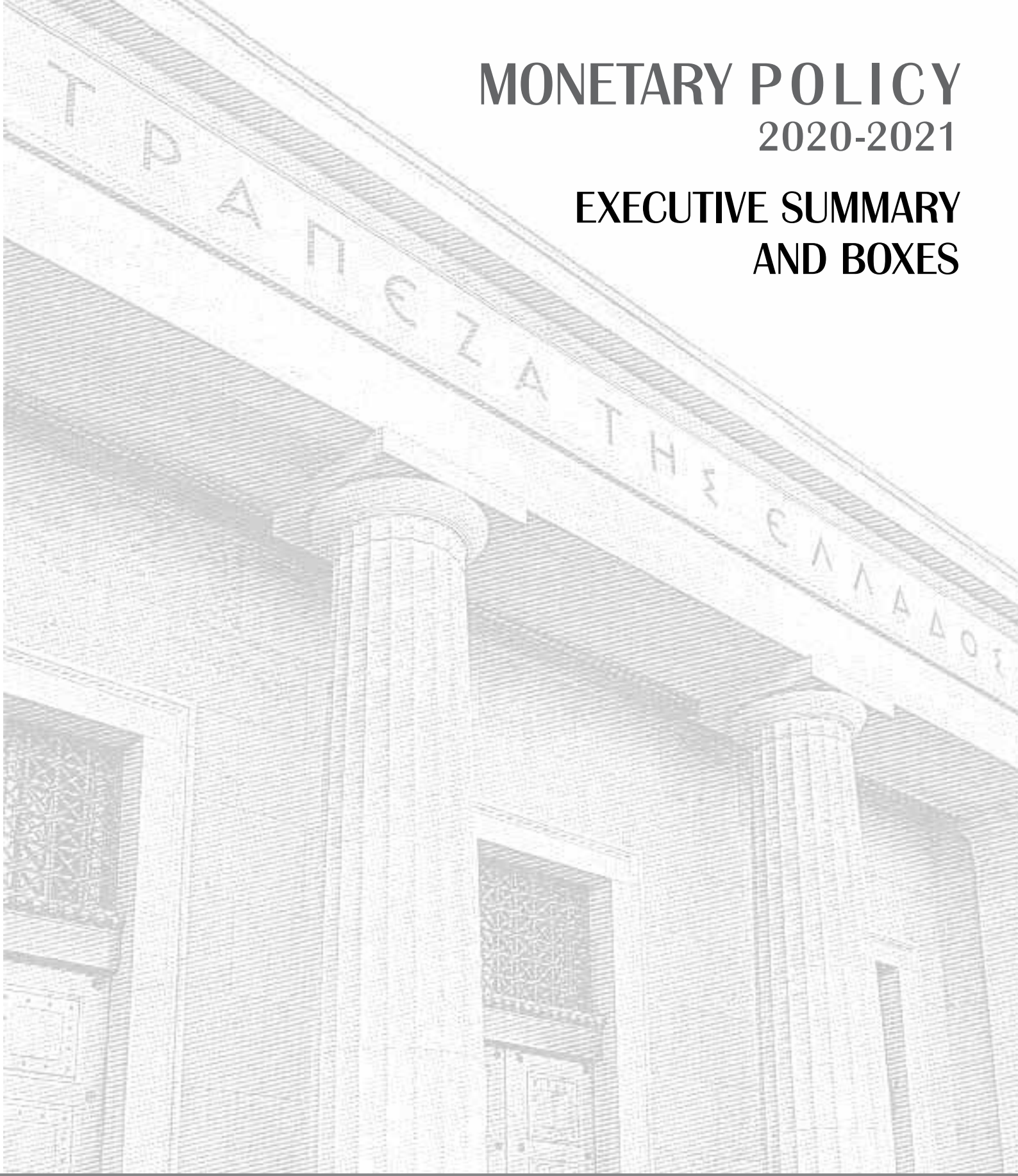

MONETARY POLICY
2020-2021

EXECUTIVE SUMMARY AND BOXES

JUNE
2021

BANK OF GREECE
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EXECUTIVE SUMMARY

IMPROVED EXPECTATIONS – THE ECONOMY SET TO REBOUND

The Greek and the world economies are still experiencing the wide-ranging effects of the COVID-19 pandemic. Nonetheless, as shown by available data, recovery has begun at a global level, although it appears to be uneven and asymmetric. This is due to significant disparities across advanced, developing and less developed countries in terms of access to vaccines and of fiscal and monetary stimulus capacity. Meanwhile, inflation rates are picking up worldwide, reflecting rises in the prices of energy, food and other commodities as well as in dry bulk freight rates, an unwinding of pent-up demand after the lifting of lockdown measures, and supply chain disruptions. The different pace of recovery across economies could lead to divergences in monetary policy stance, which would exacerbate inequalities and increase the risks to global financial stability.

