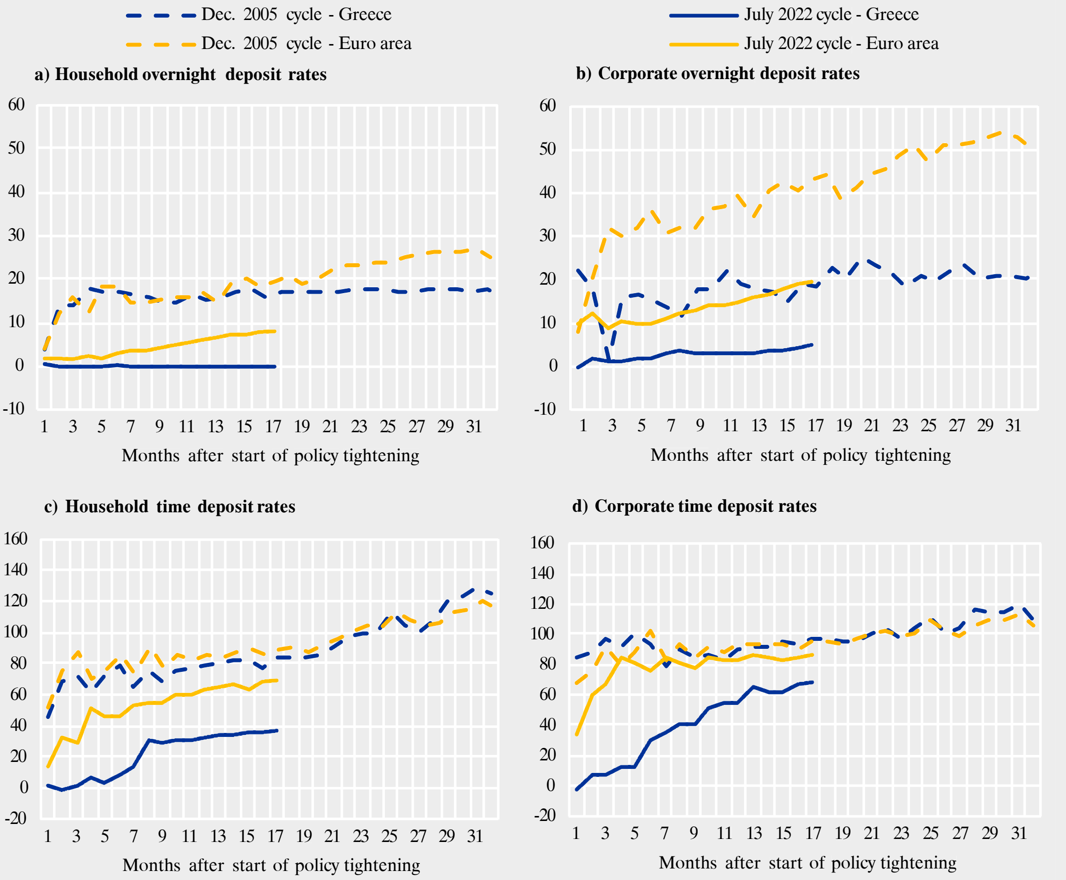
tive lower bound. In the current tightening episode, this spread rose steeply, reaching a historically high level of 413 bps (against the MRO rate) and 363 bps (against the DFR). According to Drechsler et al. (2017), this spread is representative of the opportunity cost of holding deposits instead of other saving opportunities (bonds).[1] It appears that, at the current juncture, the opportunity cost of holding bank deposits is high, and banks may encounter strong competition from other saving options which offer low risk and higher returns such as bonds, Treasury bills or mutual fund units.[2]

Chart 2 shows the evolution of bank interest rates on new overnight and time deposits[3] from firms and households in Greece and the euro area during 2002-2023. For most of this long period, these rates generally co-move, except for the years of the global financial and the sovereign debt crisis, when financial fragmentation in the euro area had been particularly intense and increases in time deposit rates in Greece significantly outpaced those in the euro area. During June 2014-June 2022, when the ECB policy rate (DFR) turned negative before reaching the effective lower bound, deposit rates gradually reached historically low, near-zero levels. Banks in Greece have been rather reluctant to charge negative deposits rates, but in the euro area interest rates on corporate deposits turned negative in 2019-2021, especially in the case of time deposits. As a result, spreads between time and overnight deposit rates shrank considerably, indicatively reaching their lowest levels in August 2022 (9 bps) in Greece and in June 2021 (13 bps) in the euro area. In the current monetary policy tightening cycle, this spread has widened again, but

1 Drechsler et al. (2017) provide a model in which households may hold either zero-paying cash or low-interest paying deposits for their liquidity characteristics; they can also invest in bonds which offer a competitive interest rate closer to the level set by the central bank. The central bank rate represents the cost of holding cash, and the difference between the central bank rate and the deposit rate (i.e. the deposit spread) equals the cost of holding deposits. When the central bank raises the policy rate, cash becomes more expensive to hold and this allows banks to increase the deposit spread without losing deposits to cash. Households respond by reducing deposit holdings, and deposits flow out of the banking system into bonds.
2 Broadly speaking, the availability of non-bank financing sources and non-bank saving options in the economy is closely linked to competitive pressures on banks.
3 In this article, time deposits refer to deposits with an agreed maturity of up to 1 year.

