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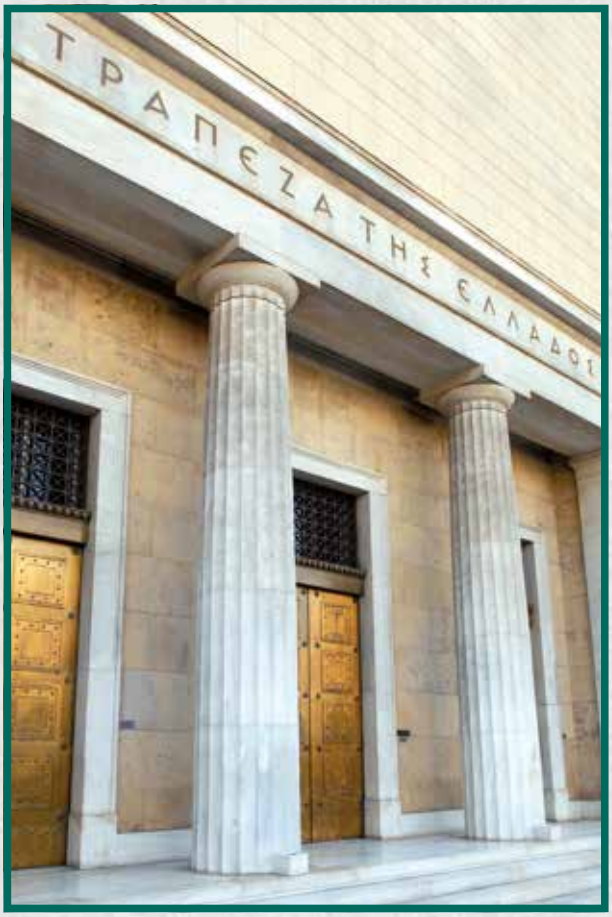

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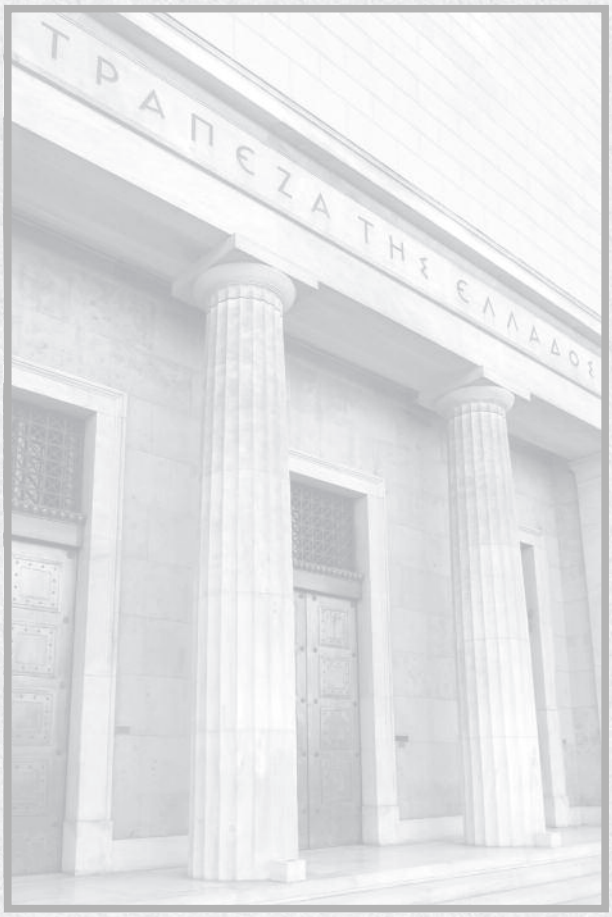

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THE IMPACT OF THE RECOVERY AND RESILIENCE FACILITY ON THE GREEK ECONOMY

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ABSTRACT

This paper assesses the macroeconomic impact of the stimulus and the structural reforms supported by the Recovery and Resilience Facility (RRF) on the Greek economy. The set-up is a Dynamic Stochastic General Equilibrium (DSGE) model that is augmented to account for the main features of Greece's plan under the RRF framework. The results suggest that the full and timely implementation of the Recovery and Resilience Plan (RRP) implies significant benefits to the Greek economy. Real GDP, private investment and employment can potentially increase by 6.9%, 20% and 4%, respectively, by 2026. Tax revenues also increase, creating fiscal space that can be used to further boost economic activity. The implementation of structural reforms included in the RRP is necessary for maintaining important benefits also in the long run. The results indicate that the potential increase in long-run GDP from selected quantifiable reforms ranges between 6% and 9.9%, with gains extending to other macro variables.

Keywords: Recovery and Resilience Facility; fiscal policy; structural reforms

JEL classification: E27; E6; O4; O52

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Η ΕΠΙΔΡΑΣΗ ΤΟΥ ΜΗΧΑΝΙΣΜΟΥ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ ΣΤΗΝ ΕΛΛΗΝΙΚΗ ΟΙΚΟΝΟΜΙΑ

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ΠΕΡΙΛΗΨΗ

Το παρόν άρθρο εκτιμά τις δυνητικές οικονομικές επιδράσεις στην ελληνική οικονομία των δαπανών και των διαρθρωτικών μεταρρυθμίσεων που αναμένεται να χρηματοδοτηθούν μέσω

επιχορηγήσεων και δανείων από τον ευρωπαϊκό Μηχανισμό Ανάκαμψης και Ανθεκτικότητας. Η εκτίμηση γίνεται με τη χρήση του Δυναμικού Στοχαστικού Υποδείγματος Γενικής Ισορροπίας (Dynamic Stochastic General Equilibrium model) της Τράπεζας της Ελλάδος, το οποίο έχει διευρυνθεί ώστε να αντανακλά επαρκώς τις υποθέσεις εργασίας που γίνονται ως προς τη χρήση των πόρων και την υλοποίηση των μεταρρυθμίσεων που προβλέπονται στο Εθνικό Σχέδιο Ανάκαμψης και Ανθεκτικότητας. Η ανάλυση διαχωρίζει τον τρόπο με τον οποίο οι επιχορηγήσεις και τα δάνεια επιδρούν στην οικονομική δραστηριότητα και το δημόσιο χρέος. Συγκεκριμένα, η επίδραση των επιχορηγήσεων εξετάζεται μέσω αύξησης των δημόσιων επενδύσεων και της δημόσιας κατανάλωσης, οι οποίες όμως δεν αυξάνουν το δημόσιο χρέος. Τα δάνεια επιβαρύνουν το δημόσιο χρέος και εισάγονται στο υπόδειγμα ως έμμεσες επιδοτήσεις επενδύσεων (implicit investment subsidies), η αύξηση των οποίων μειώνει το κόστος για κάθε μονάδα παραγωγικών επενδύσεων του ιδιωτικού τομέα, ενισχύοντας τα κίνητρα για ιδιωτικές επενδύσεις. Ως αποτέλεσμα, κινητοποιούνται ενδογενώς ιδιωτικοί πόροι για επενδύσεις πλέον του ποσού των δανείων.

Τα αποτελέσματα υποδεικνύουν ότι η πλήρης και έγκαιρη εφαρμογή του Εθνικού Σχεδίου συνεπάγεται σημαντικά οφέλη για την ελληνική οικονομία. Το πραγματικό ΑΕΠ, οι ιδιωτικές επενδύσεις και η απασχόληση μπορούν δυνητικά να αυξηθούν κατά 6,9%, 20% και 4%, αντίστοιχα, έως το 2026. Τα φορολογικά έσοδα επίσης αυξάνονται μέσω της διεύρυνσης της φορολογικής βάσης, δημιουργώντας έμμεσα πρόσθετο δημοσιονομικό χώρο που μπορεί να χρησιμοποιηθεί για μειώσεις φορολογικών συντελεστών ή αυξήσεις δαπανών, ενισχύοντας περαιτέρω την οικονομική δραστηριότητα.

Η συνολική επίδραση του Εθνικού Σχεδίου στην οικονομία μπορεί να διαχωριστεί στην επίδραση των επιχορηγήσεων και των δανείων και στην επίδραση των διαρθρωτικών μεταρρυθμίσεων. Η οικονομική μεγέθυνση που χρηματοδοτείται μέσω επιχορηγήσεων και δανείων αυξάνει το επίπεδο του πραγματικού ΑΕΠ κατά περίπου 4,3% το 2026. Οι διαρθρωτικές μεταρρυθμίσεις οδηγούν σε περαιτέρω αύξηση του επιπέδου του ΑΕΠ κατά 2,6% το 2026.

Τα αποτελέσματα επίσης υποδεικνύουν ότι οι διαθρωτικές μεταρρυθμίσεις έχουν τη δυνατότητα να οδηγήσουν μακροχρόνια σε μια μόνιμη αύξηση της παραγωγικής ικανότητας της οικονομίας, καθώς συνεπάγονται μετάβαση σε ένα νέο σημείο ισορροπίας με υψηλότερο επίπεδο παραγωγικότητας, μεγαλύτερη προσφορά εργασίας και πιο αποτελεσματική κατανομή των παραγωγικών πόρων. Συγκεκριμένα, στην παρούσα ανάλυση εξετάζονται τρεις κατηγορίες διαρθρωτικών μεταρρυθμίσεων που μπορούν να ποσοτικοποιηθούν: α) μεταρρυθμίσεις που βελτιώνουν τον ανταγωνισμό στις αγορές προϊόντων και υπηρεσιών, β) μεταρρυθμίσεις που υποστηρίζουν τη μεγαλύτερη συμμετοχή στο εργατικό δυναμικό και γ) μεταρρυθμίσεις που ενισχύουν τη συνολική παραγωγικότητα της οικονομίας. Επιπλέον, γίνεται προσπάθεια να συνεκτιμηθεί και η επίδραση μεταρρυθμίσεων που αφορούν τον ψηφιακό μετασχηματισμό της δημόσιας διοίκησης. Τα ευρήματα δείχνουν ότι η εφαρμογή αυτών των μεταρρυθμίσεων δύναται να οδηγήσει σε αύξηση του επιπέδου του πραγματικού ΑΕΠ μακροχρόνια μεταξύ 6% και 9,9%, με τις θετικές επιδράσεις να επεκτείνονται και σε άλλες μακροοικονομικές μεταβλητές. Τα οφέλη για την οικονομία θα είναι διατηρήσιμα μακροχρόνια μόνο εφόσον υπάρξει πλήρης υλοποίηση των προβλεπόμενων μεταρρυθμίσεων. Χωρίς τις προβλεπόμενες μεταρρυθμίσεις τα οικονομικά οφέλη του Εθνικού Σχεδίου θα είναι βραχυπρόθεσμα και η οικονομία θα επιστρέψει σταδιακά στην αρχική της κατάσταση.

THE IMPACT OF THE RECOVERY AND RESILIENCE FACILITY ON THE GREEK ECONOMY

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1 INTRODUCTION

The aim of this paper is to assess the potential macroeconomic effects of the Recovery and Resilience Facility (RRF) on the Greek economy in the context of a Dynamic Stochastic General Equilibrium (DSGE) model. Our approach can be summarised as follows. First, we calibrate the model to account for the current state of the Greek economy. Then, departing from the calibrated economy, we feed the model with the paths of the expenditures financed by the RRF. We also provide a quantitative assessment of a subset of the structural reforms planned by the Greek authorities to complement the RRF-backed expenditures. In doing so, we use information from structural indicators and we map changes in these indicators onto the model's appropriate exogenous variables.

The RRF is at the core of the temporary recovery instrument "Next Generation EU" (NGEU), representing the EU's key response to the COVID-19 crisis. The RRF will provide to all EU Member States up to EUR 672.5 billion to support investments and reforms, of which EUR 312.5 billion in the form of grants and EUR 360 billion in the form of loans (at 2018 prices). The aim is to mitigate the economic and social repercussions of the COVID-19 pandemic, promote smart, sustainable and inclusive growth, and enhance resilience of the EU and its Members States, while taking account of the challenges and opportunities of the green and digital transitions. The RRF entered into force on 19 February 2021.

In order to receive support from the RRF, Member States need to submit national "recovery and resilience plans" (RRPs) outlining their reform and investment programmes, as well as their targets, milestones and estimated costs. According to the RRF Regulation, the plans should address the recommendations of the European Semester and contribute to the strengthening of the growth potential, job creation, and economic and social resilience, as well as to the implementation of the European Pillar of Social Rights. At least 37% of the funds should support the green transition and 20% the digital transformation. The plans shall comprise measures for the implementation of reforms and public investment through a comprehensive and coherent package, which may also include public schemes that aim to incentivise private investment. The plans might also include cross-border or multi-country projects, fostering synergies across counties.

The funding by the RRF will be available for three years (2021-2023) but the payments can be extended to six years (until 2026). Member States can request up to 13% pre-financing for their RRPs, which applies to both grants and loans. Grants will be allocated to Member States using specific allocation keys reflecting their population size and economic conditions, including the impact of the pan-

demic.[1] The maximum amount of loans that a Member State can request amounts to 6.8% of its GNI in 2019 at current prices.

Greece submitted its comprehensive RRP ("Greece 2.0") on 27 April 2021, requesting a total of EUR 30.5 billion in support under the RRF. Loans under the RRF are meant to be used for the financing of private investment. The plan is structured around four pillars: (a) green transition; (b) digital transition; (c) employment, skills and social cohesion; and (d) private investment and economic and institutional transformation.

Research on the effects of the RRF on the EU economies in the context of micro-founded general equilibrium models is rather limited so far. Bańkowski et al. (2021) examine the potential effects of the NGEU instrument on the euro area and selected euro area countries (Germany, Italy, Portugal and Spain).[2] However, the study abstracts from examining the impact of structural reforms that accompany the use of NGEU funds. The present paper attempts to fill this gap and contribute to the literature on the effects of policy reforms.[3]

The results of our analysis suggest that the full implementation of the stimulus and the reforms envisaged by the Greek RRP can potentially increase the level of real GDP by 6.9% by 2026. Private investment increases by around 20% in 2026 and employment by 4%. This amounts to the creation of around 180,000 additional jobs by 2026. At the same time, the tax base increases, leading to a rise in the tax revenues-to-GDP ratio of 2.8 percentage points (pp) in 2026. This implies an improvement in the primary surplus of the general government by an equivalent amount (additional fiscal space).

The total effect of the RRP on the economy can be decomposed into the effect of grants and loans and the effect of structural reforms. The stimulus financed by grants and loans raises the level of real GDP by around 4.3% in 2026. Moreover, the stimulus financed by loans allocated to private investment leads to a boost in private investment of around 20% over the stimulus period. The results also suggest that the impact of loans on output is larger than that of grants.

Structural reforms lead to a further increase of 2.6% in the level of GDP in 2026. Unlike the temporary stimulus financed by grants and loans, however, reforms have the potential to lead to a permanent increase in the productive capacity of the economy. The levels of real output, private investment and employment are expected to increase by around 6%, 8.5% and 4%, respectively, in the long run. Importantly also, the reforms lead to a permanently higher tax base, so that tax revenues as a percentage of GDP increase by around 2.5 pp in the long run.

It should be stressed that our estimates of the effects of structural reforms may be interpreted as a "lower bound", in the sense that it is not possible to quantify all the reforms envisaged by the Greek RRP in a transparent way and based on reliable estimates from the empirical literature. In particular, we quantify three sets of structural reforms: reforms that improve competition in product markets; reforms that support higher labour force participation; and productivity-enhancing reforms.

1 In particular, 70% of the maximum financial contribution (frontloaded in 2021-22) should be calculated based on the population, the inverse of GDP per capita and the relative unemployment rate of each Member State. The remaining 30% (committed in 2023) should be calculated based on the population, the inverse of GDP per capita, and, in equal proportion, the change in real GDP in 2020 and the aggregated change in real GDP during the period 2020-21 (on the basis of the Commission's Autumn 2020 Economic Forecast for data not available at present, to be updated by 30.6.2022 with actuals).

2 European Commission (2020) also provides some estimates for the effects of the NGEU funds on the EU-27 economy. Canova and Pappa (2021) provide an empirical investigation of the effects of the NGEU funds on the EU economy. They show that the NGEU can be useful in creating jobs and boosting productivity and investment projects. However, they find asymmetric macroeconomic responses across regions. More recently, the European Commission (2021) in the context of its formal assessment of the Greek RRP has provided some estimates of the effects of the NGEU on the economy without including the possible positive impact of structural reforms.

3 See among many others Coenen et al. (2008), Uhlig (2010) and Drautzburg and Uhlig (2015). For the Greek economy, see Papageorgiou (2012), Dellas et al. (2017), Papageorgiou and Vourvachaki (2017), Gourinchas et al. (2017) and Economides et al. (2017, 2021).

Table 1 Expected RRF disbursements by year

	2021	2022	2023	2024	2025	2026	2021-2026 total
RRF funds (EUR billions)	3.97	5.31	5.31	5.31	5.31	5.31	30.50
of which							
Grants	2.35	3.15	3.15	3.15	3.15	3.15	18.08
Loans	1.61	2.16	2.16	2.16	2.16	2.16	12.42

Source: Authors' calculations on the basis of Ministry of Finance information (22.3.2021).

In addition, we estimate that reforms that improve the efficiency of the public sector, namely digitalisation, resulting in a reallocation of labour away from unproductive activities due to red tape and administrative costs and towards productive activities, have the potential to further boost long-run GDP by 3.9%. Reforms improving the quality of governance, the rule of law and the judicial system efficiency are not quantified in this exercise, but also have a great potential to increase productivity and allocative efficiency, thereby leading to significant additional long-run gains in terms of GDP per capita.

The rest of the paper is organised as follows. Section 2 describes the stimulus plan backed by the RRF. Section 3 describes the model and discusses the methodology used to assess the impact of the RRF. Section 4 reports the main results. Section 5 discusses the potential effects of the structural reforms included in the Greek RRP which are not easily quantifiable. Section 6 concludes.

2 STIMULUS FINANCED BY THE RRF

In order to quantify the impact of higher spending under the RRF, we need to make assumptions on the following: (a) the total amount of RRF funds available for Greece; (b) the expected flow of disbursements of the RRF funds over time; and (c) the distribution of funds across possible uses. These assumptions are based on information from the Greek Ministry of Finance and the Greek RRP as of 22.3.2021.

As regards the amount of RRF funds, it is assumed that Greece will request the maximum available funds from the RRF and will have the necessary administrative and operational capacity to complete the contracting of the total available amount for loans and grants during 2021-23, as well as to fulfil all the relevant milestones and targets on time in order to achieve full absorption of the funds by 2026. In particular, EUR 30.5 billion is expected from the RRF cumulatively in the 2021-26 period, of which EUR 18.1 billion in grants and EUR 12.4 billion in loans.

Concerning the expected disbursements, in 2021 Greece expects to receive the prepayment of 13% of both total grants and loans, in line with the RRF Regulation. For the period 2022-26, disbursements of the remaining grants and loans are evenly allocated (see Table 1), which reflects a smooth implementation of the Greek RRP. The working assumption is that the RRF disbursements are used to finance expenditures within the same calendar year.

Turning to the use of the funds, it is assumed that 67% of the RRF grants is channelled to finance government investment. The remaining 33% of the grants is used to finance government consumption.[4] The full amount of the loans is used to finance private investments. It is further assumed that the additionality principle applies, i.e. all grants and loans under the RRF finance new investments and reforms that would not materialise otherwise.

4 A constant over time allocation of fund uses is assumed. Government consumption mainly regards intermediate consumption.

3 METHODOLGY

3.1 DESCRIPTION OF THE MODEL

To evaluate the impact of policy changes, we use a version of the Bank of Greece micro-founded Dynamic Stochastic General Equilibrium (DSGE) model that includes the main characteristics commonly shared among the structural models used by most central banks and international institutions, as well as some features that are important for adapting the model to the Greek economy.[5]

In particular, the domestic economy is modelled as a small open economy that belongs to a currency area in the sense that the nominal exchange rate is exogenous and there is no monetary policy independence. In the absence of monetary policy autonomy, the domestic nominal interest rate is determined by an exogenously given, risk-free, foreign nominal policy interest rate and a risk-premium component. The domestic economy consists of a large number of households, firms and a government. There are two types of households differing in their ability to participate in asset markets. The first type of households has access to the financial markets and can transfer wealth intertemporally by trading bonds and accumulating physical capital, whereas the second type of households is assumed to be liquidity constrained in the sense that it cannot lend or borrow. Both types of households receive labour income by working in the private and the public sectors.

As regards the labour market in the private sector, households supply differentiated labour services, and there are labour unions that act as wage setters in monopolistically competitive labour markets. As a result, private sector wages can pay a premium above the marginal product of labour due to labour unions' bargaining power (wage premium). Concerning the production sector, the model features monopolistically competitive firms that produce tradable and non-tradable differentiated goods. Firms in the tradable sector sell their output domestically and to the rest of world (recorded as exports), while firms in the non-tradable sector sell their output only domestically. Firms set prices of their differentiated output according to the Calvo-type scheme with partial indexation. Prices are equal to a mark-up over the marginal cost, a feature that provides rationale for policies that increase competitiveness in the product market. All types of intermediate goods are used as inputs for the production of consumption and investment final goods. The final goods are produced by perfectly competitive firms and are sold to domestic households and the government.

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

Finally, the model includes a number of nominal and real frictions, such as habit formation in consumption, investment adjustment costs

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

and variable capital utilisation that have been empirically identified as playing an important role in the transmission of structural shocks. Overall, the model captures well the key features of the Greek economy and thus provides a parameterised general equilibrium model suitable for policy simulations.

For the purpose of assessing the impact of the RRF on the Greek economy, the model is appropriately augmented in order to allow for a different treatment of grants and loans received under the RRF. Specifically, in line with the design of the RRF, grants are treated as budgetary neutral transfers to the government that allow an increase in government expenditures (consumption and investment) without bearing any impact on public debt. Instead, loans bear a burden on public debt. According to the Greek authorities, each year the RRF loans will be channelled as loans to the private sector for investment purposes at a very favourable interest rate and with the aim to mobilise additional private funds. In the model, the RRF loans are introduced as implicit investment subsidies accruing to every unit of private investment. These investment subsidies reduce the price of investment for every unit spent by the private sector, thereby endogenously creating incentives to mobilise even higher resources for private investment compared with just adding the amount of RRF loans to the original level of private investment. The loans are assumed to be repaid by the private sector by 2058 through non-distortionary lump-sum taxes.

3.2 DESIGNING POLICY SIMULATIONS

Our approach to assessing the impact of the investments and reforms included in the Greek RRP is summarised as follows. First, the model is calibrated, i.e. specific values are assigned to the structural parameters of the model and the exogenous policy instruments, in order to capture the current state of the Greek economy. The main source of data is Eurostat data at an annual frequency.[6] In particular, the exogenous fiscal policy instruments are set equal to their average values in the data over the period 2017-19. This period is the reference level of the policy instruments across the simulations. As is usual in the relevant literature, we assume that the economy is at its steady state and that the RRP is agreed and starts to be implemented in 2021.[7]

Then, to examine the effects of the induced stimulus, i.e. of the RRF grants and loans, we feed the model with the exogenous paths of the fiscal variables (government investment and consumption) and the investment subsidy to the private sector (see Section 2), and we obtain the paths of key macroeconomic variables of interest expressed in percentage deviations from the steady state. It should be noted that after 2026 the government spending instruments and the investment subsidy return to their initial pre-RRF (pre-reform and pre-stimulus) levels.

Finally, to examine the effects of the structural reforms, we map selected reforms incorporated in the Greek RRP onto the relevant exogenous variables/parameters of the model (see the next section for details).

Three sets of policy simulations are conducted:

1) Evaluation of the impact of the expenditures relating to grants and loans (without structural reforms), compared with a policy-neutral baseline.

2) Evaluation of the impact of the structural reforms. Section 3.4 presents our approach to mapping a selection of these reforms onto the model's various exogenous variables. The selection hinges on the feasibility of this exercise in view of the challenges embedded in quantifying structural reforms.

3) Joint evaluation of policy changes under (1) and (2).

6 For the calibration strategy, see Papageorgiou (2014) and Papageorgiou and Vourvachaki (2017).
7 See also Uhlig (2010) and Drautzburg and Uhlig (2015) for a similar approach.

3.3 MAPPING STRUCTURAL REFORMS ONTO POLICY CHANGES IN THE MODEL

The Greek RRP includes an extensive list of reforms that are organised into axes that fall under four pillars: (a) green transition; (b) digital transition; (c) employment, skills and social cohesion; (d) private investment and economic and institutional transformation.[8]

In order to assess the economic impact of the structural reforms envisaged under the Greek RRP, it is necessary to map these reforms onto the model's appropriate exogenous variables, namely to identify the main channel through which a specific reform affects economic outcomes.[9] However, not all of the reforms under the Greek RRP are quantifiable. Therefore, this empirical exercise is restricted to the quantification of a subset of reforms that can be linked to structural indicators and for which the empirical literature offers reliable guidance regarding the sensitivity of key economic variables with respect to changes in these indicators.[10] As a result, our estimates of the effects of structural reforms may be viewed as a "lower bound", to the extent that not all reforms are quantifiable. We discuss below the uncertainties surrounding these estimates and the limitations in quantifying the full set of structural reforms envisaged under the Greek RRP.

In addition to the issue of mapping the reforms onto the model's exogenous variables, one needs to assess the size of the reform in question. It should be noted that quantitatively assessing *ex ante* the size of the Greek RRP reforms is presently challenging, as legislative actions and a more thorough specialisation of the structural interventions are still pending. Indeed, this task is challenging even when the legislative acts are available. A further reason why the *ex ante* assessment of the size of the reforms is challenging is that there is uncertainty as to the time needed for reforms to affect economic outcomes, as well as regarding the speed and successful completion of reform implementation.[11] The joint effect from the interaction between reforms is also difficult to properly identify and measure.

In all experiments, the size of the reforms, i.e. the size of the exogenous shocks to the model, are set so as to close Greece's gap to EU average practices (as measured in 2019 or 2020) by 2030 by at least 50%. Using some closure of the gap to EU practices is a plausible anchor, given that the RRF aims "to achieve an economic and social recovery, resilience and convergence".[12] It should also be stressed that already by design of the policy experiments, structural reforms are expected to take longer to yield full effect compared with the RRF stimulus. Such an approach is in line with the one adopted in the extant literature that focuses on the medium- to long-run effects of reforms. Finally, it is assumed that policy reforms are credibly announced and begin to be implemented in 2021.

In particular, three sets of reforms corresponding to three distinct model channels are considered in the present empirical assessment:

(i) Reforms that enhance competition in the product market: The reforms in the Greek RRP that fall into this category include the simplification of the procedures of the Ministry of Infrastructure and Transport (axis 4.6), actions for the simplification of the business environment and its upgrading in quality and safety (axis 4.7), trade facilitation (axis 4.7), and the creation of a single tax and social security contributions' collection mechanism aiming to decrease administrative burden and compliance cost (axis 4.1).

8 For the Greek RRP as submitted to the European Commission in April 2021, see https://www.minfin.gr/web/guest/tameio-anakampses.
9 A detailed mapping table is available by the authors upon request. For example, axis 4.2 under pillar 4 includes also actions for "reforming public administration", which is understood as primarily affecting positively the level of TFP.
10 A similar approach is followed in European Commission (2016). The study also discusses the challenges in quantifying the impact of structural reforms.
11 See also discussion in Box IV.5 in Bank of Greece, *Interim Report on Monetary Policy*, December 2019, pp. 113-117 (in Greek).
12 See https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_949.

To examine the impact of this set of reforms, we link changes in the regulatory burden captured by the OECD Product Market Regulation (PMR) index for services sectors with changes in the mark-ups in the product market (OECD indices for 2019).[13] The impact of the relevant reforms is simulated by a gradual permanent reduction of 1.026 pp in the price mark-up of intermediate goods-producing firms by 2030. The size of the reform is such that the gap to the EU average practices in terms of the regulatory burden to firm entry and operation is gradually closed by 2030.

(ii) Reforms that support higher labour force participation (labour supply): The reforms that belong to this category include most of the reforms that promote job creation and participation in the labour market (axis 3.1), like pension reforms, and active and passive labour market policies. This category also includes reforms aiming to improve education, vocational education and training and skills (axis 3.2), as well as reforms to increase access to effective and inclusive social policies (axis 3.4). In the latter, reforms supporting an accessible and high-quality childcare favour women's labour force participation.

The impact of these labour market reforms is simulated by cumulatively increasing labour supply by around 4% by 2030. The size of the reform is such that half of the gap to the 2019 EU average labour force participation rate is closed by 2030 (Eurostat LFS data).[14]

(iii) Productivity-enhancing reforms: Two groups of reforms that work out towards increasing the total factor productivity (TFP) of the economy are considered in the empirical exercise.

First, reforms that improve the business environment, *inter alia* by lifting the regulatory obstacles to competition. This group includes reforms that improve competitiveness and promote private investments and exports (axis 4.7), like reforms that ease doing business or actions which contribute to the simplification of the business environment. The impact of these reforms is simulated by assuming that the gap to the EU average practices in product market regulation as measured by the OECD (overall) PMR index is closed by 2030 (OECD indices for 2019). Using results from empirical studies, we are able to map changes in product market regulation affecting allocative efficiency, and thereby labour productivity, onto changes in TFP.[15] These estimates suggest a permanent increase in TFP of 1.22%. It is assumed that TFP gradually increases to its permanently higher level by 2030.

Second, reforms that enhance the digitalisation of the economy, as specified under the second pillar of the plan like the actions aiming to support switching to broadband connections and transition to 5G technology (axis 2.1), as well as under the third pillar of the plan such as the e-skill-enhancing reforms included in re-skilling/upskilling measures and active labour market policies (axes 3.1 and 3.2). Simulating the impact of these reforms is guided by the European Commission's earlier estimates on the impact of digital structural reforms.[16] Following the same approach, we quantify the impact of selected indicators of digitalisation on TFP and labour productivity, either directly or through an improvement in the allocative efficiency. As concerns the size of the reform, it is assumed that the gap between Greece and the EU average is closed by 2030 in terms of the percentage of total population employed as IT specialists (2019 Eurostat data) and in terms of the percentage of enterprises using DSL or other fixed broadband connection (2020 Eurostat data). The estimates suggest a permanent increase of 1.89% in the level of TFP.

All in all, the above estimates imply that the level of TFP increases permanently by 3.11% by 2030.

13 See Thum-Thysen and Canton (2015).
14 The labour force participation rate concerns individuals aged 15-74. It needs to be noted that the model does not feature unemployment, or changes in the population, so that labour force participation changes fully reflect changes in employment.
15 See Canton et al. (2014) and European Commission (2013). Similar conclusions are reached on the basis of OECD estimates reported in Égert (2018).
16 See Lorenzani and Varga (2014).

4 SIMULATION RESULTS

4.1 EFFECTS OF GRANTS AND LOANS

Table 2 reports the effects of RRF funds (grants and loans) on key macroeconomic variables. All variables are expressed in percentage deviations from their steady state values, with the exception of the tax revenues-to-GDP ratio that is expressed as percentage point changes. Panel A of the table reports the joint effects of grants and loans. Panels B and C of the table report the decomposition of these joint effects into the effects of grants and the effects of loans, respectively. Chart A1 in Appendix A presents the dynamic effects for key macroeconomic variables over the period 2021-50.

Regarding the propagation mechanism following an increase in grants in the model, the main impact on the economy stems from government investment (which is allocated the largest share of grants). Higher government investment induces both demand- and supply-side effects. More specifically, an increase in government investment raises aggregate demand, leading firms to increase demand for labour and capital services. The demand-side effect on labour brings about an increase in private sector average real wages and employment, generating a rise in labour income. In turn, the rise in labour income triggers an increase in private consumption that further boosts aggregate demand. The supply-side effects relate to the accumulation of public capital as a result of government investment. Higher public capital leads to higher private sector productivity (see Section 3.1). As regards the effects from the increase in government consumption, the main channel at work is the rise in aggregate demand, which raises labour and capital income and further boosts aggregate demand. Higher government investment and consumption generate inflationary pressures in the short run, owing to the rise in labour costs and the rental rate of capital that increase the marginal cost of firms. Consequently, domestic products become less competitive, which in turn dampens demand for exports in the short run, while demand for imports increases.

Next, regarding the effects of an increase in loans that are modelled as implicit investment subsidies, the first-order effect is a reduction in the price of investment, which creates incentives for the private sector to increase investment spending. Eventually, there is a strong increase in investment demand for as long as private investment is subsidised, which fosters capital accumulation. At the same time, firms increase demand for labour in order to meet higher domestic demand. Despite the higher labour costs, the marginal cost of firms decreases in response to the lower rental rate of capital, thereby generating deflationary pressures. The fall in domestic prices signals an improvement in the country's competitiveness, thereby leading to a rise in exports. At the same time, increased labour income induces households to increase private consumption, which further stimulates aggregate demand. The results in Table 2 suggest that the joint impact of grants and loans (Panel A) leads to an increase of 4.31% in the level of GDP in 2026. Private investment also increases, reaching a peak of around 21% in 2025. Employment in the private sector increases by more than 2% during the stimulus period. The rise in the tax base boosts tax revenues as a share of GDP by 1.56 pp in 2026. It should be noted that after 2026, when the stimulus period ends, the economy gradually converges to the initial steady state. Nevertheless, the speed of convergence to the initial steady state is low, so that the positive effects on GDP are found to be long-lived even after 20 years, mainly due to accumulation in the capital stock over the stimulus period that has lasting effects. Similar results are found by the European Commission (2021), which shows that the effects of the NGEU in Greece could lead to an increase in GDP of between 2.1% and 3.3% by 2026, as well as by Bańkowski et al. (2021).

Finally, it should be stressed that the stimulus financed by loans allocated to private invest-

Table 2 Effects of grants and loans

Panel A Joint effects of grants and loans								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	2.23	3.30	3.72	3.72	4.25	4.31	2.08	0.56
Private investment	7.71	14.06	18.36	20.64	20.78	18.42	2.14	-3.92
Employment – private sector	1.49	2.36	2.50	2.52	2.43	2.23	0.03	-0.51
Tax revenues / GDP	0.79	1.23	1.41	1.53	1.58	1.56	0.55	0.25
Panel B Effects of grants								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	1.04	1.29	1.23	1.26	1.33	1.45	0.30	0.29
Private investment	-0.17	-0.36	-0.49	-0.54	-0.49	-0.34	0.71	0.89
Employment – private sector	1.04	1.17	1.03	1.00	1.01	1.08	0.09	0.04
Tax revenues / GDP	0.45	0.55	0.51	0.50	0.52	0.56	0.05	0.09
Panel C Effects of loans								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	1.19	2.00	2.47	2.77	2.91	2.85	1.73	0.27
Private investment	7.75	14.16	18.51	20.81	20.92	18.47	1.35	-4.78
Employment – private sector	0.46	1.20	1.47	1.52	1.42	1.16	-0.06	-0.54
Tax revenues / GDP	0.34	0.67	0.88	1.01	1.05	0.99	0.49	0.16

Source: Authors' estimations.
Note: All variables are expressed in percentage deviations from their steady state values, with the exception of the tax revenues-to-GDP ratio that is expressed in percentage point changes.

ment has a larger impact on GDP compared with grants. This is due to the significant increase in investment demand and the accumulation of the private capital stock, as well as to the country's enhanced competitiveness that boosts exports. Conversely, the stimulus financed by grants crowds out private investment and consumption in the short run, while at the same time it generates inflationary pressures that dampen demand for exports.[17]

4.2 SIZE OF SPENDING MUTLIPLIERS

Table 3 presents the implied present-value output multipliers for grants, loans and total funds. We report cumulative present-value multipliers, which are preferred over impact multipliers or period-by-period flow changes in output and policy instruments, because they embody the full dynamics associated with exogenous policy instruments and properly discount macroeconomic effects at longer horizons.[18] In particular, the present-value multiplier T years after a change in the respective policy instrument is defined as:

$$\varphi_t = \frac{\sum_{t=0}^{T}\left(\prod_{j=0}^{t}\left(R_{t+j}\right)^{-1}\right)\Delta Y_{t+j}}{\sum_{t=0}^{T}\left(\prod_{j=0}^{t}\left(R_{t+j}\right)^{-1}\right)\Delta F_{t+j}} \qquad (1)$$

where ΔY_{t+j} and ΔF_{t+j} are, respectively, the level changes in output and the respective policy instrument of interest (i.e. grants and the investment subsidy) compared with their pre-

17 The reason for the decrease in private investment is the temporary increase in the price of investment that is driven by the rise in the price of non-tradable goods. The latter is due to the increase in demand for non-tradable inputs that are used in the production of government consumption and investment.
18 See also Uhlig (2010) and Leeper et al. (2010) for a similar approach.

Table 3 Present-value discounted multipliers

	2021	2022	2023	2024	2025	2026	10 years	20 years
Grants	0.73	0.70	0.69	0.68	0.68	0.70	0.75	0.91
Loans (investment subsidy)	1.22	1.40	1.57	1.71	1.81	1.87	2.80	3.50
Total funds	0.93	0.99	1.05	1.10	1.15	1.18	1.56	1.95

Source: Authors' estimations.

policy reform equilibrium values, and R_{t+j} is the model-based nominal return on government bonds, which is used as the discount rate.

The results in Table 3 indicate that the multiplier for the investment subsidies is higher than 1 already in the first period. It reaches a value of 1.87 in 2026, which means that a EUR 1 cumulative increase in investment subsidies over the period 2021-26 results in a GDP gain equal to EUR 1.87 in present value terms. In the long run, the multiplier converges to a value equal to 3.5. The multiplier for grants is found to be lower than 1, with a value of about 0.7 over the period 2021-26, which is within the range of values found in the relevant literature (see among others Kilponen et al. 2019).[19] The long-run multiplier for grants is 0.91. Regarding the overall multiplier for total RRF funds (grants and loans), its value is 1.18 over the 2021-26 period and converges to 1.95 in the long run.