Turning to the Greek economy, the support measures adopted at the national and the European level have had a positive effect and mitigated the impact of the pandemic in the first quarter of 2021. The gradual expansion of the vaccination campaign to more age groups and its acceleration since May 2021 have created positive expectations among consumers and businesses about the economic outlook in the months ahead and are expected to boost domestic demand. The activation of the European recovery instrument Next Generation EU (NGEU) creates prospects for increased investment and a speedier recovery. Nevertheless, the Greek economy and banking system still face considerable challenges, associated with the evolution of the pandemic and progress on the vaccination front, but also with the macroeconomic imbalances that need to be addressed in order to get the economy back on a solid growth path.

A milder-than-expected recession in the first quarter of 2021 – Expectations improving as the vaccination campaign gains momentum

In 2020 and the first quarter of 2021, economic activity declined significantly owing to the pandemic and the associated containment measures. Real GDP contracted by 8.2% in 2020, mainly on account of a decline in services exports and private consumption. On the other hand, resilient goods exports, lower imports and higher public consumption offset some of the losses. The multiple fiscal measures introduced, some of which remain in effect, combined with the policy response of EU institutions, considerably cushioned the impact of the pandemic and enabled the economy to gradually adjust to the new conditions. This gradual adjustment is reflected in the milder impact of the third wave of the pandemic on the real economy, as evidenced by the robust growth of industrial production, a rebound of exports and a strong expansion of e-commerce.

In particular, the extension and tightening of restrictive measures in response to the third wave of the pandemic led to a contraction, year-on-year, of 2.3% in economic activity in the first quarter of 2021. However, this contraction was smaller than expected, partly owing to the continuation and expansion of the support measures and to the robust performance of investment and goods exports.

Based on available soft data and conjunctural indicators, economic activity is expected to rebound in the second quarter of 2021 and to accelerate in the second half of the year in line with the progress of vaccinations, a further relaxation of containment measures and the receding of the pandemic.

Financial sector – Favourable conditions prevail – Deposits still on the rise, terms and availability of bank credit marginally improving – Positive impact of the fiscal support measures and of ECB interventions

Developments in sovereign and corporate bond markets remain favourable, reflecting the upgrades of Greece's credit ratings by Moody's and Standard and Poor's. Decisive in this respect were the Eurosystem's decision to launch a Pandemic Emergency Purchase Programme (PEPP) and its decision to grant a waiver of the Eurosystem's eligibility requirements for Greek government bonds, making them eligible for purchase under the PEPP and as collateral in the Eurosystem's liquidity-providing operations. As a result, in the past months through June 2021, Greek bond yields have stood at historically low levels, making it easier for the Greek government to tap the markets for substantial amounts through the issuance of long-term debt at historically low cost. In addition, the favourable international monetary and financial conditions have made it easier, from the fourth quarter of 2020 till now, for large Greek non-financial corporations to finance their activities, but also their maturing debt, through the issuance of corporate bonds.

Meanwhile, the ECB's relaxation of its monetary policy stance, together with the interventions of the Greek government to address the economic impact of the pandemic, especially through the provision of state guarantees, contributed to an increase in bank credit to non-financial corporations, although this increase could have been higher given the banks' liquidity situation. Credit expansion, the national fiscal measures to support incomes and bolster the liquidity of firms, and household savings, both precautionary and forced on account of the lockdown measures, led to a marked increase in private sector deposits.

Projections: the implementation of the National Recovery and Resilience Plan will speed up recovery – Deterioration of fiscal position on account of the measures to support the economy

According to the Bank of Greece, economic activity is projected to increase by 4.2% in 2021. The recovery is expected to gain momentum in the second half of 2021, driven by pent-up domestic demand, the launch of projects under the National Recovery and Resilience Plan and an expected increase in tourism receipts relative to 2020. In 2022 and 2023, the growth rate is projected to be 5.3% and 3.9%, respectively.