Chart 3 Deposit rate pass-through in the last two tightening cycles

(ratio of the cumulative change in each deposit rate category to the cumulative change in the ECB policy rate, %)



Sources: ECB and Bank of Greece.
Notes: Time deposit rate refers to the interest rate on deposits with an agreed maturity of up to 1 year. For the Dec. 2005 cycle, month 21 on the horizontal axis corresponds to the start of the 2007 global financial crisis.

deposit rate hikes in Greece seem to be less intense than in the euro area, especially in the case of overnight deposits or deposits from households.

Chart 3 presents the cumulative pass-through to deposit rates for households and non-financial corporations across the last two tightening cycles in Greece and the euro area. Comparisons are based on the ratio of the cumulative increase in the interest rate of each deposit category to the respective cumulative increase in the ECB policy rates, often referred to as "deposit beta".[4] Apart from the current tightening cycle, we turn to the previous one, which was initiated in December 2005 and lasted until July 2008. During the December 2005 cycle, time deposit rate increases followed a broadly similar pattern in Greece and the euro area for both sectors, leading to a roughly complete pass-through in the case of time deposits just before the global financial crisis in 2007. Overnight deposit rates seemed to be stickier in Greece, as after few months since the start of the tightening, pass-through in this deposit rate category hovered steadily around levels slightly below 20%. On the other hand, during

4 For more information on this measure, see Messer and Niepmann (2023) as well as Kang-Landsberg et al. (2023).

the July 2022 cycle, pass-through to deposit rates seems to be considerably more sluggish than in the previous one in both Greece and the euro area, despite the rapid policy rate increases, except for euro area corporate time deposit rates. Overnight deposit rates in Greece currently record a near-zero pass-through, especially in the case of households, while time deposit rate pass-through is faster and stronger for corporate deposits than for household deposits.

3 POTENTIAL EXPLANATIONS OF DEPOSIT RATE STICKINESS

The descriptive analysis provides evidence that deposit rate pass-through in the current tightening cycle might have been more sluggish in the euro area compared to the previous one and that this may be even more true in the case of Greece. In the next section, we are discussing some relevant factors that have drastically changed in response to the conditions created by the financial and sovereign debt crisis as well as the pandemic crisis.

3.1 AVAILABILITY OF DEPOSITS

Deposits are considered as the most stable funding source for banks, particularly well-suited to finance banks', often illiquid, core assets such as longer-term loans.[5] Bank deposits of non-financial firms and households are less volatile compared to other sources of funding, limiting the procyclical behaviour of banks and their exposure to economic shocks. As a result, the availability of deposits to banks should be closely linked with monetary policy transmission.

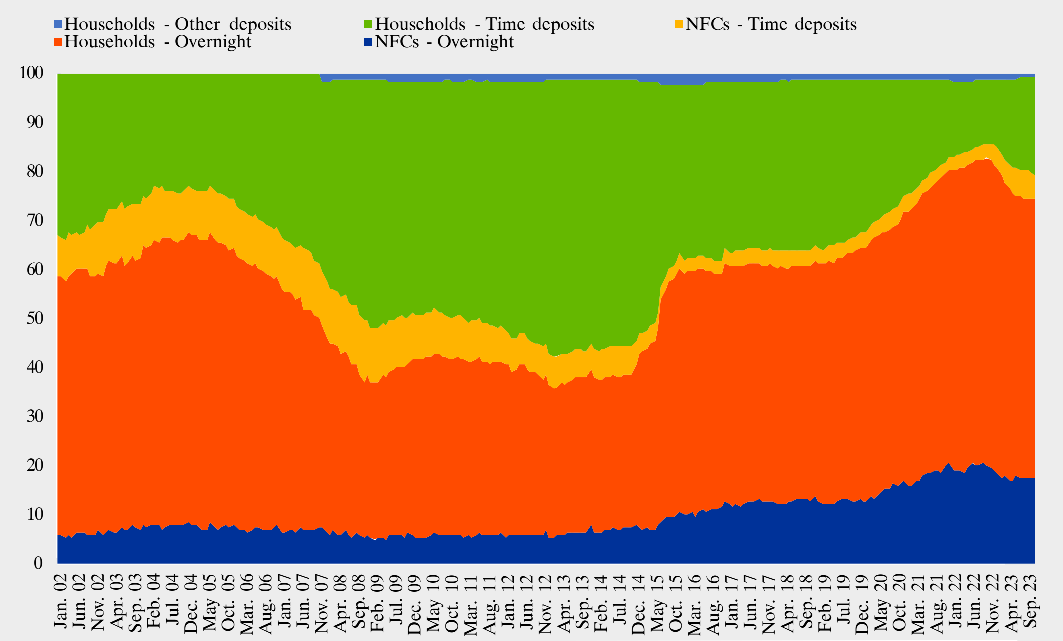
The contribution of deposits to total bank liabilities has significantly increased in Greece during the past eight years. The share of deposits in total bank liabilities rose from 33% in the second quarter of 2015 to 59% at end-2019 before the pandemic and further up to 66% in the third quarter of 2023, standing at the highest levels since Greece's entry into the euro area; the corresponding share in the euro area ranges around 40% in the past five years. The deposit base of Greek banks mainly comprises deposits of the household sector, more than half of which have low balances of up to EUR 50,000. These deposit accounts are not particularly sensitive to changes in interest rates as they are mainly used for the payment of wages or due to less financially sophisticated depositors lacking familiarity with alternative saving options. In contrast, corporate deposits consist predominantly —in a proportion of more than 70%— of accounts with balances over EUR 500,000, and their general evolution is mainly influenced by the cash balances of larger firms.[6] In terms of their liquidity characteristics, non-financial private sector deposits currently consist mainly of overnight deposits (75%) and, to a lesser extent, of term deposits (25%) (Chart 4).