4.3 EFFECTS OF STRUCTURAL REFORMS

Table 4 reports the effects from the structural reforms examined. It should be noted that the structural reforms are assumed to be permanent, which means that the economy moves towards a new long-run equilibrium (steady state). Panel A reports the joint effects of all reforms considered in this assessment. Panels B, C and D report, respectively, the results of reforms that enhance competition in the product market, reforms that support higher labour force participation, and productivity-enhancing reforms.

Looking at reforms that enhance competition in the product market (Panel B), the first-order effect is a decrease in the price of goods that are produced and sold domestically, which increases domestic demand for these goods, while reducing demand for imported goods (import substitution). Tradable sector output increases due to higher external demand that is driven by improved external competitiveness. Higher aggregate demand leads to a rise in demand for labour, which boosts the labour income of households (the real wage also increases), thereby triggering a rise in private consumption that further boosts labour and investment demand. Eventually, output and investment increase by 1.25% and 2.35%, respectively, in the new long run. The higher tax base leads to a rise of 0.5 pp in the tax revenues-to-GDP ratio.

Next, reforms that promote higher labour force participation (Panel C) and eventually lead to a rise in labour supply push private sector wages downards, leading to a fall in labour costs in the short run that allows firms to increase demand for labour. The marginal cost of firms decreases, thus exerting a downward pressure on domestic prices, which translates into a drop in domestic inflation and an improvement in the terms of trade that triggers a rise in exports. Despite the reduction in the average real wage, the total labour income in the economy eventually increases and leads to

19 An important determinant of the magnitude of the impact from government investment on output is the output elasticity of public capital. Typical values in the relevant literature range between 0.05 and 0.1; see e.g. Baxter and King (1993), Leeper et al. (2010) and Clancy et al. (2016). We follow Baxter and King (1993) and set the output elasticity of public capital equal to the government investment-to-GDP ratio found in the data. This implies a value equal to 0.046, which is in the lower range of values used in the literature. Higher values would produce stronger responses of output especially at longer horizons (see e.g. De Jon et al. 2017 and Leeper et al. 2010).

Table 4 Effects of structural reforms

Panel A Joint effects of selected reforms								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	0.36	0.68	1.07	1.53	2.05	2.60	4.86	5.99
Private investment	-0.79	-1.12	-1.01	-0.50	0.32	1.39	6.28	8.46
Employment – private sector	-0.25	-0.09	0.23	0.68	1.20	1.74	3.86	4.15
Tax revenues / GDP	0.29	0.50	0.67	0.84	1.02	1.21	1.98	2.52
Panel B Reforms that enhance competition in the product market								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	0.11	0.20	0.29	0.37	0.47	0.57	0.99	1.25
Private investment	-0.10	-0.09	0.01	0.19	0.44	0.73	1.97	2.35
Employment – private sector	-0.07	-0.06	-0.06	-0.04	-0.03	0.00	0.08	0.06
Tax revenues / GDP	0.05	0.10	0.14	0.17	0.21	0.24	0.40	0.51
Panel C Reforms that support higher labour force participation								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	0.15	0.30	0.51	0.78	1.09	1.42	2.79	3.52
Private investment	-0.59	-0.92	-0.97	-0.77	-0.36	0.22	3.08	4.68
Employment – private sector	-0.07	0.13	0.47	0.91	1.40	1.91	3.92	4.28
Tax revenues / GDP	0.16	0.27	0.37	0.46	0.57	0.68	1.13	1.47
Panel D Productivity-enhancing reforms								
Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	0.09	0.18	0.27	0.37	0.49	0.60	1.06	1.19
Private investment	-0.10	-0.14	-0.10	0.01	0.17	0.37	1.22	1.44
Employment – private sector	-0.11	-0.16	-0.19	-0.19	-0.19	-0.17	-0.17	-0.21
Tax revenues / GDP	0.07	0.12	0.16	0.20	0.24	0.28	0.42	0.50

Source: Authors' estimations.
Note: All variables are expressed in percentage deviations from the initial steady state values, with the exception of the tax revenues-to-GDP ratio that is expressed in percentage point changes.

a rise in private consumption that further boosts domestic demand. Real GDP and private investment increase by 3.52% and 4.68%, respectively, in the new long run. The rise in households' labour income and private consumption leads to an increase of 1.47 pp in the tax revenues-to-GDP ratio in the long run.

Finally, structural reforms that boost productivity (Panel D) bring about a rise in the marginal productivity of private inputs and a decrease in real marginal costs. This enables firms to increase demand for investment and labour and reduce the prices of domestically produced goods, thereby boosting exports. At the same time, the rise in labour and capital income induces households to increase private consumption. In the long run, output and investment increase by 1.19% and 1.44%, respectively.

Overall, structural reforms can jointly contribute to an increase in the levels of real GDP, private investment and employment of around 6%, 8.5% and 4%, respectively, in the long run. In addition, the reforms can permanently increase the tax base and lead to a boost of around 2.5 pp in tax revenues as a percentage of GDP.

Table 5 Overall effect of the RRF

Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	2.61	3.98	4.78	5.55	6.27	6.90	7.00	6.55
Private investment	7.18	13.32	17.7	20.35	21.15	19.75	8.70	4.77
Employment – private sector	1.24	2.26	2.70	3.16	3.58	3.93	3.92	3.65
Tax revenues / GDP	1.09	1.74	2.09	2.38	2.62	2.80	2.56	2.80

Source: Authors' estimations.
Note: All variables are expressed in percentage deviations from the initial steady state values, with the exception of the tax revenues-to-GDP ratio that is expressed in percentage point changes.

4.4 JOINT EFFECTS OF RRF FUNDS AND STRUCTURAL REFORMS

Table 5 summarises the overall impact of the RRF, including both the effects of the stimulus and the effects of the quantified structural reforms.

The results in Table 5 suggest that the full implementation of the Greek RRP can potentially increase the level of real GDP by 6.9% in 2026. It can boost private investment and employment by more than 20% and 4%, respectively, over the same period. At the same time, the tax revenues-to-GDP ratio increases by 2.8 pp, creating fiscal space that allows for a reduction in the tax rates or an increase in government spending that can further boost economic activity. Chart A2 in Appendix A presents the dynamic effects for key macroeconomic variables over the period 2021-50.

5 DISCUSSION

As discussed in Section 3, several groups of reforms envisioned in the Greek RRP are important but not easily quantifiable. They operate via multiple channels, shaping the framework conditions and institutional arrangements of the economy and influencing indirectly the effectiveness of other reforms. Examples include reforms that aim to improve the institutional quality, understood as government effectiveness, regulatory quality, rule of law and control of corruption, via the modernisation of public administration (axes 2.2 and 4.2), increased efficiency of the judicial system (axis 4.3) and improvements in the tax collection structures (axis 4.1). The impact of such complementary, horizontal and far-reaching reforms has not been explicitly addressed in the present empirical assessment, but is considered as a significant upside risk. Hence, conditional on our methodological approach, our estimates may be interpreted as a "lower bound".

There is substantial cross-country evidence that high quality of institutions is strongly correlated with subsequent long-term growth,[20] social welfare and inclusiveness. Reforms improving governance and the rule of law have great potential to reduce transaction and rent-seeking costs, support innovation and entrepreneurship, and increase productivity and allocative efficiency. A number of studies suggest that rent-seeking is associated with substantial welfare costs and tends to affect innovators and young firms more negatively than established producers, as the former lack strong lobbies. Low quality of institutions can be a key determinant of rent-seeking behaviour. Examples include ineffective or partial rule of law, absent or weakly enforced property rights, and insufficient control of corruption.[21] It is worth noting that, on the basis of OECD

20 In a seminal paper, Kaufmann et al. (1999) find that a one standard deviation improvement in governance results in per capita income increasing by a factor of between 2.5 and 4.
21 For a discussion, see among others ECB (2018).

estimates, reforms that would close the gap between Greece and the average practices in terms of the rule of law in other Southern European countries that share common experiences and features with the Greek economy (Italy, Spain, Portugal) might deliver long-run gains in GDP amounting to about 9%.[22] Reforms that reduce the gap to the average EU practices in terms of rule of law, judicial efficacy, cost of contract enforcement, or the time of insolvency procedures also relate to strong productivity effects. It is also worth noting that judicial efficacy seems to have a positive impact on average firm size, the increase of which is one of the main targets of the Greek RRP under pillar 4.

The digitalisation of public administration is a reform that also plays an important role in the Greek RRP under pillar 2, but it is rather complex and less straightforward to capture empirically and disentangle its effects on the economy. Reforms and investments to step up the digitalisation of the public sector and use data strategically for user-driven public services (axis 2.2) are expected to enhance the public sector's efficiency and governance, reduce administrative costs and rent-seeking activities by various groups, and improve transparency and accountability, thus supporting labour productivity, long-term growth and social welfare. Greece has made progress in digital government but still lags significantly behind the EU or the OECD average.[23]

Given the importance of this reform, also in terms of the relative size of the allocated budget in the Greek RRP, we provide in Appendix B the results of a separate simulation exercise that assesses the impact of the digitalisation of public administration. The results suggest that a reallocation of labour away from unproductive activities due to red tape and administrative costs and towards productive activities has the potential to boost long-run output by 3.9%. The results should be treated with caution and only as an indication of the potential gains from such a reform, bearing in mind the novelty and the complexity of the approach.

Finally, a number of reforms included in the Greek RRP but not explicitly modelled hereby are expected to increase significantly the resilience of the Greek economy to shocks, particularly in terms of its recovery capacity. Three groups of reforms stand out: (a) green reforms that boost climate resilience (axis 1.4); (b) primary healthcare system reforms (axis 3.3) that boost resilience to public health crises; and (c) protection of intellectual and physical property rights (axes 1.2, 4.2 on combatting illicit trafficking, 4.4 and 4.6) that increase the resilience of key economic sectors, such as culture and tourism, especially in a digital era. Economic resilience is also expected to be enhanced by reforms that increase flexibility in labour and product markets and labour mobility through a swift upskilling and reskilling of the labour force (pillars 3 and 4), as well as by reforms that support the shift to tradables, and in particular a higher degree of trade openness and further diversification of exports (axis 4.7). Finally, reforms that reduce the vulnerabilities of banks and further develop capital markets should increase financial resilience to shocks, shielding the economy from negative feedback loops between the real economy and the financial sector.

6 CONCLUSIONS

This paper looked into the short-term and long-term macroeconomic effects of the RRF-backed stimulus and structural reforms on the Greek economy. To do so, we have used a

22 This is equivalent to an increase in Greece's ranking in the rule of law relative to the 2019 average of Italy, Spain and Portugal (from 60.6 to 75.4 percentile rank), see https://info.worldbank.org/governance/wgi/Home/Reports. For the OECD estimates, see *Economic Surveys: Greece*, April 2018, Table 6, p. 31.

23 According to the OECD Digital Government Index, Greece ranked 29th out of 33 countries in 2019. Top performers have formal coordination mechanisms for cross-government ICT projects to steer digital government reforms. Meanwhile, training civil servants in digital skills is crucial to be able to effectively implement digital government policies. According to the eGovernment Benchmark by the European Commission, Greece ranked 25th out of 27 EU countries in 2018-19 in public services provided to both citizens and businesses. Greece is the country with the lowest performance in both digitisation and penetration. Countries can improve the penetration level by increasing the number of people that submit official forms online to administrative authorities or by automating processes and requesting fewer forms from citizens.

DSGE model appropriately modified to capture the specificities of the Greek economy and of the Greek RRP. Moreover, we have made explicit a number of working assumptions necessary for this quantification exercise, including assumptions on the size, disbursement and use of the RRF funds, as well as assumptions about the implementation pace and size of selected reforms included in the Greek RRP. One important advantage of using a structural model is that we are able to shed light on the channels through which the different expenditures or structural policies ultimately affect real outcomes and to build an understanding of how policy changes interact with the decisions of households and firms.

The results highlight that the RRF constitutes a significant growth opportunity for the Greek economy. The full and timely implementation of the RRP has the potential to bring about significant benefits to the Greek economy. Real GDP is expected to increase by 6.9% in 2026. This increase largely reflects the effect of the RRF-backed stimulus to productive public and private investments during 2021-26. The results underscore the strong multiplier effects of channelling the RRF loans to the private sector as a means of leveraging private investment.

In the long run, sustaining higher real GDP depends crucially on the full implementation of structural reforms that would close at least partly Greece's present structural gap to the EU average practices along key attributes. In this case, real GDP increases by 6.5% by 2040 compared with the pre-RRF state. Addressing Greece's structural challenges in terms of the quality of governance, rule of law, judicial efficiency and the quality of public administration could bring about additional gains. An illustration involving the digitalisation of public administration suggests additional long-run gains in real GDP of about 4%. By sharp contrast, without any structural reforms that improve the economic environment on a permanent basis, real GDP would gradually return to its pre-RRF level.

Moreover, the results point to gains in terms of investment, employment and tax revenues extended also to the long run. The gains in terms of the tax revenues-to-GDP ratio hint at the potential to further boost activity by using the additional fiscal space to reduce the size of the distortionary taxes or increase government spending.

At the same time, the RRF presents a strong challenge for the Greek public administration to deliver its ambitious plan within the tight envisaged time schedule. Delays or mishaps in the implementation and less than full absorption of the RRF funds would curtail the potential benefits from the RRF that this study has underlined. In this respect, it is further important to push forward structural reforms that would enhance the capacity and efficiency of public administration, as well as the capacity of the private sector to support growth in the long run through new productive investment projects and sustainable jobs.

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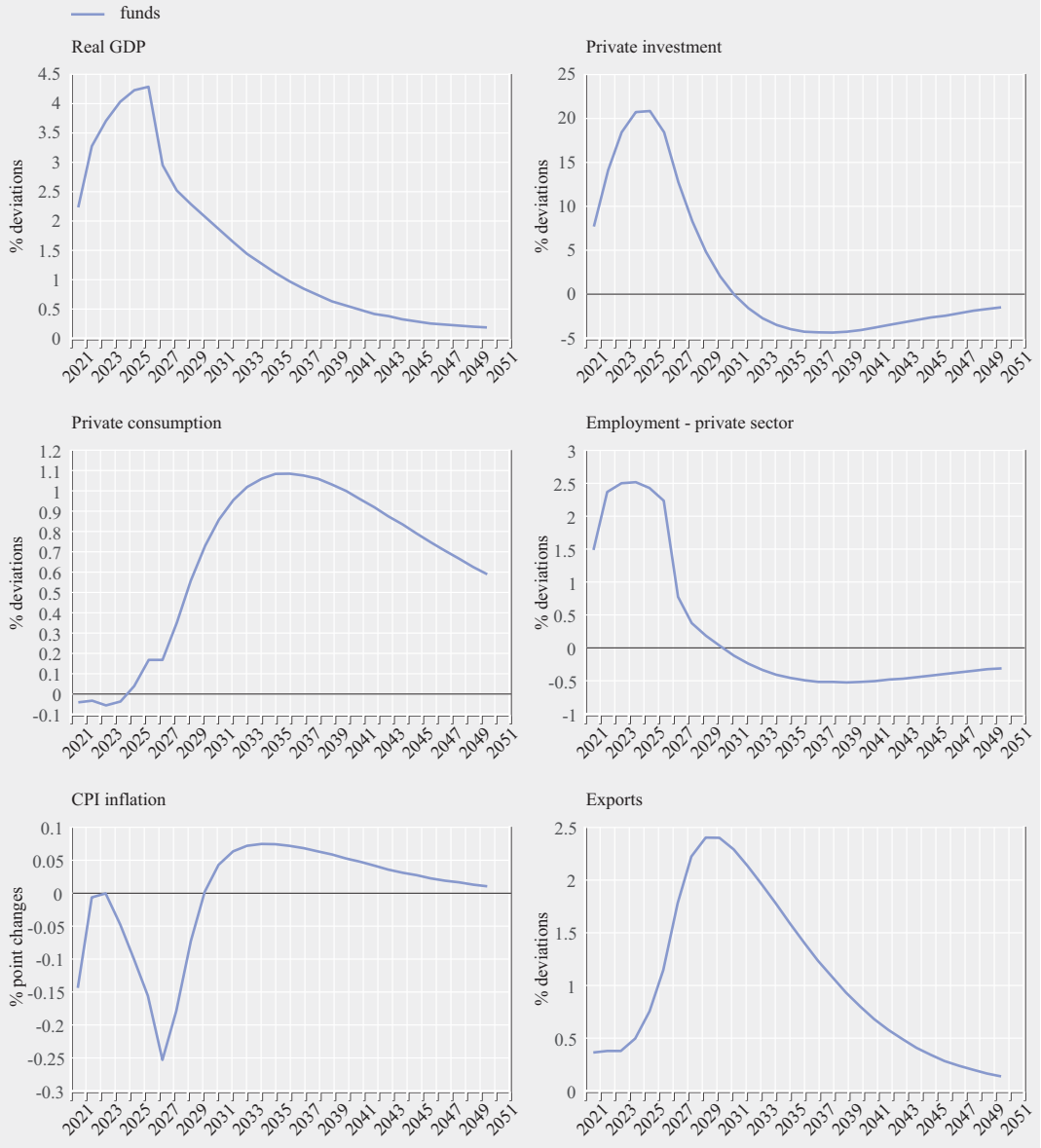
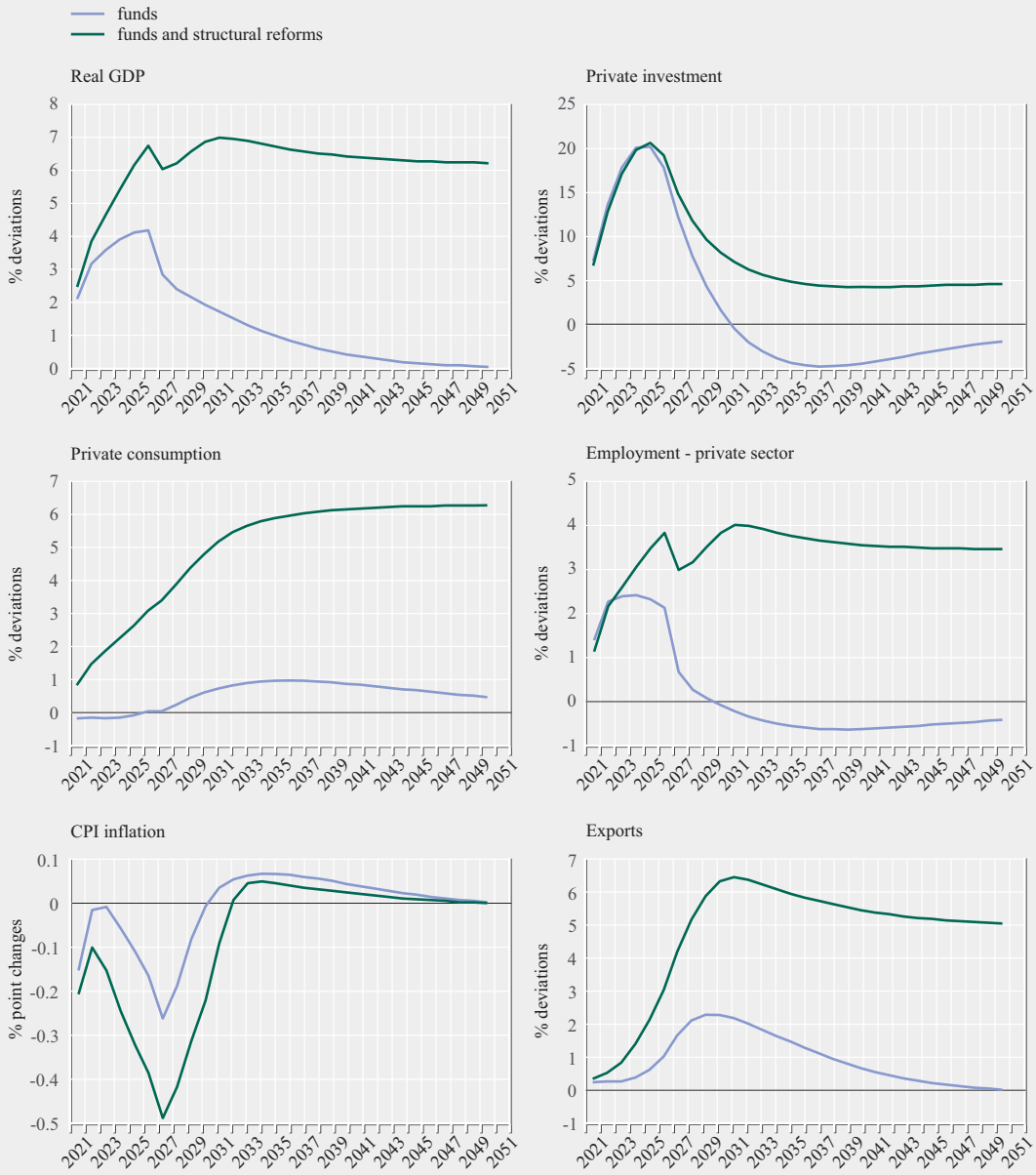
APPENDIX A

Chart A1 Dynamic effects of funds (grants and loans)



Source: Authors' estimations.
Note: All variables are expressed in percentage deviations from the steady state values, with the exception of CPI inflation that is expressed in percentage point changes.

Chart A2 Dynamic effects of the RRF in total (funds and structural reforms)



Source: Authors' estimations.
Note: All variables are expressed in percentage deviations from the steady state values, with the exception of CPI inflation that is expressed in percentage point changes. The chart does not include the effects from reforms related to the digitalisation of public administration.

APPENDIX B

EFFECTS OF THE DIGITALISATION OF PUBLIC ADMINISTRATION

In order to examine the effects of the digitalisation of public administration, we augment the model economy to account for unproductive use of resources and in particular the inefficient use of factor inputs that may result from the low efficiency of the public sector, the regulatory burden, the administrative costs on economic agents, etc. To do so, it is assumed that households allocate their available work effort time, H, between "productive work", nH, and "unproductive activities", $(1-n)H$.[1] What matters for the production of output is the amount of productive labour services nH that households supply to firms and receive a labour income. Engaging in unproductive activities involves a loss in utility for households. Reforms related to the digitalisation of public administration can be assessed through their impact on the fraction allocated to productive work, n. This is challenging because it requires an estimate for the share of productive work or unproductive activities. To obtain a value for this parameter, we link productive/unproductive work effort with the time that individuals can save from a digital interaction with the government, which is *de facto* assumed to be more efficient. To do so, we combine data on the share of individuals who interacted with public authorities via websites with the share of individuals who submitted completed e-forms. The estimated gap between Greece and the EU-27 is 10% in 2019 and is interpreted as the share of the available working time that is allocated to unproductive activities in excess of the EU average.[2] We simulate the effects of the digitalisation of public administration by assuming that Greece closes half of the gap with the EU by 2030 (i.e. the share of productive work increases by 5 pp or, equivalently, the share of unproductive activities is reduced by 5 pp). Table B1 summarises the effects of the reform.

Table B1 Effects of the digitalisation of public administration

Variable	2021	2022	2023	2024	2025	2026	10 years	20 years
Real GDP	0.18	0.35	0.59	0.89	1.23	1.60	3.10	3.91
Private investment	-0.63	-0.96	-1.00	-0.76	-0.29	0.36	3.51	5.22
Employment – private sector	-0.62	-0.94	-1.09	-1.14	-1.14	-1.11	-1.02	-0.62
Productive labour services *(nH)*	-0.07	0.17	0.56	1.05	1.60	2.17	4.39	4.78
Tax revenues / GDP	0.18	0.31	0.41	0.52	0.64	0.76	1.26	1.63

Source: Authors' estimations.
Note: All variables are expressed in percentage deviations from the steady state values, with the exception of the tax revenues-to-GDP ratio that is expressed in percentage point changes.

Regarding the propagation mechanism following the shock, the increase in the supply of productive work exerts downward pressure on demand for employment, since a given amount of output can now be produced with less labour. Eventually, employment and the average wage rate decrease during the period in which the share of productive work increases. Nevertheless, the share of productive labour services increases, leading to a boost in the labour income of households and private consumption (it should be recalled that households are paid for their productive work). In the short run, higher labour productivity allows firms to meet demand with less capi-

1 The modelling approach follows Economides et al. (2021) and Angelopoulos et al. (2009). In their set-up, households divide their work effort between productive work and anti-social or rent-seeking activities and compete with each other for a fraction of a contestable prize.
2 To compute this gap, we use data from Eurostat regarding the share of individuals who interacted with public authorities via websites and the share of individuals who submitted completed e-forms. The average of the two series in 2019 is 40% for Greece and 44.5% for the EU-27.

tal services, leading to a temporary drop in investment. The marginal cost of firms eventually decreases, allowing firms to reduce domestic prices, which in turn triggers a rise in export demand. In the new long run, real GDP and investment increase by 3.91% and 5.22%, respectively. Employment declines by 0.62%, but the productive labour services are 4.78% higher. Finally, the tax revenues-to-GDP ratio increases by 1.63% due to an increase in the tax base.

EXPLAINING THE CROSS-COUNTRY DIFFERENCES IN THE ECONOMIC FALLOUT DURING THE COVID-19 PANDEMIC CRISIS

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ABSTRACT

This paper investigates the main drivers of the differences in the economic fallout in advanced economies during the COVID-19 crisis. In addition to containment measures, the analysis places emphasis on pre-crisis factors that may have bolstered economic resilience during the health crisis and mitigated the output loss. Also, it assesses the role of discretionary fiscal policy in 2020 in explaining the cross-country variation in the economic fallout by explicitly controlling for the simultaneity of the policy measures and the size of the GDP shock. We find that factors such as social distancing measures and the structure of the economy, which are directly related to the COVID-19 crisis, explain a large part of the asymmetry in output loss in 2020 across countries. Pre-crisis structural and institutional factors also seem to contribute to economic resilience during the current crisis, while stronger discretionary fiscal support in 2020 is associated with lower output loss.

Keywords: economic resilience; COVID-19 pandemic; cross-sectional analysis

JEL classification: C21; F43; H50

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ΕΡΜΗΝΕΥΟΝΤΑΣ ΤΙΣ ΔΙΑΦΟΡΕΣ ΜΕΤΑΞΥ ΤΩΝ ΧΩΡΩΝ ΩΣ ΠΡΟΣ ΤΙΣ ΟΙΚΟΝΟΜΙΚΕΣ ΕΠΙΠΤΩΣΕΙΣ ΑΠΟ ΤΗΝ ΚΡΙΣΗ ΤΗΣ ΠΑΝΔΗΜΙΑΣ COVID-19

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ΠΕΡΙΛΗΨΗ

Η παρούσα μελέτη διερευνά τους βασικούς προσδιοριστικούς παράγοντες των διαφορών στην οικονομική επίπτωση κατά την κρίση της πανδημίας COVID-19 μεταξύ των προηγμένων οικονομιών. Η ανάλυση επικεντρώνεται στην επίδραση των μέτρων κοινωνικής αποστασιοποίησης, καθώς επίσης και παραγόντων που προϋπήρχαν της κρίσης και οι οποίοι ενδεχομένως ενίσχυσαν την οικονομική ανθεκτικότητα απέναντι στην πανδημική κρίση περιορίζοντας την πτώση του παραγόμενου προϊόντος. Επιπλέον, η μελέτη εξετάζει το ρόλο των δημοσιονομικών μέτρων στήριξης που ελήφθησαν το 2020 στην εξήγηση των διακυμάνσεων της οικονομικής επίπτωσης μεταξύ των χωρών, λαμβάνοντας υπόψη το συγχρονισμό των μέτρων και του μεγέθους της πτώσης του ΑΕΠ. Διαπιστώνουμε ότι παράγοντες όπως η κοινωνική αποστασιοποίηση και η διάρθρωση της οικονομίας, που συνδέονται άμεσα με την κρίση της πανδημίας COVID-19, εξηγούν μεγάλο μέρος της ασυμμετρίας μεταξύ των χωρών στην απώλεια προϊόντος το 2020. Επιπλέον, στην οικονομική ανθεκτικότητα φαίνεται να συμβάλλουν διαρθρωτικοί και θεσμικοί παράγοντες που προϋπήρχαν της κρίσης, ενώ μεγαλύτερη δημοσιονομική στήριξη το 2020 συνδέεται με χαμηλότερη απώλεια προϊόντος.

EXPLAINING THE CROSS-COUNTRY DIFFERENCES IN THE ECONOMIC FALLOUT DURING THE COVID-19 PANDEMIC CRISIS*

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I INTRODUCTION

The COVID-19 pandemic crisis has had a severe negative impact on the global economy. Pandemics typically produce economic losses both directly, due to mortalities, and indirectly, due to disruptions in activity (Anyfantaki et al. 2020). Indeed, the COVID-19 crisis has led to a fall of 4.7% in GDP in advanced economies as a whole in 2020, compared with an increase of 1.6% in 2019.

Moreover, the economic fallout from the pandemic appears to be unevenly distributed across countries, with some economies registering considerably higher losses. This cross-country variation can be partly attributed to differences in containment measures across countries, as there is a negative relation between containment measures and economic resilience (see Chart 1). However, other factors are also at play, since countries with similar degrees of stringency in containment measures, such as Greece and Germany, have experienced a varying economic fallout. Consequently, countries have displayed different levels of economic resilience to the pandemic crisis, which could be associated with asymmetries in pre-existing macroeconomic, institutional and structural factors as well as in the policy measures to support economic activity during the crisis.

The aim of this paper is to investigate the main drivers of the differences in the economic fallout across advanced economies during the COVID-19 pandemic crisis. The empirical setup explores the effect of factors directly linked to the current health crisis as well as the effect of individual economies' pre-crisis features that may have bolstered economic resilience and mitigated the output loss during the COVID-19 outbreak. In addition, we assess the role of the discretionary fiscal policy response in 2020 in explaining the cross-country variation in the economic fallout by explicitly controlling for the simultaneity of the policy measures and the size of the GDP shock. To the best of our knowledge, this is the first study to explicitly consider the role of structural and institutional factors as well as discretionary fiscal policy measures in explaining differences in the economic consequences of the COVID-19 crisis.

The paper draws on the literature on economic resilience, which examines variations in economic performance across national and regional economies following a common shock. The concept of economic resilience is broad and is often explained in terms of three components: the exposure or vulnerability to a shock; the capacity to absorb a shock; and, finally, the ability to recover and return quickly to pre-crisis or medium-term rates of growth. Economic resilience was used widely after the global financial crisis to explain cross-country variations (particularly among EU countries) in both the economic losses triggered by the global fallout in financial markets and the speed of the subsequent recovery. It was also used in order to analyse the degree of preparedness of countries in case a similar crisis occurred in the future and placed increased emphasis on the reduction of financial sector vulnerabilities.

Empirical findings support the role of macroeconomic imbalances as well as the role of various structural and institutional factors

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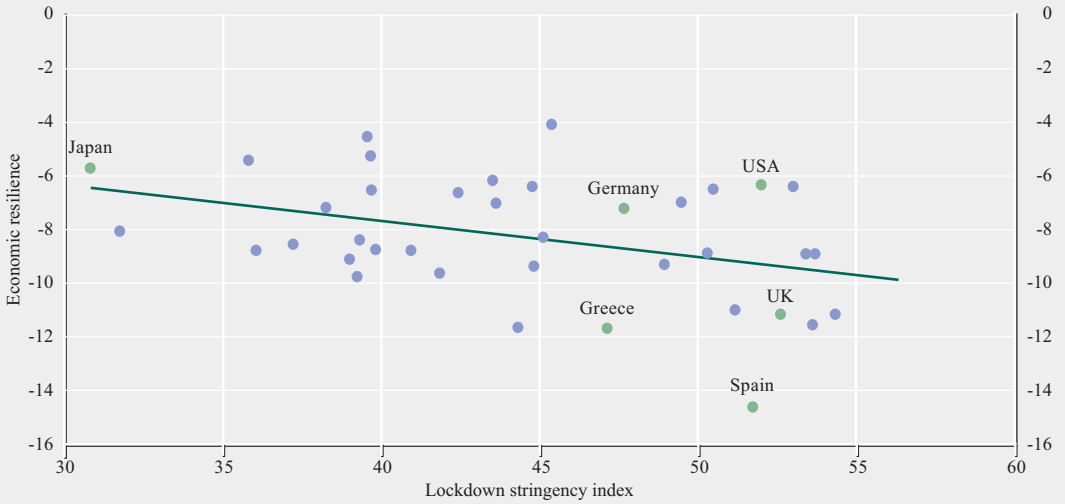
Chart 1 Economic resilience[1] and lockdown stringency index[2]



Sources: IMF and Oxford COVID-19 Government Response Tracker (OxCGRT) Database , authors' own calculations.
Note: Each dot in the chart represents one of the 39 countries in the sample (see Section 3.1).
1 The difference in the GDP growth forecast for 2020 between IMF *World Economic Outlook* October 2020 and October 2019 (in percentage points). More negative values signify lower resilience.
2 OxCGRT Stringency Index, 0 to 100 (from lowest to highest stringency).

in forging economic resilience. Public debt sustainability, a current account surplus and a positive net international investment position seem to shield economies against an abrupt unwinding of excessive negative imbalances, which can exacerbate external shocks. Moreover, they increase the fiscal and monetary policy space for mitigating the effects of the shock (Alessi et al. 2018; Hermansen and Röhn 2015). Additionally, the role of labour and product market institutions is ambiguous and depends on the definition of resilience. A higher degree of regulation is likely to contain output losses in the short term (higher resilience) but impede the reallocation of resources in the recovery (lower resilience) (Groot et al. 2011; Gianmoena and Rios 2018; Hundt and Holtermann 2020). On the other hand, evidence from advanced economies suggests that properly calibrated reforms that include lower regulation in labour and product markets can increase overall resilience by aiding the reallocation of workers and capital to the more productive jobs and firms, while protecting employment in the short term (Bluedorn et al. 2019). Also, a favourable business environment as well as strong and efficient institutions (judicial, political and financial) have been shown to play an important role in raising countries' economic resilience (Sondermann 2016; Jolles et al. 2018; Alessi et al. 2018; Bluedorn et al. 2019). These factors increase the ability of the economy to make adjustments that cushion the impact of a shock or facilitate the necessary reallocation of resources for a rapid recovery.

In light of the COVID-19 crisis still unfolding, only a handful of papers have so far assessed the factors that may explain the cross-country variation of its economic effects. A number of these studies examine resilience from a regional perspective. Gong et al. (2020) and Hennebry (2020) look at the resilience of Chinese and Irish regions, respectively, to the COVID-19 crisis. Using the regional GDP growth rate for the first quarter of 2020 as an indicator of economic resilience and its correlation with pre-existing factors, Gong et al. (2020) find that the characteristics of the pan-

demic crisis, institutional experience in tackling past epidemic crises, government measures to support the economy and the economic structure of regions, including reliance on contact-sensitive industries and foreign trade, affect the resilience of Chinese regions. Hennebry (2020) employs a similar method using unemployment data and finds that resilience to the financial crisis is not correlated with resilience to the current COVID-19 crisis, highlighting the importance of the crisis characteristics for economic outcomes.

Other studies construct composite indices to analyse the variability in output loss among countries. In Diop et al. (2020), countries are ranked on the basis of vulnerability and resilience indices, which are constructed using a principal component analysis. The vulnerability index is based on indicators on the structure of the economies (such as international tourism receipts, oil and natural resources rents and personal remittances). The resilience index is constructed using a combination of institutional factors (including regulatory quality and government effectiveness) and other factors that can facilitate the absorption of shocks, such as fiscal space, external debt position and unemployment. On the basis of this analysis, advanced economies rank overall lower in vulnerability and higher in resilience compared with emerging market economies, with notable variation also within country groups.

Similar conclusions on the resilience of groups of countries are drawn in Noy et al. (2020). The authors measure the hazard, exposure, vulnerability and resilience of economies in order to compute a disaster risk index for each country. Tourism and ageing population are associated with higher vulnerability, while lower government debt as a percentage of GDP and a higher share of government expenditure in GDP are related to more resilience. In a study for Latin American countries, Montenegro et al. (2020) use principal component analysis to identify differences in pre-existing patterns of resilience of Latin American countries across four components: socioeconomic infrastructure; macroeconomic conjuncture; financial and banking structure; and productive and environmental capacity. Countries with greater resilience exhibit advanced macroeconomic and financial development, while social, institutional and cultural tensions, and low productive capacity in high technology sectors are associated with lower resilience. In a somewhat different study, Pierri and Timmer (2020) examine the effects from the decline in mobility and from information technology (IT) adoption across US states during the COVID-19 crisis using a linear probability model. They find that IT adoption mitigates the economic fallout from reduced mobility during the pandemic, which they measure in terms of unemployment increases rather than output losses.

Similar to our study, Sapir (2020) uses the revision of the GDP forecast for 2020 to measure resilience and assesses the drivers of the GDP shock during the COVID-19 pandemic in EU countries by estimating a simple OLS cross-sectional regression. The analysis finds that the stringency of social distancing measures, the share of tourism in GDP and the quality of governance in each country can explain the differences in economic losses across EU countries. By contrast, public indebtedness does not play a role in economic resilience.

The present paper contributes to the literature on economic resilience to the COVID-19 shock by formally examining the disparities in economic outcomes across advanced economies based on macroeconomic and institutional variables identified in the literature on economic resilience to macroeconomic shocks. It draws on the analysis by Sapir (2020) and extends it by looking at pre-existing structural and institutional factors beyond tourism and governance. Our paper also extends the analysis to a large dataset for 39 advanced economies and provides robustness checks on model uncertainty in cross-sectional regressions using Bayesian model averaging techniques.

We find that factors which are directly associated with the COVID-19 crisis explain a large

part of the cross-country variation in the output loss in 2020. In particular, the contribution of contact-sensitive sectors, such as tourism, to the economy, lockdown measures and participation in global value chains (GVCs) seem to be robust to alternative model specifications as well as to Bayesian model averaging techniques. The pre-crisis fiscal space seems to matter in shaping the resilience of EU countries. Moreover, a better quality of governance and more stringent regulation in product and labour markets are related to increased economic resilience during the current crisis. Finally, stronger discretionary fiscal support in 2020 is also associated with lower output loss.