The increase in savings during the pandemic, either precautionary or forced due to the containment measures, and the release of pent-up demand are expected to support an increase in private consumption expenditure this year. 2022 and 2023 should see a faster increase in private consumption, in line with an expected improvement in labour market conditions and a rise in disposable income.

Investment is expected to pick up significantly over the entire projection horizon. A crucial role should, in this regard, be played by EU resources, which will finance public and private investment geared towards the green and digital transition of the economy. Goods exports are projected to continue to grow, on the back of stronger foreign demand. Services exports are expected to trend upward this year, driven by a rebound in tourism receipts, while demand for shipping services should increase in line with global economic and trade developments. The rise in services exports is expected to continue through the projection horizon. On the other hand, imports should increase too, in line with domestic demand.

Inflation, as measured by the Harmonised Index of Consumer Prices (HICP), is expected to remain negative in 2021, mainly on account of its services component, particularly tourism, and of the lockdown measures imposed during the first months of 2021 which adversely impacted both demand and supply of goods and services. In 2022 and 2023, headline inflation will post positive, albeit low rates.

The third wave of the pandemic at the beginning of 2021 necessitated an extension of the lockdown measures and a continuation and expansion of the fiscal support measures. According to revised projections by the Bank of Greece, the general government primary balance in 2021, calculated using the enhanced surveillance methodology, is expected to turn out a deficit of 7.1% of GDP.

The expansionary fiscal measures of 2020-2021 have weighed on the public debt-to-GDP ratio and government gross financing needs. However, according to Bank of Greece estimates, the long-term sustainability of public debt is not at risk. Whereas the public debt continues to trend downwards, the financing needs for the coming decade remain marginally at the reference level of 15% of GDP, on condition however that cash buffers remain high. This leaves no room for a relaxation of the longer-term primary surplus targets, while there are increasing risks in the event of negative shocks.

Projections subject to risks and uncertainties – Nevertheless, a recovery faster than in the baseline scenario seems feasible

The projections are subject to risks, associated with the evolution of the pandemic at the national and global level. Although the vaccination programme is well on track, the spread of the virus mutations is a source of uncertainty, while a worsening of the pandemic could result in a weak tourism season and delay the return to normality. A withdrawal of the support measures, national and European, could lead to possible business bankruptcies, especially in the sectors hardest hit by the pandemic, to an increase in non-performing loans (NPLs) and to a deterioration in the labour market. An additional risk arises from possible delays in the absorption of NGEU funds.

On the upside, a faster implementation of structural reforms and the full absorption and effective utilisation of EU resources could result in a stronger increase in investment and faster economic recovery over the projection horizon. Meanwhile, given the significant improvement in the consumer confidence index in recent months, households could increase consumption far more than expected, drawing on their accumulated savings, whether precautionary or forced, and unleashing their pent-up demand.

In the medium term, the stronger bank-sovereign nexus at the national and European level (via increased holdings of government bonds by banks, the provision of government guarantees to the banking system, and deferred tax credits) amplifies risks to financial stability. The re-emergence of the twin deficits and the high private and public debt overhang (as well as the high stock of contingent liabilities of the government due to provision of guarantees) are risk factors that make the economy more vulnerable to a new negative external shock. An additional risk in the medium term is a possible termination of the ECB emergency pandemic-related monetary policy measures before Greek bonds regain investment grade status. In such an event, Greek bonds would be vulnerable to possible shocks to the global financial system, which could arise from an abrupt tightening of monetary policy in advanced economies in response to a faster than anticipated rise in inflation.

In the external environment, any geopolitical tensions in the wider South-Eastern Mediterranean region would exacerbate the refugee crisis and adversely impact economic sentiment and investment.

Despite the downside risks and uncertainties about the future path of the economy, Bank of Greece estimates suggest that the expected positive results from timely and complete absorption of EU resources should tilt the balance of risks to the upside, over both the short-term and the medium-term horizons. Therefore, a better-than-expected performance of the economy appears feasible for the period 2021-2023.