Deposit availability is reflected in banks' ratio of loans to deposits. A relatively low loan-to-deposit ratio should imply that the availability of deposits is ample, and banks do not have strong motives to attract new deposits by offering higher interest rates. According to Chart 5, the loan-to-deposit ratio of Greek banks was falling continuously, in 2015-2021, due to various credit containment factors; these factors included the broad deleveraging process recorded for most of this period stemming from banks' and borrowers' balance sheet constraints induced by the above-mentioned crises. The downward trend in the ratio was also due to the consolidation of banks' loan portfolios and loan transfers that took place especially during 2020-2021 in the context of addressing the high stock of non-performing loans. This ratio continued its downward path during the pandemic years, as a result of the extensive money transfers from the government to the private sector and the broader accumulation of deposits amid the economic

5 Indicatively, it is reported that prudential requirements on bank liquidity for the calculation of the Net Stable Funding ratio set out a weight of 90-95% for retail deposits with a maturity of up to 1 year, while the weight for central bank financing with a corresponding maturity is 50% (BIS 2014).
6 See Georgiou and Voridis (2022).

Chart 4 Composition of deposits of the non-financial private sector in Greek banks (January 2002-November 2023)

(%)

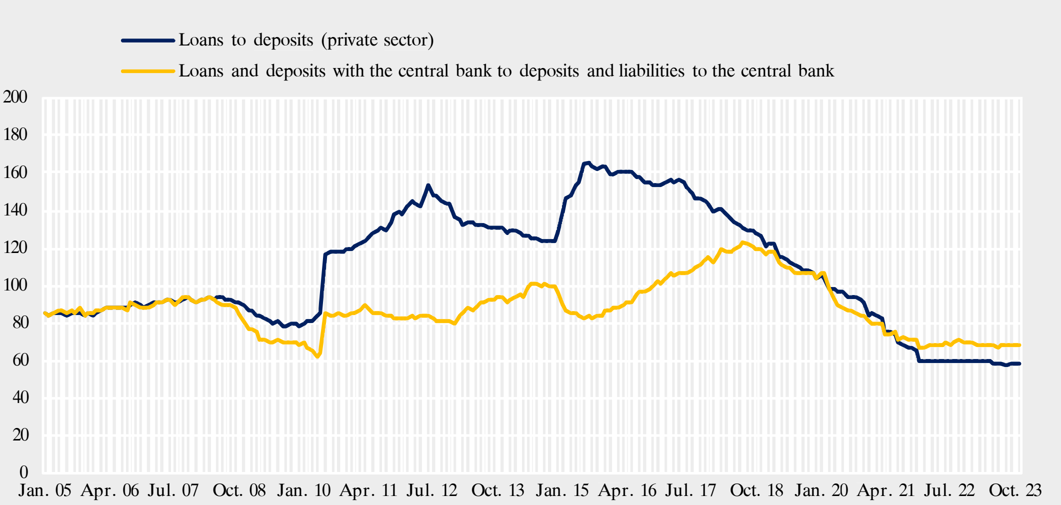


Source: Bank of Greece.
Note: Time deposits include repos, while other deposits include deposits redeemable at notice and deposits in foreign exchange.

lockdown measures. However, since 2021, the ratio seems to have stabilised at very low levels, reflecting the combined effect of the substantial corporate credit expansion in 2022 and the deceleration in private deposit growth after the pandemic.

Chart 5 Loan-to-deposit ratio of Greek banks

(%)



Source: Bank of Greece.