The rest of the paper is structured as follows: Section 2 outlines the baseline empirical specification and Section 3 presents the main results. Section 4 performs a battery of robustness checks and Section 5 assesses the role of discretionary fiscal policy in 2020 in explaining cross-country differences in the size of the GDP shock. Section 6 concludes.

2 EMPIRICAL SPECIFICATION

2.1 BASELINE MODEL

We examine the factors that explain the differences in the depth of the COVID-19 crisis across advanced economies by employing a simple cross-country regression of the form:

$$GDPr_i = \alpha_0 + X_i\alpha_1 + \varepsilon_i, \qquad \varepsilon \sim N(0, \sigma^2 I) \qquad (1)$$

The dependent variable, $GDPr_i$, is the difference in the GDP growth forecast for 2020 between the IMF *World Economic Outlook* (WEO) October 2020 and the IMF WEO October 2019, in line with the definition used in Sapir (2020).[1] The greater the downward revision of economic growth for 2020 in an economy, the higher the economic fallout from the COVID-19 pandemic and, therefore, the lower the economic resilience to the current crisis. The merit of this definition is that it accounts both for the unprecedented decline in real GDP in 2020 as a result of the pandemic and for the expected path of the economy in 2020 prior to the crisis. In other words, the dependent variable also captures differences in the business cycle across economies before the pandemic.

Matrix, X_i, includes a set of independent variables that are related to the characteristics of the COVID-19 crisis, as well as factors that are key, according to the relevant literature, to explaining the resilience of an economy in the face of a large economic shock. Specifically, during the COVID-19 pandemic, social distancing measures introduced by governments to contain the spread of the virus have taken a heavy toll on economies, notably during the first half of 2020. Also, the contribution to GDP of sectors exposed to social distancing controls and travel restrictions can determine to a large extent the exposure and vulnerability of an economy to the current crisis. As a result, equation (1) includes as independent variables an index for lockdown measures, namely the Oxford COVID-19 Government Response Stringency Index, the direct contribution of tourism to GDP in 2019, and participation in GVCs as a proxy of trade openness (see Table 1 for data definitions). We expect that more open economies would face a sharper output loss during the COVID-19 outbreak due to disruptions in global value chains and international trade.

Moreover, differences in economic resilience across countries may depend on pre-crisis macroeconomic imbalances, as well as on structural and institutional factors that are closely related to preparedness and the pursuit of effective economic policies during a crisis. To this end, the general government structural budget balance in 2019 (as a percentage of potential GDP) is included in the analysis

1 The cut-off date of the analysis is early March 2021. Due to lack of realised values for real GDP growth in 2020 for all countries in the sample, we employ its estimate drawn from the IMF WEO October 2020 database. However, Section 4 presents a set of robustness checks by employing alternative definitions of the dependent variable, including the available realised GDP figures for 2020.

Table 1 Source and methodology for the main variables

Variable	Source	Year	Methodology
GDP growth revision	IMF WEO Database	2020	Difference in the GDP growth forecast for 2020 between the IMF World Economic Outlook (WEO) October 2020 and the IMF WEO October 2019
Lockdown measures	Oxford COVID-19 Government Response Tracker (OxCGRT) Database	2020	Stringency Index: composite index which is a simple additive score of several indicators of government response around the world (such as school and business closures and travel restrictions) rescaled to vary from 0 (lowest stringency) to 100 (highest stringency). Data up until 28 September 2020 (in line with the cut-off date of the IMF WEO October 2020)
Tourism	World Travel and Tourism Office	2019	Direct contribution of tourism to GDP
Participation in global value chains (GVCs)	UNCTAD	2019	Foreign value added as a percentage of exports of goods (Koopman et al. 2011)
Structural budget balance	IMF WEO Database	2019	Structural primary budget balance (as a percentage of potential output)
Governance	World Bank Governance Indicators	2018	Governance is the sum of six indicators: control of corruption, government effectiveness, political stability and absence of violence/terrorism, regulatory quality, rule of law, voice and accountability
Financial development	IMF Financial Development Database	2019	Index summarising the depth, access and efficiency of financial institutions and financial markets
Regulation in labour and product markets	OECD	2019 (or latest available)	Synthetic indicator constructed on the basis of the following OECD indicators: EPL (for 2019), PMR (for 2018), trade union density (for 2018), collective bargaining coverage (average 2010-2017)

Note: Due to large differences across countries in the latest available year for the OECD indicator on collective bargaining coverage, the average value after the global financial crisis is computed as in Duval et al. (2007).

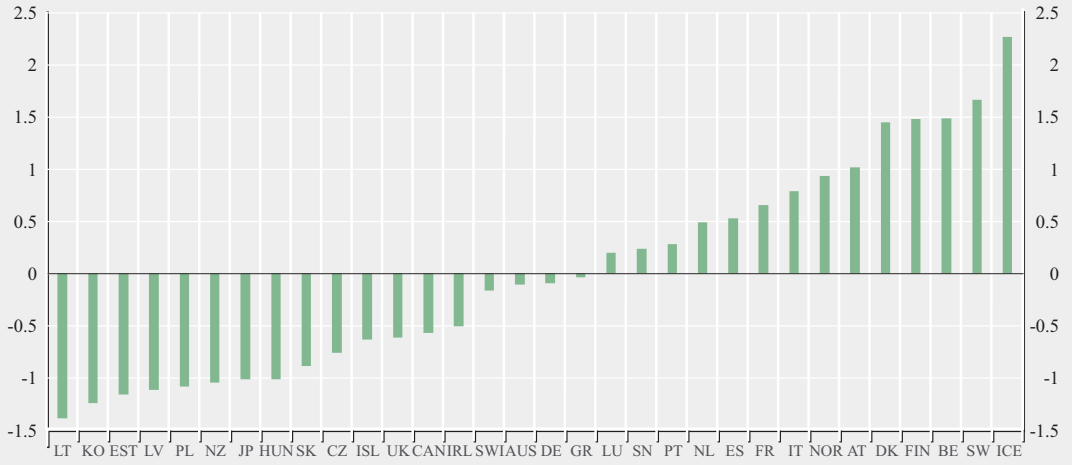
as a measure of the available fiscal space prior to the crisis. We expect that a higher fiscal space would be associated with a lower economic fallout during the COVID-19 crisis.[2] Furthermore, the quality of governance and the degree of financial development could impact the ability of an economy to weather the negative effects of the economic shock. Strong institutions and a better quality of governance are generally associated with better economic outcomes, as the ability of the policy framework to cushion the impact of the crisis in the short term is key to economic resilience (see among others Acemoglu and Robinson 2012; Caldera-Sánchez and Röhn 2016). Besides, a higher degree of financial development, namely deep, accessible and effective financial markets and institutions, implies a more efficient allocation of financial capital, improved liquidity and a better functioning of capital markets, which can contribute to lower output losses during adverse tail risk events (Caldera-Sánchez and Gori 2016; Caldera-Sánchez et al. 2016).

Finally, according to the relevant literature, structural factors, such as regulation in labour and product markets, seem to play an important role in dampening the initial impact of an economic shock. Empirical studies corroborate that a more stringent regulation in labour and product markets is not only associated with a milder recession in the short term, but also with increased persistence of the negative shock and a slower economic recovery due to an inefficient allocation of resources (Duval et al. 2007; Gianmoena and Rios 2018; Bluedorn

2 The pre-crisis structural budget balance is widely used in academic and policy analyses as a measure of the available fiscal space. However, for EU countries, fiscal space is usually defined as the difference between the general government structural balance and the medium-term objective (MTO). In terms of magnitude, the difference between the two definitions is small for EU countries.

Chart 2 Synthetic indicator of regulation in labour and product markets in 2019

(number of standard deviations from the 2019 OECD average)



Source: OECD, authors' own calculations.
Note: The OECD average is the simple arithmetic average of the individual country scores.

et al. 2019).[3] In the present analysis, the role of regulation in labour and product markets in explaining the cross-country variation in the GDP shock is examined using a synthetic indicator based on relevant OECD structural reform indices.

2.2 A SYNTHETIC INDICATOR OF LABOUR AND PRODUCT MARKET REGULATION

We construct a synthetic indicator to examine the effects of labour and product market regulation on economic resilience during the COVID-19 crisis. The indicator can be viewed as a simple summary measure of the stringency of regulation in labour and product markets. Hence, it only partly reflects the implementation of past structural reforms, which are captured by the level of the indicator and can affect the resilience of economies in the event of crises.[4] In our empirical set-up, the use of individual indicators of regulation in product and labour markets is subject to several caveats. These include lower degrees of freedom in the estimation due to sample size restrictions. The use of a synthetic indicator is also justified by the fact that countries tend to follow broadly similar attitudes across policy areas, leading to a high correlation of reforms in labour and product markets. Often, such correlation is also evident between broader institutional frameworks (e.g. quality of governance) and structural reforms in product and labour markets, giving rise to multicollinearity issues in empirical analyses.

Following Duval et al. (2007) and Nicoletti and Scarpetta (2005), the synthetic indicator is derived from a principal component analysis. In particular, the index is the first principal component of the following OECD policy indicators for 2019 (or the latest available year): (a) trade union density; (b) the strin-

3 In line with a standard New Keynesian model, wage and price stickiness is associated with a more flat Phillips curve and, thus, with a higher trade-off between output and inflation. Under optimal monetary policy and price stability, the central bank will react less to shocks, as a more aggressive reaction would lead to greater output loss with limited benefits to price stability. In effect, policies that increase wage and price stickiness (e.g. higher product market regulation, more employment protection regulation, etc.) are expected to lead to a smaller (though more persistent) output fall after a shock.

4 It should be noted, however, that the synthetic indicator does not allow inference on the effects of changes in regulation over time, since it is constructed using the level of the OECD structural reform indicators for the latest available year. In countries that have stepped up reform efforts in recent years, a higher pace of reforms can result in lower business cycle volatility and potentially stronger recovery after the current crisis, which, notwithstanding, is not examined in the present analysis.

Table 2 Data summary

	Obs	Mean	Std. Dev.	Min	Max
GDPr	39	-8.3	2.3	-14.7	-4.1
Lockdown measures	39	44.6	6.4	30.8	54.3
Tourism	39	9.8	4.9	4.2	25
Participation in GVCs	39	78.6	29.1	29.9	161.7
Structural budget balance in 2019	39	-1.3	2.4	-8.1	3.5
Governance	39	6.9	2.8	1.4	10.7
Financial development	39	0.6	0.2	0.2	0.9
Regulation in product & labour markets	32	54.7	30.9	11.9	124.4

gency of employment protection legislation for regular workers (EPL); (c) the stringency of product market regulation (PMR); and (d) the collective bargaining coverage, namely the share of workers covered by a collective agreement.[5] The weight of each policy indicator in the synthetic index is obtained from the scoring coefficients of the first principal component.

As an illustration of the cross-country values of the synthetic indicator, Chart 2 shows the number of standard deviations around the 2019 OECD average for a set of advanced economies. A negative (positive) deviation from the OECD average indicates a lower (higher) value of the synthetic indicator and, therefore, higher (lower) flexibility in product and labour markets relative to the OECD average. Countries such as Korea, Lithuania, Estonia and New Zealand note less stringent regulation in labour and product markets compared with the OECD average, while in Iceland, Sweden and Belgium more stringent regulations apply.[6] High reform efforts during recent years in euro area countries under an economic adjustment programme, such as Greece and Portugal, are reflected in a value of the synthetic index near the OECD mean.

Table 1 presents the source and methodology for each of the main variables used in the analysis and Table 2 summarises their statistical properties.

3 EMPIRICAL RESULTS

3.1 BASELINE ESTIMATES

We employ a cross-sectional dataset for 39 advanced economies, which comprises all EU countries (excluding Malta) and economies classified as advanced according to the IMF "Economy Groupings" of the IMF *Fiscal Monitor* October 2020. These economies are the United States, the United Kingdom, Switzerland, Japan, Korea, Iceland, Israel, New Zealand, Norway, Singapore, Hong Kong, Australia, and Canada.

Table 3 presents the baseline results on the factors that explain the disparity in countries' resilience to the current crisis. Variables associated with the distinct characteristics of the crisis, such as the stringency of social distancing measures and the economy's reliance on tourism, are statistically significant under all

5 For more information on the timing of the OECD indicators, see Table 1. These indicators are infrequently revised due to data validations and methodological changes. Therefore, the latest data can often overestimate the stringency of regulation in labour and product markets, notably in countries that have recently increased their reform efforts. However, this should not affect the estimations, since the pace of reforms in most countries is commonly slow and potential data revisions should only marginally affect aggregate indicators.

6 The relative ordering of the countries in Chart 2 depends on the weight (i.e. the scoring coefficients) of the individual OECD structural reforms indicators in the synthetic index. For instance, a lower weight applies to regulation in product markets compared with regulation in the labour market. Hence, countries, such as Sweden, with less regulated product markets do not score high when flexibility in labour markets is also taken on board.

Table 3 Factors explaining the economic fallout during the COVID-19 crisis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lockdown measures	-0.11** (0.04)	-0.12*** (0.03)	-0.12*** (0.03)	-0.12*** (0.03)	-0.19*** (0.04)	-0.17*** (0.04)	-0.16*** (0.04)
Tourism	-0.27*** (0.05)	-0.27*** (0.05)	-0.27*** (0.05)	-0.29*** (0.05)	-0.27*** (0.05)	-0.39*** (0.07)	-0.43*** (0.07)
Participation in GVCs		-0.034*** (0.008)	-0.034*** (0.008)	-0.029*** (0.008)	-0.028*** (0.009)	-0.042*** (0.013)	-0.038*** (0.012)
Structural budget balance in 2019			0.02 (0.09)	-0.10 (0.11)			-0.17 (0.14)
Structural budget balance* EU dummy				0.41* (0.21)			0.74*** (0.23)
Structural and institutional factors							
Governance	0.22** (0.09)	0.34*** (0.09)	0.34*** (0.09)	0.25** (0.09)			
Financial development					3.31** (1.41)		
Regulation in product & labour markets						0.032** (0.012)	0.031*** (0.011)
Constant term	-2.64 (2.22)	0.10 (2.00)	0.10 (2.03)	0.77 (1.97)	2.94 (2.13)	4.74* (2.33)	4.32** (2.05)
Adjusted R^2	0.458	0.615	0.604	0.635	0.522	0.554	0.663
No. of countries	39	39	39	39	39	32	32

Source: Authors' own estimations.
Notes: The dependent variable is the difference in the GDP growth forecast for 2020 between IMF WEO October 2020 and October 2019. All independent variables refer to 2019 or latest available year, except lockdown measures which refer to 2020 (see Table 1). Standard errors are reported in brackets. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

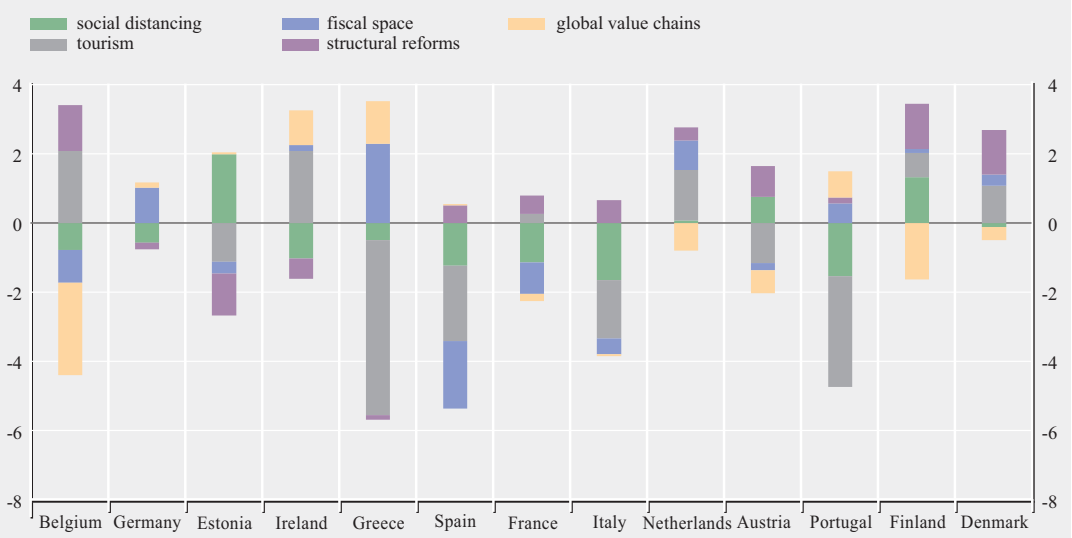
model specifications. In particular, a 1 percentage point (pp) increase in the direct contribution of tourism to GDP is associated with about 0.3 pp downward revision in GDP growth for 2020. Moreover, social distancing measures and tourism taken together explain around 45% of the GDP growth revision for 2020. In addition, higher integration into GVCs leads to a higher downward GDP revision (Column (2)), reflecting the supply disruptions that took place mainly during the first half of 2020 as well as the restrictions on supply chains and international trade. The inclusion of participation in GVCs in the estimations substantially increases the model's explanatory power.

Column (3) in Table 3 adds the structural general government budget balance for 2019, which is not statistically significant, suggesting that the pre-crisis fiscal space does not matter for the disparities in economic outcomes across advanced economies. However, this finding may reflect the extensive quantitative easing measures taken by central banks, which reduced restrictions on fiscal policy in large economies. Moreover, fiscal space may be more important in EU-27 countries, given the common fiscal rules and the budgetary assessment process inherent in the European Semester. The positive and statistically significant coefficient of the interaction term of the structural budget balance with a dummy capturing a country's membership in the EU (see Table 3, Column (4)) reveals that pre-pandemic fiscal space in EU countries is associated with a smaller recession in 2020.[7]

Moreover, the empirical results highlight the importance of institutional factors for absorbing the COVID-19 shock. Countries with bet-

7 Based on an F statistic, the hypothesis that the coefficients of the budget balance and the interaction term are equal cannot be accepted at the 10% significance level.

Chart 3 Model-based GDP decomposition relative to the shock observed in the EU-26 on average



Source: Authors' own calculations.
Notes: The chart shows the contribution of factors (in percentage points) based on the estimates in Table 3, Column (7). For all factors, except social distancing measures, 2019 values are used. A positive (negative) value indicates the contribution of the factor in containing (deepening) the downward GDP growth revision for 2020 relative to the EU average.

ter quality in governance and higher financial development show greater economic resilience, or otherwise, lower GDP growth revisions for 2020 (see Table 3, Columns (2) and (5), respectively). At the same time, Columns (6) and (7) suggest that less flexible product and labour markets are related to higher resilience in the short term, by promoting job retention and supporting incomes during the crisis. However, previous empirical studies show that structural reforms in product and labour markets contribute to a speedier recovery in the economy following an economic shock.[8]

For illustrative purposes, we perform a model-based decomposition of the GDP shock during the COVID-19 crisis based on the estimates presented in Table 3 (Column (7)). Chart 3 shows the decomposition relative to the shock observed in the EU on average (EU-26).[9] A positive value indicates that the factor in question contributed to the containment of the downward revision of GDP growth for 2020 relative to the EU average. Similarly, a negative value denotes that the factor contributed to a further deepening of the shock relative to the EU average.

The chart shows that the stringency of social distancing measures had a relatively greater recessionary effect on certain economies, such as Italy, Spain and France. By contrast, more relaxed social distancing measures in other countries, such as Estonia and Finland, relative to the EU as a whole, have contained to a certain extent the downward GDP growth revision. Tourism had a relatively larger contribution to the decline in economic activity in Southern European countries (Greece, Spain, Italy and Portugal). Also, the short-term effect of GVC integration has been negative for the more open economies, like Belgium, the Netherlands and Finland, as a result of the distinct characteristics of the current crisis and

8 When both the depth of the recession and the speed of the recovery after a crisis are taken into account, lower flexibility in product and labour markets is linked to a stronger economic impact (Bluedorn et al. 2019).
9 The EU average is computed as the simple average of the respective indicators over the 26 Member States included in the sample.

the disruptions in international trade. Moreover, higher pre-crisis structural budget surpluses appear to have contained the recession in 2020 in Greece, Germany and the Netherlands. Finally, increased product and labour market flexibility, relative to the EU average, in countries like Estonia, Ireland and, to a lesser extent, Germany appears to be linked to a higher contraction of GDP in the short term.

4 ROBUSTNESS CHECKS

This section provides a set of robustness checks of the baseline empirical findings. In particular, we account for model selection uncertainty in the cross-sectional regressions by employing a Bayesian model averaging technique. We also perform estimations for alternative definitions of the dependent variable on the size of the GDP shock, as well as of social distancing measures and tourism.

4.1 MODEL SELECTION: A BAYESIAN MODEL AVERAGING MODEL

The relatively small cross-sectional sample underpinning the present analysis (39 observations) could lead to biased estimates. Moreover, testing the significance of individual regressors increases the risk of omitted variable bias. Given the model uncertainty over the best approximation to the "true model" and the restrictions on the size of the dataset, we perform a robustness check of the baseline findings by employing a Bayesian Model Averaging (BMA) empirical framework. BMA is a model averaging technique which allows fitting multivariate linear regression models with uncertainty about the choice of the explanatory variables.

In principle, BMA assigns a prior probability to each model, takes into account the dataset to update these priors and computes a weighted average of the conditional estimates across all models since each model provides some information over the regression parameters. Assuming the model form as described by equation (1), the model weights stem from the posterior model probabilities (PMP) which are determined by:

$$p(M_i|GDPr,X) \propto p(GDPr|M_i,X)p(M_i)$$

where the first term of the product denotes the marginal likelihood function of the model, which is the probability of the data given model M_i, and the second term is the prior probability of model M_i. In turn, the marginal likelihood function is calculated by:

$$p(GDPr|M_i,X) = \int_{\alpha} p(GDPr|a_i,X,M_i)p(a_i|M_i,X)da_i$$

In effect, the posterior distribution of any coefficient, α_i, is given by:

$$p(a|GDPr,X) = \sum_{a=1}^{2^k} p(a|M_i,GDPr,X)p(M_i|X,GDPr)$$

where the sum denotes the posterior density of α_i weighted by the PMP of each model M_i. The posterior inclusion probability (PIP) of a variable is then the sum of the posterior model probabilities of all models that include the particular variable.[10] Based on this context, BMA provides a coherent inference approach on the regression parameters of interest by taking explicitly into account the uncertainty due to both the estimation and the model selection.

In the present analysis, for each model M_i, we assume a normal error structure. As regards the priors of the model parameters, we assume full prior uncertainty over the constant term and the error variance.[11] For the remaining parameters, α_i, we assume a conservative mean value of zero, which reflects the fact that less is known with certainty about the coefficients, while their variance is defined based on the Zellner's g prior (i.e. the variance-covariance structure is close to that of the data).[12] We follow a standard approach in the BMA framework and set a unit information prior (UIP) for the hyperparameter, g, i.e. $g = N$ for all mod-

10 In large sample sizes, the posterior probability of the best model (i.e. the one closest to the "true model") converges to 1.
11 In other words, we set $p(\alpha_0) \propto 1$ and $p(\sigma) \propto \sigma^{-1}$.
12 Otherwise stated, we set for the coefficients: $\alpha_i|g \sim N(0, \sigma^2 (\frac{1}{g} X_i' X_i)^{-1})$.

Table 4 Model selection based on Bayesian model averaging

	(1) - Governance		(2) - Regulation	
	Posterior mean	PIP	Posterior mean	PIP
Lockdown measures	-0.11	0.87**b**	-0.15	0.93**b**
Tourism	-0.26	0.99**d**	-0.31	0.98**c**
Participation in GVCs	-0.03	0.96**c**	-0.03	0.74**a**
Governance	0.29	0.91**b**		
Structural budget balance ratio	0.018	0.187	0.018	0.187
Regulation in labour and product markets			0.014	0.52**a**
Financial development	-0.001	0.27	0.519	0.27
Current account balance ratio	0.02	0.26	0.011	0.208
Net international investment position ratio	0.001	0.26	0.002	0.34
Nominal long-term interest rate	0.06	0.23	0.06	0.21
Model space	515		515	

Source: Authors' own estimations.
Notes: The dependent variable is the difference in the GDP growth forecast for 2020 between IMF WEO October 2020 and October 2019. All independent variables refer to 2019 or latest available year, except lockdown measures which refer to 2020 (see Table 1). PIP denotes posterior inclusion probability. a, b, c, d denote weak, positive, strong, very strong impact on the GDP shock, respectively.

els, where N is the sample size. Finally, on defining the model prior, we assume a hyperparameter, $\theta = 0.5$, which implies a uniform model prior and therefore an equal probability for all models.

With regard to the factors included in the BMA analysis, we take on board a wide set of independent variables based on the literature on economic resilience, our baseline regressions about the economic fallout during the COVID-19 pandemic and the pairwise correlations with the GDP shock. In particular, we employ the lockdown measures, tourism, participation in GVCs, the quality of governance, regulation in labour and product markets, the nominal long-term interest rate, the degree of financial development, the structural budget balance, the current account balance and the net international investment position. The number of independent variables results in a model space of 2^9 (over 500) alternative models. We derive the posterior model distribution by employing a Markov Chain Monte Carlo (MCMC) sampler algorithm with 100,000 iterations and 50,000 burn-ins.

Table 4 shows the BMA estimates. Column (1) shows the posterior mean and the posterior inclusion probability when the quality of governance is included in the model, while Column (2) shows the respective estimates when regulation in labour and product markets is included in the model variables. We opt to perform separate estimations for the two variables, since the small sample properties of BMA under the presence of potential multicollinearity are still under theoretical validation in the relevant literature.[13] Following Kass and Raftery (1995), we assume that the importance of an independent variable for explaining the GDP shock is weak, positive, strong and very strong if the PIP is between 0.5-0.75, 0.75-0.95, 0.95-0.99 and 0.99-1, respectively. The BMA estimates shown in Table 4 coincide with the baseline findings that the lockdown measures, tourism, participation in GVCs, the quality of governance and regulation in product and labour markets are the most robust deter-

13 The pairwise correlation of the quality of governance and the synthetic indicator of regulation in labour and product markets is 0.41 in our sample.

minants of the GDP shock during the COVID-19 pandemic.[14]

4.2 ALTERNATIVE DEFINITIONS OF DEPENDENT AND INDEPENDENT VARIABLES

We assess the robustness of the baseline results presented in Table 3 (Column (2)) accounting for two alternative definitions of the dependent variable. The dependent variable proxies for the size of the GDP shock in 2020 and, so far, it was defined as the difference in real GDP growth for 2020 between two IMF forecast rounds, before and during the pandemic (see Table 1). However, this definition may exacerbate the magnitude of the output loss as it accounts for both the expected economic path for 2020 before COVID-19 and the expected GDP decline in 2020. The first alternative definition assumes only the expected output loss in 2020, namely the change in real GDP in 2020 compared with the previous year. The second definition uses the baseline definition for the GDP shock but replaces the IMF WEO October 2020 estimates for GDP growth in 2020 with the available releases of provisional annual national accounts data. Failing to account for the realised GDP values could, to some extent, induce a measurement error of the dependent variable. For several advanced economies, the provisional GDP growth figures for 2020 were more upbeat relative to the IMF WEO October 2020 projections. Columns (1) and (2) in Table 5 present the results for the two alternative definitions of the size of the GDP shock, respectively. These are in line with the baseline findings.

Furthermore, we assess the validity of the Oxford Stringency Index as a proxy for social distancing measures. The introduction of lockdown measures differs across countries. This is captured by the index with the inclusion of zero values from 1 January 2020 until the date of initiation of social distancing measures in each country. Chart 4 shows that Greece opted for an earlier adoption of social distancing measures compared with Sweden. In other words, the index combines an intensity and a timing effect of the lockdown measures. For instance, when the daily values of the stringency index are averaged over the first half of 2020, this results in lower values of the index during the first wave of the pandemic compared with the second half of the year, when the strict lockdown measures were relaxed (though not completely lifted). From a cross-country perspective, countries that initiated lockdown measures earlier than others will have higher values of the index in the first half of the year, though the intensity of the measures may be low.

In Table 5, Column (3) separates the two effects embedded in the lockdown proxy. We control for the timing of the lockdown measures by constructing an ordinal variable, taking a value of 1 when the country introduced social distancing measures within January 2020, a value of 2 when the measures were introduced within February and a value of 3 when the measures were introduced thereafter. The intensity effect is captured by the average of the lockdown index, starting from the initiation of social distancing measures in each country until late September 2020. Estimates suggest that countries that initiated social distancing measures earlier in 2020 faced a more pronounced GDP shock. Also, the intensity of the lockdown still matters for explaining the cross-country variation in output, though the size of the coefficient is now somewhat lower compared with the baseline estimates.

An additional robustness check concerns the potential endogeneity of lockdown measures. It could be the case that lockdown measures are only weakly exogenous to the economic fallout, reflecting policymakers' concerns about the size of the output loss due to the restrictions. To some extent, such concerns may have affected the decision to relax lockdown measures after the first wave of the pandemic. To address this issue, Column (4) in

14 A BMA analysis, in which both the quality of governance and regulation in labour and product markets are included in the estimations, results in a weaker PIP for labour and product market regulation.

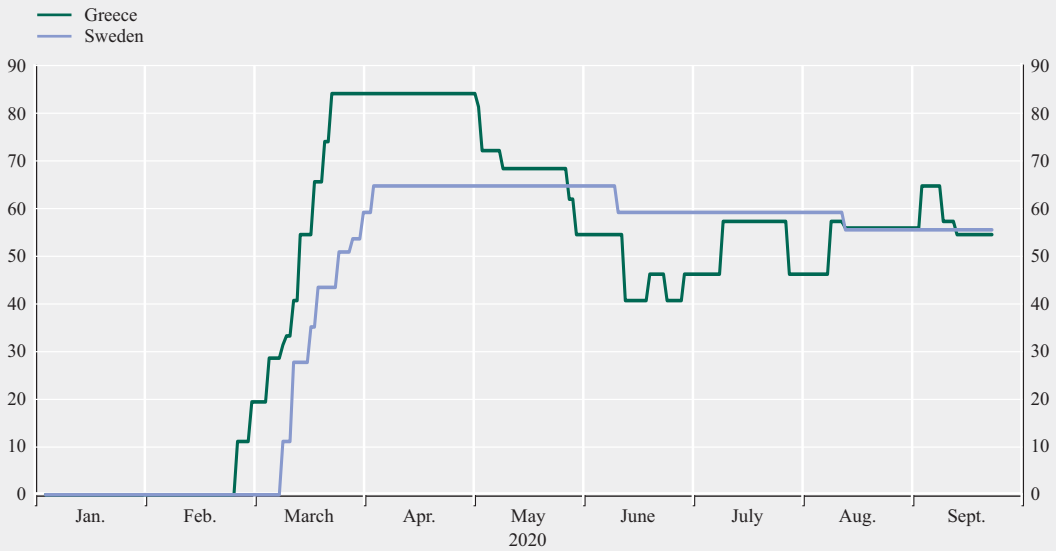
Table 5 Robustness checks on dependent and independent variables

	Alternative dependent variable		Alternative regressors		
	2020 GDP growth	GDP shock with realised values	Lockdown - timing effect	Lockdown in 2020H1	Tourism receipts
	(1)	(2)	(3)	(4)	(5)
Lockdown measures	-0.15*** (0.04)	-0.10** (0.04)			-0.13*** (0.04)
Intensity effect			-0.10*** (0.03)		
Timing effect			0.69** (0.33)		
Lockdown measures (2020H1)				-0.13*** (0.05)	
Tourism (contribution to GDP)	-0.30*** (0.05)	-0.31*** (0.06)	-0.27*** (0.05)	-0.27*** (0.05)	
Tourism receipts					-0.27*** (0.07)
Participation in GVCs	-0.04*** (0.01)	-0.02** (0.01)	-0.03*** (0.009)	-0.03*** (0.009)	-0.03*** (0.01)
Governance	0.21** (0.10)	0.37*** (0.11)	0.33*** (0.09)	0.29*** (0.10)	0.30*** (0.10)
Constant term	5.38** (2.23)	0.08 (2.44)	-1.32 (2.02)	0.71 (2.44)	-0.49 (2.30)
Adjusted R^2	0.587	0.547	0.595	0.588	0.495
No. of countries	39	39	39	39	39

Source: Authors' own estimations.
Notes: The intensity effect is captured by the average of the lockdown stringency index starting from the initiation of social distancing measures until 28 September 2020. The timing effect is an ordinal variable taking a value of 1 if lockdown measures were introduced in January, a value of 2 if introduced in February and a value of 3 thereafter. Standard errors are reported in brackets. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Chart 4 Oxford COVID-19 Government Response Stringency Index, Sweden – Greece

(daily values, 1 January 2020-28 September 2020)



Source: Hale, T., S. Webster, A. Petherick, T. Phillips and B. Kira (2020), Oxford COVID-19 Government Response Tracker (OxCGRT), Blavatnik School of Government.

Table 5 includes as a proxy for lockdown measures the average of the Oxford Stringency Index over the first half of 2020, which should better reflect governments' aim to mitigate the human cost of the health crisis, abstracting from economic considerations. The point estimate of the coefficient of lockdown measures is close to that in the baseline findings.

Finally, we employ an alternative measure of tourism, since the direct contribution of tourism to GDP used in the baseline findings can be subject to measurement error and can bias the estimates. In that regard, we use the share of tourism receipts in GDP as a proxy for an economy's reliance on tourism. Results presented in Column (5) in Table 5 are consistent with the baseline estimates.

5 ASSESSING THE IMPACT OF DISCRETIONARY FISCAL POLICY DURING COVID-19

Fiscal policy in advanced economies has responded to the pandemic via increased discretionary spending to support the incomes of businesses and households and to cushion the economic loss of the health crisis. According to the IMF *Fiscal Monitor Update* (January 2021), fiscal measures (expenditures or foregone revenue) in advanced economies amount to about 12.7% of GDP, while measures to support liquidity through government guarantees, loans or subsidies amount to about 11% of GDP.

However, the overall size of the fiscal support varies across economies, mainly reflecting differences in fiscal space and the evolution of the health crisis in each country. According to the IMF, the size of the fiscal support packages affecting the general government budget balance (on-budget measures) is negatively related to a country's initial borrowing costs, while fiscal measures that are not included in the budget balance (off-budget measures), such as the provision of liquidity and guarantees, are positively related to the initial debt-to-GDP ratio.

Given the observed differences across advanced economies in the size of fiscal support in 2020, the question arises as to whether expansionary fiscal policy contributed to the cross-country disparity in economic outcomes during the crisis. In order to examine the role of discretionary fiscal policy, we re-estimate equation (1) by including the change in the cyclically adjusted primary balance (Δcapb) in 2020 (as a percentage of potential output) as a proxy for the discretionary fiscal stance in advanced economies. At the same time, we explicitly account for the potential simultaneity bias of fiscal policy measures and the size of the GDP shock by employing an instrumental variable regression. Given the difficulty of finding a valid instrument, we employ the cyclically adjusted primary balance in 2019, the nominal long-term interest rate in 2019 and the public debt-to-GDP ratio in 2019. The selected instruments should be correlated with the fiscal stance in 2020, yet they should be more orthogonal to the GDP shock. The estimated equation is of the following form:

$$GDPr_i=\alpha_0+\Delta capb_i\alpha_1+X_i\alpha_2+\varepsilon_i, \quad \varepsilon\sim N(0,\sigma^2 I) \tag{2}$$

where *GDPr* is the difference in the real GDP growth rate for 2020 between the IMF WEO October 2020 and the IMF WEO October 2019, $\Delta capb$ is the change in the (cyclically adjusted) primary balance (as a percentage of potential GDP) for 2020, and X_i is the matrix that includes the lockdown measures, the contribution of tourism to GDP, the quality of governance and the output gap in 2019.[15]

Table 6 presents the estimates. Columns (1) and (2) show the OLS estimates of equation (2), which do not account for the simultaneity bias. To address the potential interplay of the fiscal stance with social distancing measures, Column (2) includes the lockdown measures, averaged only over the first half of

15 The output gap aims to control for any remaining effects from the cyclical variation (see Golinelli and Momigliano 2009).

Table 6 The role of discretionary fiscal policy during the COVID-19 crisis

	(1)	(2)	(3)	(4)	(5)
	(OLS)	(OLS)	(IV)	(IV)	(IV)
Lockdown measures	-0.13*** (0.04)		-0.13*** (0.05)	-0.12** (0.05)	
Lockdown measures (2020H1)		-0.16** (0.06)			-0.14** (0.06)
Δcapb (2020)	-0.29** (0.13)	-0.26* (0.13)	-0.64** (0.28)	-0.49*** (0.19)	-0.47** (0.19)
Tourism	-0.29*** (0.07)	-0.31*** (0.07)	-0.27*** (0.07)	-0.28*** (0.07)	-0.29*** (0.07)
Governance	0.22* (0.12)	0.17 (0.13)	0.17 (0.13)	0.20 (0.13)	0.18 (0.13)
Output gap	-0.18 (0.17)	-0.15 (0.17)	-0.12 (0.18)	-0.15 (0.18)	-0.14 (0.18)
Constant term	-2.37 (2.66)	-0.75 (3.37)	-3.72 (3.05)	-3.54 (2.81)	-2.78 (3.51)
Adjusted R^2	0.568	0.553			
Sanderson-Windmeijer F statistic (p-value)			7.58	7.18	7.28
Anderson canon. corr. LM test (p-value)			0.00	0.00	0.00
Sargan test (p-value)			-	0.577	0.589
Durbin-Wu-Hausman chi-sq test (p-value)			0.1	0.05	0.03
Number of instruments			1	3	3
No. of countries	32	32	31	29	29

Source: Authors' own estimations.
Notes: The dependent variable is the difference in the GDP growth forecast for 2020 between IMF WEO October 2020 and October 2019. Δcapb is the change in the cyclically adjusted primary budget balance in 2020 (as % of potential GDP). Remaining independent variables refer to 2019 or latest available year, except lockdown measures which refer to 2020 (see Table 1). Standard errors are reported in brackets. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively. The Sanderson-Windmeijer F statistic assesses the hypothesis of weak instruments, the Anderson canonical correlation LM test examines the underidentification of the model, the Sargan test assesses the overidentification and the Durbin-Wu-Hausman chi-squared test examines the null hypothesis that the instrumented variable is exogenous.