Banking system – Losses reported in the first quarter of 2021 – Decline in capital adequacy – Capital increases: significant steps in the right direction – The high share of DTCs in bank capital remains a challenge

In the first quarter of 2021, Greek banks, in aggregate, posted losses (as they had in 2020). Despite higher net income, higher loan loss provisions (mainly reflecting losses from the planned sale of a large volume of NPLs by one systemic bank) resulted in losses for the Greek banking system as a whole. In terms of capital adequacy, both the Common Equity Tier 1 (CET 1) and the capital adequacy ratio on a consolidated basis declined slightly in the first quarter of 2021 relative to 2020, but remained at satisfactory levels (13.6% and 15.6%, respectively, at end-March 2021). Still, both indices remain below the European average. In the last few quarters, capital adequacy ratios were negatively affected by securitisations in the context of the NPL reduction effort and by the phased-in implementation of the International Financial Reporting Standard 9 (IFRS 9). With a fully phased-in IFRS 9 effect, the CET1 and the Capital Adequacy Ratio came to 11.8% and 13.8%, respectively. Roughly 65% of banks' CET1 capital corresponds to deferred tax credits (DTCs), and this percentage is expected to increase further in the context of the current NPL reduction strategy.

Banks need to strengthen their capital base in terms of quality and quantity, and positive developments have already been seen in this direction. However, the relatively weak capital adequacy positions of certain non-systemic banks are a source of concern.

Marginal rise in non-performing loans in the first quarter of 2021 – A further increase is expected, due to the pandemic – The activation of the new bankruptcy code is a positive development

The stock of NPLs, after declining in 2020, mainly through the sales of loans under the Hellenic Asset Protection Scheme (HAPS) providing Greek State guarantees for NPL securitisations, increased marginally in the first quarter of 2021 to €47.3 billion at end-March 2021. The NPL ratio to total loans remained high (30.3%) at end-March 2021, about twelve times the respective ratio for euro area banks under the direct supervision of the Single Supervisory Mechanism.

The ongoing pandemic and the withdrawal of support measures are expected to worsen the financial condition of certain businesses and households hit by the pandemic, thereby leading to new NPLs. Thus, banks need to reassess the adequacy of their provisions for credit risk, in particular the repayment capacity of borrowers hit by the pandemic, given that government support measures mask the true picture.

Meanwhile, banks, especially the systemic ones, are pursuing more aggressive NPL reduction policies. As a result, the system-wide NPL ratio could fall to a single-digit level by end-2022, although certain mostly non-systemic banks do not appear to be keeping up with the overall pace of NPL reduction. Moreover, the new bankruptcy code came into effect on 1 June 2021. This is expected to help improve bank asset quality.

Challenges

The Greek economy still faces significant challenges in the short and the medium-to-long term. In the short term, the primary challenges are to contain the pandemic and get the economy back on a solid growth trajectory.

Turning to the medium-to-long term horizon, the pandemic has brought about new challenges and has exacerbated pre-existing macroeconomic imbalances, associated with chronic weaknesses of the Greek economy. These challenges are the following:

- The re-emergence of twin deficits, along with a private and public debt overhang, increases risks and could hamper the achievement of the objectives set in the National Recovery and Resilience Plan.

- A possible termination of the ECB's Pandemic Emergency Purchase Programme before the Greek economy regains investment grade could result in upward pressure on Greek government borrowing costs.

- Banks are still burdened by a high stock of NPLs, which is expected to increase further when the support measures are withdrawn. Moreover, banks' capital base is expected to weaken further as a result of the current NPL reduction policies.

- The structural competitiveness of the Greek economy remains comparatively low, despite improving in certain sectors.

- Unemployment remains high and could increase further once the support measures are withdrawn, especially in service sectors adversely affected by the pandemic. As the pandemic induces changes in consumption patterns, recovery in these sectors may occur with some delay, posing the risk of unemployment becoming structural.

- The high investment gap of the previous decade dampens the long-term outlook of the economy.

Prerequisites for a speedier recovery and for a productive transformation of the economy

A return to a solid growth path will hinge upon the containment of the pandemic, the reopening of all activities and the lifting of travel restrictions so that tourism activity can grow in line with expectations. Key to containing the pandemic and ensuring sustainable recovery will be the highest possible vaccination coverage of the population.

The viability of many businesses and jobs could be threatened after the end of the pandemic and the withdrawal of bank moratoria and government support schemes to support businesses and workers. This is why support measures should be withdrawn gradually and in sync with the recovery gaining traction. As regards the labour market, the withdrawal of support measures should be coupled with active employment policies, so as to avert an increase in structural unemployment and to help workers, discouraged during the pandemic, return to the labour force.