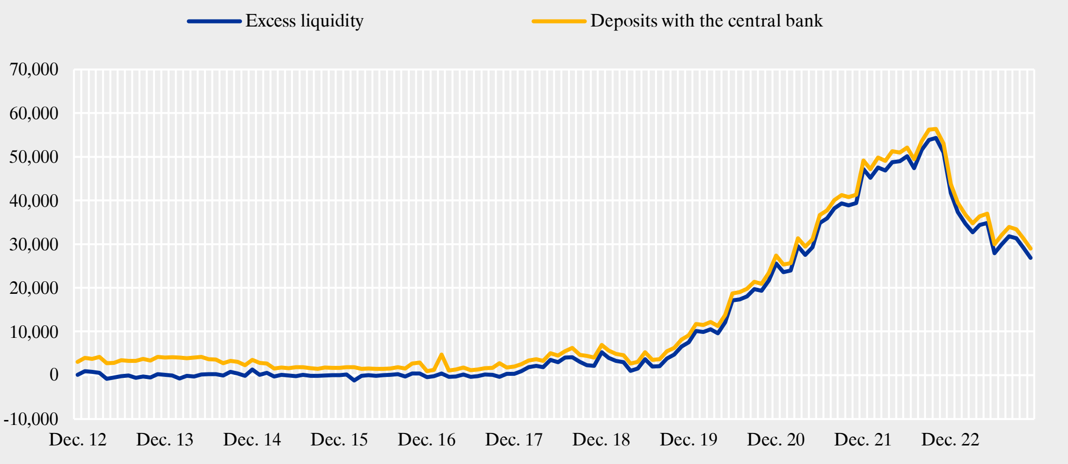
3.2 UNCONVENTIONAL MONETARY POLICY AND EXCESS LIQUIDITY

For the most part of the period between the onset of the financial and sovereign debt crisis and 2014, i.e. before the adoption of extensive unconventional monetary policy interventions in the euro area, central bank funding could be seen as a measure of banks' funding stress. Banks had recourse to this funding source mostly because they could not access the interbank or other funding markets and faced significant funding constraints. Thus, increased dependence on central bank funding rather implied a lack of market access and could also be related to a weaker pass-through stemming from banks' balance sheet constraints (Holton and Rodriguez d'Acri 2018). However, unconventional monetary policy instruments such as large-scale asset purchase programmes and the targeted longer-term refinancing operations (TLTROs) were introduced by the Eurosystem to counter disinflationary forces in view of the effective lower bound of interest rates and, later on, to counter the serious risks to monetary policy transmission and to the outlook of the euro area economy posed by the outbreak of the pandemic. In particular, TLTROs provided funding cost relief and funding reassurance to banks, while they contributed to supporting the provision of credit to the economy at lower rates for firms and households. In the current tightening cycle, apart from interest rates rises, unconventional policy tools also needed to be adjusted to reinforce the transmission of the ECB interest rate policy to the economy. The Eurosystem adapted the terms and conditions of TLTRO-III at late 2022, by increasing the cost of funding through these operations along with offering additional early repayment options, to ensure that TLTRO-III funds did not impede, but rather reinforced the tightening of monetary policy; moreover, since March 2023, the asset portfolio of the Eurosystem started to shrink in a measured and predictable manner, as appropriate to normalise the Eurosystem balance sheet.

From a central bank balance-sheet perspective, the implementation of unconventional monetary policies in the euro area is reflected in the expansion of central bank assets and the accumulation of excess reserves in the banking sys-

Chart 6 Excess liquidity and deposits with the central bank of Greek banks

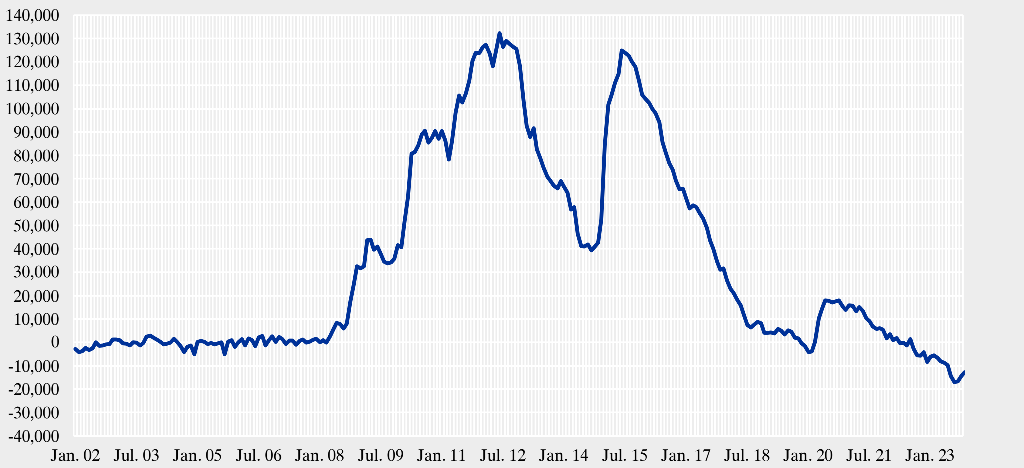
(EUR millions)



Sources: ECB and Bank of Greece.
Note: Excess liquidity is defined as the sum of banks' reserves in the current accounts of the Eurosystem plus the deposit facility minus minimum reserve requirements and the marginal lending facility.

Chart 7 Borrowing of Greek banks from the central bank

(net; EUR millions)



Source: Bank of Greece.
Note: Net borrowing from the central bank is the sum of liabilities of Greek banks arising from the central bank's credit operations minus the amount of liquidity held in deposits with the central bank.

tem (i.e. central bank reserves well in excess of minimum reserve requirements). Excess reserves of Greek banks started to gradually rise in Greece since 2018 and most prominently since end-2019 in the context of their participation in the TLTRO operations and asset purchase programmes of the Eurosystem (Chart 6). As was the case in other euro area countries, a large part of this excess liquidity was held in banks' current accounts or the deposit facility of the central bank;[7] on many occasions, this fact has been interpreted as indicative of banks' limited opportunities to extend loans in the euro area[8] or of their unwillingness to attract more deposit funding by offering higher interest rates, thus contributing to a weaker interest-rate pass-through.[9] It should be noted that the repayment of TLTRO-III in 2023 has already resulted in a decrease of liquidity drawn from the central bank. However, net borrowing from the central bank remains negative, implying that Greek banks rely on private deposits to finance their lending to the economy (Chart 7). As illustrated from this discussion, in analysing the role of central bank liquidity, we should consider two alternative measures: i) net borrowing from the central bank; and ii) excess liquidity held in deposits with the central bank to total assets.