2020.[16] Columns (3)-(5) present the respective IV regressions. Column (3) includes only the initial cyclically adjusted primary balance as an instrument for the fiscal stance, while Column (4) incorporates in addition the nominal long-term interest rate and the public debt-to-GDP ratio as valid instruments. Column (5) repeats the estimates shown in Column (4), including an exogenous proxy of the lockdown measures.

A battery of statistical tests for the IV regressions is outlined at the bottom of Table 6. These examine the identification of the IV model, inference amid potentially weak instruments, as well as the endogeneity of the fiscal stance that would support the use of an IV estimator. In particular, the Anderson canonical correlation LM statistic tests for model underidentification, i.e. under the null hypothesis, the set of instruments is not correlated with the endogenous regressors. Also, the Sanderson-Windemeijer statistic assesses the presence of weak instruments in the first-stage regression and the Sargan test assumes, under the null hypothesis, that the orthogonality condition is met, namely that the instruments are uncorrelated with the error term. Finally, the Durbin-Wu-Hausman chi-squared statistic formally tests for the exogeneity of the fiscal stance. Overall, the tests confirm that the instruments used are relevant, the estimated IV models are not underidentified and the use of an IV estimator is

16 It could be the case that less stringent lockdown measures in 2020 are associated with lower fiscal support in the same year. At the same time, higher fiscal support can lead to more stringent lockdown measures to tackle the health crisis. Notwithstanding, social distancing measures during the first half of 2020 should be more exogenous to the fiscal stance as they were to a large extent associated with the policy aim to mitigate the human cost of the pandemic and were therefore less related to the economic losses or to policy accommodation.

justified, i.e. the fiscal stance is endogenous to the GDP shock.

Our estimates suggest that the fiscal stance in 2020 in advanced economies is statistically significant and associated with a smaller economic fallout during the COVID-19 crisis; the more expansionary the fiscal stance, the lower the output loss. When accounting for the potential endogeneity of fiscal policy measures with the GDP shock in 2020, the impact of the fiscal stance strengthens. All in all, cross-country differences in the size of expansionary fiscal policy in 2020 seem to explain the asymmetric economic losses in advanced economies during the pandemic.

6 CONCLUSIONS AND POLICY RECOMMENDATIONS

The concept of economic resilience provides a useful tool for the discussion about the prevention and containment of crises. Given the high degree of global interconnectedness of countries, it is impossible to accurately predict and avert economic shocks. However, enhancing the resilience of countries increases their ability to absorb economic effects and facilitates a speedier and more robust recovery through a reallocation of resources and structural transformation.

Our empirical results confirm the significance of factors associated with the features of the COVID-19 crisis for explaining the uneven output loss across economies. Namely, the effects of social distancing measures, which have been implemented in the interest of public health, and the relative stronger impact of the pandemic on specific sectors such as tourism, due to the restrictions in international travel and contact-intensive services, and on global value chains, due to supply and international trade disruptions. Moreover, our analysis points to the significance of institutional factors, extending the existing literature by not only looking at the quality of governance, but also examining the level of financial development as well as product and labour market flexibility. Our results indicate that the pre-crisis characteristics of the economies can indeed determine their resilience in the face of a pandemic shock. Moreover, pre-crisis fiscal space is a key factor of economic resilience for EU Member States, supporting the view that containing macroeconomic imbalances can shield economies from excessive destabilising effects during crises. Finally, our analysis on discretionary fiscal policies during the pandemic crisis has underscored the importance of government support to containing the short-term effects of the shock.

Eradicating the pandemic and supporting the most vulnerable should remain a priority as long as contagion and death rates remain high. However, when the world will begin to move out of the pandemic and countries start thinking about rebuilding their economies in the new reality, important policy implications will emerge. Increasing economic resilience through horizontal reforms that raise potential output, facilitate an efficient reallocation of resources, improve the business environment and promote investment is key to addressing the effects of economic shocks, irrespective of their origin.

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THE IMPACT OF ECONOMIC UNCERTAINTY AND INFLATION UNCERTAINTY ON THE GREEK ECONOMY

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ABSTRACT

We provide estimates of economic uncertainty and inflation uncertainty for the Greek economy, and consider their time-varying impact on the corresponding macroeconomic variables, i.e. GDP growth and inflation. We find that, in both cases, the degree of uncertainty varies over time. Its impact on the underlying variable also fluctuates and is statistically significant and negative during both the global financial crisis and the Greek sovereign debt crisis, as well as during the COVID-19 pandemic. Thus, during these periods, uncertainty weighs on the economy's fundamentals. Our findings have a number of policy implications, including that the extraordinary policy measures taken to contain the economic impact of the COVID-19 pandemic should be withdrawn gradually and with due caution, as any increase in uncertainty may have an adverse effect on economic activity and a deflationary impact on prices.

Keywords: stochastic volatility; time-varying parameters; financial crisis; COVID-19 pandemic

JEL classification: C11; C22; E31; E32

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ΟΙ ΕΠΙΠΤΩΣΕΙΣ ΤΗΣ ΟΙΚΟΝΟΜΙΚΗΣ ΑΒΕΒΑΙΟΤΗΤΑΣ ΚΑΙ ΤΗΣ ΑΒΕΒΑΙΟΤΗΤΑΣ ΓΙΑ ΤΟΝ ΠΛΗΘΩΡΙΣΜΟ ΣΤΗΝ ΕΛΛΗΝΙΚΗ ΟΙΚΟΝΟΜΙΑ

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ΠΕΡΙΛΗΨΗ

Στο άρθρο παρουσιάζονται οικονομετρικές εκτιμήσεις για την οικονομική αβεβαιότητα και την αβεβαιότητα σχετικά με τον πληθωρισμό στην ελληνική οικονομία και εξετάζεται κατά περίπτωση η χρονικά μεταβαλλόμενη επίδραση της εκτιμώμενης αβεβαιότητας στην αντίστοιχη μακροοικονομική μεταβλητή, δηλαδή το ρυθμό οικονομικής ανάπτυξης και τον πληθωρισμό. Βρίσκουμε ότι η εκτιμώμενη αβεβαιότητα εμφανίζει, και στις δύο περιπτώσεις, σημαντική μεταβλητότητα κατά τη διάρκεια του δείγματος. Επιπλέον, η επίδραση της αβεβαιότητας στην αντίστοιχη μακροοικονομική μεταβλητή επίσης μεταβάλλεται διαχρονικά και είναι, κατά περιόδους, στατιστικά σημαντική. Μεταξύ άλλων, εκτιμάται ότι η επίδραση της αβεβαιότητας στο ρυθμό οικονομικής ανάπτυξης και τον πληθωρισμό είναι αρνητική και στατιστικά σημαντική κατά τη διάρκεια τόσο της παγκόσμιας χρηματοπιστωτικής κρίσης και της ελληνικής κρίσης δημόσιου χρέους όσο και της πανδημίας COVID-19. Δηλαδή σε αυτές τις περιόδους η αβεβαιότητα επιδεινώνει τα θεμελιώδη μεγέθη της ελληνικής οικονομίας. Από τα ευρήματα της μελέτης προκύπτουν συμπεράσματα χρήσιμα για την άσκηση πολιτικής, μεταξύ των οποίων και ότι η διαδικασία απόσυρσης των έκτακτων μέτρων κρατικής στήριξης που υιοθετήθηκαν κατά την πανδημία ενδείκνυται να είναι σταδιακή και προσεκτική, καθώς τυχόν περαιτέρω αύξηση της αβεβαιότητας ίσως έχει αρνητική επίδραση στην οικονομική δραστηριότητα και τον πληθωρισμό.

THE IMPACT OF ECONOMIC UNCERTAINTY AND INFLATION UNCERTAINTY ON THE GREEK ECONOMY

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I INTRODUCTION

Policymakers routinely monitor key macroeconomic variables, such as inflation and GDP growth, in order to gauge which phase of the cycle the economy is in and set policy accordingly. They also consider the degree of uncertainty surrounding the outlook for these variables, as it may have both real and nominal effects. Such effects can vary over time, both qualitatively and quantitatively, and may be of particular concern during periods of stress such as the global financial crisis or the COVID-19 pandemic.

Indeed, the pandemic has triggered an increase in economic uncertainty, which permeates all facets of economic activity. Uncertainty surrounds the length and intensity of the pandemic as well as the duration, nature and severity of its economic consequences. An increase in economic uncertainty affects the decisions of households and firms, which are based on their forward-looking expectations of the economy's trajectory. First, due to the pandemic and the ensuing containment measures, future labour income flows are rendered uncertain, while firms' assessment of future demand for their goods and services is also called into question. Moreover, economic uncertainty forces entrepreneurs and investors to re-assess the viability of their investment plans and possibly to postpone or cancel some of them. Thus, uncertainty *per se* can have a substantial negative impact on economic activity. There is however also the view that, under certain circumstances, an increase in economic uncertainty can lead to the pursuit of riskier investment projects which offer higher expected returns, thus boosting the rate of economic growth.

On the nominal side, the COVID-19-induced decline in economic activity exerted deflationary pressures which brought the rate of inflation once again into negative territory. Additionally, the degree of uncertainty regarding the future trajectory of inflation increased, as reflected *inter alia* in survey responses.[1] Just as an increase in economic uncertainty affects agents' decisions, with potentially adverse implications for economic activity, heightened uncertainty regarding the path of inflation is a hindrance to monetary policymaking, potentially reducing its effectiveness to the extent that it may directly affect the level of inflation.

An increase in inflation uncertainty during the pandemic could reflect opposing economic forces at play. Households and firms have drastically reduced their consumption, as a result of the sharp income decline seen in many sectors as well as of the difficulty to spend posed by the social distancing measures. Savings have increased in tandem, partly for precautionary purposes, with a deflationary effect. On the other hand, there are mounting concerns that the adoption of numerous extraordinary fiscal and monetary policy measures to provide support during the pandemic will prompt inflationary pressures once the economy gradually starts recovering. Thus, the question arises as to whether inflation uncertainty may affect the level of inflation itself and, if so, via which mechanism.

In this paper we provide time-varying estimates of two types of uncertainty for the Greek economy, namely real (economic) uncertainty and inflation uncertainty, and consider their impact

1 See the speech by Fabio Panetta, 1.7.2020 (https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200701.en.html).

on the underlying macroeconomic variables, i.e. GDP growth and inflation. We find that, in both cases, the degree of uncertainty fluctuates over time. Moreover, its impact on the corresponding variable also varies and has been significant during certain periods. In particular, it seems to have been both statistically significant and negative during the COVID-19 pandemic, acting as a drag on the Greek economy's fundamentals. Our findings have a number of policy implications, not least that the extraordinary policy measures taken to contain the economic fallout of the COVID-19 pandemic should be lifted gradually and with due caution, as any rise in uncertainty may have an adverse effect on economic activity and a deflationary impact on prices, at a time when both variables' sensitivity to uncertainty is heightened and significant.

The remainder of this paper is structured as follows: Section 2 provides a literature review. Section 3 describes the data and econometric methodology employed. Section 4 presents and discusses the findings about the relationship between (i) real economic uncertainty and GDP growth and (ii) inflation uncertainty and inflation. Section 5 provides some policy implications and conclusions.

2 LITERATURE REVIEW

2.1 REAL ECONOMIC UNCERTAINTY AND GDP GROWTH

The question of how economic uncertainty may affect real economic activity has been repeatedly explored in the relevant academic literature. There are arguments both ways. In early work, Sandmo (1970) and Black (1987) argue that increased real uncertainty will raise average economic growth. For Sandmo (1970), the effect works through precautionary balances. Increased uncertainty generates incentives to hold higher precautionary savings, which, within a simple Solow growth model, will increase growth. Black (1987) starts from the positive relationship between risk and return in a portfolio model, and suggests that increased uncertainty may encourage greater investment in riskier projects. Such projects have higher mean returns, thus boosting real output growth on average, but they come at the cost of rendering output growth more volatile. There is also the view that uncertainty may, under certain circumstances, stimulate R&D. Faced with a more uncertain future, some firms may have a stronger incentive to innovate, which could potentially have a positive effect on long-run growth (see for example Lee 2016).

Conversely, Pindyck (1991) suggests that, if output becomes more variable and uncertainty increases, investment and hence growth will decline. The rationale is that, as investment is usually irreversible, heightened uncertainty will cause entrepreneurs to put off investments, thus slowing growth. Similar arguments are later formalised within richer general equilibrium models – see for example the influential work by Bloom et al. (2007). Blackburn and Pelloni (2005) generate the same result from an endogenous growth model, where increases in real uncertainty cause workers to react by setting higher wages, thereby lowering employment, investment and growth.

The experience of the global financial crisis provides support to the latter of the two effects, as reflected in recent research. Fajgelbaum et al. (2017) and Bloom et al. (2018) among others propose models in which economic uncertainty can have a detrimental effect on economic activity by altering investment decisions. Samaniego and Sun (2019) and Arata et al. (2017) further explore the role of investment lumpiness and irreversibility and show, both theoretically and empirically, that it implies slow growth in times of high uncertainty. Basu and Bundick (2017) and Leduc and Liu (2016) develop models in which the impact of economic uncertainty on economic activity works through search frictions and sticky prices, while Nakata (2017) also builds a sticky price model to show that the effects of uncertainty are substantially worse at the zero

lower bound (ZLB). Finally, Bianchi et al. (2018) distinctly model demand- and supply-side uncertainty and show that, while both cause contractions in real activity, supply-side uncertainty takes a greater toll on investment.

As regards the empirical evidence, the first effect seems to dominate in early work. Kormendi and Meguire (1986) study 47 countries for the post-war period and find that economic uncertainty has a positive and statistically significant effect on economic growth. Grier and Tullock (1989) study an even larger dataset and draw the same conclusion, as do Caporale and McKiernan (1996) for the UK and Fountas et al. (2006) for the G7. Subsequent empirical evidence, however, weighs mostly in favour of the opposite effect, i.e. that economic uncertainty dampens growth. Ramey and Ramey (1995) first report significant negative effects for a large sample of countries. Kneller and Young (2001) report the same for OECD countries. See also Bredin and Fountas (2009) for EU countries up to 2003 for similar findings. In the case of Greece, the question has been explored by Chapsa et al. (2011), Gibson and Balfoussia (2010) and Tsouma (2014), who, by and large, find that economic uncertainty negatively affects economic activity.

Recent work focuses on possible regime dependence and non-linearities. Martin and Rogers (2000) show that a country's stage of development may matter, as they find a negative and significant effect for more advanced economies but no significant effect for developing countries. Using 50 years of data on the G7, Neanidis and Savva (2013) find that uncertainty regarding output growth is related with a higher average growth rate mostly in a low-growth regime. Conversely, Bredin et al. (2021) exploit a centuries-long sample of UK data and report that low-growth regimes are associated with a negative effect of uncertainty on growth, while medium- or high-growth regimes are associated with a positive effect. Christou et al. (2020) also study 150 years of UK data and find a negative effect, the strength of which exhibits substantial time-variation. Jovanovic and Ma (2020) document that higher uncertainty is associated with a more dispersed and negatively skewed distribution of output growth, while the response of economic growth to an increase in uncertainty is non-linear and asymmetrical. Angelini et al. (2019) show that, in the United States, uncertainty generates a decline in economic activity, and the effect is amplified during periods of economic and financial turmoil. Similarly, Alessandri and Mumtaz (2019) estimate that the recessionary effect of uncertainty shocks in the United States is six times larger when the economy is going through a financial crisis. Finally, a strand of recent research studies the impact of uncertainty shocks when the economy is at the zero lower bound, and finds that their contractionary effect is significantly larger (see for example Caggiano et al. 2017 and Plante et al. 2018).

2.2 INFLATION UNCERTAINTY AND INFLATION

As regards inflation uncertainty, its relationship with the level of inflation is more nuanced. Uncertainty about future inflation is generally thought to distort the relative-price mechanism, leading to a misallocation of resources and thus lower growth. An early attempt to explain this was made by Lucas (1973). In his model, unanticipated inflation causes economic agents to mistake general price increases for relative price changes and to make inappropriate economic decisions in response. In this context, unpredictable inflation is costly, as prices no longer reflect underlying real changes in the economy, which would in turn warrant a change in the allocation of resources, or investment in one sector rather than another. The question then arises as to whether inflation uncertainty is somehow connected to the actual level of inflation.

Several, often contradictory, theoretical arguments can be found in the academic literature regarding the possible direction of a causal relationship between inflation and inflation uncertainty. There is extensive evidence that countries with high rates of inflation are also likely to experience high inflation variability as

well as growth and welfare losses – see Friedman's 1977 Nobel lecture for a first explanation of this phenomenon, which was later formalised by Ball (1992) as a game of information asymmetries between the monetary authority and the public. This line of argument, i.e. that inflation causes inflation uncertainty and that its costs (in terms of economic activity) also materialise through the uncertainty channel, is often referred to in the literature as the Friedman-Ball hypothesis.

Another strand of the academic literature pursues the idea that causality may run in the opposite direction, i.e. that in fact it is greater inflation uncertainty that causes higher average inflation. This possibility has been formalised as a feature of models based on the Barro-Gordon framework. Seminal among this body of work is that by Cukierman and Meltzer (1986) and Cukierman (1992), in whose model low policy credibility, an ambiguity of objectives and poor monetary control on behalf of policymakers increase the average rate of inflation. The monetary authority has a dual mandate: to contain inflation and to promote economic growth. However, there is a trade-off between the two objectives and there is no commitment mechanism. The monetary authority has an incentive to create monetary surprises —i.e. to generate inflation uncertainty— in an effort to stimulate economic growth; this in turn leads to increases in the level of inflation. The money supply process is also assumed to have a random component, due to the monetary authority's inability to discern which is the most appropriate monetary policy instrument and to precisely control it. Therefore, not only are economic agents uncertain about the level of future inflation but also they have no way of inferring whether an increase in the observed level of inflation is due to a random money supply disturbance or to a shift in policymakers' emphasis on unemployment. In this context, higher inflation uncertainty leads to higher inflation and suggests an "opportunistic" or "myopic" central bank, according to the Cukierman-Meltzer hypothesis.

It is not only the direction of causality that is questioned —that is, whether it is inflation that drives inflation uncertainty, or vice versa— but also the sign. In both the Friedman-Ball and the Cuckierman-Meltzer hypotheses, higher inflation is associated with higher inflation uncertainty. Following a different thread, Holland (1995) proposes that, if the Friedman-Ball hypothesis is valid, there may also be a secondary feedback effect from inflation uncertainty back to inflation, as a result of policymakers' stabilisation efforts. As inflation uncertainty rises due to increasing inflation, there is an increased incentive for policymakers to respond by contracting money supply growth, so as to contain inflation in order to reduce inflation uncertainty and the associated negative real output and welfare effects. Thus, a negative causal effect of inflation uncertainty on inflation points to what is known as the "stabilisation motive" of the monetary authority, which views inflation uncertainty as a welfare cost. As a result, higher inflation uncertainty lowers inflation because of the monetary authority's response.[2]

The different hypotheses on the link between inflation and inflation uncertainty have given rise to a large empirical literature. Here we focus mostly on the strand which explores the impact of inflation uncertainty on inflation, in line with our empirical approach. In a much-cited seminal empirical study, Grier and Perry (1998) use a GARCH-M specification to explore this relationship for the G7 countries in the period 1948-1993. They report that higher inflation significantly raises inflation uncertainty in all countries. As regards the reverse causal relationship, increased inflation uncertainty appears to lower inflation in the United States, the UK and Germany in line with Holland's concept of the monetary authority's "stabilisation motive", while it

2 There is also a final line of argument, according to which it is inflation that causes inflation uncertainty but, in contrast with the Friedman-Ball theory, higher inflation reduces inflation uncertainty. Pourgerami and Maskus (1987) and Ungar and Zilberfarb (1993) argue that as inflation increases, agents invest more resources in forecasting inflation, which, in theory at least, reduces inflation uncertainty. However, there is little evidence in support of this hypothesis.

raises inflation in Japan and France, as predicted by the Cukierman-Meltzer model of "opportunistic" central bank behaviour. Notably, the authors note that these differential responses to inflation uncertainty are correlated with Cukierman's (1992) ratings of central bank independence, with Japan and France ranking as less independent than the rest. Numerous studies followed suit, employing similar ARCH-type techniques to explore the relationship. Apergis (2004) among others finds evidence of both the Friedman-Ball and the Cukierman-Meltzer hypotheses for the G7 economies. In a more recent study of the G7, Neanidis and Savva (2013) find that the effect of inflation uncertainty on inflation is typically positive, especially during inflationary periods. Fountas et al. (2004) consider six major EU countries and report Friedman-Ball effects in all of them, while increased inflation uncertainty lowers inflation in Germany and the Netherlands and raises it in Italy, Spain and France. Karanasos and Schurer (2008) study Sweden, Germany and the Netherlands and find a negative impact of inflation uncertainty on inflation for Sweden, in line with the Holland hypothesis, whereas the opposite holds for Germany and the Netherlands, in line with the Cukierman-Meltzer hypothesis. Finally, Živkov et al. (2014) confirm both hypotheses for the largest Eastern European countries (EEC) with flexible exchange rates, but reject them for smaller, open EEC economies with a fixed exchange rate regime.

Stepping away from the ARCH tradition, Bhar and Hamori (2004) use a Markov switching model to examine inflation uncertainty at different horizons and find that high uncertainty about long-run inflation is associated with an increase in inflation for Canada, Germany and Japan, while high uncertainty about short-run inflation is associated with an increase in inflation for Germany and the United States, but with a decrease in inflation for Canada. Berument et al. (2009) use a stochastic volatility in mean model for the United States and find strong evidence that shocks to inflation volatility increase inflation persistently. In a more recent paper on the United States, Bredin and Fountas (2018) use two centuries of data and find that, since its establishment, the US Federal Reserve (Fed) has responded to increasing inflation uncertainty in a stabilising manner, in line with the Holland hypothesis. In a panel set-up, Kim and Lin (2012) estimate a system of simultaneous equations using data for 105 countries over the period 1960-2007 and find a two-way interaction between inflation and its variability that is consistent with the Friedman-Ball and Cukierman-Meltzer theories, and robust to alternative model specifications, time periods and country-specific characteristics. More recently, Barnett et al. (2020) construct a time-varying stochastic volatility measure of inflation uncertainty for the United States, the UK, the euro area, China and South Africa, and confirm that causality between the two variables is not time-invariant, with inflation lagging in some cases and time periods and leading in others.

Finally, a number of papers find that specific policy or regime shifts may be associated with a halt or a reversal of a previously detected relationship. For example, Neanidis and Savva (2011) study new EU Member States and candidate countries and find that uncertainty positively affects inflation in the pre-EU accession period, but not during EU accession and following entry. Conversely, Balfoussia and Gibson (2010) find evidence of Friedman-Ball effects in the case of Greece prior to EMU convergence, but not after the adoption of the euro. Finally, for the euro area, Caporale et al. (2012) also find a structural break in the inflation-inflation uncertainty relationship, coinciding with the introduction of the euro, which is associated with a reversal of causality, pointing towards Friedman-Ball effects in the EMU era.

In summary, the empirical evidence paints a rather mixed picture. While there is evidence supporting the Friedman-Ball hypothesis, the same is also true for the Cukierman-Meltzer and Holland hypotheses, according to which it is inflation uncertainty that affects the level of inflation either positively or negatively. Most

importantly, the literature clearly illustrates that the relationship between the two variables varies over time in terms of direction, sign and significance of the effect, thus highlighting the empirical relevance of time-varying parameter models, as proposed by Chan (2017). With this in mind, we explore the relationship for Greece using a time-varying parameter framework, in order to detect and understand any such changes.

3 ECONOMETRIC METHODOLOGY AND DATA

Uncertainty is not directly measurable; it is typically proxied for by alternative metrics. For example, in the case of economic uncertainty these may include the economic sentiment indicator and its sub-indices, or uncertainty indicators based on textual analysis of economic articles published in the daily press (see e.g. Hardouvelis et al. 2018). Such indices occasionally track each other closely but do not, in general, exhibit a high degree of correlation. Moreover, it is preferable, if possible, to directly estimate the degree of uncertainty associated with a variable from the underlying data. This is the approach we adopt in this paper.

We employ a time-varying parameter stochastic volatility in mean (TVP-SVM) model to estimate the stochastic volatility of each of the two variables in question, i.e. real GDP growth and inflation. The model allows us to explore the impact of the estimate of each variable's uncertainty on the level of the variable itself, over different periods of time. For instance, in the case of economic uncertainty, the model estimates the stochastic volatility of economic growth, which is contemporaneously used as an explanatory variable driving economic growth itself. Thus, it is possible to study the effect of economic uncertainty on economic activity over time. We proceed similarly in the case of inflation uncertainty and inflation.

The TVP-SVM model employed in this paper is an extension of that developed by Chan (2017). In particular, assuming that y_t, where $t=1,...,T$, is the variable of interest, i.e. the rate of either real GDP growth or inflation, then the model is specified as follows:

$$y_t=c_t+\beta_{1,t}y_{t-1}+\beta_{2,t}y_{t-2}+a_t e^{h_t}+\varepsilon_{y,t}, \quad (1)$$
$$\text{with } \varepsilon_{y,t}\sim N(0,\ e^{h_t})$$

$$h_t=\mu+\varphi(h_t-\mu)+by_{t-1}+\varepsilon_{h,t}, \quad (2)$$
$$\text{with } \varepsilon_{h,t}\sim N(0,\ \sigma_h^2)$$

$$\gamma_t=\gamma_{t-1}+\varepsilon_{\gamma,t},\ \text{ with } \varepsilon_{\gamma,t}\sim N(0,\ \boldsymbol{\Omega}) \quad (3)$$

The mean equation in (1) is a time-varying autoregressive model with two lags, AR(2), which allows for a possible volatility feedback, i.e. volatility may have an impact on the level of variable y_t. Obviously, the subscript t implies that all parameters change over time, capturing potential structural changes in the unconditional mean, c_t, the autoregressive parameters, $\beta_{1,t}$, $\beta_{2,t}$, and the volatility sensitivity parameter a_t. The errors of the process, $\varepsilon_{y,t}$, are distributed as normal with time-varying stochastic volatility, e^{h_t}. For the logarithmic stochastic volatility, h_t, in (2) we use an AR(1) process and we also allow for the lagged dependent variable to affect the current volatility via parameter b. The time-varying parameters are gathered in vector γ_t, $\gamma_t=(c_t,\beta_{1,t},\beta_{2,t},a_t)'$ which follows a driftless random walk process with $\boldsymbol{\Omega}$ being the 4×4 covariance matrix as shown in (3). The model is estimated with Bayesian methods using the algorithm and the elicitation of the prior distributions proposed by Chan (2017).[3]

For our empirical analysis, we use the Gross Domestic Product (GDP) as a measure of economic activity and the Harmonised Index of Consumer Prices (HICP) as a measure of the price level. For both measures we use quarterly, seasonally adjusted, annualised percentage changes, i.e. $y_t=400\times\ln(p_t/p_{t-1})$ where p_t is the quarterly GDP and HICP, respectively. Note that in the Appendix we also provide

3 The readers are referred to Chan (2017) for further estimation details.

empirical results using alternative price indices, as a robustness check. All the data used in this article were downloaded from the Hellenic Statistical Authority (ELSTAT) website.[4] As ELSTAT publishes all price indices at a monthly frequency and seasonally unadjusted, we use the Tramo-Seats method to account for the seasonality of the monthly price indices and then we take a three-month average to compute a quarterly index. The sample covers a 25-year period spanning from 1995Q1 (1996Q1 for HICP) to 2021Q1. It includes all phases of the Greek business cycle and several periods of increased volatility.

4 EMPIRICAL FINDINGS

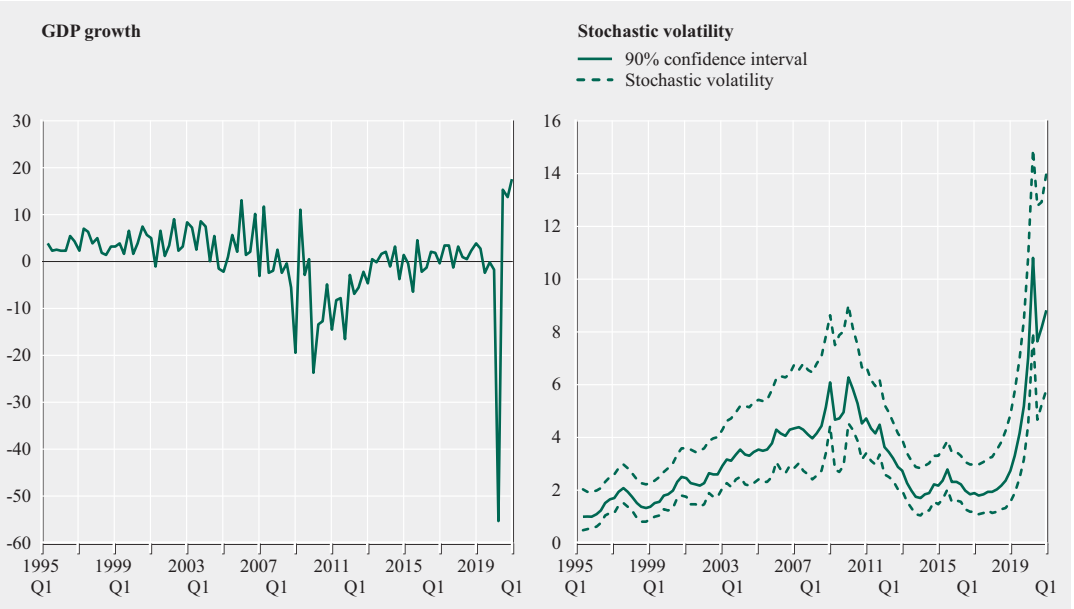
4.1 ECONOMIC UNCERTAINTY AND GDP GROWTH

All estimates are presented in graphical form. Chart 1 shows the rate of change in GDP on the left-hand scale and our estimates of economic uncertainty with the corresponding confidence bands on the right-hand scale. The estimated economic uncertainty varies substantially over time. We first trace a short period of somewhat elevated uncertainty prior to Greece's entry into the European exchange rate mechanism (ERM) in 1998. Once Greece joins the ERM, economic uncertainty temporarily subsides. The estimates then point towards a gradual but protracted increase in economic uncertainty throughout the 2000s, especially in the second half of the decade, whose peak coincides with the global financial crisis in 2008 and the subsequent sovereign debt crisis. Afterwards, a gradual easing of uncertainty is observed, followed by a second period of relative increase, which culminates in 2015Q3 with the imposition of capital controls. Economic uncertainty then subsides again, as the Greek economy gradually returns to positive growth rates. However, this trend is abruptly interrupted as the outbreak of the COVID-19 pandemic leads to an unprecedented surge in economic uncertainty, reaching in 2020Q2 levels higher than those

4 https://www.statistics.gr.

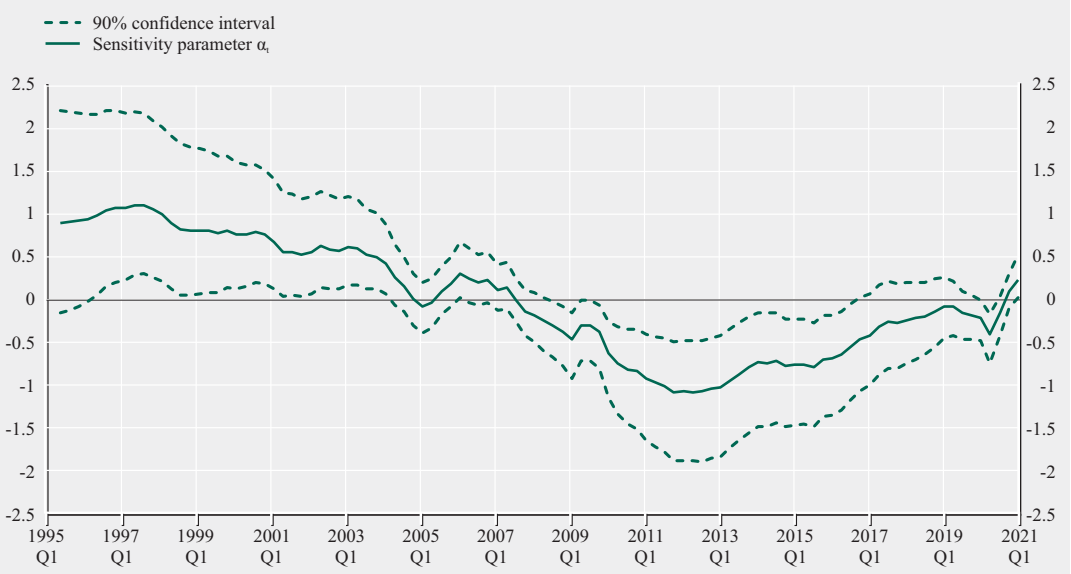
Chart 1 Economic activity and economic uncertainty (1995Q2-2021Q1)

(%)



Sources: ELSTAT and Bank of Greece estimations.

Chart 2 Time-varying coefficient, α_t, of economic activity's sensitivity to changes in economic uncertainty (GDP)
(1995Q2-2021Q1)



Sources: Bank of Greece estimations.

recorded during the financial crisis. Uncertainty declines somewhat in the following two quarters, possibly as a result of the fast adoption and implementation of containment measures and their economic impact, to rebound once again in 2021Q1. Overall, uncertainty remains substantially elevated compared with its pre-pandemic levels until the end of the sample.

Chart 2 presents the evolution of the time-varying coefficient a_t, which captures economic activity's sensitivity to changes in economic uncertainty. This estimated parameter captures how the prevailing level of economic uncertainty affects GDP growth at different points in time. It exhibits significant time-variation over the sample period. The effect of economic uncertainty on GDP growth is positive and mostly statistically significant up until 2007, in line with the theoretical arguments of Sandmo (1970) and Black (1987) and previous empirical evidence by Balfoussia and Gibson (2010). Thereafter, the effect is negative and statistically significant up until end-2016 and then again during the outbreak of the COVID-19 pandemic in Greece in 2020Q1, when strict social distancing measures were implemented, drastically limiting economic activity and travel. The coefficient takes its smallest negative values during the sovereign debt crisis, implying an increasing adverse effect of uncertainty on economic activity, and peaks at about the time of the PSI in 2012. It then declines in absolute value, only to increase again during the pandemic. In sum, our estimates reveal a structural break in the way economic activity depends on economic uncertainty: from the global financial crisis onwards economic uncertainty negatively affects economic activity, while the opposite is the case during the earlier part of the sample. The tracing of the financial crisis as a turning point is in line with our broader understanding of economic developments in Greece. Moreover, our findings echo those of Angelini et al. (2019), Alessandri and Mumtaz (2019), Caggiano et al. (2017) and others who find that the adverse effect of uncertainty on economic activity is amplified during periods of financial turmoil and when

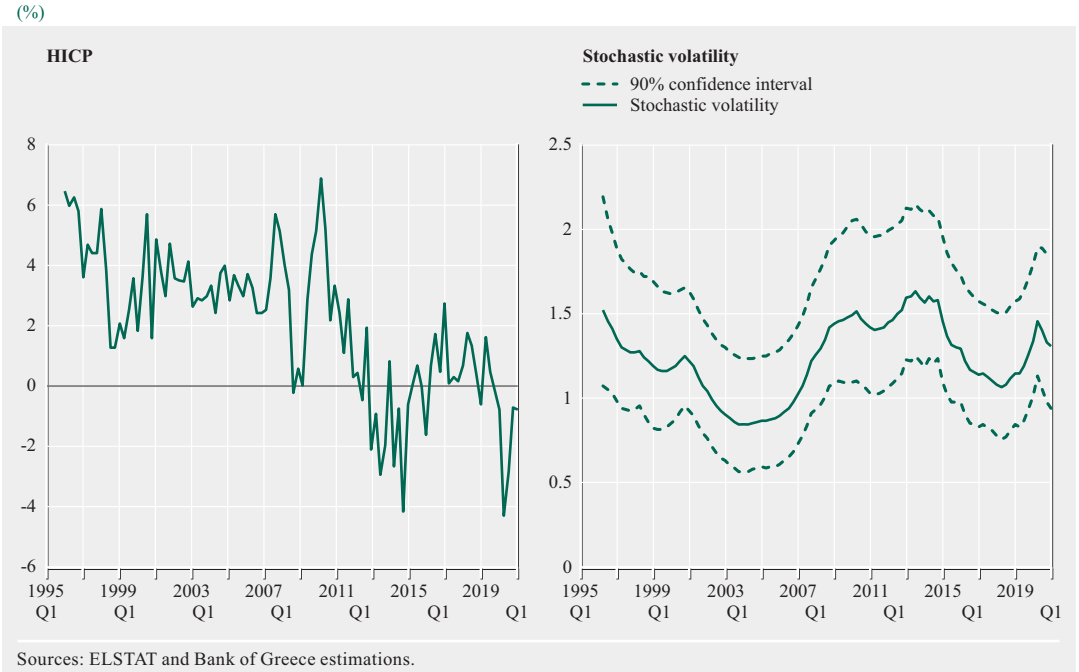
at the zero lower bound. As regards recent events, our estimates indicate that the sharp spike in economic uncertainty during the COVID-19 pandemic may have significantly contributed to halting the previous positive growth trajectory of the Greek economy. Following the adoption of targeted fiscal and monetary policy measures to support households and firms, the effect of economic uncertainty becomes insignificant in 2020Q4. The coefficient moves into positive territory towards the end of our sample, possibly indicating the start of a positive growth period, during which economic uncertainty could have a positive impact on economic activity.