Fiscal expansion will need to remain targeted and temporary, in order to preserve public debt sustainability and prevent the health crisis from turning into a sovereign debt crisis. Furthermore, the cash buffer will need to be kept at high levels, as it contributes to maintaining investor confidence and thereby to reducing the debt refinancing costs, given that Greek government bonds are still below investment grade. In the medium term, the high debt-to-GDP ratio and increased financing needs call for a rapid and credible restoration of fiscal sustainability. With specific regard to public debt, its strong increase despite low borrowing costs and the favourable repayment schedule eliminates all room for a relaxation of the long-term primary surplus targets and makes it all the more crucial to safeguard fiscal credibility, through a return to realistic primary surpluses and compliance with EU fiscal rules.

Achievement of high and sustainable growth rates, which will also help reduce the public debt-to-GDP ratio, calls for a rapid absorption and effective utilisation of European resources that will provide impetus to growth through an acceleration of public and private investment. Implementation of growth-enhancing high value added projects associated with the green and digital transition of the public and the private sector can be expected to strengthen infrastructures and boost output, employment and private investment.

Meanwhile, the implementation of reforms under the National Recovery and Resilience Plan and an acceleration of the privatisation programme that has stalled during the pandemic, will help increase real GDP and total productivity in the economy over time.

A key factor in the growth effort and in the achievement of the goals of the National Recovery and Resilience Plan will be a well-functioning banking system able to finance healthy businesses post-pandemic. This will call for:

- addressing existing NPLs and all new NPLs that emerge once support measures are withdrawn;
- re-assessment of loan loss provisions;
- active use of the new bankruptcy code, which will help improve bank asset quality and restructure viable businesses;
- reduction of the high share of deferred tax credits in bank capital; and
- strengthening of banks' capital base.

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Progress with the vaccination programme, an easing of the pandemic and the gradual relaxation of the associated containment measures, together with the financial support measures, have started to yield their first positive results. Key short-term indicators of economic activity and expectations point to a rebound in the second quarter that is expected to pick up steam in the second half of the year.

The course of the Greek economy in the coming months is closely linked with the evolution of the pandemic, the progress of vaccinations, a release of pent-up demand and a recovery of tourism. Despite the downside risks and uncertainties, improved confidence should lead to an increase in consumption, supported by high levels of savings, especially in expenditure categories that involve services affected by the lockdown measures. Furthermore, the advance disbursement and utilisation of 13% of NGEU funds in the period ahead will boost investment and economic activity.

In the medium term, the outlook for the Greek economy is indisputably positive, in light of the available EU resources. The realisation of investments and reforms under the National Recovery and Resilience Plan will improve the business environment, support the green and digital transition of the public and the private sectors, while also preserving social cohesion, and will make the Greek economy more extrovert and competitive. These changes will enable permanent increases in real GDP, employment, productive capital and overall productivity of the economy. However, the effort to transform the Greek economy into an extrovert, sustainable and inclusive growth model presupposes financing to businesses from a strong banking system.

Despite positive medium to long-term prospects, the Greek economy faces significant challenges and imbalances that worsened on account of the pandemic. This calls for vigilance, an alignment of political forces and a stepping-up of efforts towards the productive transformation of the economy. The NGEU provides a unique opportunity in this respect.

Box II.1

POST-PANDEMIC INFLATIONARY PRESSURES ON THE GLOBAL ECONOMY

The economic crisis caused by the pandemic has unique features, because of the extent and depth of the recession, the speed, coordination and range of economic policy response, and the continued uncertainty about the duration of the health crisis. Despite current projections for a rapid recovery of the global economy in 2021 and 2022, there are concerns about the likelihood of scarring effects on overall productivity, capital accumulation and employment. The IMF estimates that, despite individual differences in the rate of recovery among economies, global GDP until 2024 will stand 3% below the pre-pandemic forecasted level.