3.3 COMPETITION IN THE BANKING SECTOR

As already mentioned, banking market competitive conditions are among the factors that may affect the formation of interest rate spreads and pass-through. Although a country's banking structure may involve numerous parameters, a large part of the literature employs the concentration level of the banking system as a repre-

7 During the negative interest rate period and in order to support the bank-based transmission of monetary policy, the Eurosystem also adjusted the remuneration of excess reserve holdings at the current accounts of the Eurosystem by introducing a two-tier system of remuneration which lasted until early September 2022. After the suspension of the two-tier system in September 2022, the remuneration of excess reserves has been set at the deposit facility rate or 0%, whichever is lower.

8 However, at the aggregate level, the amount of reserves is rather a reflection of central bank policy and does not indicate much about banks' lending activities (Rule 2015). The banking system as a whole can only lower central bank liquidity and thus excess liquidity independently by exchanging liquidity holdings for banknotes or reducing uptake of refinancing operations (Deutsche Bundesbank 2021).

9 While prior to the 2007-2008 global financial crisis the ECB could steer short-term interest rates by adjusting the amount of liquidity provided through refinancing operations, this was only possible because the banking system operated under a structural liquidity deficit regime. As the quantity of reserves in the system grew, mirroring the large-scale asset purchases and other longer-term refinancing operations, this scarcity vanished, and reserves became abundant, by far surpassing the minimum reserve requirements. When interest rates hit the zero lower bound, the ECB in effect switched from a corridor to a floor operating system, in which the deposit facility rate sets the floor of the Eurosystem rate corridor and, if there are ample excess reserves, it exerts a downward pull on the overnight interest rate in the money market from which all other medium- to longer-term interest rates are derived.

sentative one. According to the "structure-conduct performance" hypothesis, a high degree of concentration and market power of banks may lead them to adopt non-competitive behaviour resulting in higher interest rate spreads that are less favourable for households and firms (i.e. higher lending rates and lower deposit rates). In contrast, the "efficient structure" hypothesis implies that higher concentration could be the result of the dominant presence of the more efficient banks; higher efficiency, in terms of more efficient management, production technologies or scales of production, will be, at least to some extent, reflected in lower interest rate spreads (Berger 1995; Brissimis and Vlassopoulos 2007).

Regarding the structure of the Greek banking system, its concentration level, measured by the assets of the five largest credit institutions as a share of the total assets of the banking system, initially rose in 1997-2005 in Greece (as in other euro area countries) because of mergers and acquisitions in the banking sector that took place mainly in the context of efforts to reduce the involvement of the government in the domestic banking system and enhance the latter's efficiency, in view of the country's accession to the euro area, the introduction of new technologies and increased competition from foreign banks. Since the sovereign debt crisis, concentration in the Greek banking sector rose significantly further, due to the restructuring, recapitalisation and consolidation of the banking sector that took place to overcome the severe consequences of the sovereign debt crisis. This concentration measure, which ranged around 70-75% up to mid-2012, strengthened to 93% by the end of 2013,[10] while since 2015 it has been around 96-97%, remaining the highest in Europe.[11] From a European perspective, the general pattern of changes that have occurred in recent years is similar to the picture observed in Greece, albeit with some heterogeneity across countries (Chalamandaris et al. 2023).

In close relation with the conditions of competition in the Greek banking industry, the surge in electronic payments since 2015 is also worth noting. The imposition of capital controls in the Greek economy in 2015 and, later on, the economic lockdown and other restrictions on face-to-face transactions due to the outbreak of the pandemic in 2020-2021 triggered an increasing familiarisation of firms and households with the use of deposit accounts as a means of electronic payments.[12] This technology-induced change in payment habits and patterns entails maintaining higher outstanding amounts in overnight deposit accounts of the private sector compared to the past, for the mere execution of payments. This means that the supply of deposits from the private sector to banks may have become during the last decade somewhat less elastic to changes in interest rates.

4 EMPIRICAL ESTIMATION

In this section we proceed with an empirical analysis of the deposit rate pass-through, taking into account the above-mentioned factors. We will derive the deposit rate pass-through by estimating the following regression:

$$\Delta r_t^d = a\,\Delta r_{t-1}^d + \Sigma_{j=0}^{k}\beta^j \Delta r_{t-j}^{ECB} + \gamma X_t + \delta LD_t + \varepsilon\, Conc_t + \zeta CB_t + e_t$$

where Δr_t^d stands for the monthly change in the deposit rate (average rate, overnight deposit rate and time deposit rate) in month t, and Δr_t^{ECB} is the respective change in the ECB policy rate (DFR) with K time lags.[13] Vector X_t contains two control variables to take into

10 At that time a series of mergers and acquisitions was completed, including the absorption of the healthy part of Agricultural Bank of Greece by Piraeus Bank, the acquisition of Emporiki Bank by Alpha Bank, the acquisition of the Greek networks of Bank of Cyprus, Cyprus Popular Bank and Hellenic Bank by Piraeus Bank, the acquisition of Millenium Bank by Piraeus Bank, the acquisition of FBB and Probank by National Bank of Greece and the acquisition of TT Hellenic Postbank and New Proton Bank by Eurobank.

11 At a national level, the share of total assets of the five largest credit institutions ranged from 31.16% in Luxembourg to 95.72% in Greece at the end of 2022, while the EU average was 68.27% (ECB, EU structural financial indicators: end of 2022).

12 After the imposition of capital controls in 2015, the number (value) of card payments in Greece increased at a very fast pace, from 88 million payments (EUR 6 billion) in 2014 to 505 million payments (EUR 21.5 billion) in 2017. A further significant rise in card payments was recorded during the pandemic crisis of 2020-2021, from 792 million payments (EUR 21.6 billion) in 2019 to almost 1500 million payments (EUR 45 billion) in 2021.