4.2 INFLATION UNCERTAINTY AND HICP GROWTH

Turning to inflation uncertainty, the corresponding data and estimates are depicted in Charts 3 and 4. Uncertainty regarding inflation is high prior to EMU membership. It then declines and remains low for several years, arguably reflecting the beneficial effect of joining a monetary union with a credible monetary authority which targets inflation. Inflation uncertainty then rises again substantially during the global financial crisis and the Greek sovereign debt crisis, reaches its highest levels in 2013-14 and remains elevated during much of 2015. It subsequently steadily declines, as the Greek economy gradually begins to record positive rates of economic growth and inflation. This positive momentum is halted by the outbreak of the COVID-19 pandemic, which prompts a new spike in inflation uncertainty. A relative decline in uncertainty follows during the last two quarters of our sample.

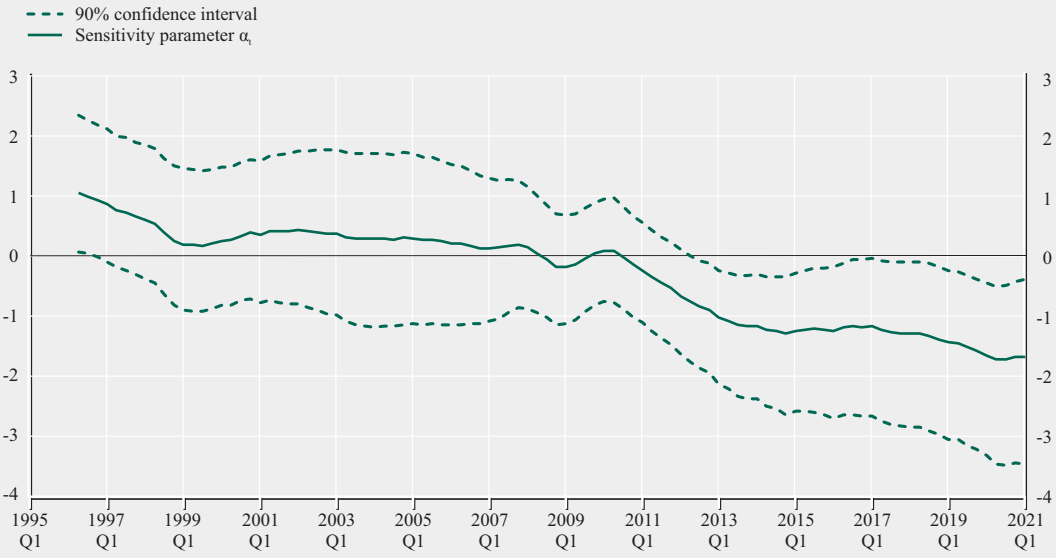
The estimated coefficient of inflation's sensitivity, a_t,to changes in inflation uncertainty is plotted in Chart 4. Its trajectory is highly time-varying and, as in the case of economic uncertainty, a clear structural break emerges. The impact of inflation uncertainty on inflation is briefly significant and positive at the beginning of the sample, indicating that, prior to Greece's EMU convergence process, the relatively high degree of uncertainty surrounding inflation

Chart 3 Inflation and inflation uncertainty (HICP) (1996Q2-2021Q1)



Sources: ELSTAT and Bank of Greece estimations.

Chart 4 Time-varying coefficient, α_t, of inflation's sensitivity to changes in inflation uncertainty (HICP) (1996Q2-2021Q1)



Sources: Bank of Greece estimations.

generated significant inflationary pressures, in line with the Cukierman-Meltzer hypothesis. The coefficient of sensitivity remains positive but is insignificant from 1997 onwards, up until the financial crisis. The relationship between the two variables then undergoes a structural change: the estimated coefficient a_t becomes negative, indicating that inflation uncertainty now exerts a deflationary pressure on prices. Moreover, the sensitivity coefficient is clearly statistically significant from 2012Q3 onwards, up until the end of the sample, including the period of the COVID-19 pandemic, in line with some of the results reported by Barnett et al. (2020). In other words, throughout the last decade of the sample, inflation uncertainty has a significant and negative impact on the level of inflation. Moreover, the value of the estimated coefficient is increasing in absolute value, thus this effect becomes increasingly strong. Inflation uncertainty seems to have the greatest deflationary impact during the COVID-19 pandemic. It is worth noting that the abovementioned empirical findings are quite robust under alternative measures of inflation such as the GDP price deflator, the Consumer Price Index (CPI) and the core CPI. The corresponding empirical results are presented in Charts A1 to A6 in the Appendix.

Our findings could suggest that, in the post-crisis low or negative inflation environment, where the zero lower bound is binding, higher inflation uncertainty predominantly reflects higher downside risks, i.e. a heightened prospect of further deflation, rather than a greater probability of inflation rebounding into positive territory. The exact economic mechanism through which the adverse impact comes about is unclear and, to our knowledge, has not, to date, been studied within a theoretical model.[5] However, it is likely that it works through expectations. When faced with the downside risk of protracted deflation, consumers and firms may act in a way that accentuates that risk, i.e. they may choose to limit their consumption and investment for precautionary purposes, as they foresee a possible further decline in prices and

5 The Holland (1995) argument is not applicable, as it refers to an inflationary environment where the monetary authority observes a damagingly high degree of inflation uncertainty and tries to contain it in order to curb inflation. In our case, the policy goal is to increase inflation in order to achieve the price stability objective.

economic activity. Such economic behaviour is one possible interpretation of the negative and statistically significant sensitivity coefficient during the past decade.

Our findings illustrate that the systematic effort made by the Eurosystem to anchor inflation expectations and limit inflation uncertainty is important for the trajectory of inflation itself and, during economic downturns and periods of deflation, it may help limit the likelihood of further deflation. In such circumstances, containing inflation uncertainty, i.e. enhancing the public's trust in the inflation-targeting monetary authority, is in itself a form of expansionary monetary policy. It follows that the extraordinary measures taken by the Eurosystem in order to maintain bank liquidity and the provision of credit to the private non-financial sector during the pandemic may also have operated by reducing inflation uncertainty, at a time when the deflationary effect of inflation uncertainty was at its highest in terms of both size and significance.

5 CONCLUSIONS

In this paper we provide time-varying estimates of economic uncertainty and inflation uncertainty for the Greek economy, and consider their impact on the corresponding macroeconomic variables, i.e. GDP growth and inflation. We find that, in both cases, the degree of uncertainty fluctuates over time. Moreover, its impact on the underlying variables also varies and has been significant during certain periods. *Inter alia* it seems to have been both significant and negative during the global financial crisis and the Greek sovereign debt crisis, as well as during the COVID-19 pandemic, weighing on the Greek economy's fundamentals. Our findings have a number of policy implications, not least that the extraordinary policy measures taken to contain the economic impact of the COVID-19 pandemic should be withdrawn gradually and with due caution, as any increase in uncertainty may have an adverse effect on economic activity and a deflationary impact on prices.

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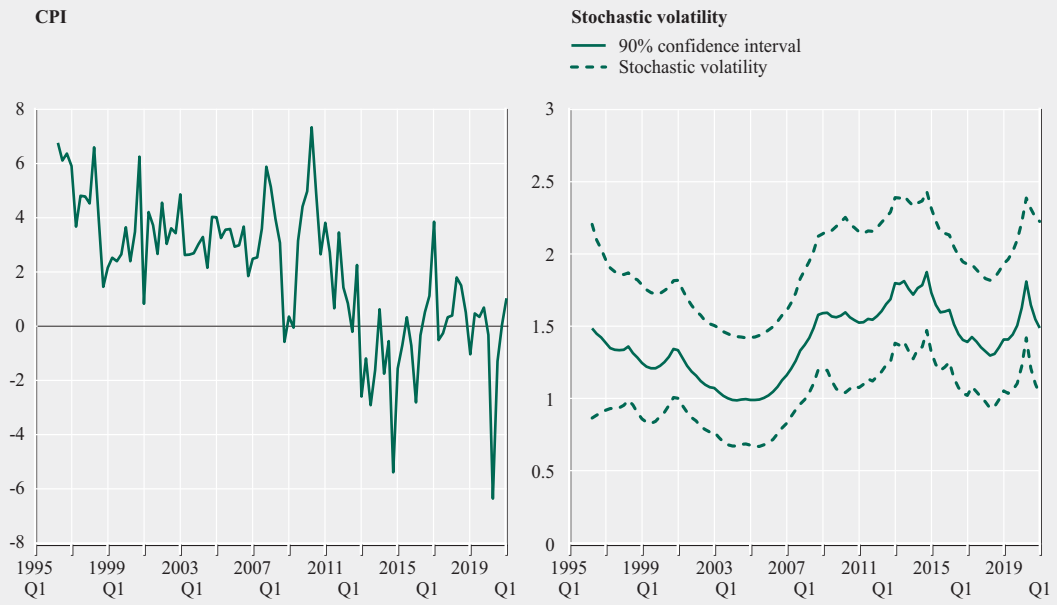
APPENDIX

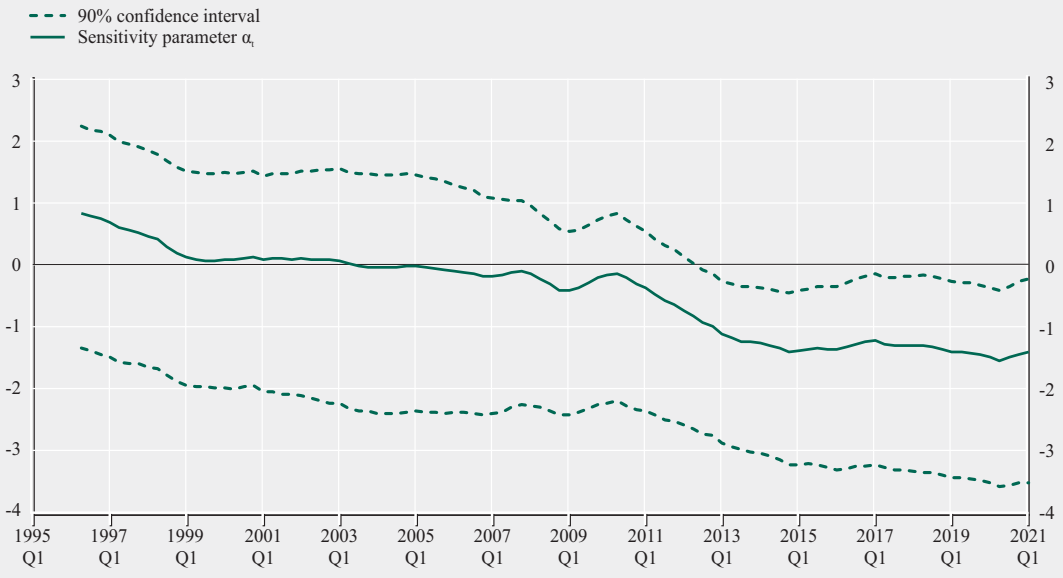
Chart A1 Inflation and inflation uncertainty (CPI) (1996Q2-2021Q1)

(%)



Sources: ELSTAT and Bank of Greece estimations.

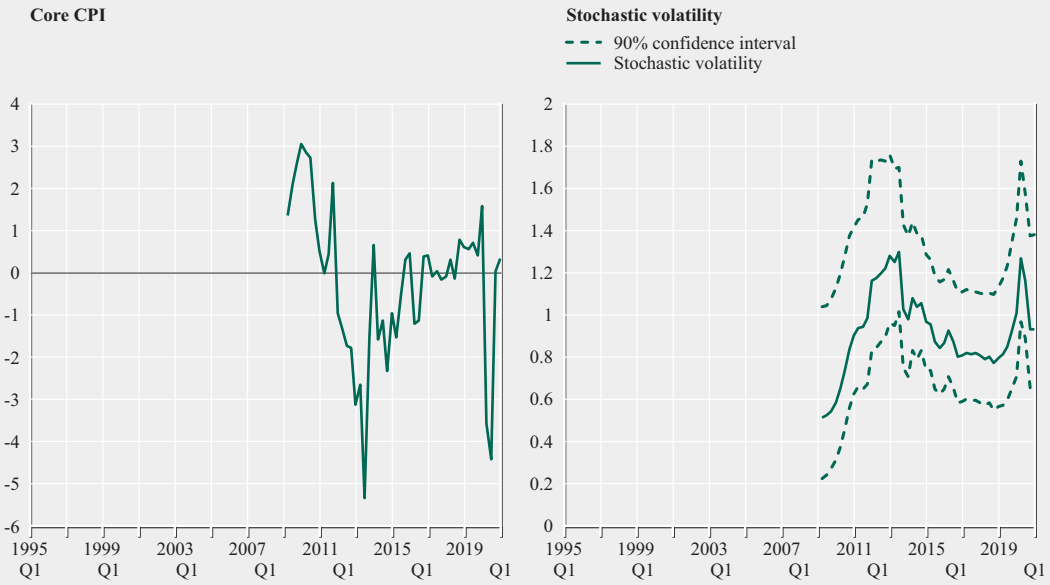
Chart A2 Time-varying coefficient, α_t, of inflation's sensitivity to changes in inflation uncertainty (CPI) (1996Q2-2021Q1)



Sources: Bank of Greece estimations.

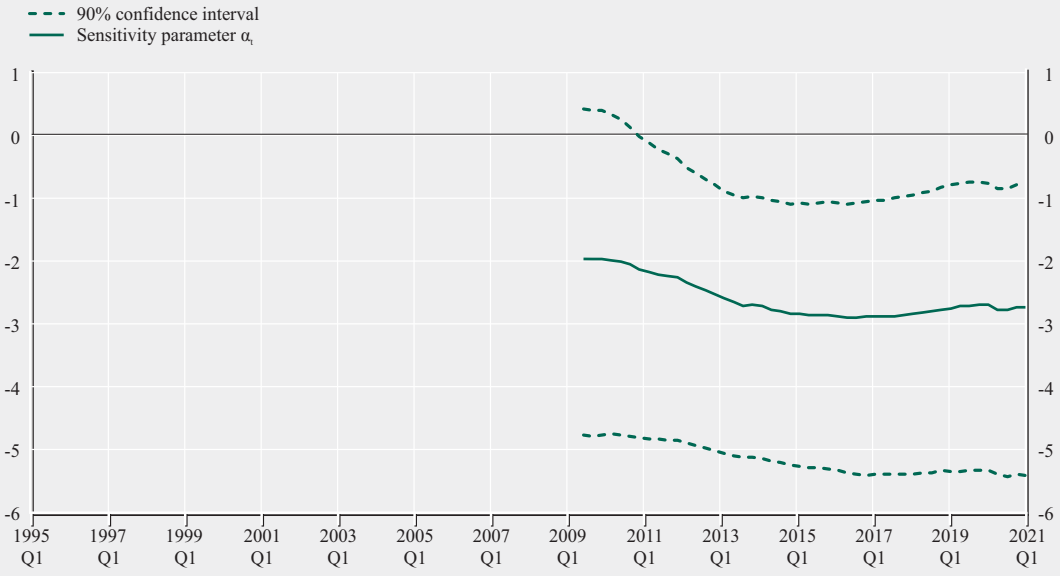
Chart A3 Inflation and inflation uncertainty (core CPI) (2009Q2-2021Q1)

(%)



Sources: ELSTAT and Bank of Greece estimations.

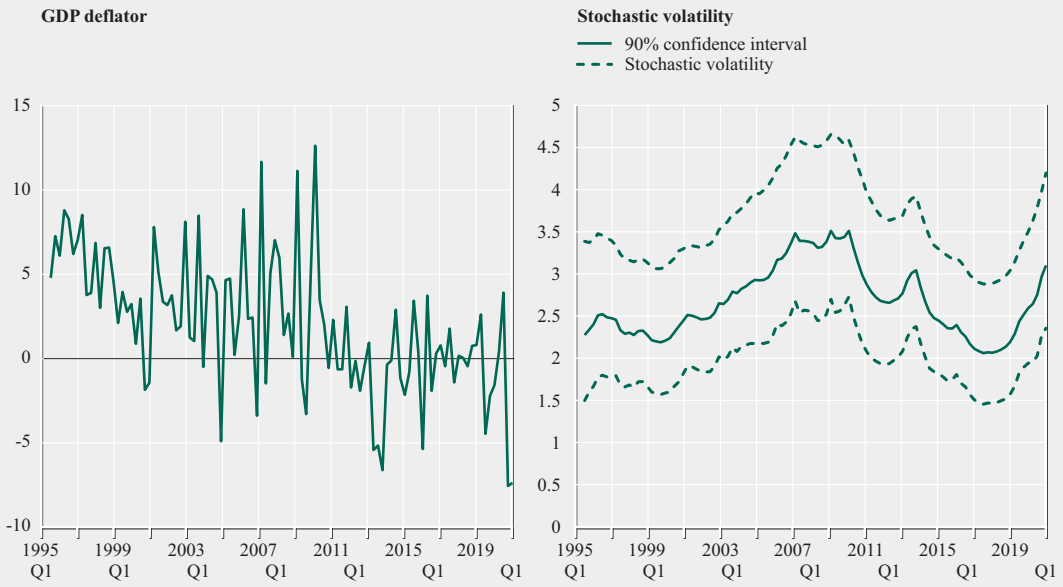
Chart A4 Time-varying coefficient, α_t, of inflation's sensitivity to changes in inflation uncertainty (core CPI) (2009Q2-2021Q1)



Sources: Bank of Greece estimations.

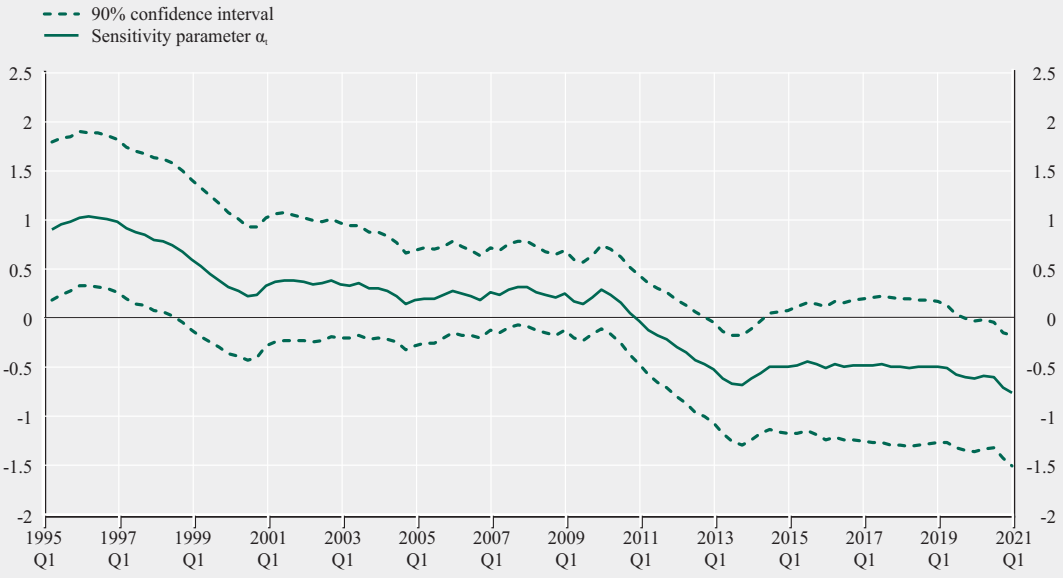
Chart A5 Inflation and inflation uncertainty (GDP deflator) (1995Q2-2021Q1)

(%)



Sources: ELSTAT and Bank of Greece estimations.

Chart A6 Time-varying coefficient, α_t, of inflation's sensitivity to changes in inflation uncertainty (GDP deflator) (1995Q2-2021Q1)



Sources: Bank of Greece estimations.

STOCK PRICE REACTIONS TO THE FIRST WAVE OF THE COVID-19 PANDEMIC: EVIDENCE FROM GREECE

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ABSTRACT

This study investigates stock price performance at the industry level during the first wave of the COVID-19 pandemic in Greece. We identify five periods from January to May 2020, namely the pre-incubation, incubation, outbreak, lockdown, and lockdown lift periods. We provide evidence that industry-level stock returns witnessed their largest drop during the outbreak period. In particular, the travel and leisure, construction, telecommunications, industrial goods, real estate, technology and utility sectors had, on average, highly negative cumulative returns. The results also reveal a partial recovery in equity prices during the lockdown period, possibly due to the announcement of fiscal stimulus measures by the Greek government along with the initiation of the ECB's pandemic emergency purchase programme (PEPP). The telecommunications, construction, technology, and travel and leisure sectors exhibited the highest performance over that period. We then evaluate the reaction of industry-level stock returns relative to the market index, performing an event study analysis. The empirical findings show that the utilities, telecommunications, personal goods and retail sectors experienced less losses compared with the market index during the outbreak period in Greece. Finally, despite the partial recovery of equity prices in the lockdown period, the results show that the basic raw materials, food and beverage, industrial goods and retail sectors underperformed compared with the market index in the short run.

Keywords: COVID-19 pandemic; incubation; outbreak; lockdown; industry-level stock returns; event study

JEL classification: G14; G12

doi: https://doi.org/10.52903/econbull20215304

Η ΑΝΤΙΔΡΑΣΗ ΤΩΝ ΤΙΜΩΝ ΤΩΝ ΜΕΤΟΧΩΝ ΣΤΟ ΠΡΩΤΟ ΚΥΜΑ ΤΗΣ ΠΑΝΔΗΜΙΑΣ COVID-19: ΕΥΡΗΜΑΤΑ ΑΠΟ ΤΗΝ ΕΛΛΑΔΑ

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ΠΕΡΙΛΗΨΗ

Η παρούσα μελέτη αναλύει την απόδοση των τιμών των μετοχών σε επίπεδο κλάδου στη διάρκεια του πρώτου κύματος της πανδημίας COVID-19 στην Ελλάδα. Αναγνωρίζουμε πέντε περιόδους από τον Ιανουάριο μέχρι και το Μάιο του 2020, και συγκεκριμένα την περίοδο πριν από την επώαση του κορωνοϊού, την περίοδο της επώασης, την περίοδο εκδήλωσης του ιού, την περίοδο του lockdown και την περίοδο άρσης του lockdown. Τα ευρήματα δείχνουν ότι οι αποδόσεις των μετοχών σε επίπεδο κλάδου υπέστησαν τη μεγαλύτερη πτώση την περίοδο εκδήλωσης του κορωνοϊού. Συγκεκριμένα, οι κλάδοι ταξιδιών και αναψυχής, κατασκευών, τηλεπικοινωνιών, βιομηχανικών αγαθών, ακινήτων, τεχνολογίας και κοινής ωφέλειας είχαν κατά μέσο όρο αρνητικές σωρευτικές αποδόσεις. Τα αποτελέσματα αποκαλύπτουν επίσης ότι την περίοδο του lockdown παρατηρήθηκε μερική ανάκαμψη των τιμών των μετοχών, η οποία πιθανόν να οφείλεται στην ανακοίνωση των δημοσιονομικών μέτρων στήριξης από την ελληνική κυβέρνηση σε συνδυασμό με τη θέσπιση του έκτακτου προγράμματος αγοράς στοιχείων ενεργητικού λόγω πανδημίας (PEPP) από την Ευρωπαϊκή Κεντρική Τράπεζα. Οι κλάδοι τηλεπικοινωνιών, κατασκευών, τεχνολογίας και ταξιδιών και αναψυχής παρουσιάζουν τις μεγαλύτερες αποδόσεις την περίοδο του lockdown. Στη συνέχεια, αξιολογούμε την αντίδραση των αποδόσεων των μετοχών σε επίπεδο κλάδου με βάση την ανάλυση της μελέτης γεγονότων (event study). Τα εμπειρικά ευρήματα δείχνουν ότι οι κλάδοι κοινής ωφέλειας, τηλεπικοινωνιών, προσωπικών αγαθών και λιανεμπορίου έχουν υποστεί λιγότερες ζημίες σε σχέση με το γενικό δείκτη της αγοράς την περίοδο εκδήλωσης του COVID-19 στην Ελλάδα. Τέλος, πάρα τη μερική ανάκαμψη των τιμών των μετοχών την περίοδο του lockdown, τα αποτελέσματα δείχνουν ότι οι κλάδοι βασικών πρώτων υλών, τροφίμων και ποτών, βιομηχανικών αγαθών και λιανεμπορίου βραχυπρόθεσμα υποαποδίδουν σε σχέση με το γενικό δείκτη της αγοράς.

STOCK PRICE REACTIONS TO THE FIRST WAVE OF THE COVID-19 PANDEMIC: EVIDENCE FROM GREECE

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1 INTRODUCTION

The outbreak of COVID-19 came as a surprise to the world economy. The spread of the new coronavirus disease in China's Hubei Province at the end of December 2019 was initially considered a regional crisis and received little attention. Indicative of the latter was that in the World Economic Forum's (2020) *Global Risks Report* published on 15 January 2020, none of the five-top rated risks were associated with public health. Instead, they were all linked to environmental issues.

As the coronavirus spread beyond China, the COVID-19 pandemic attracted a great deal of attention. There is a rapidly growing literature that investigates the impact of the COVID-19 pandemic on firms' stock returns. Davis et al. (2021) document that value-weighted global stock prices fell by 40% between 17 February and 23 March 2020. Focusing on the two largest economies, they find that the pandemic had greater effects on stock market levels and volatilities in the United States than in China. Using text-based methods, Baker et al. (2020) find that newspapers attribute 18 market jumps to COVID-19 and policy responses to the pandemic from 24 February to 24 March 2020. Ramelli and Wagner (2020) analyse stock price reactions focusing on the role of firms' exposure to international trade, corporate debt and cash holdings. They find that firms with greater export or supply chain exposure to China exhibit lower returns during the COVID-19 pandemic. Also, they show that firms with high leverage and little cash perform worse in reaction to bad news about the pandemic. This has also been documented in Alfaro et al. (2020) and Ding et al. (2020). Davis et al. (2020) provide evidence that bad COVID-19 news is associated with lower returns for firms with high exposures to travel, traditional retail, aircraft production, and energy supply, but with higher returns for firms with high exposures to healthcare policy, e-commerce web services, drug trials, and materials that feed into supply chains for semiconductors, cloud computing and telecommunications.

In this study we provide evidence from the Greek stock market on how the COVID-19 pandemic impacted on stock returns across industries, focusing on the first wave of the pandemic. Our analysis is organised along five periods that are associated with the first phase of the COVID-19 pandemic in Greece, namely the pre-incubation period (1 January-30 January 2020), the incubation period (31 January-25 February 2020), the outbreak period (26 February-22 March 2020), the lockdown period (23 March-3 May 2020) and the lockdown lift period (4 May-31 May 2020).

We first investigate the performance of industry-level stock returns in the five identified periods of the first wave of the pandemic in Greece, focusing on the mean cumulative returns (MCRs). To this end, we use daily stock return data for 112 Greek listed firms from January to May 2020. We find that all industries performed well prior to the incubation period, as the COVID-19 pandemic was not considered a high-risk event at that time. In particular, the technology, industrial goods, basic raw materials and real estate sectors exhibit highly positive and statistically significant MCRs. In the incubation period, industries delivered negative returns, mainly because the COVID-19 pandemic captured considerable attention as the probability of an outbreak in Greece had increased. Basic raw materials, retail, industrial goods, technology, construction and real estate exhibit negative and significant MCRs.

We provide evidence that firms experienced the largest drop in their equity prices during the outbreak period, as investors perceived the real shock of the COVID-19 pandemic and the

effects of the evolving health crisis on economic activity. The MCRs of Greek industries suggest that the travel and leisure, construction, telecommunications, industrial goods, real estate, technology and utilities sectors were the big losers. In the lockdown period, equity prices rebounded. This is possibly due to the announcement of the fiscal stimulus measures by the Greek government and the ECB's intervention in the bond market via the pandemic emergency purchase programme (PEPP). Telecommunications, construction, technology, and travel and leisure yielded the highest MCRs during the lockdown period. In the lockdown lift period, they had much lower positive MCRs than in the lockdown period, with the construction and food and beverage sectors having a positive and statistically significant performance.

Finally, we perform an event study to assess how industry-level stock returns reacted during the five periods of the early stages of the COVID-19 pandemic in Greece, with a focus on the mean cumulative abnormal returns (MCARs). We show that in the pre-incubation period most industries outperformed the market index, i.e. the Athens Exchange Composite Index. More specifically, the technology, industrial goods, real estate and basic raw materials sectors have positive and significant MCARs. In addition, we do not find any significant reaction of stock returns for most industries during the incubation period. In the outbreak period, that is the period in which the Greek stock market crashed, we find based on a 10-day event window that the retail, food and beverage, personal goods and industrial goods sectors experienced significantly smaller losses than the market index. However, during the lockdown and the lockdown lift periods most industries underperformed compared with the market index.

The remainder of the study is organised as follows. The next section describes the timeline of events, the data and the methodology used. Section 3 analyses the performance of industry-level stock returns for the five identified periods of the first wave of the COVID-19 pandemic in Greece. Section 4 evaluates how industry-level stock returns responded in each of the five periods using the event study methodology. Section 5 concludes.

2 TIMELINE OF EVENTS, DATA AND METHODOLOGY

The coronavirus (COVID-19) disease was first detected in Wuhan, China in late December 2019. On 20 January 2020, the Chinese health authorities confirmed the human-to-human transmission of COVID-19 and on 23 January, Wuhan city was closed. On 24 January, France announced the first confirmed COVID-19 cases in Europe referring to three people who had recently travelled to China. On 30 January, the World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC). The period extending from 1 January to 30 January 2020 is labelled as the "pre-incubation period", as COVID-19 received very little attention in Greece and in most European countries at the time.

On 31 January, the first confirmed COVID-19 case in Italy was reported. Since that day, the Greek health authorities had been worrying about COVID-19-related developments, stressing that the probability of having COVID-19 cases in Greece in the following weeks had considerably increased. On 23 February, Italy imposed a strict lockdown for almost 50,000 people in two regions close to Milan, i.e. Veneto and Lombardy. We label the period from 31 January to 25 February 2020 as the "incubation period".

On 26 February, Greece confirmed its first COVID-19 case, and the first restrictive measures were introduced at the beginning of March 2020. On 10 March, with 84 confirmed cases and no deaths in the country, the Greek government decided to suspend the operation of educational institutions at all levels nationwide. On 13 March, all leisure, entertainment

and cultural activities were suspended and on 18 March, all retail stores (excluding supermarkets, groceries and banks) were closed. The period from 26 February to 22 March 2020 is labelled as the "outbreak period".

Mention should be made on the response of the Greek government and the ECB to the COVID-19 pandemic during this period of time. In particular, on 18 March 2020 the Greek government announced a package of fiscal measures amounting to 14% of GDP, or EUR 24 billion. On that same day, the ECB announced the pandemic emergency purchase programme (PEPP) to counter the serious risks to the monetary policy transmission mechanism and the outlook for the euro area posed by the COVID-19 outbreak. The PEPP foresees purchases of eligible private and public sector securities at a volume of EUR 750 billion, including bonds issued by the Greek government.

On 23 March 2020 the Greek government announced a national lockdown that lasted until 3 May 2020. This period is labelled as the "lockdown period". On 4 May, the Greek government implemented a gradual re-opening of the economy in three stages until the end of May 2020. On 4 May, less crowded retail businesses (such as bookstores, opticians/eyewear shops and sports retailers) as well as businesses offering services by appointment only (such as hairdressers) reopened. On 11 May, all the remaining retail businesses except shopping malls were permitted to reopen. On 18 May, some cultural and leisure activities were allowed, such as visits to archaeological sites, zoos and botanical gardens. We label the 4 May-31 May 2020 period as the "lockdown lift period".

Our final dataset comprises 112 Greek listed firms and was obtained from Thomson Datastream, while the sample period is January-May 2020. We exclude finance and insurance companies as well as companies with missing data and non-traded shares. We retrieve daily stock prices for common shares from Thomson Datastream from 2 January to 29 May 2020. Prices are adjusted for dividends. We also obtain daily data on the returns of the Athens Exchange composite share price index (Athex composite index) for the same trading period. Based on the Thomson Datastream industry classification, we classify firms into twelve industry groups: Basic Raw Materials;[1] Construction; Food and Beverage; Healthcare; Industrial Goods; Personal Goods; Real Estate; Retail; Technology; Telecommunications; Travel and Leisure; and Utilities. We exclude industries in which less than four firms are included.[2] Table 1 describes in detail the distribution of firms across these industry groups. The table also shows the market value shares as of 31 December 2019 for each industry in our sample. Telecommunications, travel and leisure, personal goods, industrial goods, and utilities have the largest market value shares.

Table 1 Allocation of firms into industry groups

Industry	Number of firms	MV share (%)
Basic raw materials	13	2.74
Construction	11	4.91
Food and beverage	7	3.73
Healthcare	4	1.33
Industrial goods	21	11.63
Personal goods	10	12.73
Real estate	7	6.69
Retail	9	1.74
Technology	12	1.58
Telecommunications	6	24.39
Travel and leisure	7	16.95
Utilities	5	11.58
Total	112	

Notes: This table shows the allocation of Greek Athex-listed firms into twelve industry groups. The second column shows the market value (MV) share for each industry as of 31 December 2019.

1 The basic raw materials sector comprises companies involved in the discovery, extraction and processing of raw materials, such as aluminium, iron, steel, coal, etc.
2 In particular, the energy, fisheries and farming, and media sectors are excluded as they include less than four firms.

To investigate stock price reactions during the first wave of the COVID-19 pandemic, we perform an event study analysis based on the seminal works by Fama et al. (1969), Brown and Warner (1980, 1985). In particular, for each of the five identified periods associated with the COVID-19 pandemic in Greece we define the date of the event and the period over which the impact on stock prices will be examined, that is the event window. We calculate the abnormal returns based on the Market Adjusted Model for each day of the event window as follows:

$$AR_{i,\tau} = R_{i,\tau} - R_{m,\tau} \quad (1)$$

where the daily abnormal return $AR_{i,\tau}$ is defined as the daily actual stock return $R_{i,\tau}$ minus the daily market return $R_{m,\tau}$, i.e. the return on the Athex composite index.[3] For each firm we then calculate the cumulative abnormal return (CAR) for a specific event window associated with the pre-defined five periods used in our study as follows:

$$CAR_{i,\tau} = \sum_{\tau=0}^{n} AR_{i,\tau} \quad (2)$$

where $\tau=0$ is the date of the event and n the days post the event.

Finally, we calculate the mean CAR (MCAR) for each industry group to evaluate how stock prices reacted during the five periods of the COVID-19 pandemic.

Chart 1 depicts the number of COVID-19 cases (left-hand scale) and the number of deaths (right-hand scale) in Greece from January to September 2020. In the outbreak period, that is 26 February-22 March 2020, the number of COVID-19 cases came to 530. The first death from COVID-19 in Greece was reported on Thursday, 12 March and the total number of deaths during the outbreak period was 8. Finally, the maximum daily number of new confirmed COVID-19 cases over the outbreak period was 103 and it was registered on Monday, 16 March.

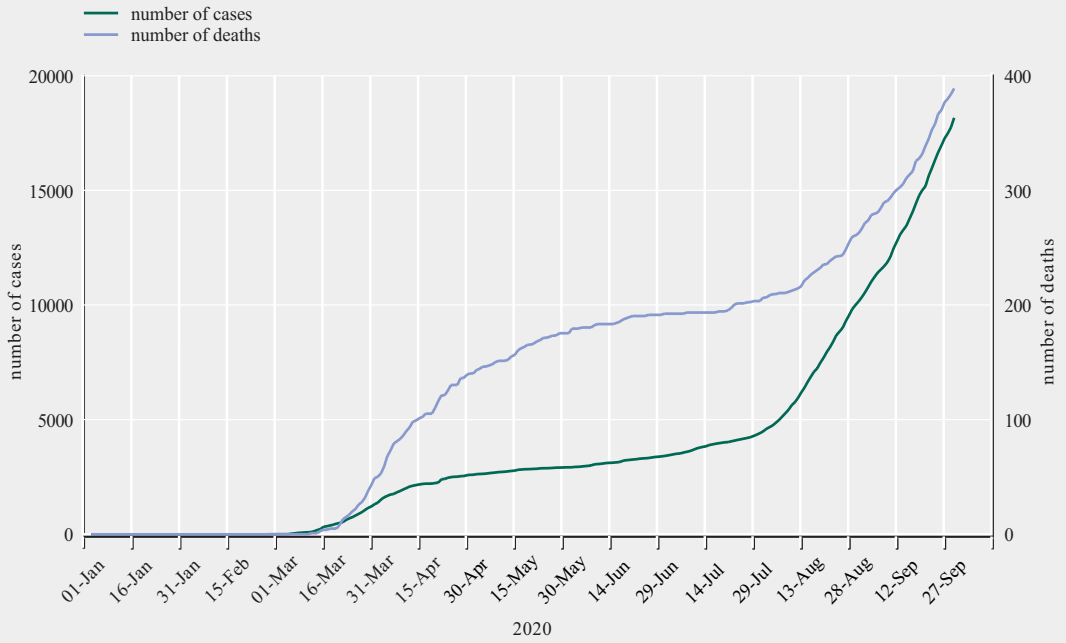
During the lockdown period, from 23 March to 3 May 2020, the total number of COVID-19 cases increased significantly to 2,620, whereas the total number of deaths was 143. The number of COVID-19 cases in the first ten days of the lockdown more than tripled. The maximum daily number of new COVID-19 cases for the lockdown period stood at 156 and was recorded on Wednesday, 22 April. Since 25 April, the daily number of COVID-19 cases had decreased and, as a result, the lockdown was gradually lifted from 4 May onwards. Throughout the three stages of the lockdown lift period from 4 May to 31 May 2020, the rate of increase in the number of cases continued to decline along with the number of deaths. More specifically, at end-May, the total number of COVID-19 cases and deaths came to 2,915 and 175, respectively.

Following the pattern of May 2020, the daily number of COVID-19 cases and deaths dropped in June and July. At the end of July the total number of COVID-19 cases was 4,401, whereas the corresponding number of deaths was 203. In August and September the numbers of COVID-19 cases and deaths rose sharply. By the end of September, the total number of COVID-19 cases had reached 18,123, that is four times higher than in July, whereas the total number of deaths was 388, that is two times higher than in July.