In line with the rebound of output, inflation is expected to increase in 2021, but will have even more asymmetric features at global level, as developments in domestic demand, output gap and inflation expectations will vary across economies. In advanced economies, the IMF estimates the Consumer Price Index (CPI) to increase by 1.6% in 2021 and 1.7% in 2022, from 0.7% in 2020, while in developing and emerging economies, it is estimated to decline slightly by 4.9% in 2021 and 4.4% in 2022. International organisations, while generally forecasting a temporary increase in the aggregate CPI in 2021 and a slowdown thereafter in the United States and the euro area, they expect that core inflation will improve further in both regions over the medium term (see Chart A). The acceleration in CPI inflation in 2021 is largely due to the base effects of a sizeable percentage increase in energy goods prices (compared to the very low levels seen in 2020). Significant inflation volatility is expected in the euro area in the coming quarters, but the ECB does not forecast severe inflationary pressures over the medium term. HICP inflation is estimated to increase to 1.9% in 2021, from 0.3% in 2020, but to decline slightly over the next two years. By contrast, core inflation (HICP excluding energy and food) in the euro area, although lower, is projected to continue to increase every year and reach 1.4% in 2023. In the United States, the OECD projects a decline in headline inflation in 2022 and a further increase in core inflation to 2.6% based on the PCE price index.

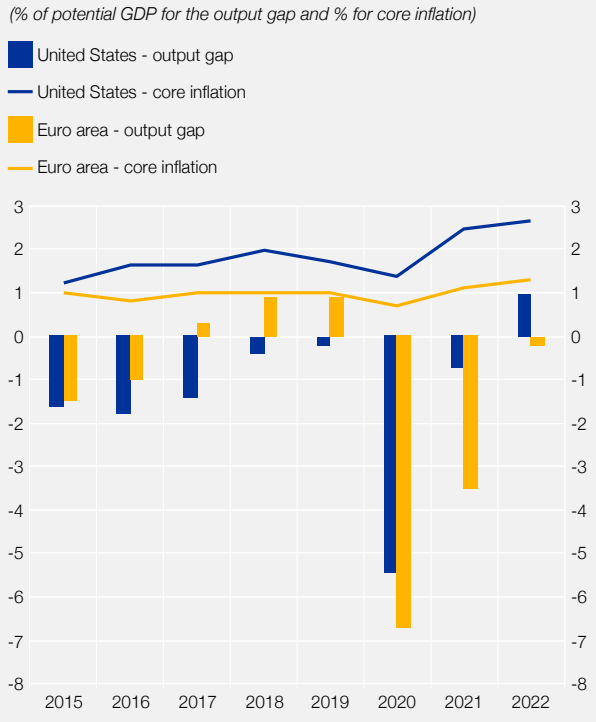
Rising inflation in the coming years: temporary or more permanent?

A number of factors are expected to increase headline inflation, at least in the short term, such as: (a) the positive base effects of rising energy and other primary commodities prices; (b) the surge in container freight rates; and (c) the withdrawal of anti-inflationary measures, such as tax reliefs (e.g. VAT), adopted in the midst of the pandemic. In emerging market economies, currency devaluation and increases in indirect taxes and administered energy and food prices have already exerted further pressure on consumer prices in several countries.

In addition, inflationary pressures are expected to stem from stimulated demand, combined with limited supply, until the latter fully returns to normal. As unemployment starts to decline and confidence recovers, consumption is projected to strengthen due to a number of factors. First, on account of pent-up demand, mainly for services unavailable due to the lockdown. Secondly, consumption is expected to be boosted by the use of part of the largely compulsory savings accumulated during the quarantine. Finally, increased household wealth owing to higher real estate and equity prices will have a positive impact on consumption. These asset price increases are noteworthy during such a deep economic downturn and are in contrast with the conditions prevailing after the global financial crisis of 2007-08. At the same time, inflationary pressures on the demand side are expected to be exacerbated by temporary shortages of goods and higher production costs on the supply side, partly due to disruptions in global supply chains, rising prices of intermediate goods such as energy and base metals, firm bankruptcies and, finally, higher operating costs due to the implementation of new coronavirus protection rules.