13 For a similar approach, see Messer and Niepmann (2023).

account changes in deposit demand (based on changes in industrial production and in the HICP at time t, with 8 time lags). LD_t represents bank liquidity, as measured by the loan-to-deposit ratio. $Conc_t$ is the concentration level in the Greek banking system as measured by the share in total assets of the five largest credit institutions, and CB_t stands for central bank liquidity proxied by two alternative measures: i) net borrowing from the central bank (liabilities minus claims on the central bank) and ii) excess liquidity held in deposits with the central bank to total assets. A dummy variable for the negative interest rate period June 2014-June 2022 has also been used.[14] We use monthly data covering the period September 2002-September 2023; with the exception of the interest rate data, all other series have been transformed in logarithmic form. Data on interest rates and all other financial variables are from the Bank of Greece (and the ECB for the interest rate on the deposit facility), while data on industrial production and the HICP are from the Hellenic Statistical Authority (ELSTAT). Regressions have been estimated with Ordinary Least Squares (OLS) corrected for autocorrelation and heteroskedasticity in standard errors (Newey-West method).

5 RESULTS

Table 1 summarises estimation results obtained for household deposit rates across the three interest rate categories (overnight, time and average deposit rate). Each interest rate category includes two separate columns, each reporting results using a different measure of central bank liquidity, i.e. for the first column, net borrowing from the central bank, and for the second column, deposits with the central bank, including a multiplicative term with a dummy for the period since the pandemic to control for any change in the effect of excess liquidity on interest rate pass-through during this period of ample liquidity.

The effect of a policy rate change on the adjustment of household overnight rates is found to be significant up to two months after the policy change, implying an adjustment of 13-14 bps in the short run. Focusing on the impact of deposit availability, the loan-to-deposit ratio appears to be positively related to changes in household overnight deposit rates. This would indicate that increased bank deposit availability relative to outstanding loans to the economy (i.e. a lower loan-to-deposit ratio) could be related to a lower overall pass-through (by 3 to 5 bps) to household overnight rates. The coefficient of the level of concentration in the banking system is negative and statistically significant, pointing in favour of the structure performance hypothesis and indicating that high market concentration allows Greek banks to buffer the impact of monetary policy changes on overnight deposit rates by 5 to 9 bps. Taking into account that concentration in the Greek banking market is the highest in the euro area, this effect could be expected to be more pronounced in Greece than in other euro area countries. With regard to net borrowing from the central bank, this measure is found to have a negative and statistically significant impact on overnight deposit rate changes, which could be associated with a lower pass-through (by 0.2 bps); as already discussed, this could reflect the fact that, for most of the period under consideration, high dependence on Eurosystem credit has been the result of severe funding constraints and balance sheet impairments of Greek banks. Regarding column (1b) in Table 1, liquidity held in deposits with the central bank seems to be overall positively related to the adjustment of the overnight rate; also, interestingly enough, the coefficient on the multiplicative term for the period since the pandemic, which has been characterised by an extraordinary provision of central bank liquidity, has been found to be statistically insignificant.

Turning to household time deposit rates, it is estimated that the adjustment occurs in the second and the third month after the policy change,

14 The more sluggish adjustment of deposit rates in the current tightening cycle could be related to the fact that, during the atypical period of negative interest rates that preceded, nominal deposit rates in Greece remained at slightly positive or zero levels.

Table 1 Estimation results for household deposit rates

	Overnight deposit rate		Time deposit rate		Average deposit rate	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Δr^{d}_{t-1}	0.20 * (0.11)	0.19 * (0.11)	0.28 *** (0.10)	0.25 ** (0.11)	0.39 *** (0.08)	0.35 *** (0.09)
Δr^{ECB}_{t}	0.06 * (0.03)	0.06 * (0.03)	0.08 (0.07)	0.08 (0.07)	0.07 (0.05)	0.06 (0.03)
Δr^{ECB}_{t-1}	0.02 ** (0.01)	0.03 ** (0.01)	0.15 (0.12)	0.15 (0.11)	0.08 (0.07)	0.07 (0.06)
Δr^{ECB}_{t-2}	0.05 ** (0.03)	0.05 ** (0.03)	0.27 *** (0.10)	0.28 *** (0.10)	0.13 ** (0.06)	0.13 ** (0.10)
Δr^{ECB}_{t-3}			0.20 *** (0.07)	0.21 *** (0.07)	0.07*** (0.04)	0.08 ** (0.04)
$L\,D_t$	0.03*** (0.01)	0.05*** (0.01)	-0.02 (0.05)	0.14* (0.08)	0.01 (0.03)	0.10* (0.04)
$Conc_t$	-0.05*** (0.01)	-0.09*** (0.02)	-0.36*** (0.10)	-0.43*** (0.11)	-0.21*** (0.05)	-0.28*** (0.07)
$CB_{1,t}$	-0.002** (0.001)		0.008 (0.01)		0.002 (0.004)	
$CB_{2,t}$		0.01** (0.00)		0.03 (0.02)		0.02 ** (0.01)
$CB_{2,t}{}^{*}d_{2020\text{-}2023}$		-0.001 (0.002)		-0.010 (0.009)		-0.002 (0.005)
Negative interest rate period	0.01** (0.01)	0.02*** (0.00)	0.09*** (0.03)	0.08*** (0.03)	0.05*** (0.02)	0.05*** (0.02)
N	244	244	244	244	244	244
Adj. R^2	0.41	0.42	0.54	0.55	0.55	0.56