Chart 2 illustrates the performance of the Athex composite index during the first wave of the COVID-19 pandemic in Greece. The four red vertical lines of the chart refer to the starting dates of the incubation, outbreak, lockdown and lockdown lift periods, i.e. 31 January, 26 February, 23 March and 4 May 2020, respectively. We observe that the Athex composite index fell in the incubation period as the COVID-19 pandemic started to attract atten-

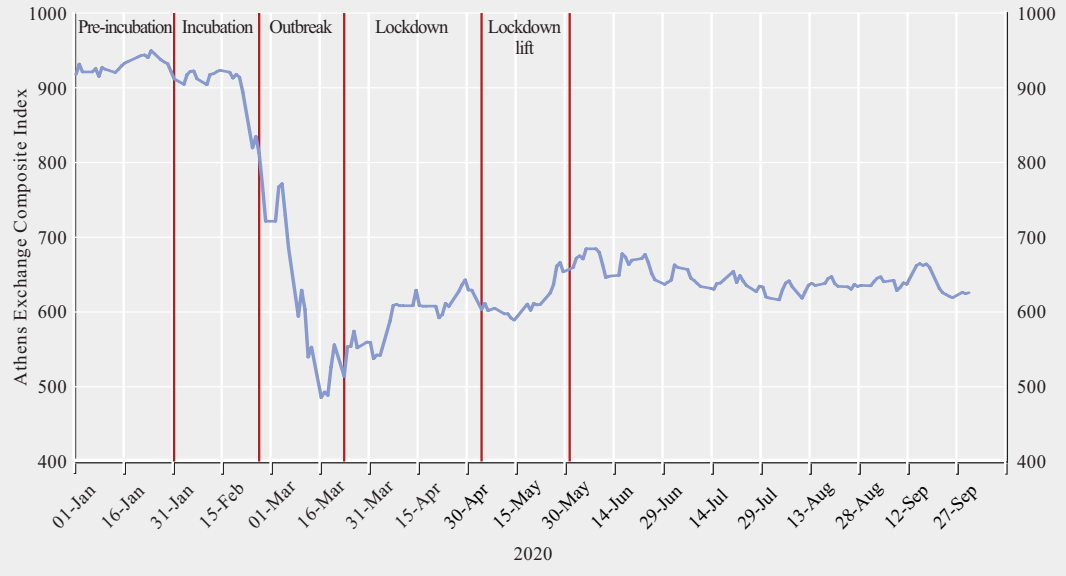
3 We have also used the market model to calculate the abnormal returns. We regress daily stock returns on the daily returns on the market index for the estimation period, defined as the period between 175 and 25 trading days prior to the event. Then we use the estimated alphas and betas to calculate the abnormal return. In particular, we calculate the abnormal returns as the actual returns minus alpha minus the stock's beta times the market return. The market model approach yields similar results.

Chart 1 Number of COVID-19 cases and deaths in Greece



Source: World Health Organization.

Chart 2 Athens Exchange Composite Index during the first wave of the COVID-19 pandemic



Source: Thomson Reuters.

tion in Greece. However, the Athex composite index experienced its sharpest declines throughout the outbreak period, dropping to its lowest level on 16 March. During the lockdown period we observe that the Athex composite index partly recovered thanks to the fiscal support provided by the Greek government and the PEPP introduced by the ECB. The positive performance of the Athex composite index continued into the lockdown lift period, especially from the second half of May onwards.

3 STOCK PERFORMANCE DURING THE COVID-19 PANDEMIC

We evaluate how Greek listed firms performed during the COVID-19 pandemic, focusing on industry-level cumulative stock returns. Table 2 presents the mean cumulative return (MCR) by industry for each period associated with the first wave of the COVID-19 pandemic in Greece, i.e. the pre-incubation, incubation, outbreak, lockdown and lockdown lift periods. We observe that Greek stock returns were not negatively affected in the pre-incubation period, from 1 January to 30 January 2020. Apart from telecommunications and utilities, all the remaining industries exhibited positive stock returns. In particular, technology (10.5%), industrial goods (8.1%), real estate (5.1%) and basic raw materials (4.6%) have the highest and statistically significant MCRs. Personal goods and healthcare have also positive MCRs, albeit not statistically significant.

In the incubation period, between 31 January and 25 February 2020, the performance of Greek stocks deteriorated. This can be explained by the fact that the COVID-19 pandemic attracted the attention of the Greek media, which placed emphasis on news related to COVID-19 developments on a daily basis. At the same time, many newspaper articles and media reports had been pointing out that the probability of a COVID-19 outbreak in Greece had increased dramatically. Looking at the second column of Table 2, all groups of industries have negative MCRs. On the basis of the MCRs, basic raw materials (-10.3%), retail (-10.1%), industrial goods (-10%), construction (-8.3%) and technology (-7.7%) were most strongly affected in the incubation period. The MCRs in the travel and leisure, telecommunications, food and beverage, and healthcare industries were also affected, but the effect on these industries is not statistically significant.

During the outbreak period (26 February-22 March 2020), the COVID-19 pandemic had a severe impact on Greek stock returns. This is possibly driven by a surge in economic uncertainty as concerns about the COVID-19 pandemic grew dramatically throughout this period. The cumulative return on the Athex composite index plummeted by 32%. The third column of Table 2 shows that all industry groups have highly negative and statistically significant MCRs. Travel and leisure (-36.2%), construction (-35.1%), telecommunications (-30.7%), industrial goods (-23.1%) real estate (-22.4%), technology (-22.2%), personal goods (-21.8%) and utilities (-21.1%) exhibited the highest negative MCRs during the outbreak period. The large decline in equity prices observed in the Greek stock market for this period is in line with that observed in the US and the global stock markets in reaction to the COVID-19 pandemic. By way of illustration, between 19 February and 23 March 2020 the S&P 500 stock market index lost 34% of its value, while global stock prices fell by 40%.

Turning to the lockdown period, i.e. 23 March-3 May 2020, a recovery in Greek stock returns is observed. This recovery could be attributed, to some extent, to the intervention of the Greek government to provide a fiscal package of income support and debt relief measures amounting to 14% of GDP. The Athex composite index recouped one-third of its losses over the lockdown period. At the industry level, except the MCRs in the basic raw materials, healthcare and real estate sectors, which are positive but statistically insignificant, the MCRs of all the remaining sectors are positive and statistically significant. Telecommunica-

Table 2 Mean cumulative returns (MCRs) by industry

(%)

Industry	Pre-incubation period	Incubation period	Outbreak period	Lockdown period	Lockdown lift period
Basic raw materials	**4.60****	**-10.26*****	**-25.74*****	12.33	12.33
Construction	3.31	**-8.29****	**-35.09*****	**30.40*****	**5.81*****
Food and beverage	2.38	-5.71	**-19.77*****	**10.14***	**5.48***
Healthcare	9.42	-5.58	**-18.04***	13.06	4.69
Industrial goods	**8.07****	**-10.02*****	**-23.10*****	**15.24*****	3.02
Personal goods	11.29	-4.37	**-21.76*****	**15.45*****	-1.34
Real estate	**5.06***	**-5.82*****	**-22.41*****	16.11	2.56
Retail	3.40	**-10.07*****	**-20.74*****	**12.82****	4.19
Technology	**10.51****	**-7.68****	**-22.21*****	**27.59*****	-2.32
Telecommunications	-3.94	-6.52	**-30.66*****	**34.46****	-4.65
Travel and leisure	1.53	-6.98	**-36.18*****	**21.51****	5.47
Utilities	-1.18	-1.42	**-21.13****	**17.97****	**19.37*****

Notes: This table shows the mean cumulative returns for the twelve industries during the pre-incubation (1 January-30 January 2020), incubation (31 January-25 February 2020), outbreak (26 February-22 March 2020), lockdown (23 March-3 May 2020) and lockdown lift (4 May-31 May 2020) periods. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

tions (34.5%), construction (30.4%), technology (27.6%) and travel and leisure (21.5%) yielded the highest positive MCRs during the lockdown period.

In the lockdown lift period, i.e. 4 May-31 May 2020, most industries exhibited positive MCRs. However, only utilities (19.4%), construction (5.8%) and food and beverage (5.8%) exhibited positive and statistically significant MCRs. Travel and leisure, basic raw materials, healthcare, retail and industrial goods have positive but statistically insignificant MCRs. Conversely, MCRs in telecommunications, technology and personal goods are negative but statistically insignificant.

4 STOCK PRICE REACTIONS TO COVID-19 PANDEMIC EVENTS

We proceed to investigate how Greek equity prices reacted to the five event periods of the first wave of the COVID-19 pandemic in Greece, focusing on the mean cumulative abnormal returns (MCARs) across industries. Table 3 presents the MCARs of the twelve industries along with the statistical inference for the pre-incubation period. We observe that between 1 January and 30 January 2020, except telecommunications, all the remaining sectors outperform the Athex composite index, exhibiting positive MCARs. The technology (11.7%), industrial goods (9.2%), basic raw materials (6.2%) and real estate industries have positive and statistically significant MCARs. Healthcare, personal goods, retail, construction, food and beverage, and travel and leisure have positive MCARs, which however are not statically significant. With respect to the incubation period, we do not find statistically significant MCARs across the sectors of the Greek stock market, with the exception of utilities (see Table 4). This means that most firms neither overperformed nor underperformed compared with the market index during the incubation period.

Despite the aforementioned Greek stock market crash during the outbreak period, we provide evidence that some industries experienced smaller stock price losses relative to the market index losses. In particular, Table 5 shows that retail (10.7%), food and beverage (9.1%),

Table 3 Mean cumulative abnormal returns for the pre-incubation period by industry

(%)

Industry	MCAR	t-stat
Basic raw materials	**6.21****	3.14
Construction	4.75	1.47
Food and beverage	3.61	1.70
Healthcare	10.53	1.89
Industrial goods	**9.22*****	3.40
Personal goods	6.52	1.05
Real estate	**6.28***	2.34
Retail	5.28	1.21
Technology	**11.73*****	3.06
Telecommunications	-2.72	-0.72
Travel and leisure	3.05	1.27
Utilities	0.05	0.05

Notes: This table shows the mean cumulative abnormal returns (MCARs) for the twelve industries during the pre-incubation period (1 January-30 January 2020). ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

Table 4 Mean cumulative abnormal returns for the incubation period by industry

(%)

Industry	MCAR	t-stat
Basic raw materials	-1.77	-0.82
Construction	-0.11	-0.03
Food and beverage	2.04	0.50
Healthcare	2.59	0.68
Industrial goods	-2.41	-1.06
Personal goods	4.90	1.52
Real estate	2.23	1.89
Retail	-1.58	-0.66
Technology	0.60	0.15
Telecommunications	1.69	0.26
Travel and leisure	0.75	0.11
Utilities	**6.84***	2.41

Notes: This table shows the mean cumulative abnormal returns (MCARs) for the twelve industries during the incubation period (31 January-25 February 2020). ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

personal goods (7.6%) and industrial goods (6.6%) exhibit positive and statistically significant MCARs in a 10-day event window. Also, healthcare and real estate have highly positive MCARs but these are not statistically significant. Looking at the fourth column of Table 5, the utilities, telecommunications, personal goods and retail sectors yield positive

Table 5 Mean cumulative abnormal returns for the outbreak period by industry

(%)

Industry	MCAR (0.10)	t-stat	MCAR (0.17)	t-stat
Basic raw materials	-1.42	-0.29	2.94	0.76
Construction	-8.61	-1.78	3.49	1.57
Food and beverage	**9.05****	2.07	3.11	1.15
Healthcare	11.88	1.59	3.08	1.19
Industrial goods	**6.57****	2.22	1.41	0.76
Personal goods	**7.60****	2.43	**5.22****	2.31
Real estate	5.18	1.40	3.81*	2.03
Retail	**10.73****	2.51	**4.31***	1.84
Technology	3.21	0.77	3.12	1.95
Telecommunications	-0.96	-0.11	**5.52****	3.87
Travel and leisure	-6.64	-0.88	3.37	0.81
Utilities	-0.75	-0.08	**10.74*****	6.84

Notes: This table shows the mean cumulative abnormal returns (MCARs) for the twelve industries during the outbreak period (26 February-22 March 2020). MCAR(0.10) refers to a 10-day event window since the beginning of the outbreak period, whereas MCAR(0.17) refers to the entire outbreak period. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

Table 6 Mean cumulative abnormal returns for the lockdown period by industry

(%)

Industry	MCAR (0.10)	t-stat	MCAR (0.28)	t-stat
Basic raw materials	**-9.97****	-2.52	-4.17	-0.59
Construction	-3.82	-1.05	**10.73***	1.83
Food and beverage	**-9.73****	-4.85	**-7.53***	-1.83
Healthcare	**-4.05***	-0.92	-0.59	-0.60
Industrial goods	**-8.03*****	-4.94	-2.05	-0.86
Personal goods	-2.04	-0.46	-1.02	-0.18
Real estate	-3.81	-0.66	-2.84	-0.41
Retail	**-9.60***	-1.85	-3.32	-0.64
Technology	-4.17	-1.42	**8.13***	2.54
Telecommunications	0.21	0.03	14.06	1.64
Travel and leisure	**-6.16***	-1.69	3.75	1.05
Utilities	-0.91	-0.23	-0.47	-0.09

Notes: This table shows the mean cumulative abnormal returns (MCARs) for the twelve industries during the lockdown period (23 March-3 May 2020). MCAR(0.10) refers to a 10-day event window since the beginning of the lockdown period, whereas MCAR(0.28) refers to the entire lockdown period. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

and statistically significant MCARs for the entire outbreak period.

Table 6 shows the MCARs for each industry group in the lockdown period. While Greek share prices recovered to a large extent during the lockdown period, the basic raw materials, food and beverage, industrial goods and retail sectors were significantly affected by the lockdown, as they underperformed compared with

Table 7 Mean cumulative abnormal returns for the lockdown lift period by industry

(%)

Industry	MCAR (0.10)	t-stat	MCAR (0.19)	t-stat
Basic raw materials	2.28	0.78	-3.07	-0.82
Construction	-0.77	-0.53	-2.44	-1.35
Food and beverage	0.60	0.22	-2.77	-1.16
Healthcare	0.09	0.02	-3.56	-0.59
Industrial goods	**-3.70****	-2.22	**-5.22****	-2.51
Personal goods	-1.90	-0.68	**-9.59****	-2.90
Real estate	0.29	0.14	**-5.69****	-3.00
Retail	-0.87	-0.17	-4.06	-0.68
Technology	**-5.23****	-1.95	**-10.58****	-2.62
Telecommunications	-4.35	-1.14	**-12.90****	-2.53
Travel and leisure	3.64	0.98	-2.78	-0.59
Utilities	3.75	1.41	**11.12****	3.24

Notes: This table shows the mean cumulative abnormal returns (MCARs) for the twelve industries during the lockdown lift period (4 May-31 May 2020). MCAR(0.10) refers to a 10-day event window since the beginning of the lockdown lift period, whereas MCAR(0.19) refers to the entire lockdown lift period. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

the market index. More specifically, the MCARs for the basic raw materials, food and beverage, industrial goods, retail and healthcare sectors are -10%, -9.7%, -8%, -6.2% and -4.1%, respectively, focusing on a 10-day event window. The impact of the lockdown on Greek stock returns weakens in a broader event window covering the entire lockdown period. The fourth column of Table 6 shows that only the food and beverage sector yields a negative and statically significant MCAR. In addition, construction and technology outperformed the market index.

Table 7 illustrates the MCARs of the Greek industries for the lockdown lift period. Using a 10-day event window, we observe that industry-level stock returns were not significantly affected in the lockdown lift period. In particular, the second column of Table 7 shows that only the MCARs in technology and industrial goods are negative and statistically significant, i.e. -5.2% and -3.7%, respectively. However, using a wider event window that includes the entire three-stage lockdown lift period, more industries underperformed relative to the Athex composite index. Telecommunications (-12.9%), technology (-10.6%), personal goods (-9.6%), real estate (-5.7%) and industrial goods (-5.2%) exhibit negative and statistically significant MCARs.

5 CONCLUDING REMARKS

In this study, we provide evidence on the response of stock returns at the industry level to the first wave of the COVID-19 pandemic in Greece. For our analysis, we identify five periods associated with COVID-19 developments from January to May 2020 as follows: (a) pre-incubation (1 January-30 January 2020); (b) incubation (31 January-25 February 2020); (c) outbreak (26 February-22 March 2020); (d) lockdown (23 March-3 May 2020); and (e) lockdown lift (4 May-31 May 2020).

We initially focus on the mean cumulative returns (MCRs) of each industry in our sample to evaluate the performance of industry-level stock returns for the five corresponding periods. We document that in the pre-incubation period, in which the COVID-19 pandemic received little attention in Greece, all industries, with the exception of telecommunications and utilities, had positive MCRs. Besides, technology, industrial goods, real estate and basic raw materials had positive and statistically significant MCRs throughout this period.

During the incubation period, in which the COVID-19 pandemic attracted the attention of the Greek public and the media, all industries performed poorly. In addition, we find that the MCRs of the basic raw materials, retail, construction, technology and real estate sectors are negative and statistically significant. In the outbreak period, industries witnessed the largest drop in their stock returns. The MCRs for all industries are negative and statistically significant, with the travel and leisure, construction, telecommunications, industrial goods, real estate, technology and utilities sectors sustaining the heaviest losses.

During the lockdown period a recovery in industry-level stock returns was observed. This may be due to the income support and debt relief measures announced by the Greek government and the response of the ECB to the COVID-19 pandemic via the pandemic emergency purchase programme (PEPP). Telecommunications, construction, technology, and travel and leisure exhibit the highest and statistically significant MCRs. The sharp decline in equity prices during the outbreak period, followed by an increase in equity prices during the lockdown period, is in line with the pattern of global and US equity prices for the same time horizon. This V-shaped trajectory in the Greek stock market is possibly attributed to changes in risk attitude and investor sentiment.[4] However, more research is needed to further investigate this puzzle in the stock market in the

4 Cox et al. (2020) find a similar pattern for the US stock market in the early weeks of the coronavirus pandemic. Using a dynamic asset pricing model, they argue that this was driven by shifts in risk aversion or sentiment.

early stages of the COVID-19 pandemic. With respect to the lockdown lift period, we document that most industries exhibited positive MCRs. However, only the construction and food and beverage sectors had a positive and statistically significant performance.

We also examine whether and how industry-level stock returns reacted in each of the five periods associated with the COVID-19 pandemic in Greece, turning our attention to the mean cumulative abnormal returns (MCARs). We report that most industries exhibited positive MCARs, with the technology, industrial goods, real estate and basic raw materials sectors outperforming significantly the market index in the pre-incubation period. During the incubation period, industry-level stock returns did not significantly react, with the exception of the utilities sector. The latter has a positive and statistically significant MCAR at 10%.

Despite the turmoil in the Greek stock market during the outbreak period, most industries experienced smaller losses compared with the market index, as most of the industries exhibit positive MCARs using a 10-day event window. Retail, food and beverage, personal goods and industrial goods yield positive and statistically significant MCARs. For the entire outbreak period, industrial goods, retail, telecommunications and utilities outperformed the market index.

While equity prices rebounded during the lockdown period, we provide evidence that the impact of the lockdown had been strong for the first ten days since its implementation. Using a 10-day event window, all industries included in our study underperformed relative to the market index, with the basic raw materials, food and beverage, industrial goods, travel and leisure, and healthcare sectors exhibiting negative and significant MCARs. However, the effect of the lockdown weakens using the event window that covers the entire lockdown period. Food and beverage only exhibits negative and statistically significant MCARs. We also document that even when some of the lockdown measures were lifted, most industries underperformed. Except utilities, the telecommunications, technology, personal goods, real estate and industrial goods sectors have negative and significant MCARs during the lockdown lift period.

Overall, the study provides evidence on the heterogeneous impact of the first wave of the COVID-19 pandemic in Greece across industries, possibly due to sector-specific idiosyncratic features. This is more evident in the outbreak and lockdown periods, as reflected in the V-shaped trajectory of the market index over these two periods. While most sectors of the Greek economy performed badly in the outbreak period, as captured by the sharp decline of the market index, the event study analysis shows that the utilities, telecommunications, personal goods and retail sectors were significantly less exposed to the COVID-19 outbreak compared with the market index. Despite a partial recovery in equity prices during the lockdown period, we provide evidence that there was a short-term negative effect on the basic raw materials, food and beverage, industrial goods and retail sectors. However, the impact of the lockdown weakens when extending the event window.

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ESG RISKS: A NEW SOURCE OF RISKS FOR THE BANKING SECTOR

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ABSTRACT

The financial sector has been mandated to support political decisions promoting sustainable development. For the banking sector, ESG (environmental, social and governance) risks constitute a new source of risks which should be identified, evaluated, monitored and managed. Given the novel nature of these risks, this is a challenging task and the purpose of the paper is to clarify concepts, increase awareness and facilitate the assimilation of the regulation into the decision-making process. The first part analyses the ESG themes and the transmission channels towards the traditional banking risks. The second part focuses on the initiatives that may facilitate the ESG framework to be introduced into the financial sector. The third part focuses on how banks can incorporate ESG themes into decision-making. The ambitious policy agenda in relation to sustainability requires a shifting mindset in the financial sector in order to finance the transformation towards sustainability.

Keywords: sustainable finance; UN SDGs; Paris Agreement; ESG risks; transmission channels; responsible banking; responsible investing; ESG-linked financial products; ESG and bank corporate governance; ESG and bank risk management; ESG investing

JEL classification: E44; G10; Q1; Q5

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ΚΙΝΥΔΝΟΙ ESG: ΜΙΑ ΝΕΑ ΠΗΓΗ ΚΙΝΔΥΝΩΝ ΓΙΑ ΤΟΝ ΤΡΑΠΕΖΙΚΟ ΤΟΜΕΑ

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Ο χρηματοπιστωτικός τομέας έχει εξουσιοδοτηθεί να υποστηρίξει τις πολιτικές αποφάσεις σχετικά με την προώθηση της βιώσιμης ανάπτυξης. Οι τράπεζες είναι αντιμέτωπες με μια νέα μορφή κινδύνων, που είναι συλλογικά γνωστοί ως "κίνδυνοι ESG" και τους οποίους καλούνται να αναγνωρίσουν, να αναλύσουν, να παρακολουθήσουν και να διαχειριστούν. Λόγω της διαφορετικότητας αυτών των περιβαλλοντικών, κοινωνικών και σχετικών με τη διακυβέρνηση κινδύνων, πρόκειται για ένα δύσκολο εγχείρημα και σκοπός της παρούσας μελέτης είναι να αποσαφηνίσει τις έννοιες, να αυξήσει την ευαισθητοποίηση απέναντι σε αυτούς τους νέους κινδύνους και να διευκολύνει την ενσωμάτωση του συναφούς κανονιστικού πλαισίου στη διαδικασία λήψης αποφάσεων. Αρχικά, αναλύονται τα θέματα ESG και οι δίαυλοι μετάδοσης προς τους παραδοσιακούς τραπεζικούς κινδύνους. Στη συνέχεια, η μελέτη επικεντρώνεται στις πρωτοβουλίες που μπορούν να διευκολύνουν την εισαγωγή του πλαισίου ESG στο χρηματοπιστωτικό τομέα. Τέλος, εστιάζει στον τρόπο με τον οποίο οι τράπεζες μπορούν να ενσωματώσουν τα θέματα ESG στη λήψη αποφάσεων. Εν κατακλείδι, οι φιλόδοξες πολιτικές σε σχέση με τη βιωσιμότητα απαιτούν την αλλαγή νοοτροπίας στο χρηματοπιστωτικό τομέα ώστε να είναι δυνατή η χρηματοδότηση της μετάβασης προς τη βιώσιμη ανάπτυξη.

ESG RISKS: A NEW SOURCE OF RISKS FOR THE BANKING SECTOR*

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I INTRODUCTION

Over the past decade or so, the concepts of sustainable finance, responsible investment and responsible banking have increasingly gained popularity around the world. One should consider the reasons for shifting from finance to sustainable finance, from investment to responsible investment, or from banking to responsible banking. Do these adjectives have any significance? Up until today were market participants not responsible, or did they not have responsible strategies? Obviously, they were responsible and their investments or lending policies were aimed at sustainable companies with robust financials and effective corporate governance settings. However, there is a new momentum for sustainability and responsibility due to the global threat of climate change, environmental degradation and the need to address social and governance issues across economies. The dramatic potential consequences have triggered political willingness and have mobilised the international community in joining efforts to address the problem. The initial step is to define the problem. The scientific community has converged to the idea that a limit to the increase in average global temperature well below 2˚C above pre-industrial levels, and preferably closer to 1.5˚C, may prevent catastrophic consequences from climate change. For the time being, the culprit is the accumulation of CO_2 emissions, which account for most of greenhouse gas (GHG) emissions[1]. The process involves complex interactions between the atmosphere, the upper oceans and the biosphere, and the deep oceans. The mitigation pathways point to the need for cutting emissions to net zero levels by 2050, in order to meet the target of limiting the rise in global temperature by less than 1.5˚C relative to pre-industrial levels.[2]

Undoubtedly, this is primarily a task for governments but the financial sector can also act as a catalyst in multiple ways. Decision-makers regarding sustainable or responsible strategies have to take the environmental parameter into account in order to comply with growing public sentiment, emerging regulations as well as new technologies and market swifts. Although much of the attention is directed towards climate change, the traditional parameters of sustainability, i.e. the social, governance and economic factors, cannot be overlooked. Therefore, the modern concept of sustainability encompasses environmental, social, governance and economic issues, all considered equal, although some of them are gaining in momentum depending on the circumstances. For instance, the pandemic has emphasised the urgent need to improve health systems and to address the problems that are affecting people's well-being, thus strengthening the social factor.

The concept of sustainable finance has evolved as part of the broader notion of sustainable growth, which was defined by the United Nations as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. At the 1992 Rio summit the concept was formalised and a framework was introduced as the foundation for further action but without imposing legal requirements. Yet climate change mitigation policies were hampered by the free-rider problem since the agreements were voluntary and there were no sanctions. The EU acknowledged the problem and, as a partial remedy, expanded the concept in order to take into account the environment,

* The views expressed in this article are personal and do not necessarily reflect those of the Bank of Greece. I would like to thank colleagues at the Bank of Greece for useful comments on earlier drafts.

1 CO_2 emissions account for 80% of GHG emissions in the United States (https://www.epa.gov/ghgemissions/overview-greenhouse-gases).

2 Intergovernmental Panel on Climate Change (IPCC), *Special Report: Global Warming of 1.5˚C* (https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf).

society and governance (hence the acronym ESG), specifically underlining their equal importance. The year 2015 was a major milestone, as the UN 2030 Agenda for Sustainable Development and the Paris Agreement were adopted, significantly boosting the effort to tackle the problem. The UN 2030 Agenda introduced 17 main goals (Sustainable Development Goals – SDGs) and 169 targets, measured through 232 individual indicators, in effect a checklist of appropriate actions, aiming at sustainable economies without exclusions, while the objective of the Paris Agreement was to increase resilience and adaptation to climate change. It is generally acknowledged that achieving the sustainability goals requires decarbonising our production and consumption system by 2050. Both initiatives, which are the basis of all subsequent initiatives, indicated clearly that the cost of inaction far exceeds the cost of action.

The Paris Agreement statement that "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development"[3] paves the way to a radical reorientation of capital allocation. Thus, financial markets are directly involved in mainstreaming sustainability, with an ultimate goal to scale up the financing to achieve the transition. At the same time, however, two questions arise: (i) whether this is an appropriate task for financial markets; and (ii) how market participants can be motivated to channel investment into projects that are aligned with the aims of sustainable economic growth. Markets are anticipated to seize the opportunity created by political agendas and introduce ESG themes into decision-making. Legislative activity and market participant initiatives are buoyant, despite the EBA observation[4] that "most international frameworks and standards have refrained from establishing a single definition of ESG factors. While there is general agreement that ESG factors represent the main three pillars of sustainability, the lack of a single definition of ESG factors complicates its understanding and management in a consistent way". But the lack of a widely accepted definition did not deter ESG analysis from gaining importance during the pandemic, since it has highlighted the economic, social and environmental vulnerabilities which may translate into uneven income distribution and a widening of the wealth gap. Actually, most policy initiatives for the post-pandemic recovery emphasise the importance of the environmental and social factors, while the governance factor is always on demand.

The paper analyses the ESG themes from three perspectives. The first part explores the concept of ESG factors as well as the transmission channels towards the traditional banking risks. The second part focuses on the enablers, i.e. the initiatives that may facilitate the ESG framework to be introduced into the financial sector. Thus, responsible banking, responsible investment, ESG-linked financial products and regulatory initiatives are respectively discussed. The third part focuses on how banks can incorporate ESG themes into decision-making. In effect, the analysis highlights the necessary modalities for strategy and governance, risk management, credit risk allocation, investment strategies and client engagement. The general purpose of the paper is to clarify concepts, raise awareness and facilitate the assimilation of the upcoming regulation into decision-making.

2 SUSTAINABLE FINANCE AND ESG RISKS

Sustainable finance refers to the inclusion of environmental, social and governance criteria in business or investment decisions for recognising a long-lasting benefit for shareholders, stakeholders and society at large. The ultimate objective is to achieve economic growth that is voluntarily aligned with the political commitments specified in international agreements such as the Paris Agreement, the UN Sustainable Development Goals, the UN Guiding

3 Article 2(1) letter (c).
4 European Banking Authority (2020), "EBA Discussion paper on management and supervision of ESG risks for credit institutions and investment firms", October.

Principles on Business and Human Rights, and the ILO Fundamental Principles and Rights at Work. Thus the topic is rather broad, and sustainable finance can be defined as the process of taking due account of ESG considerations in decision-making along with profit-making considerations. Furthermore, collaboration between corporations in various industries, the financial sector and other stakeholders is required to achieve the environmental and social objectives set. Such objectives may cover a broad spectrum within an entity's functions, including business models and strategies, organisational structure, culture and internal processes, risk management, disclosures, as well as green financing and investing, in order to minimise its environmental footprint and maximise its social footprint. The issue attracts public interest due to the shifting market forces, the changes in society's expectations, the development of policies designed to protect the environment and the technological advances and the relevant regulation under development which is addressed to financial entities. It has evolved into an approach of creating and protecting value through proactive management and reporting of environmental, social and economic impacts as well as stakeholder concerns and expectations.

2.1 ESG THEMES

The ESG definition is rather straightforward but the challenge is to specify the indicators pertaining to the ESG themes and measure them. Several authorities have come up with alternative lists depending on the focus. There is a broad consensus that the environmental considerations usually refer to climate change, mitigation and adaptation to a new normal, physical disasters, air and water pollution, resource depletion, and biodiversity loss. The social considerations refer to issues of inequality, inclusiveness, labour relations, investment in human capital and communities as well as human rights issues. The governance considerations refer to the corporate governance and managerial structures that ensure inclusion of social and environmental considerations in the decision-making process, as well as employee relations and executive remuneration. The priorities reported by participating entities in a survey of practices prepared by the European Commission[5] are presented in Table 1.

Table 1 Ranking of ESG themes

E	Climate change	Physical weather events Transition to low-carbon economy Carbon footprint
	Natural resources & pollution	Waste management Water management Biodiversity & land use Raw material sourcing
S	Internal stakeholder management	Worker's rights Diversity and culture Talent management
	External stakeholder management	Community relations Customer relations
G	Board quality	Board independence Board effectiveness
	Corporate behaviour	Business ethics Ownership & control Audit & tax

ESG themes are a conceptual grouping of topics falling under each of the "E", "S" and "G" pillars that may translate into risks and which collectively are referred to as ESG risks. The ESG risk perimeter includes:

(a) Environmental pillar risks – "E"

The "E" pillar comprises two types of risks: (i) climate-related risks, which refer to risks caused by or related to climate change (e.g. extreme or chronic weather events); and (ii) environmental risks, which refer to risks caused or affected by environmental degradation and the loss of ecosystems (e.g. water pollution and scarcity of fresh water).[6] There is a connection and overlap between the two risks. Climate change can also lead to environmental degra-

5 European Commission (2020), *Interim study on the development of tools and mechanisms for the integration of environmental, social and governance (ESG) factors into the EU banking prudential framework and into banks' business strategies and investment policies*, December. Prepared by: BlackRock / Financial Markets Advisory.

6 The COVID-19 pandemic initiated a discussion on whether a third source should be added, namely the risk from biodiversity loss. See the speech by Sylvie Goulard, Banque de France Deputy Governor, at the Green Swan Conference, 3 June 2021.

dation, such as biodiversity loss, but some sources of environmental degradation are unrelated to climate change, such as water pollution due to industrial spillage.

There are two main channels through which climate and environmental risks are manifested, i.e. physical risk and transition risk. Physical risk arises from damages to physical assets, natural capital and/or human lives leading to output losses, as a result of climate-induced weather events. Physical risks are either acute, resulting from extreme weather events such as heat waves, droughts, floods, etc., or chronic, arising from progressive shifts in climate patterns such as rising sea levels, rising average temperatures and ocean acidification. Transition risks are risks induced from the shift towards a low-carbon economy that aims to slow the rate of climate change. There are three main drivers of transition risks: (i) climate-related transition policies, such as the introduction of carbon pricing; (ii) technological changes, in particular those contributing to energy transition and affecting the relative pricing of energy sources; and (iii) shifts in consumer and investor sentiment or market patterns that can increase reputation risk. These types of climate risks may have significant macro and micro impacts with feedback loops on the economy, counterparties and banks and have the potential to generate significant and recurring financial losses through multiple chain reactions. In addition, although climate change is a global phenomenon, its impacts and the associated financial losses vary depending mainly on (a) the geographical location, as different regions exhibit distinct climate patterns and levels of development, and (b) the type of activities, business model and value chain of an entity.

Physical and transition risk channels are interconnected and can lead to stranded assets. Assets in affected sectors, such as the oil and gas sector, may lose value to become "stranded". The International Energy Agency (IEA)[7] provides a definition from an energy economist's perspective as follows: "... those investments that have already been made but which, at some time prior to the end of their economic life, are no longer able to earn an economic return as a result of changes in the market and regulatory environment brought about by climate policy." There are four sources of asset stranding. The first is related to abandoned carbon, since, if temperature targets are met, a part of fossil fuel reserves is not to be extracted. The second source is related to abandoned capital, since some investments in the fossil fuel industry will become obsolete once the economy switches to renewable energy. The other two sources are related to anticipated and realised stranded assets. The driver for the former is the prices of fossil fuel assets, which may adjust long before the climate policy is enacted affecting the valuation of these assets. For the realised stranded assets the driver is policy changes that are not anticipated with certainty and announcements that are subject to doubt about their actual implementation.

(b) Social pillar risks – "S"

The concept of social sustainability is neither absolute nor constant. It is a dynamic concept that changes over time and place in line with the question of what constitutes a good life and good society. Social sustainability is sometimes considered as a standalone pillar, separate from environmental and economic sustainability concerns and associated with economic growth. In other frameworks it is considered as a foundation for the other pillars of sustainability, where the formation of social capital is seen as a stimulus to growth and a prerequisite for economic and environmental development. Over time, social sustainability progressively widened and it is now considered as an independent sustainability factor rather than solely part of sustainable development. However, there is still ambiguity on the role of "S" in corporate frameworks and its integration into decision-making. It is possible to contemplate two different approaches:

7 International Energy Agency (2013), *Redrawing the energy-climate map: world energy outlook special report.*

- addressing general social issues; and
- addressing stakeholder welfare.

Corporate citizenship is a widely accepted concept and, as such, companies should incorporate general social issues, over and above human rights, labour issues, workplace health and safety, and product safety and quality. They should also incorporate wider issues, such as unemployment, education, the impact of modern supply-chain systems and the adoption of technology across business sectors. More recently, new issues are emerging such as the social tensions and upheaval related to environmental issues and the environmental degradation that affects the lives of the poor. All of the above are reflected in the corporate culture. Where companies have a strong and shared culture across the organisation, "S" practices tend to be strong. Where a culture is poor, or considered toxic, "S" tends to follow the same pattern.

Regarding stakeholder welfare, the "S" factors represent business-oriented issues such as customer or product quality, data security, industrial relations or supply-chain and other issues that may create or destroy value. These issues are related with the wider interests of stakeholders and even if they entail cost in the short term, they create value in the long term to the benefit of companies.

Both approaches are partially manifested in social responsibility policies where companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.[8] Being socially responsible means not only fulfilling legal expectations, but also going beyond compliance and investing "more" in human capital, natural capital, the environment and the relations with stakeholders. On several occasions, the responsibility of companies for the "S" pillar is exhausted in Corporate Social Responsibility (CSR) policies.

Disclosure is another relevant issue. While companies have made significant progress in the disclosure of their environmental impact and governance standards, the same cannot be said of social impact and performance. This is perhaps expected, since the impact on the environment tends to emanate from measurable and widely accepted criteria and good governance practice transcends sectors and institutions. These considerations are echoed by the UN Principles for Responsible Investment (PRI),[9] which state that, despite the increasing prominence of "S" factors, the lack of data and consistency presents challenges: "The social element of ESG issues can be the most difficult for investors to assess. Unlike environmental and governance issues, which are more easily defined, have an established track record of some market data, and are often accompanied by more robust regulation, social issues are less tangible, with less mature data to show how they can impact a company's performance. But issues such as human rights, labour standards and gender equality —and the risks and opportunities they present to investors— are starting to gain prominence."

A major stimulus to the "S" pillar has been given by the pandemic. In general, the pandemic has affected ESG considerations in a positive way. While for many governments the post-pandemic recovery has been associated with the green recovery, it is less clear how it has affected the ESG efforts of market participants. Many traditional norms of living, working and doing business have now changed and are not expected to return to pre-pandemic patterns. In this new reality, some established business models are likely to struggle but a new consensus has emerged regarding the role of business in society. The impact on ESG factors brings about a stronger focus on the "S" pillar going forward, for instance, on labour management. There was increased interest in

8 European Commission (2001), "Green Paper: Promoting a European framework for Corporate Social Responsibility", COM(2001) 366 final.
9 United Nations Principles for Responsible Investment (2017), "ESG integration: how are social issues influencing investment decisions?".

the social dimension of sustainable investment due to digitalisation[10] and globalisation,[11] since social exclusion is a real danger. Now the "S" visibility is expected to increase due to the aftermath effects of the pandemic. This new emphasis on "S" is expected to bring more scrutiny from rating agencies, regulators and other market participants.