Compared to previous crises and subsequent recovery periods, the current COVID-19 pandemic is characterised by three economic policy peculiarities, which are expected to have a strong inflationary impact when economies return to normal. First, immediate and full coordination of both fiscal and monetary policies towards an expansionary stance in order to mitigate the economic repercussions of the pandemic. Secondly, global synchronisation in policy response. Thirdly, the unprecedented size of fiscal and monetary support to economies. Unprecedented fiscal stimulus packages, exceptionally low interest rates, household income support in the form of cash and other corporate liquidity support measures have generally resulted, among other things, in accelerating money

Chart A Output gap and core inflation



Sources: OECD and ECB.
Notes: Estimates for 2021 and projections for 2022. For US, inflation is measured on the basis of the PCE price index.

supply growth while increasing fiscal deficits globally, which inevitably exert inflationary pressures.[1] For example, government transfers in the United States have increased from 17% of household income before the pandemic to 31% in April 2020 and remained at 27% in January 2021, implying that fiscal policy gave a more direct boost to the real economy.[2] Concerns about high inflationary pressures intensify, as there are signs that policy support will remain ample in the coming period or will increase further, as planned in the United States, although economies are entering a recovery phase. More generally, long-term fiscal commitments without a clear plan to finance expenditure and with limited benefits on the supply side could create higher inflationary risks.[3]

Renewed market-based expectations for inflation

The improved outlook for global recovery, as vaccinations go forward, containment measures are gradually withdrawn and economic activity resumes in all sectors producing goods and services, has significantly increased inflation expectations in major advanced economies in the first months of 2021, reinforcing the upward trend already observed since last year. Especially in the United States, where the economy is recovering vigorously, supported by unprecedented fiscal and monetary support, medium-term inflation expectations, as measured in government bond markets, hit decade highs in May 2021. The breakeven inflation rate suggests average expected inflation in the United States at 2.57% over the next five years (see Chart B) and slightly lower (2.42%) over the decade (May 2021). A similar trend was observed in the United Kingdom and, to a lesser extent, in the euro area, where recovery prospects remain more subdued.

In absolute terms, current medium- to long-term inflation expectations are not much higher than the central banks' inflation target of 2%, but of concern is a potential sharp rise and destabilisation of these expectations, which would hamper the implementation of effective monetary policy.

Uncertain inflation path in the long term

While the observed increase in inflation is considered temporary and is moderated by a large output gap and low wage pressures due to labour market slack, uncertainty about inflation developments in the long term has intensified, especially in the light of rising market-based expectations about medium- to long-term inflation. The question is how the various structural factors will interact with inflation developments in the long term and how monetary policy will respond in an economic, political and social environment where the role of the State appears to become more expansionary and fiscal policy more active.

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1 In contrast with the global financial crisis of 2007-08, since the onset of the COVID-19 pandemic there has been a large rise in monetary aggregates in the United States, the euro area, Japan and the United Kingdom. M2 has grown at an unprecedented rate of almost 25% in the United States, while monetary growth is also reflected in broader liquidity indicators (M3) worldwide. This shows that quantitative easing policies have led to increased bank deposits, rather than remaining as bank reserves, as observed in the previous crisis. See Ilzetzki, E., C. Reinhart, and K.S. Rogoff (2020), "Will the Secular Decline in Exchange Rate and Inflation Volatility survive COVID-19?", NBER Working Paper Series No. 28108.

2 https://www.bbh.com/us/en/insights/private-banking-insights/light-at-the-end-of-the-tunnel-the-economy-and-markets-postcovid-19.html.

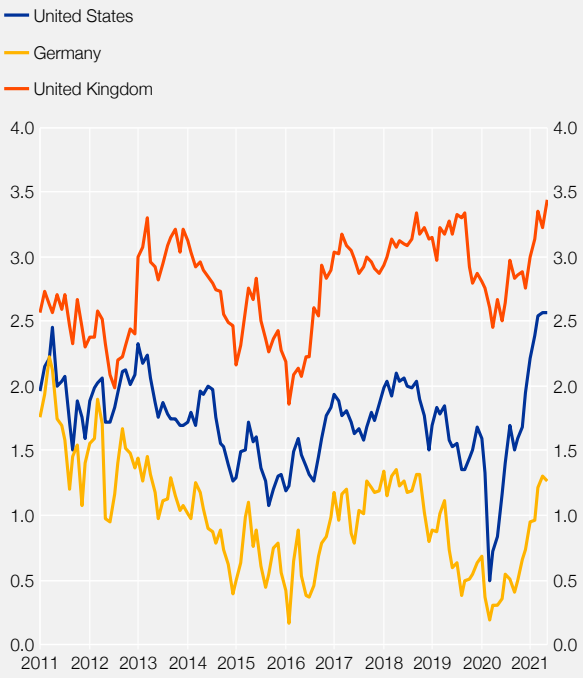
3 Ball, E., G. Gopinath, D. Leigh, P. Mishra and A. Spilimbergo (2021), "US inflation:set for take-off?", VoxEU, 7.5.2021.