Notes: In each deposit rate category, columns (a) and (b) differ in the central bank liquidity measure employed each time, i.e. net borrowing from the central bank ($CB_{1,t}$) in column (a) and deposits with the central bank ($CB_{2,t}$) in column (b). Standard errors have been corrected for autocorrelation and heteroskedasticity using the Newey-West method. ***, ** and * denote significance at 1%, 5% and 10%, respectively.

bringing about a swifter pass-through of 47-49 bps in the short run. The effect of banking market concentration remains consistently negative and statistically significant but is stronger compared to the case of overnight rates. Net borrowing from the central bank remains insignificant in estimation (2a), as is also the case for the loan-to deposit ratio. However, the loan-to deposit ratio gains some importance and is statistically significant in (2b) when deposits with the central bank are employed as the relevant measure for central bank liquidity. For the time deposit rate, the effect of excess liquidity held in deposits with the central bank remains statistically insignificant.

With regard to the average deposit rate, adjustments to policy rate changes are found to be significant in the second and the third month after the policy change and, as expected, market concentration is strongly associated with a weaker pass-through. As is the case with the household time deposit rate, the significance of the loan-to-deposit ratio increases somewhat in (3b), when employing liquidity held in deposits with the central bank. In this specification, central bank liquidity seems to facilitate the deposit rate pass-through, while there is no indication that this liquidity could be associated with a lower pass-through in the past few years. During the negative interest rate period, deposit rates remained higher (by 5 bps on average) compared to the rest of the sample period, suggesting that banks faced some constraints regarding the extent to which they could actually reduce household deposit rates. Furthermore, apart from the immediate pass-through given by coefficients β^{j} analysed above, we could also look at the long-run pass-through to deposit rates for households; this may be defined as the sum of coefficients β^{j} divided

Table 2 Estimation results for corporate deposit rates

	Overnight deposit rate		Time deposit rate		Average deposit rate	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Δr^{d}_{t-1}	-0.32 *** (0.05)	-0.33 *** (0.05)	0.09 (0.08)	0.06 (0.08)	0.13* (0.07)	0.11 (0.07)
Δr^{ECB}_{t}	0.08 *** (0.03)	0.08 *** (0.03)	0.27*** (0.09)	0.26*** (0.09)	0.17** (0.07)	0.17** (0.07)
Δr^{ECB}_{t-1}	0.03 ** (0.01)	0.03 ** (0.01)	0.36*** (0.12)	0.35*** (0.12)	0.12 (0.07)	0.12* (0.07)
Δr^{ECB}_{t-2}	0.06 ** (0.03)	0.06 ** (0.03)	0.28 *** (0.11)	0.28 *** (0.11)	0.13 ** (0.07)	0.13 ** (0.07)
Δr^{ECB}_{t-3}	0.05 * (0.03)	0.05 ** (0.03)				
$L\,D_t$	0.03** (0.02)	0.05** (0.02)	-0.01 (0.04)	0.17* (0.10)	0.03 (0.03)	0.12** (0.05)
$Conc_t$	-0.08*** (0.02)	-0.11*** (0.03)	-0.28** (0.12)	-0.38*** (0.13)	-0.19*** (0.06)	-0.28*** (0.07)
$CB_{\ 1,t}$	-0.003 (0.003)		0.01 (0.01)		-0.00 (0.005)	
$CB_{\ 2,t}$		0.01* (0.01)		0.02 (0.02)		0.02* (0.01)
$CB_{\ 2,t}{}^{*}d_{2020\text{-}2023}$		0.002 (0.004)		-0.031** (0.015)		-0.007 (0.008)
Negative interest rate period	0.02** (0.01)	0.02*** (0.01)	0.06 (0.04)	0.05 (0.04)	0.05** (0.02)	0.05** (0.02)
N	244	244	244	244	244	244
Adj. R^2	0.27	0.28	0.33	0.33	0.28	0.29

Notes: In each deposit rate category, columns (a) and (b) differ in the central bank liquidity measure employed each time, i.e. net borrowing from the central bank ($CB_{1,t}$) in column (a) and deposits with the central bank ($CB_{2,t}$) in column (b). Standard errors have been corrected for autocorrelation and heteroskedasticity using the Newey-West method. ***, ** and * denote significance at 1%, 5% and 10%, respectively.

by one minus the coefficient α on the lagged change in the deposit rate.[15] The long-run pass-through to deposit rates for households is estimated to be higher for time deposit rates reaching up to 65 bps and very low for overnight deposits (16 bps), while it stands at around 33 bps for the average household deposit rate.

Table 2 reports the corresponding results for interest rates on deposits from non-financial corporations (NFCs). In contrast to the case of households, the coefficient on the lagged change in corporate deposit rates across the three categories does not point to any significant persistence of this change, i.e. a change in corporate deposit rates does not seem to depend on past changes. Overall, the adjusted R^2 of these estimations is lower than in the case of households, suggesting that there could be other important determinants of this pass-through, apart from the liquidity and banking concentration measures that we have used.