(c) Governance pillar risks – "G"

The incorporation of governance issues in ESG analysis can take three forms:

- governance from banks' own operational and organisational perspective;
- governance structures set up to implement and oversee the environmental and social risk framework throughout the bank; and
- governance of the counterparties banks lend to.

Bank governance is a long-standing issue which has been analysed from several angles and which is dealt with from both a compliance and an ethical perspective. Typical governance issues in the narrow sense such as the role of the board of directors, the board composition, the board quality, the internal control system, etc., as well as issues in the broader sense such as money laundering, know-your-customer policy, client onboarding, etc. are addressed according to existing regulation, business conduct and compliance requirements.[12] New requirements emerge for the incorporation of ESG factors into bank governance (see section 4.1).

The governance issues of the bank borrowers may have a major impact and, if appropriately incorporated, can advance the sustainability cause significantly. The need for robust structures and procedures in any company is firmly articulated in the G20/OECD Principles of Corporate Governance[13]. Their scope and recommendations extend beyond traditional financial and operational risks and point to the need to address corporate policies and performance with respect to environmental and social issues. The principles identify some key areas for ESG-related risks consideration but the responsibility for the detailed design and implementation remains with the company, and in particular with the board. The principles recommend that the board of directors is vested with the responsibility to incorporate environmental and social factors and this cannot be seen in isolation from the overall recommendations for good corporate governance. Thus, the board's quality and business ethics are of paramount importance.

Board quality has several dimensions. Board diversity is an important factor and it is possible to distinguish between task-related diversity, such as education or functional background, and non-task related diversity, such as gender, age, race, or nationality. All of them affect the board's leadership role and in the case of sustainability, its leadership towards the positive footprint of ESG factors in decision-making. This incorporation has a compliance dimension for meeting regulatory requirements and a strategic dimension for incorporating the entire spectrum of ESG requirements in order to shift behaviours from myopic short-termism to a long-term approach and create a long-term sustainable business. There are several practices that favour short-termism such as the focus on quarterly financial results, variable pay based on annual results, marking-to-market of investments, or treatment of illiquid investments among other things, and the change in behaviour is a necessary condition to incorporate ESG themes. In the strategic dimension, the major issue is the time horizon

10 For instance, social disruption following artificial intelligence (AI) application may significantly upgrade the "S" pillar. The European Commission has proposed an AI ethics regulation where it is clearly articulated that all systems that represent a clear threat to the safety, livelihoods and rights of people will be banned. This includes AI systems or applications that manipulate human behaviour to circumvent users' free will and systems that allow "social scoring" by governments. See European Commission (2021), "Laying down harmonised rules on artificial intelligence", COM(2021) 206 final, April.

11 Shafik, N. (2018), "The new social contract", *IMF Finance & Development Magazine*, Vol. 5, No. 4.

12 Basel Committee on Banking Supervision (2015), "Guidelines. Corporate governance principles for banks", July; and European Banking Authority (2017), "Guidelines on internal governance under Directive 2013/36/EU", September.

13 OECD (2015), *G20/OECD Principles of Corporate Governance*, OECD Publishing, Paris.

since the risks usually crystallise beyond many current business planning horizons. The time horizon of ESG impacts is longer than the typical time horizon of strategic planning and thus there are methodological challenges when integrating these risk drivers into strategy and the risk management framework.

2.2 MAPPING ESG RISKS ONTO FINANCIAL AND STABILITY RISKS

Banks can be exposed to ESG risks in two ways. The first, the direct exposure, arises from own operations; for instance, a bank may be exposed to operational risk if a branch is located in a high-risk flood area. Thus, the "E" pillar of the ESG framework is transformed into a familiar risk setting. The second, the indirect exposure, arises from lending and investment activities. For instance, a bank may lend to a counterparty that does not respect the regulation of safety in the workplace and after an accident suffers from reputational risk and loss of customers, leading to an increased risk of default on the loan. Thus, the "S" pillar of the ESG framework is transformed into credit risk. Further, a bank may invest in a counterparty's securities and a major fraud is detected in the accounting books of that counterparty. Thus, the "G" pillar of the ESG framework is transformed into profitability, credit, market and liquidity risks.

Therefore, all ESG pillars should be transformed into traditional risk categories. The European Central Bank (ECB) in its relevant guide notes that "institutions are expected to incorporate climate-related and environmental risks as drivers of established risk categories into their existing risk management framework".[14] The ECB focuses on the "E" pillar and this is justified,[15] as the relevant work in the academic literature and in policy institutions is much more advanced whereas the situation with the other pillars is somewhat vague. In some cases the analysis focuses on the ES framework (disregarding the "G" pillar), but again priority is given to environmental issues. A study by the NYU Stern Center for Business and Human Rights[16] reviewed reporting in relation to the "S" pillar and concluded that the measurement of "S" usually focused on what was "most convenient" as against what were "most meaningful" and that "S" measures were often "vague". Consequently, measuring "S" is unlikely to yield the information needed to facilitate the transposition into well-known banking risks.

There is general consensus that "E" pillar risks are not the typical type of risks that economists and bankers are used to. Risk managers are familiar with the theory of black swans, and stress testing exercises have now been incorporated into risk management decision-making to address unexpected extreme events. Now, risk managers are faced with green swans,[17] that is extreme events due to climate change, to which they should also get accustomed. Green swan and black swan events are not similar. Black swans lead to financial distress, yet the existing tools are capable of restoring financial stability. Green swans lead to a climate crisis, which may not only have an irreversible impact but the causes of which may also be difficult, if not impossible, to reverse. If a crisis is triggered by a rapid transition to a low-carbon economy, the substitutability between financial and natural capital may prove imperfect. Probably, both financial stability and climate stability should be considered interchangeably as public goods.

14 European Central Bank (2020), "Guide on climate-related and environmental risks. Supervisory expectations relating to risk management and disclosure", November.

15 Other prudential supervisors are in a similar vein. See for instance Australian Prudential Regulation Authority (2021), "Consultation on draft Prudential Practice Guide on Climate Change Financial Risks", April, and Bank of England (2019), "Enhancing banks' and insurers' approaches to managing the financial risks from climate change", Supervisory Statement no SS3/19, April.

16 O'Connor, C. and S. Labowitz (2017), "Putting the 'S' in ESG: Measuring Human Rights Performance for Investors", NYU Stern Center for Business & Human Rights.

17 The black swan theory is used in finance to describe unexpected and very rare events, outside the realm of regular expectations, with extreme impact, and which can be explained in retrospect. Green swan and black swan events are not similar. First, the impact of climate change is highly uncertain and cannot be predicted from historical data; second, climate catastrophes are much more serious than most systemic financial crises, posing existential threat; and third, the complexity related to climate change is of a higher order than for black swans due to chain reactions. See Bank for International Settlements (2020), "The green swan: central banking and financial stability in the age of climate change", January.

Furthermore, climate-related risks are different from more traditional financial risks, with their most important differences being the deep uncertainty, the non-linearity and the endogeneity of risk. The uncertainty is caused by the speed of changes which are unprecedented, and very little reliance can be placed upon historical experience to assess their magnitude and breadth or to identify patterns. Climate-related risks are relevant to multiple lines of business, sectors and geographies, and this heterogeneity exacerbates uncertainty. Their full impact may be larger than for other types of risks. They are also subject to non-linearities and the probability distribution cannot be inferred from historical data or proxied. They are characterised by fat tails, which means that if not addressed appropriately, they may impede return to pre-crisis status. Traditional pricing models neglect tail risk and incomplete markets.

As for the endogeneity of risks, this is the outcome of different risk perceptions[18] which are related to policy responses and transition patterns. Discussions of climate change government policies are often framed as a choice between acting now or waiting until we know more about the problem. The ability to learn may have two competing effects: on the one hand, the uncertainty and irreversibility of damages may lead to more active *ex ante* emission reductions, but on the other hand the irreversibility of the capital invested and the likelihood that the problem is less severe than expected may lead to less active *ex ante* emission reduction. This ambiguity coupled with technological innovation uncertainty and the risks involved in different transition patterns lead to the formation of different risk perceptions. This in turn affects the response of decision-makers, which further alters market perceptions, and this circularity introduces new sources of uncertainty and enhances financial complexity.

All of the above lead to the conclusion that climate risks require a rethinking of financial risk, since traditional approaches to financial pricing and pure scenario-based stress tests are inadequate to incorporate the specific nature of climate risks and the associated financial risks. Aligning finance with climate targets requires new, transparent methodologies to price forward-looking climate risks (and opportunities) in financial contracts and in investors' portfolios. This means that new types of expertise, additional information channels, better analytical tools and data, novel internal policies and practices that are tailored to assessing the specificities of climate-related risks are needed.

Despite their complexity, the causal chains linking climate risk drivers to financial risks should be mapped. In other words, banks should explore the appropriate transmission channels, that is the way through which climate change might materialise as a source of financial risk.[19] There are microeconomic and macroeconomic channels. The microeconomic channels have a direct impact on banks, reflecting the effects of climate change on banks' operations or on the households, businesses and governments they lend to or invest in. The macroeconomic factors have an indirect effect on the transmission consequences through macroeconomic variables, such as labour productivity, output demand and supply, inflation, economic growth or market factors, such as interest rates and commodity prices. For instance, a bank may face an increase in credit risk resulting (i) from an income effect, that is a reduction in borrowers' ability to service debt, (ii) from a wealth effect, that is loss stemming from default on mortgage-backed loans when the value of collateral decreases, (iii) from a transition effect, that is an increase in the probabilities of default (PD) and loss given default (LGD) of exposures

18 Risk perception refers to the process of discerning and interpreting signals from diverse sources regarding uncertain events, and forming a subjective judgement of the probability and severity of current or future harm associated with these events. See Bradley, G.L. et al. (2020), "The role of climate change risk perception, response efficacy, and psychological adaptation in pro-environmental behavior: a two nation study", *Journal of Environmental Psychology*, 68.

19 Bank for International Settlements (2021), "Climate-related risk drivers and their transmission channels", April.

within sectors or geographies vulnerable to the transition towards a low-carbon economy, or (iv) from a sovereign effect, that is the impact from exposure to countries which experience climate risk events that may primarily affect tax and spending channels.

Market risk increases through a price effect, that is the sudden reduction in financial assets and commodities values stemming from negative price adjustments where climate risk is not yet incorporated into prices, or through a volatility effect, that is uncertainty about the timing, intensity and location of future climate events that may lead to higher volatility in financial markets. This also includes the risk of losses from stranded assets.

Liquidity risk increases through second-round effects, that is the realisation of credit, market and other financial risks that may have a negative impact on the liquidity gap, and through the collateral effect, that is the diminishing ability to raise funds from the market or central bank facilities due to unacceptable collateral related to its sensitivity to climate events. There is also the risk of deposit withdrawals by counterparties that have experienced damages from climate change or due to negative publicity regarding a bank financing "high emitters".

Operational risk increases (i) through a direct effect, that is loss resulting from damage to bank infrastructure due to a climate event, (ii) through a business continuity effect, that is a disruption of the critical financial intermediation functions from damages to the branch network, data centres located in vulnerable locations, outsourced activities and affiliates with shared functions, (iii) through a reputation effect, that is an increase in reputational risk due to changes in market sentiment, (iv) through a strategy effect, that is a misalignment of the business model to market best practices (e.g. not being able to finance the environmental transition), or (v) through a compliance effect, that is an incurrence of fines due to lack of consideration on compliance with international ESG standards and regulation.

In addition, there are feedback loops and amplification drivers which are manifested as financial stability risks. It is possible to distinguish three types of drivers that may affect financial stability: (i) demand and supply shocks, (ii) the risk of stranded assets, and (iii) the insurance coverage of losses. Both demand and supply affect physical and transition risks. If they are not addressed properly and in a timely manner, they can lead to "tipping points"[20] in the ecosystem that can generate social disruptions, particularly in the food-water-energy nexus. These lead to demand and supply shocks, significantly delaying the return to the pre-crisis status. On the demand side, extreme climate events could reduce household and corporate wealth and change savings and consumption patterns. Investment initiatives could also be diminished by uncertainty about future demand, growth prospects and price impacts. On the supply side, natural disasters can disrupt business activity and import and export flows, destroy infrastructure and ration energy supply, diverting capital from technology and innovation to reconstruction and replacement (adaptation capital). Climate change can also trigger migration on a grand scale, cause potential social conflict and have an impact on labour market dynamics. Labour productivity can be affected from loss of hours worked, absenteeism and, possibly, increased mortality.

The risk of stranded assets may have potential financial stability implications[21] through economic and financial channels. Diverting capital assets away from carbon-intensive industries is costly and almost impossible in the short term.

20 "Tipping points" are thresholds where a tiny change could push a system into a completely new state. Climate tipping points are of particular interest in reference to concerns about global warming. See Steffen, W. et al. (2018), "Trajectories of the Earth system in the Anthropocene", *Proceedings of the National Academy of Science of the United States of America*, 115(33).

21 Rozenberg, J., A. Vogt-Schilb and S. Hallegatte (2014), "Transition to clean capital, irreversible investment and stranded assets", Policy Research Working Paper No. 6859, The World Bank.

The affected businesses may face an unanticipated drop in demand for their products, leading to shrinking financial performance and cascading losses in business value chain, thereby increasing the risk of economic downturns. The banking sector may face a surge in non-performing loans and write-offs. Furthermore, investor sentiment may shift away from these companies, affecting negatively their stock price returns and creating market turbulence. There may be sudden market corrections and a drop in market valuations, generating losses on the portfolios of investors that are exposed to these financial contracts.

Therefore, the risk of stranded assets depends on the type of transition to a low-carbon economy. If financial markets essentially support an orderly transition with credible and stable policies, then investors can anticipate the policy, the price adjustment will be smooth and the losses will be limited.[22] On the other hand, a disorderly transition, e.g. a delayed policy introduction, will result to abrupt market changes and volatility, as investors will be unable to prepare the alignment of their portfolio with sustainability goals in anticipation to the policy impact. For financial institutions an orderly transition is crucial in order to avoid climate "Minsky moments"[23] and to have the necessary time to adapt. A sharp adjustment with a view to lowering emission standards means that several assets may become stranded, increasing the risk of an economic downturn and financial losses.

A third channel that affects financial stability is the losses of insurance providers and the disruption caused by the non-insured loss.[24] As natural catastrophes increase worldwide, insured losses threaten the solvency of insurance firms, while non-insured losses threaten the solvency of households and businesses and therefore of financial institutions and the economies. Insurance liabilities are particularly exposed to the frequency and severity of climate-related events that place insurers and reinsurers in a situation of fragility. Uninsured losses are expected to weaken household and corporate balance sheets, reduce the valuation of collaterals held by banks and constrain lending, with possible systemic effects. There is also the risk that insurance premia rise or that insurers refrain from insuring certain rising climate risks, with more risks becoming uninsured and the losses borne directly by households and corporations.

Table 2 Transmission channels

Credit risk	Wealth effect / income effect / transition effect/ sovereign effect
Market risk	Price effect / volatility effect
Liquidity risk	Second-round effect / collateral effect/ deposit withdrawal effect
Operational risk	Direct effect / business continuity effect / reputation effect / strategy effect / compliance effect
Financial stability risks	Demand and supply shocks effect / the risk of stranded assets effect / the coverage of losses effect

Table 2 summarises the above discussion.

3 WHO SHOULD CONTRIBUTE TO SUSTAINABLE FINANCE?

Climate change could lead to green swan events and trigger a systemic financial crisis with unpredictable environmental, social, economic and geopolitical dynamics. Economists have long identified market failures at the root of climate change. The environmental risks pose externalities for three reasons: (i) the tragedy of horizons,[25] i.e. the fact that the cat-

22 European Central Bank (2021), "Climate-related risks to financial stability", *Financial Stability Review*, May.
23 A Minsky moment refers to reckless speculative activity in the financial market resulting in an unsustainable bullish period, which ultimately leads to market collapse. In terms of climate change, it refers to a severe tightening of financial conditions for companies relying on carbon-intensive activities, which leads to stranded assets.
24 Only a third of climate-related economic losses in the euro area is insured. See European Central Bank (2021), "Climate-related risks to financial stability", *Financial Stability Review*, May.
25 Mark Carney, then Governor of the Bank of England and Chairman of the Financial Stability Board, was the first to coin the term explaining the paradox of inaction in responding to growing evidence of the severity of climate change. See Carney, M. (2015), "Breaking the tragedy of the horizon – climate change and financial stability", speech given at Lloyd's of London, London, 29 September, page 3.

astrophic impacts of climate change will be felt beyond the traditional horizons of most banks, investors and financial policymakers, imposing costs on future generations that the current one has no direct incentives to repair; (ii) the tragedy of commons, i.e. when an open-access resource is overused and this is not reflected in prices, for example the price of fossil fuels that does not account for environmental depletion; and (iii) the social costs of climate change, which are not recognised. Therefore, policy should focus on internalising the externalities and this can be done by governments, the financial sector and the corporate sector. The burden cannot weigh on one party alone and no party can keep waiting for someone else to act.

(a) Governments

Addressing climate change is primarily a task for governments. These are best placed to tackle the climate challenge globally and collectively. The best option is to raise prices through taxation to reduce demand and internalise the climate externalities. Alternatively, emission trading schemes (ETS), also known as cap-and-trade systems, can be considered, where prices are determined according to demand and supply of quotas to emit CO_2. These schemes should ensure that all emitting activities are addressed and that the emission allowances provided are limited to the extent necessary to drive transition. The second best option is the cooperation among key players to introduce rules governing a common good and to monitor these rules. This can be achieved by forging a "coalition of the willing" in order to recognise and streamline actions of all actors at all levels. This international cooperation sometimes is possible (ozone layer) but often is lacking (carbon tax). Nevertheless, there are problems. Pricing has not, so far, resulted in a reallocation from "brown" (or carbon-intensive) to "green" (or low-carbon) assets. Global coordination is difficult, enforcement mechanisms are absent and there are huge incentives to free riding. In conclusion, climate change is not another market failure but "the greatest market failure", and the involvement of other actors is warranted. However, a recent IEA report stresses that "the global pathway to net-zero emissions (...) requires all governments to significantly strengthen and then successfully implement their energy and climate policies. Commitment made to date fall short of what is required".[26]

(b) Central banks

The mandate of central banks is to conduct monetary policy, to ensure financial stability and, in several cases, to supervise banks. *Prima facie* the direct contribution of central banks is limited to the structure of their own portfolios,[27] but the indirect contribution can be sizeable since they can guide the financial sector towards appropriate risk management and they can mobilise mainstream finance to support the transition toward a sustainable economy. Central banks are expected to have a more visible impact on climate change and this has initiated discussions for greening monetary policy. Climate change may affect inflation through several channels and this impacts the central bank's primary mandate, i.e. price stability. For instance, extreme weather events are likely to change the distribution of shocks and the transition to a low-carbon economy is likely to lower growth and increase inflation. Higher energy prices and/or limited availability of energy may spur inflation expectations. In a context of frequent and persistent supply shocks, inflation targeting policy may not be fit for purpose.

The transmission of monetary policy may also be affected through the repricing of stranded assets. A sharp fall in physical capital values and a drop in asset prices could potentially trigger an economy-wide recession. Sudden adjustments in financial markets and the consequent losses of financial institutions may impair the interest rate channel.

26 International Energy Agency (2021), *Net Zero by 2050. A Roadmap for the Global Energy Sector*, May.

27 For instance, see European Central Bank (2021), "Eurosystem agrees on common stance for climate change-related sustainable investments in non-monetary policy portfolios", press release, February.

Monetary policy instruments can facilitate the greening of monetary policy, and in particular the eligibility criteria for assets and collateral. These criteria are important for the market because eligible securities provide banks with liquidity. Greening monetary policy operations would involve steering the eligibility criteria towards low-carbon assets.[28]

Furthermore, in December 2017 the Central Banks and Supervisors Network for Greening the Financial System (NGFS) was established, acknowledging that "climate-related risks are a source of financial risk. It is therefore within the mandates of central banks and supervisors to ensure the financial system is resilient to these risks".[29] This provides clear evidence of the central banks' collective engagement with climate change. But as the Bank for International Settlements (BIS) has warned,[30] relying too much on central banks would be misguided for many reasons. First, it may further distort markets and create disincentives. Second, and perhaps most importantly, it risks overburdening central banks' existing mandates since climate-related issues necessitate broader sociopolitical adjustments. "Skeptics" focus on central banks' action against inflation, whereas "activists" call for a broader mandate. The ECB is on the "activist" side and this is clearly articulated in its strategy review.[31] In December 2020 the US Federal Reserve Board joined the "activist" side by announcing its formal engagement with the NGFS.

(c) Financial markets

One of the aims set by the international community (Article 2, para. 1(c) of the Paris Agreement) is "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development". Since the financial flows entered the scene, sustainability as an investment objective emerged as a key issue on the financial markets. An increasing number of governments, central banks and regulators have taken action to drive sustainability into the core of the financial system. The aim is to increase the visibility of emerging risks, build competitiveness, attract investment and drive policy consistency across economic and financial frameworks for the low-carbon transition. Is this an appropriate task for financial markets? If so, how can financial market participants channel investment into projects that are aligned with the aims of sustainable economic growth and mitigating the impact of ESG themes? The answers may conflict with the traditional financial doctrine and illustrate a more contemporary approach. This refers to the shareholder model versus the stakeholder model versus the shared value model. In the shareholder model, managers are bound to the interests of the shareholders and their duties are to take a long-term view of shareholder interest and maximise shareholder wealth using legal and non-fraudulent means. Milton Friedman, the main advocate of the approach, used to say that "the business of business is business" and "the social responsibility of business is to increase its profits so long as it stays within the rules of the game".[32] In this context, the ESG considerations are rather limited.

In the stakeholder model, managers are entrusted with a responsibility (fiduciary or not) to all those who hold a stake in or a claim on the firm. Stakeholders are all groups that vitally affect the corporate survival and success, that is employees, clients, shareholders, society and environment. Management must enact and follow policies that balance the rights of all stakeholders without imposing upon the rights of any one particular stakeholder. In this context, ESG themes can be incorporated, having the same footing as profits and shareholder return.[33]

28 Schoenmaker, D. (2021), "Greening monetary policy", *Climate Policy*, 21(4).
29 Network for Greening the Financial System (2018), *NGFS First Progress Report*, October.
30 Bank for International Settlements (2020), "The green swan: central banking and financial stability in the age of climate change", January.
31 See https://www.ecb.europa.eu/home/search/review/html/index.en.html.
32 Friedman, M. (1970), "The Social Responsibility of Business Is to Increase Its Profits", *New York Times Magazine*, 13 September.
33 Freeman, R.E. (2009), "Managing for Stakeholders" in *Ethical Theory and Business*, edited by Tom L. Beauchamp, Norman E. Bowie and Denis G. Arnold.

In the shared value model, managers should not concentrate exclusively on increasing firm profits, but their strategy should focus on creating shared value, a concept that involves creating economic value for shareholders as well as social value by addressing society's needs and challenges. The company is bound by a social contract and is expected to create more value to society than it consumes, that is to create a "net" benefit to society. It is expected to create value for society in a manner that is just, therefore possibly discriminating against any group for implementing social justice. In the ESG context, this implies that ESG themes may have a higher ranking than profits and returns.[34]

A crucial difference among the models is time horizon. The shareholder model is considered as short-term, the stakeholder model as medium-term and the shared value model as long-term. It is clear that the incorporation of ESG themes in the decision-making process of financial market participants requires a shift in the time horizon, and as the President of the ECB Christine Lagarde said,[35] "by shifting the horizon away from the short term and contributing to a more sustainable economic trajectory, the financial sector can become a powerful force acting in our collective best interest."

3.1 ENABLERS: RESPONSIBLE BANKING

Responsible banking is an emerging concept with neither a universally accepted content nor a formal definition. It is widely understood as the effort to integrate the management of environmental, social and governance issues with banking activities, aiming to transform the intermediation function of the banking sector and develop a new sustainable business model. Thus, it incorporates ESG themes into traditional banking and sets ESG benefits as a significant objective. However, depending on the focus, the effort takes different names. When environmental issues are highlighted, then there is a reference to green banking, as an umbrella term, covering practices and guidelines that make banks sustainable in economic, environmental and social dimensions. Green banking is often associated with ethical banking, in the sense that banks encompass environmental and social responsibility during the normal course of their banking activities. When social issues are highlighted, then there is a reference to social banking, where the focus is on social issues such as supporting local communities, vulnerable population groups, etc. which are addressed through the corporate social responsibility framework. On the other hand, the term "sustainable banking" is used interchangeably with "responsible banking", in order to indicate the commitment to the UN SDGs. Despite these differentiations, responsible banking is understood as an intention to embrace a strong commitment to sustainable development and to address social responsibility as an integral part of business activities. Several banks have adjusted their business models and pledged to sustainability commitments, which translate into concrete opportunities, to become more innovative and reduce their environmental footprint. However, these commitments are rather broad and different banks have interpreted the goals and targets differently. Although there are diverse avenues of improvement of the concept, based on the available practices, some general guiding principles can be developed. Although suboptimal due to the absence of a mandatory framework, the purpose is better served if banks can form coalitions in order to coordinate their engagement, develop and adopt standards, principles and risk management frameworks, as well as share knowledge and best practices. In this regard, several financial institutions around the world have voluntarily either created their own networks and initiatives or joined platforms established by international development agencies such as the Equator Principles or the United Nations Environment Programme Finance Initiative (UNEP FI).

34 Porter, M. and M. Kramer (2011), "Creating Shared Value", *Harvard Business Review*, 89.
35 Lagarde, C. (2020), "Climate change and the financial sector", speech by Christine Lagarde, President of the ECB, at the launch of the COP 26 Private Finance Agenda.

The Equator Principles refer to project finance and the associated risk management framework for determining, assessing and managing environmental and social risk linked with commercial projects. The principles can be applied globally to four broad types of financial products across industries, namely project finance advisory services, project finance, project-related corporate loans and bridge loans. On the other hand, the UNEP FI launched in 2019 the Principles for Responsible Banking,[36] illustrating commitment from signatory banks to strive for a more sustainable future. The main purpose and aim is to enhance transparency regarding their products and services and to create value for both customers and society by addressing sustainability issues. The initiative has therefore been designed to create a framework that the banks can use as a guideline to structure their strategy. The signatory banks are committed to align their policies around six principles: alignment, impact and target setting, clients and customers, stakeholders, governance and culture, transparency and accountability. They are required to describe how they are aligning their business strategy with the SDGs, the Paris Agreement and other frameworks and to undertake an analysis of their impacts on society, the environment and the economy, identifying the most significant impact. Banks are also required to consult with and engage all relevant stakeholders for the purpose of implementing the principles and to develop governance structures that enable and support effective implementation.

3.2 ENABLERS: RESPONSIBLE INVESTING

Responsible investing views sustainability from the financial investor's perspective and focuses on the mechanisms through which ESG themes and sustainable finance affect asset prices and portfolio returns. It advocates the incorporation of environmental, social and governance themes into investment decisions as a complement to traditional financial analysis and asset allocation. This can be achieved by considering ESG issues in portfolio building and by exerting influence over companies to adopt sustainable strategies and business models. In effect, it promotes a new paradigm in finance since capital market decisions used to be based on a two-dimensional risk and return analysis. In the new era of sustainable investment, this should be replaced by a three-dimensional analysis, i.e. risk, return and impact, where the impact is the outcome of the ESG themes. The well-known portfolio construction tools should be adjusted to incorporate the new approach.[37]

As in responsible banking, depending on the focus, the initiative takes different names. The momentum focuses on the "E" issue, and thus the initiative is called green investing or greening finance. Greening finance is short for "greening the financial system" that is the factoring of environmental issues in financial decision-making. It corresponds to the diffusion of new tools, procedures and regulations aimed at inducing the financial system to take due account of climate and environmental considerations in financial risk management. The aim is to mobilise capital flows in green investments and several new instruments have been presented to the market, such as green bonds, green loans, sustainable bonds, sustainability-linked bonds and sustainability-linked loans.

When the focus is on the "S" factor, the term socially-responsible investing is used which indicates investment decisions towards companies that exhibit social sensitivities and have social impact. Although the "S" umbrella covers a range of topics which are qualitative in nature, "socially conscious" investing has been

36 UNEP Financial Initiative (2019), "Principles for Responsible Banking".

37 Modern portfolio theory is founded on the idea that utility-maximising investors rely on historical risk and return data as a primary input to identify optimal portfolios along an efficient frontier. If additional constraints are imposed, e.g. that the portfolio must have an environmental or social footprint, the optimal portfolio is away from the efficient frontier. This suggests that ESG integration restricts investment opportunities and worsens the risk/return profile. Despite these theoretical predictions, empirical studies indicate that positive and/or neutral results for investing in sustainability dominate. See NYU Stern Center for Sustainable Business and Rockefeller Asset Management (2021), "ESG and financial performance: Uncovering the Relationship by Aggregating Evidence from 1,000 Plus Studies Published between 2015-2020".

growing into a widely followed practice. However, lack of mandatory social reporting by companies hinders the process since it adds complexity and the investment decisions are often based on intuition and the nature of the business e.g. by elimination from portfolio construction of "sin" securities such as arm dealing, tobacco, etc. Thus, the avoidance of certain securities based on ethical principles and guidelines led to using the term social investing and ethical investing interchangeably.

When the focus of the investment process is on all ESG themes, the term ESG investing is used, which involves the integration of ESG factors into fundamental analysis to the extent that they are material to investment performance. These non-financial factors are used to identify material risks and growth opportunities. Sometimes ESG investing is used as an umbrella term to incorporate all other forms of investing. In another context, it is considered as a triple bottom line, since all ESG themes are considered with a minimum purpose to avoid doing harm. Responsible investment does not necessarily require investing in a specific strategy or product. It simply involves including ESG information in investment decision-making practices, to ensure that all relevant factors are accounted for when assessing risk and return.[38]

A distinct form of responsible investing is impact investing, where the focus is on the impact of the investment decision, either environmental or social. It seeks to highlight the generation of specific and measurable benefits, in addition to financial gains. This dual objective gives rise to a double dividend – i.e. financial and moral. The fundamental idea is to direct private capital to companies with mission-related social or environmental goals, that is to deliver solutions with a positive impact. For a strategy to qualify as "impact investing", it should disclose the intention to generate and measure social and environmental benefits alongside a financial return. The issue is whether investors are willing to target a lower return to maximise impact.

According to the Global Impact Investing Network (GIIN),[39] a private sector initiative, the practice of impact investing has four core characteristics:

- investors intend to have a social and/or an environmental impact;
- investments are expected to generate a financial return on capital and, at a minimum, a return of capital;
- investments are to generate returns that range from below market to risk-adjusted market rate; and
- investors are committed to measuring and reporting the social and environmental impacts.

Along with these general characteristics, a variety of lenses can be used under the umbrella of impact investing, including gender equity, climate consciousness and education empowerment among other things. These lenses are also applied to several sectors within the international economy such as healthcare, microfinance, agriculture, renewable energy and housing. A key characteristic is the "intentionality" or the intention of the investor to create a positive impact through mobilising capital. This is the central idea of impact investing, making the active decision to pursue the opportunity to create systemic change.[40] The second key characteristic of impact investments is their financial returns. Investors focusing on impact investing generally expect positive financial returns. In other words, impact investing is neither charity nor subsidised investment, but investment with anticipated returns, even if these returns may diverge according to asset classes. However, the most

38 See UN Principles for Responsible Investment, https://www.unpri.org/.
39 See https://thegiin.org/.
40 The framework for analysing the intentionality is the "Theory of Change". The theory of change framework is generally regarded as an assessment of inputs, activities, outputs, outcomes and impacts, articulating how certain types of interventions are expected to lead to changes and achievements. See Park, H. and J.D. Kim (2020), "Transition towards green banking: role of financial regulators and financial institutions", *Asian Journal of Sustainability and Social Responsibility*, 5(5).

controversial characteristic is the measurement of its impact. The accurate documentation and communication of the social and environmental performance of investments is essential to claim a true "impact investment". But these are subjective in nature, and impact investing philosophy may gain further prominence if the value of an impact can be standardised. Some general guidelines have been developed by the GIIN, which are the following:

- declaring the social or environmental objectives that an investment is attempting to accomplish;
- using standardised metrics to set performance targets for these objectives;
- utilising key performance indicators (KPIs) to measure performance and optimising specific parts of a business model; and
- reporting social and environmental performance in the context of the standardised metrics that were previously set.

3.3 ENABLERS: CORPORATIONS

For corporations that embrace the stakeholder approach, the incorporation of ESG themes indicates their intention to create common values and, more importantly, their commitment to creating long-term values. In order to achieve the benefits associated with sustainable finance, companies must modify their operational processes, investment decision-making processes and their priorities accordingly. However, the use of resources to impact the broader community and to signal a switch in long-termism is not a substitute for short-termism, which remains the main agenda of shareholders. Thus, corporations engaged in sustainability must also gain a competitive advantage to satisfy the short-term ambitions of their "clientele". They cannot automatically switch by simply requiring or permitting the management body to have regard to sustainability and the company's long-term interest. Some of the drivers for competitive advantage are signalling the company's product quality, better brand image, building social capital and trust, gaining stakeholder support, the ability to protect against these risks, the motivation of employees and the consequent employee satisfaction, the lower idiosyncratic risk and the generation of reputation effect that may have a positive impact on valuation.

3.4 ENABLERS: ESG-LINKED FINANCIAL PRODUCTS

The exponential increase of financial products that incorporate directly or indirectly the ESG themes provides a major boost to the cause. These products have started to appear on the market a few years ago and their volumes continue to increase significantly. They are primarily debt instruments, even though an ECB working paper[41] concludes that for given levels of economic development, financial development and environmental regulation, CO_2 emissions per capita are lower in economies that rely more on market-based equity funding because, first, stock markets reallocate investment towards less polluting sectors more effectively than other types of financial markets, and, second, equity markets better motivate carbon-intensive sectors to develop and implement greener technologies.

In order to classify the ESG-related products, it is possible to use three types of models, namely the use of proceeds model, the counterparty profile model and the hybrid model.

(a) Use of proceeds model

According to the use of proceeds model, the bonds are issued for specific projects that are labelled environmentally and/or socially friendly rather than for general financing purposes. These bonds, as the name suggests, fund projects with an earmarked environmental and/or social purpose. The issuer should describe the usage of proceeds in legal documents and the purpose should have a material impact on high-level objectives or particular

41 De Haas, R. and A. Popov (2019), "Finance and carbon emissions", ECB Working Paper No. 2018, September.

areas of concern. Specific sustainability objectives are outlined allowing to evaluate eligibility and appropriateness with strategy, policy or processes. Furthermore, the issuer should disclose details regarding the management of the proceeds, such as the degree of funds ring-fencing, a comparison of the amounts raised and used, and the impact of the project. Depending on the focus, the instruments that qualify under the use of proceeds model can be green bonds, social bonds or sustainability bonds.

Green bonds finance specific projects that are labelled environmentally friendly such as renewable energy, green buildings, or resource conservation.[42] Social bonds finance projects that address social issues and/or seek to achieve positive social outcomes, especially for a targeted population, e.g. vulnerable groups, the unemployed, minorities. Sustainability bonds finance projects with a mix of green and social purposes. These are green projects having social co-benefits, or certain social projects also having environmental co-benefits. Most of the time, the funds are committed to social or green impact projects that are aligned with the UN SDGs. There are further sub-groupings according to more specific purposes, such as the blue bonds, which are government bonds the proceeds of which are used to finance marine and ocean-based projects with positive environmental, economic and climate benefits, or the green securitised bonds, which either are collateralised by one or more specific green projects or anticipate a green use of proceeds that will be used for investment in green projects.

The use of proceeds logic embedded in green finance has catalysed the market by facilitating the greening of traditionally brown sectors and making new green financial products available to responsible and long-term investors. However, it also raised allegations regarding "greenwashing"[43] and concerns regarding the creation of a market for virtue without driving systemic changes in global business operations. In order to mitigate the possibility for greenwashing, private initiatives, such as the International Capital Market Association, have developed principles to increase the transparency, integrity and acceptance of green bonds.[44] The European Commission followed suit, in order to make the signalling effect more clear, and an EU Green Bonds Framework is under consideration, a protocol that confirms the voluntary alignment of the green bonds issued under the EU standards. Issuers that adhere to the standards must explain how their strategy aligns with the EU's environmental objectives, as defined in the Taxonomy Regulation (see section 3.5), must not significantly harm any of these objectives, must comply with minimum safeguards and must provide details on the most important aspects of their use of the proceeds.

The pace of growth for social bonds is not similar to that for green bonds. These are committed to financing social projects, including projects aiming at creating food security and sustainable food systems, at sustaining vulnerable groups in the aftermath of a natural disaster, or at alleviating unemployment stemming from a socioeconomic crisis. Recently, a new type of social bond has emerged in the form of COVID-19-related bonds. Such bonds have a use of proceeds specifically aimed at mitigating COVID-19-related social issues and are particularly focused on the populations most impacted.[45]

Several lending instruments offered by banks also fall within the use of proceeds model.

42 The European Commission will fund 30% of the NGEU programme through green bond issuance and for that a specific NGEU Green Bond framework will be published. See European Commission (2021), "A new funding strategy to finance NextGenerationEU", COM(2021) 250 final.

43 Greenwashing is the practice of misleading the public by stressing environmental credentials of a person, a product or an organisation when these are unfounded or irrelevant. The claim can be unsubstantiated (a fib) or irrelevant (a distraction). Greenwashing is considered as a deceptive use of "green public relations" or "green marketing".

44 International Capital Market Association – ICMA (2021), "Green Bond Principles", June.

45 Although the market is limited, the initiative by the European Commission to issue the EU SURE social bonds may accelerate developments. The Eligible Social Expenditures are: (i) short-time work schemes or similar measures designed by Member States with the intention to protect employees and the self-employed against the risk of unemployment and the loss of income; and (ii) health-related measures in the workplace.