Overnight corporate deposit rates adjust somewhat more intensely than the corresponding rates for households, as the effect from a policy rate change is statistically significant up to three months after the change, suggesting an immediate effect of 22 bps. The effect of the loan-to-deposit ratio is positive, statistically significant and of a similar magnitude as in the case of households. Concentration in the banking sector negatively affects pass-through to overnight rates for corporations, but net borrowing from the central bank does not seem to matter for the adjustment of these rates. Results in (1b) of Table 2 provide some evidence that excess liquidity held in deposits with the central bank could be associated with a

15 See also Kwapil and Scharler (2006).

positive effect on pass-through, while no discernible change is detected for this effect in the past few years of abundant liquidity since the pandemic.

As far as corporate time deposit rates are concerned, it appears that they adjust up to two months after the policy change and that this pass-through in the short run is almost complete (90 bps). Banking market concentration is, also in this case, strongly associated with a lower pass-through (by 28 to 38 bps), while the loan-to-deposit ratio and borrowing from the central bank do not seem to weigh on these pricing decisions. The loan-to-deposit ratio is found to be statistically significant only under estimation (2b), in which liquidity held in deposits with the central bank also appears —for the first time in our estimations— to be related to a more sluggish pass-through in the past few years. Furthermore, the period of negative interest rates is insignificant for corporate time deposits, pointing to some discrimination against negative interest rates to corporate time deposits.[16]

As far as the average deposit rate for corporations is concerned, the adjustment occurs up to two months after the policy rate change (30-43 bps). The level of banking market concentration negatively affects corporate deposit rate pass-through (19-29 bps). The loan-to-deposit ratio and liquidity deposited with the central bank are estimated to be positively associated with pass-through, while no significant indication is provided that excess liquidity deposited with the central bank has in the last few years been related to a slower pass-through. As has been the case with overnight deposit rates for corporations, the negative interest rate period seems to be related to somewhat higher average deposit rates for corporations compared to the rest of the sample period.

6 CONCLUDING REMARKS

In this article, we examine interest rate pass-through to deposit rates in Greece. We present some evidence that pass-through has been more sluggish in this tightening cycle compared to the past both in Greece and in the euro area and we discuss a number of factors that could be relevant in this respect, also in the light of the fundamental policy and structural changes that have occurred in the Greek banking system since the financial and sovereign debt crisis.

The evidence presented in this article shows that interest rates on overnight deposits are much less sensitive to policy rate changes compared to term deposits; monetary policy is currently transmitted to bank funding costs mainly through the interest rates offered on term deposits. In contrast, interest rates to overnight deposits —which represent 3/4 of private deposits— currently present a near-zero pass-through. The composition of banks' deposit base consisting mainly of household overnight deposits with low balances, in combination with the increased use of deposit accounts as a means of payments in the last decade, could have supported this development.

The pass-through to deposit rates is found to be more incomplete for households than for corporations. Term deposit rates for households adjust with a longer time lag and could reach a pass-through of up to 65% of a policy rate change in the long run, while the adjustment of time deposit rates for corporations is more immediate and ends up being almost complete.

The high concentration level of the domestic banking system is a structural characteristic which allows banks to buffer the impact of monetary policy changes. Given that the degree of concentration in the banking market has been on the rise in the aftermath of the financial and sovereign debt crisis, this finding implies a more sluggish pass-through towards

16 This finding is in line with other recent findings in the literature regarding the possible existence of a corporate channel of monetary policy, according to which negative interest rates on corporate deposits may lead firms to reduce corporate savings and increase employment and investment, thus stimulating the real economy (Altavilla et al. 2022).

the end of the sample period. Increased availability of deposits relative to bank lending to the economy has also allowed banks to increase deposit rates at a slower pace than in the past, mainly regarding overnight deposits. The broad deleveraging recorded in bank balance sheets since the sovereign debt crisis and, more recently, the wide accumulation of deposits during the pandemic crisis could be among the main drivers of this development. Net borrowing from the central bank, which was particularly high for Greek banks during the sovereign debt crisis as well as during 2015, is found to be associated with a negative impact on pass-through to overnight deposits of households. Overall, we do not find strong evidence that excess liquidity in the banking system has contributed to a weaker pass-through to deposit rates in Greece, except for the case of corporate time deposit rates in the post-pandemic period. This could reflect the fact that the terms and conditions of unconventional monetary policy tools and the remuneration of excess reserves were occasionally adjusted so as to be aligned with the monetary policy stance.

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WORKING PAPERS
(JULY – DECEMBER 2023)

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CONTENTS

Can central banks do the unpleasant job that governments should do?

Working Paper No. 324

Vasiliki Dimakopoulou, George Economides, Apostolis Philippopoulos and Vanghelis Vassilatos

This paper investigates what happens when the fiscal authorities do not react to rising public debt so that the unpleasant task of fiscal sustainability falls upon the Central Bank (CB). In particular, the study explores whether the CB's bond purchases in the secondary market can restore stability and determinacy in an otherwise unstable economy. This is investigated in a dynamic general equilibrium model calibrated to the Euro Area (EA) and where monetary policy is conducted subject to the numerical rules of the Eurosystem (ES). The paper shows that given the recent situation in the ES, and to the extent that a relatively big shock hits the economy, there is no room left for further quasi-fiscal actions by the ECB; there will be room only if the ES's rules are violated. The authors then search for policy mixes that can respect the ES's rules and show that debt-contingent fiscal and quantitative monetary policies can reinforce each other; this confirms the importance of policy complementarities.

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