Green loans are instruments whose funds are committed exclusively to green projects, addressing key areas of environmental concern. As in the case of green bonds, a fundamental part of the green loan is the periodic reporting by the borrower of the actual use of proceeds. Further, more specific loan instruments are being developed,[46] such as social loans, green efficiency mortgages, electric car loans, loans to vulnerable segments, consumer loans for renewable energy instalments and credit for energy efficiency.

(b) Counterparty profile model

The use of proceeds model was a useful starting point but has somehow reached its limits, since an evaluation of green activities cannot be indefinitely separated from the performance of the entire company. For instance, green bonds, although exclusively financing green projects, are not ring-fenced. This means that bond payments are not necessarily tied to the green project and, therefore, their creditworthiness is similar to other bonds from the same issuer with the same terms and conditions. The main difference is the commitment to use the proceeds for green projects. Even if a market segment is prepared to pay a premium (greenium)[47] and thus enjoy a lower yield, green bonds cannot be considered in isolation.

The design limits of the instruments according to the use of proceeds model led to an alternative consideration, the counterparty profile model, and to a new generation of financial products, the sustainability-linked bonds.[48] Sustainability-linked bonds do not finance particular projects but rather they finance the general operations of an issuer with explicit sustainability targets that are linked to the financing conditions of the bond. The bonds are structurally linked to the issuer's achievement of climate or broader SDG goals. For instance, usually there are covenants than link the coupon of the bond with the progress, or lack of, vis-à-vis the specified objective. The coupon increases or decreases accordingly.

There are three basic characteristics of sustainability-linked bonds. First, the selected key performance indicators (KPIs) should be relevant, core and material to the issuer's overall business, measurable, externally verifiable and able to be benchmarked. Second, the KPIs should be assessed against agreed sustainability performance targets (SPTs), which should represent a material improvement in the respective indicators, beyond a "business as usual" trajectory, and be determined on a predefined timeline, set before (or concurrently with) the issuance of the bond. Third, depending on the performance, the bond characteristics, e.g. coupon rate, should significantly vary in relation to the issuer's original characteristics. This mechanism is a financial incentive linked to the attainment of the sustainability objectives.

In a similar vein, sustainability-linked loans are being developed, whereby the counterparty itself is being considered when assessing sustainability, on the basis of predefined criteria. Such loans are not project-specific but counterparty-specific. In the case of a company, it must be either active in a certain industry or sector focused on specific activities or assessed as overall sustainable or committed to improving its performance on certain sustainability indicators. In the case of a private individual, they often need to meet certain criteria, such as belonging to a vulnerable segment in relation to financial inclusion considerations. The setting is fairly similar with that of sustainability-linked bonds. The SPTs specified should be linked to the company's social responsibility policy as well as to the loan terms. For instance, the interest rate of

46 European Commission (2020), *Interim Study on the development of tools and mechanisms for the integration of environmental, social and governance (ESG) factors into the EU banking prudential framework and into banks' business strategies and investment policies*, December. Prepared by: BlackRock Financial Markets Advisory.

47 The term "greenium" refers to a lower yield for green bonds compared with conventional bonds with a similar risk profile, reflecting the fact that green projects benefit from cheaper financing.

48 In January 2021, the ECB made sustainability-linked bonds eligible for inclusion in asset purchase programmes and for use as collateral.

the loans is tied to the borrower's sustainability performance, as measured e.g. by an ESG rating.

(c) Hybrid model

In some cases, both the use of proceeds and the counterparty profiles should be used in order to assess the impact. This refers to the so-called transition bonds, i.e. instruments which are designed to help companies that are considered "brown" to transition towards becoming "greener". The proceeds from these bonds are used to improve the sustainability and environmental profile of the issuer. Thus, a twofold analysis is warranted, including both issuance-level considerations (use of proceeds) and issuer-level considerations (counterparty profile), the former ensuring that the funds are used for transition eligible projects and the latter ensuring the necessary strategy and business model adjustments for a smooth transition. The smooth transition is of particular importance in order to avoid climate Minsky moments.

3.5 ENABLERS: REGULATORY INITIATIVES

In 2018 the European Commission adopted a package of measures on sustainable finance based on the UN SDGs and the Paris Agreement, which was a turning point for the financial system. The ultimate goal is for Europe to become the first climate neutral economy by 2050, quite an ambitious goal but indispensable to ensure long-term competitiveness. This requires a change in the production model of the European economy, affecting several, if not all, sectors. The strategy to achieve this goal is twofold, entailing a short-term action plan regarding the financing of sustainable growth and a long-term plan outlining the necessary economic and social measures for a prosperous EU.

The short-term action plan focuses on the transformation of the financial sector and can be summed up in the motto "transforming finance to finance the transformation".[49] The goals are to reorient capital flows towards sustainable investments (taxonomy-aligned as well as transition-aligned), to incorporate sustainability into risk management (mitigating the impact of ESG factors and themes) and to foster transparency and long-termism in financial and economic activity (non-financial disclosures and climate-related information).

The long-term plan, envisioning a Clean Planet for All, anticipates an intermediate goal for 2030 to reduce emissions by at least 55% from their 1990 levels. The implication of the plan is a radical transformation of the production model of the European economy. The two critical milestones are 2030 and 2050, in the sense that if some goals are not achieved by 2030, tougher measures are warranted for 2050. Considering the vast needs[50] for financing the transition to net zero emissions, both private and public sector initiatives should be undertaken to achieve the goal. The public sector initiatives in the EU abound. The European Green Deal, Next Generation EU, Invest EU and the Just Transition Fund are some of the initiatives to finance the long-term goal introducing the motto "leaving no one behind". As for the private sector, the financial sector is seen as the most appropriate to lever the policies and lead the effort to channel funds into sustainable investments. The European Supervisory Authorities (ECB, EBA, EIOPA and ESMA) have been given the mandate to assess how to incorporate ESG issues into the prudential frameworks and the entities within their remit. Other market initiatives, as already discussed, are in place, notably the UNEP FI Principles for Responsible Banking and the UN Principles for Responsible Investment, as well as the International Capital Market Association

49 "Sustainable finance: transforming finance to finance the transformation", keynote speech by Fabio Panetta, Member of the Executive Board of the ECB, at the 50th anniversary of the Associazione Italiana per l'Analisi Finanziaria.

50 The OECD estimates that €6.35 trillion a year will be required globally to meet the Paris Agreement goals by 2030, while the European Commission estimates that in the climate and energy areas alone an additional annual investment of €330 billion is needed to meet the EU's climate and energy targets by 2030. See OECD (2017), *Investing in Climate, Investing in Growth*, OECD Publishing, Paris, and European Commission (2020), "Impact Assessment" accompanying the document "Stepping up Europe's 2030 climate ambition: Investing in a climate-neutral future for the benefit of our people", September.

(ICMA) initiative for developing principals for green financial products.

In order to make the Action Plan on Sustainable Finance implementable, the European Commission adopted a package of legislative measures. This package included proposals aimed at establishing a unified EU classification system of sustainable economic activities (Taxonomy Regulation), improving ESG disclosure requirements to facilitate informed investor decision-making (Disclosure Regulation) and creating a new category of benchmarks which will help investors compare the carbon footprint of their investments (Benchmarks Regulation) setting the requirements for "EU Climate Transition Benchmarks" and "EU Paris-aligned Benchmarks".[51]

As for the EU taxonomy, it aims to provide businesses and investors with a common language to identify which economic activities can be considered as sustainable under EU law. The definition of sustainability includes social elements on top of environmental objectives, since it explicitly refers to the violation of minimum social and labour safeguards. The six environmental objectives identified for the purposes of the taxonomy are: climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems. According to the "do not significantly harm" principle, an activity should have at least one positive environmental effect, without harming the other five. However, an activity with a positive environmental effect but an adverse social impact is not considered to be taxonomy-aligned.

Therefore, for an economic activity to be considered taxonomy-compliant, it must contribute substantially to one or more of the environmental objectives, do no significant harm to any other environmental objective, comply with minimum social safeguards and comply with technical screening standards. The aforementioned definitions and clarifications on the EU legislation are very important, since they define and set the boundaries of what is considered compliant with sustainable activity and can therefore be financed though the green-labelled financial instruments. They will allow market participants to determine whether the issuer of a financial instrument has environmental sustainability as its objective or promotes environmental characteristics. However, it should be mentioned that an activity that it is not taxonomy-compliant is not *per se* unsustainable. It is simply outside the current scope of the taxonomy. For the time being, "brown taxonomy" may be not in the European Commission's plans, but the answer to a relevant FAQ question indicated that the political agreement includes "the extension of the current taxonomy to cover economic activities that are significantly environmentally harmful (brown activities)".

As for disclosures, banks that are subject to the Non-Financial Reporting Directive (NFRD) are required to disclose, in their financial statements, information on the proportion of their activities that are classified as environmentally sustainable, as well as several considerations on social issues such as the policies that they implement in relation to social responsibility and treatment of employees, respect for human rights, anti-corruption and bribery, and diversity on company boards. The NFRD is under review and the European Commission has a new proposal, the Corporate Sustainability Reporting Directive (CSRD), which requires large companies to publish regular reports on the social and environmental impacts of their activities.

Banks will also have the obligation to disclose, under Pillar 3, the ESG risks set out in the Capital Requirements Regulation. The European Banking Authority (EBA) is finalising the technical standards which aim to address how climate change may exacerbate other risks

51 Regulation (EU) 2020/852, Regulation (EU) 2019/2088 and Regulation (EU) 2019/2089, respectively.

within bank balance sheets, the key performance indicators (KPIs) on how banks are mitigating those risks, and the percentage of exposures that finance taxonomy-aligned activities (green asset ratio).[52]

The regulatory initiatives focus on the disclosure of climate-related risks to accelerate assessment of exposures to climate change. Besides, it was also suggested using the capital adequacy framework to incentivise green lending.[53] In particular, it is being discussed to introduce a "green supporting factor" (GSF) in order to lower capital requirements on banks for certain climate-friendly investments. Alternatively, a "brown penalising factor", i.e. increasing capital requirements for banks exposed to carbon-intensive assets and companies, is proposed. The academic literature is still inconclusive on the issue, but some initial studies indicate that the GSF has no significant effects on the reduction of carbon emissions.[54]

4 INCORPORATION OF ESG THEMES INTO DECISION-MAKING

Generally, banks have two paths in incorporating ESG risks, the first via their corporate governance structures and the second via risk management frameworks. ESG risks have a long-term impact and if not properly addressed, they might negatively affect the solvency and liquidity position of a bank. Banks should adjust their management and oversight structures and internal processes – including the roles and responsibilities of the Board of Directors (BoD) and the management body,[55] so as to incorporate ESG risks and meet societal expectations to contribute to the overall objectives of sustainable development. The risk management path should embed ESG factors into existing frameworks as well as translate ESG risks into traditional financial risks. A necessary step forward is to consider different time horizons (short, medium-term and longer-term) and translate the risks into accurate, complete, simple, easily understood and comparable metrics. For that, a scenario analysis is of paramount importance in order to understand the potential impact on financial performance, allowing the management to adjust business models and internal processes accordingly. The ability to effectively classify, measure and monitor the ESG business profile of their credit allocation, portfolio management as well as investment advice to their clients is essential in order to be able to set informed ESG commitments and track progress against them. Both paths will be further explored in the following subsections.

4.1 ESG THEMES AND BANK CORPORATE GOVERNANCE

Several EU regulations require banks to have in place robust governance arrangements, appropriate organisational structures, transparent and consistent lines of responsibility, as well as effective processes to identify, manage, monitor and report on the risks they are exposed to. These risks include ESG risks, but the specificities for their assimilation into governance are not defined yet and differ across banks. Apart from regulation, board members have fiduciary duties against their stakeholders to create long-term value by ensuring that the bank is aware of and able to navigate in an ever-evolving risk landscape. To that end, the board should ensure that the ESG risk management system is consistent with the overall approach to risk and fully aligned with the business model and its value proposition to stakeholders. However, there is no one-size-fits-all solution to the challenges, and the boards should devise a fit-for-purpose solution within the boundaries of the existing regulation. Furthermore, board members have

52 European Banking Authority (2021), "Implementing Standards on prudential disclosures on ESG risks", Consultation Paper.
53 Dombrovskis, V. (2018), speech by the Vice-President of the European Commission Dombrovskis at the High-Level Conference on Financing Sustainable Growth, available at https://ec.europa.eu/commission/presscorner/detail/en/ SPEECH_18_2421.
54 Dafermos, Y. and M. Nikolaidi (2021), "How can green differentiated capital requirements affect climate risks? A dynamic macro-financial analysis", *Journal of Financial Stability*, 54.
55 The terms are used in their general sense and embrace the different models of board structures. In the two-tier system it includes both "supervisory board" and "management board", whereas in the unitary system it covers both the "executive" and the "non-executive" members of the single board.

the duty of care, that is the duty to adequately inform themselves on the risks issues prior to making business decisions. To fulfill this responsibility, they need to be able to understand and evaluate the risks that arise from ESG factors. This gives rise to the issue of education and skills. The nominating committee considers ESG skills, expertise, knowledge and experience, devises appropriate educational programmes and incorporates ESG issues into the self-assessment process. This may be evidenced by whether ESG issues are discussed on a regular basis in board meetings and whether these issues are addressed systematically.

As for the organisational structure, there could be three options:

- Standalone ESG risk committee (at the board or management level)
- ESG themes within other committees
- Corporate Social Responsibility / Sustainability teams

Corporate governance principles recommend that banks consider setting up a specialised risk committee that can support the board in performing its duties. For ESG risks this may be a desirable option, especially when they are salient and/or where the implementation and monitoring of KPIs around ESG require a high degree of technical expertise. However, the board needs to pay attention to how a bank's limited resources are allocated to address actual and potential risks in the most cost-effective way and how different board committees coordinate. In that respect, the bank may choose to incorporate ESG risks within already established committees. There are advantages to this option, since ESG risks are not considered in isolation but as a cross-cutting risk that materialses, to a varying degree, through well-known banking risks. This enhances risk management integration without significantly adding complexity, but requires coordinated deliberations on ESG risks across committees to avoid gaps or overlapping duties. The incorporation of ESG themes into the existing Corporate Social Responsibility (CSR) is another option, since it builds on existing experience and norms. However, the definition of CSR is still vague,[56] since it is a voluntary approach and a broader or narrower definition is used depending on the circumstances. There is also the risk of reducing the importance of the ESG incorporation, while the CSR teams usually lack expertise and knowledge in risk management.

Regarding the board's role as a steward of long-term corporate performance, it plays a critical role in ensuring that the bank's strategy and culture is closely aligned with its business model, in taking into account sustainability risks from various different perspectives in its activity, in articulating the risk appetite by specifying the types and the degree of risk that the bank is willing to accept and in formalising appropriate oversight and disclosure.

The board ensures that the purpose, mission, vision, values and code of conduct encompass ESG themes and sets the "tone at the top" to encourage ESG considerations in the culture. Material ESG issues are addressed in the bank strategy, the business model and the executive compensation. In the context of the bank strategy, sustainability issues are incorporated either as a separate dedicated strategy or as a complementary strategy to existing ones. The business model is assessed in terms of its resilience to sustainability risks. Compensation is linked to performance on both short- and long-term ESG goals and targets by including ESG metrics in both annual and long-term incentive plans.

The board assumes ultimate responsibility for ensuring that sustainability risks are adequately considered for the respective risk categories. For that, the risk management func-

56 Liang, H. and L. Renneboog (2020), "Corporate Social Responsibility and Sustainable Finance: A Review of the Literature", European Corporate Governance Institute, ESGI Finance Working Paper No. 701.

tion plays a central role by supporting the board with analyses regarding the identification and assessment of sustainability risks in order to enable a well-founded decision-making process and management of the risks. It also contributes towards establishing the corresponding risk culture, with the appropriate tone at the top.

The bank's risk appetite must also be taken into account when assessing sustainability risks. The board should articulate how the bank manages the risks that arise through its operations and relationships in order to provide the necessary guidance ensuring that risks are managed in a way that meets the desired risk profile. Risk appetite considers the types and thresholds of the risks the bank may take, or avoid, in order to achieve its strategic plan. The boundaries for defining meaningful risk appetite and tolerance is set by risk capacity. Risk capacity is the maximum amount of risk that an entity is able to absorb in the pursuit of strategy and business objectives.

The board exercises appropriate oversight on internal stakeholders, e.g. management's assessment of material ESG topics, risks and opportunities to include in the bank's external reporting and disclosures, and on external stakeholders though mandatory and voluntary disclosures, e.g. to demonstrate the significance of ESG to bank performance and to engage stakeholders in the process.

4.2 ESG THEMES AND RISK MANAGEMENT

ESG risks are not similar to the traditional banking risks and their incorporation into the existing risk management framework includes several challenges, the most important being the long time horizon, the high level of uncertainty and the interlinkages amid lack of data and methodologies. EGS risks are of a long-term nature beyond the timeline with which the strategy is set or risks have been considered historically. Thus a new area of analysis is required with new tools and methodologies.

Following the typical risk management path, as a first step banks should define the context, that is they should introduce the appropriate culture. This is a difficult endeavour and includes norms, attitudes and behaviours related to ESG risk awareness. Then, risks should be identified. This task is not similar to the self-assessment of traditional risks since they are new and emerging with far-reaching impact in breadth and magnitude and the bank needs to understand which are the relevant ESG risks to address depending on its own business, market, customers, risk profile, geographical location, risk appetite and so on.

Risk identification may start with a risk inventory, a heat map for climate-related risks, where threats to and opportunities for achieving the strategy and business objectives are recorded. This can be suitable for an initial risk screening and a starting point for prioritisation. It indicates whether an additional step towards a more detailed risk assessment is needed. Due to the novel characteristics of the risks and the limited knowledge, a more precise description is warranted, focusing on the risks themselves, rather than referring to a general ESG issue (e.g. climate change). For instance, different time horizons, the appropriate level of disaggregation, geographical location, the carbon emission intensity of exposures, the effect of alternative scenarios for transition, *inter alia*, should be considered. The analysis can be facilitated and deepened if a root cause approach[57] is used. This can further underlie the ESG drivers of business risk, their potential impact and the remedial action required. The analysis helps to isolate the required changes, so that banks can address a problem at its source rather than its symptoms.

Regarding prioritisation, this can be based on several criteria, including the ability of the bank to adapt and respond to risks, the scope and nature of the risk for the bank's portfolios, the speed and magnitude at which the risks can

57 Tools for understanding root causes include the five whys, cause-and-effect charts, hypothesis testing and comparative analysis.

impact the bank, and the institutional and financial ability of the bank to restore normality. Prioritisation can help the bank to understand and address the urgency of the required response, the types of action necessary as well as the level of investment in the risk response.

The next step for integration into the risk management framework is risk evaluation and the assessment of the impact of ESG risks on bank lending or investment portfolios. Given that many of the risks are unprecedented and have complex and non-linear effects, the modelling of these risks is difficult. Scenario analysis is particularly useful in this respect, allowing the exploration of a range of possible outcomes and the assessment of the evolution of the portfolio under different scenarios. In addition, these exercises can familiarise the banks with the nature of ESG risks, increase awareness and provide experience. For the time being, climate-related risk exercises are more advanced,[58] allowing banks to experiment with impact quantification from transition or physical risks in their portfolio. Stress testing for these risks can be very complex and less intrusive than scenario analysis, but some indications may be extracted for the impact of climate risks on banks' business model and strategy.[59]

Physical risk exercises adopt different approaches based on the underlying portfolio in scope. For real estate portfolios, exercises assess the impact of extreme weather events on property values and, subsequently, on metrics such as loan-to-value ratios. For corporate portfolios, they tend to focus on sectors that may be impacted by weather changes (e.g. agriculture or the energy sector), decreasing their output. As for transition risk exercises, these are most commonly performed on the corporate loan book pertaining to high-carbon sectors and they try to reflect how low-carbon policy and technology transition could impact the credit risk of exposures. Transition risk exercises usually focus on two types of transition shocks, policy-driven shocks (e.g. a carbon tax or extension of emission trading schemes) or technology-driven shocks. In the former they describe the additional costs or revenues that could arise from changes in the policy environment, whereas in the latter they focus on changes in the relative prices of services, for instance through falling costs of renewable energy generation.

4.3 ESG THEMES AND CREDIT ALLOCATION

The incorporation of ESG factors and ESG risks into the lending business impacts the entire lending process, from risk governance to credit analysis, to credit origination, to monitoring, and to ongoing client engagement. The EBA has issued guidelines on loan origination and monitoring,[60] where it is clearly stated that ESG factors and associated risks should be integrated into lending processes. This is a clear indication that sustainability is becoming an important factor at the core of banking operations. Integrating ESG factors into key business practices will support the transition of the financial sector towards a more purpose-driven industry and will contribute to a more sustainable economy. ESG factors and risks can be incorporated into each of the steps of the lending process and as the EBA suggests, "institutions should adopt a holistic approach".

Regarding risk governance, the tone should be given at the top by ensuring that the credit risk culture incorporates ESG factors and the credit risk appetite operationalises these factors. The ultimate purpose is to initiate sustainable lending covering the granting and

58 For the "S" and "G" pillars the scenario analysis exercises are scarce, besides the stress test for COVID-19-related scenarios, which can be considered to be related to the "S" pillar.

59 Given the potential significant financial stability challenges, some central banks have started to perform climate-related stress testing exercises, stretching the scope of these exercises to new frontiers. For instance, the ACPR exercise (Banque de France) has a 30-year time horizon, assuming a static balance sheet for the first five years and a dynamic balance sheet onwards. It uses three scenarios: an orderly transition to 2050 goals, a sudden transition and a late transition. The results are quantified mainly as credit risk manifestation and in particular as the increase in the probability of default of different sectors affected. See ACPR (2021), "A first assessment of financial risks stemming from climate change: the main results of the 2020 climate pilot exercise".

60 European Banking Authority (2020), "Guidelines on loan origination and monitoring", May, EBA/GL/2020/06.

monitoring of such credit facilities. The real challenge however lies with credit risk analysis where two broad approaches can be adopted, either to incorporate ESG factors into credit assessment or to apply a mission-driven approach where impact prevails over the other goals. The former assesses the borrower's exposure to ESG factors, its business model and mitigating strategies, whereas the latter focuses mainly on the footprint of the borrower's activities. In both cases, banks' ability to effectively classify, measure and monitor the ESG business profile of their borrowers is the basis for setting informed ESG commitments and tracking progress against them. Bank clients or potential clients often have to undergo an ESG assessment process or due diligence in the case of extending credit to a new client or of renewing credit to an existing client. ESG factors can be directly integrated during the client onboarding process, since the bank evaluates the counterparty's profile and assesses any discrepancies. The OECD states that due diligence is "preventive" and can help banks avert or address adverse impacts related to human and labour rights, the environment and corruption associated with their clients, as well as to avoid financial and reputational risks.[61] The due diligence approach leads to ESG classification which, as expected, considers the use of proceeds and/or the ESG profile of a counterparty as the primary factor. Other factors are the client's vulnerability to physical and transition risks and the assessment of the client's future plans to address ESG risks.

Finally, an important part of the process is client engagement, which is considered significant for "encouraging sustainable practices and accompanying their customers and clients in their transition towards more sustainable business models, technologies and lifestyles".[62] The engagement policy has two perspectives that complement each other, the internal perspective, e.g. building capacities and expertise, and the external perspective, e.g. interaction with stakeholders to mitigate ESG risks. The latter highlights the importance of relationship banking and the nudging policy, which both are critical for ESG sustainable policies.

4.4 ESG THEMES AND INVESTMENT MANAGEMENT

An old but unresolved question in investing is whether to pursue a passive or an active investment strategy. The question becomes further complicated in the case of ESG-compatible investments. Passive investment follows an ESG index, whereas active investment searches for mispriced securities in terms of ESG factors. Some scholars and practitioners associate ESG investing with active investing, given that financial markets fail to achieve societal goals. ESG indices have been developed, but the reliability of ESG data is questionable and ESG indices do not outperform their parent index, the non-ESG index of this asset class, over time.[63]

ESG-compatible investing does not necessarily require investing in a specific strategy or product. Some investors are unaware of ESG information and do not include it in their risk-return preferences. Other investors are aware of ESG information and update their risk-return preferences, whereas some other investors use ESG information in their investment decisions and have strong preferences for securities with a high ESG profile. Exactly how an investor incorporates ESG information varies. There are four main strategies:[64]

(a) Screening

Screening refers to applying filters to lists of potential investments to rule companies in or out of investment pool, based on an investor's ESG preferences, values or ethics. There are three methods for applying this strategy. First, negative or exclusionary screening, where there

61 OECD (2019),"Due Diligence for Responsible Corporate Lending and Securities Underwriting: Key considerations for banks implementing the OECD Guidelines for Multinational Enterprises".
62 UNEP FI (2019), "Principles for Responsible Banking – Guidance Document".
63 Cerqueti, R., R. Ciciretti, A. Dal and M. Nicolosi (2021), "ESG investing: a chance to reduce systemic risk", *Journal of Financial Stability*, 54.
64 Deutsche Bundesbank (2019), "The sustainable finance market: a stocktake", *Monthly Report*, 13.

is avoidance of firms/sectors with undesirable activities such as alcohol, tobacco, weaponry, abortion-related drugs and pornography. The so-called "sin" stocks are excluded from the portfolio. For companies that are engaged in multiple business lines, a materiality threshold for the activity that constitutes a "negative screen" can be established. Second, positive screening, which involves actively investing in sectors/companies with good ESG performance (the "leaders" or the "compliant ones") relative to peers. In this approach there is an explicit incorporation of sectors/companies in the investment universe. Third, norm-based screening, where enterprises that do not uphold and support certain international norms and standards are excluded from the portfolio.

(b) Best-in-class

The best-in-class strategy is an active investment in companies with strong ESG ratings. The first step is to evaluate all companies in the theoretical investment universe, the benchmark, using predefined ESG criteria. The controversy of the approach focuses on the appropriateness of ESG ratings, since there is significant divergence in ESG measurement among data providers. This is evidenced by the weak correlation among ESG ratings of prominent ESG rating agencies, as compared with the stronger correlation among traditional credit ratings.[65]

(c) Thematic investment

Thematic investment focuses on at least one of the environmental, social or governance areas. Its goal is a single ESG-related area, such as clean energy, sustainable forestry, female leadership, or good board governance. These funds seek to invest in companies that are most actively working to address the chosen issue, while avoiding those that are not. This is a suitable strategy for investors who are passionate about one particular issue, but usually the diversification benefits are rather limited. In this case, non-financial objectives are put over financial ones, which sometimes results in higher costs, possibly hurting long-term performance. Thematic investing resembles to impact investing, but greater emphasis is placed on non-financial results and thematic investment is often subsidised.

(d) Activism

Activism refers to an investor exercising formal rights as a shareholder. This can take the form of either voting in the Annual General Meeting (AGM) or consistent engagement to improve board ESG practices ahead of an AGM vote. In the former case, there is a chance of a more proactive role in forwarding a change, but this can be done more effectively in collaboration, thus using proxy votes to try to change the behaviour or practices of the company. In the latter case, investors try to enhance ESG practices, sustainability outcomes or public disclosures. If unsuccessful, it is possible to resort to escalation methods such as using voting power to replace unresponsive board members and/or directors. The process can be much more efficient where institutional investors are involved. In general, forming coalitions of the willing to move forward a particular case is an efficient way of promoting ESG initiatives.

4.5 ESG THEMES AND INVESTMENT SERVICES

The client engagement policies discussed in credit allocation also apply to investment services. Client engagement policy was further institutionalised under the Markets in Financial Instruments Directive (MiFID) framework. When providing investment advice and portfolio management, banks should conduct a suitability assessment, in order to obtain the necessary information on the knowledge and experience of the clients, their financial objectives, investment horizon and risk profiles, including capacity and willingness to bear losses. The purpose is to protect the clients and recommend financial instruments that are suitable for them given their overall circum-

65 Berg, F., J. Koelbel and R. Rigobon (2019), "Aggregate Confusion: the Divergence of ESG Ratings", MIT Sloan School Working Paper No. 5822-19.

stances and preferences. However, preferences in sustainability have not featured prominently nor have they been explicitly provided for in the regulations. However, investment advice "can play a central role in reorienting the financial system towards sustainability".[66] Therefore, the European Commission proposed amendments in the MiFID framework and introduced the concept of "sustainability preferences".[67]

Sustainability preferences are defined as investors' choice to integrate into their investment strategy a financial instrument that has as its objective sustainable investments, i.e. an investment in an economic activity that contributes to an environmental objective or a financial instrument that promotes, among other things, environmental or social characteristics. Financial products that pursue sustainable investment objectives guarantee the attainment of a certain level of sustainability, whereas those that promote environmental or social characteristics do not necessarily achieve that. Therefore, during the suitability assessment sustainability preferences should be considered as part of the assessment of the client's investment objectives. However, sustainability preferences should be addressed within the suitability process only once the client's conventional investment objectives, time horizon and individual circumstances have been identified. This chronological order, with the sustainability test coming after the "ordinary" suitability test, implies that ESG objectives are of secondary importance, and are only to be considered after a first product selection has taken place on the basis of the client's knowledge and experience, financial situation and investment objectives.

5 CONCLUSION

The ambitious policy agenda for sustainability requires a shifting mindset from greening finance to financing green. The financial sector has initially chosen and was then mandated to fulfil a stewardship role to steer companies towards sustainable business practices. This is natural, since finance is about anticipating events and pricing them in for today's investment decisions. Thus the financial sector can contribute to a swifter transition, but in order to ensure that it is part of the solution and supports businesses and companies in their transition pathways, several adjustments are needed. First and foremost, long-termism must be promoted, which is counter to the long-standing behaviour in the financial markets. To that end, private sector frameworks should be motivated to align with public sector initiatives, particularly in the post-pandemic era where huge amounts of public money are poured into the system for recovery. These funds should incentivise the private sector to steer its activities in the right direction, that is not only accelerate transition but also minimise activities that significantly harm the environment. Reducing harm can become a key policy objective. However, the sustainability agenda can gain significant credibility if the social and governance pillars draw more appropriate attention. The policies so far gave priority to the environmental issues, but disregarding social and governance issues can undermine the whole initiative because the pursuit of long-term targets can weaken, even fade, if more imminent and pressing issues are not appropriately handled. All ESG themes and factors should be put on an equal footing.

6 FURTHER READING

The academic literature and the empirical papers on ESG issues abound. It is a constantly rising topic in terms of both interest and academic contributions. Policymaker commitment to address the problem provides fertile ground for research and investigation. Some contributions are listed below.

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67 Commission Delegated Regulation (EU) of 21.4.2021, C(2021) 2616 final.

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WORKING PAPERS (JANUARY – JULY 2021)

This section contains the abstracts of *Working Papers* authored by Bank of Greece staff and/or external authors and published by the Bank of Greece. The unabridged version of these texts is available on the Bank of Greece's website (www.bankofgreece.gr).

CONTENTS

Disrupted lending relationship and borrowers' strategic default: evidence from the tourism industry during the Greek economic crisis

Working Paper No. 285
Panagiotis Avramidis, Ioannis Asimakopoulos and Dimitris Malliaropulos

Using a sample of bank loans to firms operating in the tourism industry for the period 2010-2015 and regional variation of tourism activities to identify the strategic defaulted firms, the authors examine the impact of Greek banks' consolidation on the firms' payment behaviour. They show that a merger-induced impairment of the lending relationship is related to a higher likelihood of strategic default by the target bank's borrowers. By contrast, mergers with a limited impact on the lending relationship have no effect on the probability of strategic default of the target bank's borrowers. The results highlight the importance of relationship lending benefits in strategic default decisions. The findings are robust to the alternative interpretation of soft budget constraints.

The Greek Great Depression from a neoclassical perspective

Working Paper No. 286
Dimitris Papageorgiou and Stylianos Tsiaras

This paper follows the Great Depression methodology of Kehoe and Prescott (2002, 2007) to study the importance of total factor productivity (TFP) in the Greek economic crisis over the period 2008-2017. Using growth accounting and the neoclassical growth model, the paper shows that exogenous changes in TFP are crucial for the Greek depression. The theoretical model reproduces quite well the decline in economic activity over 2008-2013 and the subsequent period of slow recovery found in the data. Nevertheless, it is less successful in predicting the magnitude of the decline in output and the labour factor. In addition, including financial frictions and risk shocks in the neoclassical growth model does not significantly improve the model's performance.

Interest rate pass-through in the deposit and loan products provided by Greek banks

Working Paper No. 287
Panagiotis Lazaris, Anastasios Petropoulos, Vasileios Siakoulis, Evangelos Stavroulakis and Nikolaos Vlachogiannakis

A core input in performing a regulatory stress test is the evolution of interest rates, as it affects the income generated from the assets' side and the expenses from the liabilities' side. In this work, the authors apply an autoregressive model with distributed lags (ADL) to quantify the pass-through rates, that is the degree and speed of incorporation of changes in money market rates by banks into their customers' deposit and loan rates. In doing so, on the liabilities' side, the analysis differentiates between open and term deposits, as well as between households and non-financial corporates. The results indicate that for term deposits the long-term pass-through rate is very high, exceeding 91% for non-financial cor-

porate customers and 81% for households. For open deposits, the pass-through rate dynamics appear less prevalent, amounting to 21% for non-financial corporate customers and 16% for households. When exploring the pass-through rate dynamics on the assets' side of banks, the authors observe full long-term pass-through of money market rates for mortgage and consumer loans. By contrast, the non-financial corporate loan rate is stickier and less reactive to money market rate changes, with long-term pass-through adjustment being approximately equal to 40%. Furthermore, the results provide evidence that the Greek sovereign spread movement has practically a negligible pass-through rate both for loan and deposit products. In particular, it hardly affects the pricing of new term deposits, with a pass-through rate of around 5%. This finding can be attributed, among others factors, to the fact that the Greek sovereign credit spread has approached several times non-tradable territories, which makes it an insignificant variable in determining customer rates.

Implications of market and political power interactions for growth and the business cycle

Working Paper No. 288
Tryphon Kollintzas, Dimitris Papageorgiou and Vanghelis Vassilatos

In this paper, the authors develop a two-sector DSGE model with market and political power interactions. These interactions are motivated by the politico-economic systems of several Southern European countries over the last half century. In these countries the State permits the existence of industries, typically related to the extended public sector, where firms and workers employed therein have market power (insiders), unlike other firms and workers in the economy (outsiders), as insiders, that dominate the major political parties, cooperate to influence government decisions, including those that pertain to the very existence of such a politico-economic system. In line with stylised facts of growth and the business cycle of these countries, the model predicts: (i) large negative deviations of GDP per capita from what these countries would have been capable of, if their politico-economic system were not characterised by the above mentioned frictions; and (ii) deeper and longer recessions in response to negative shocks, as their politico-economic system reacts so as to amplify these shocks.

The Greek tourism-led growth revisited: insights and prospects

Working Paper No. 289
Sarantis Lolos, Panagiotis Palaios and Evangelia Papapetrou

The paper investigates empirically the tourism-growth relationship in Greece over the period 1960-2020. The authors find that the long-run relationship between tourism and output is positive and characterised by a substantially faster convergence of output after a negative shock than after a positive one. Using asymmetric error correction model analysis the results show that the short-term adjustment path occurs through the level of output for negative deviations from the long-run equilibrium, thus supporting the tourism-led growth hypothesis. Linear quantile regression analysis indicates that while the impact of tourism remains positive and significant across the output distribution, it is stronger at lower quantiles of output than at higher ones. The results have important policy implications, since the tourism-led growth hypothesis is a useful policy recommendation, but it should not be considered a cure-all policy.

Nobody's child: the Bank of Greece in the interwar years

Working Paper No. 290
Andreas Kakridis

Neither history nor economic historians have been kind to Greece's central bank in the interwar years. Born at the behest of the League of Nations to help the country secure a new international loan, the Bank of Greece was treated with a mixture of suspicion and hostility. The onset of the Great Depression pitted its statutory objective to defend the exchange rate against the incentive to reflate the domestic economy. Its policy response has generally been criticised as either ineffectual or detrimental: the Bank is accused of having pursued an unduly orthodox and restrictive policy, both during but also after the country's exit from the gold exchange standard, some going as far as to argue that the 1932 devaluation failed to produce genuine recovery.

Relying primarily on archival material, this paper combines qualitative and quantitative sources to revisit the Bank of Greece's birth and operation during the Great Depression. In doing so, it hopes to put Greece on the map of international comparisons of the Great Depression and debates on the role of the League of Nations, the effectiveness of money doctoring and foreign policy interventions more generally. What is more, the paper seeks to revise several aspects of the conventional narrative surrounding the Bank's role. First, it argues that monetary policy was neither as ineffective nor as restrictive as critics suggest; this was largely thanks to a continued trickle of foreign lending, but also to the Bank's own decision to sterilise foreign exchange outflows, thus breaking the "rules of the game". Second, it revisits Greece's attempt to cling to gold after sterling's devaluation, a decision routinely denounced as a critical policy mistake. Last but not least, it challenges the notion that Greece constitutes an exception to the rule that wants countries who shed their "golden fetters" recovering faster.

The effect of Eurosystem asset purchase programmes on euro area sovereign bond yields during the COVID-19 pandemic

Working Paper No. 291
George Hondroyiannis and Dimitrios Papaoikonomou

The authors investigate the effect of Eurosystem asset purchase programmes (APP) on the monthly yields of 10-year sovereign bonds for eleven euro area sovereigns between January and December 2020. The analysis is based on time-varying coefficient methods applied to monthly panel data covering the period 2004m09-2020m12. During 2020 the APP contributed to an average decline in yields estimated in the range of 58-76 basis points (bps). In December 2020 the effect per EUR trillion ranged from 34 bps in Germany to 159 bps in Greece. The findings suggest that a sharp decline in the size of the APP in the aftermath of the COVID-19 crisis could lead to very sharp increases in bond yields, particularly in peripheral countries.

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