In the long term, the de-globalisation of production (reduced offshoring to depend less on Asian economies) and stronger protectionism in global trade could have a rising inflationary impact on production and labour costs. A potentially disorderly green transition would also drastically raise energy prices. In addition, widening social inequalities could trigger the need for greater income redistribution and wage support through regulatory and fiscal measures, thereby increasing average labour costs and fiscal transfers. Finally, any increase in the oligopolistic power of some large companies in capital-, technology- and innovation-intensive industries could lead to price increases in certain sectors.

By contrast, the resurgence of structural factors that had a deflationary effect in the decades before the pandemic would contain inflationary pressures. Such factors include technological progress,[4] automation and digital transformation, which reduce the relative cost of capital, increase efficiency and lower total production costs, as well as demographic factors[5] such as migration, which would increase labour supply. The possibility of a wave of post-pandemic firm bankruptcies would lead to structural changes on the supply side, job losses, loss of confidence, falling demand and ultimately declining inflation.

Chart B Market expectations of medium-term inflation

(breakeven inflation rates based on 5-year bonds; %)



Sources: FRED and Refinitiv.

Monetary policy challenges – dilemmas

1. Public and private debt continue to increase globally, reaching new historical highs. Although high debt build-up in previous crises (e.g. after wars or pandemics) did not necessarily lead to persistent inflation in the medium term,[6] a very large increase in debt-to-GDP ratio would bring the "natural interest rate" close to or above the growth rate,[7] thereby causing inflation. Several analysts are concerned about potential fiscal dominance in the economy, which would exert political pressures on central banks to maintain low interest rates and quantitative easing over a longer period, so that debt can be refinanced and serviced, but also reduced through high inflation.

2. Inflation is likely to exceed the central banks' target in the post-pandemic economic recovery. While strengthening inflation and raising equilibrium interest rates remain crucial in many advanced economies, a potential overheating of economic activity and persistent inflation well above the central banks' targets would in normal conditions trigger a contractionary monetary policy stance. Higher borrowing costs amid high and rising debt would probably lead to financial turmoil, sovereign debt crises and a large wave of bankruptcies in the private sector. Major central banks such as those in the United States, Canada and the United Kingdom have voiced their intention to tolerate higher inflation (above the 2% target) in the medium term. The adoption of a new monetary policy framework by the US Federal Reserve confirms its intention to accept a temporary overshooting of inflation in order to foster growth, while the Eurosystem is also currently reviewing its monetary policy

4 Lv, L., Z. Liu, and Y. XU (2019), "Technological progress, globalization and low integration: Evidence from the United States", PLoS ONE 14 (4).

5 Bobeica, E., C. Nickel, E. Lis and Y. Sun (2017), "Demographics and inflation", ECB Working Paper No 2006.

6 Miles, D. and A. Scott, (2020), "Will inflation make a comeback after the crisis ends?", VoxEU, 4.4.2021 and Daly, K. and R. Chankova (2021), "Inflation in the aftermath of wars and pandemics", VoxEU, 15.4.2021.

7 According to the literature, a 1 percentage point increase in the debt-to-GDP ratio leads to a 2-4 basis points increase in the natural interest rate. See Blanchard, O., (2020), "High injection is unlikely but not impossible in advanced economies", Peterson Institute.

strategy. At present, the increase in inflationary pressures appears to be manageable and inflation expectations anchored in several economies, such as the euro area.

3. Inflation expectations are likely to increase at a faster pace. Preserving central bank independence and the credibility of the monetary policy framework are crucial to stabilise inflation expectations. Central banks should be vigilant and closely monitor developments in inflation and inflation expectations to prevent abrupt increases in borrowing costs in the real economy, acting either within the framework of their non-conventional tools or by communicating their intentions in a timely and clear manner. Forward guidance played a critical role during the pandemic. While the path of short-term interest rates appears to be well-understood at the current conjuncture, there is uncertainty in the markets about the prospects of quantitative easing by central banks and the tolerable level of above-target inflation,[8] as partly implied by the increase in the term premium on 10-year US Treasury bonds since February 2020. It is therefore crucial, especially for the US Federal Reserve, once the process of monetary policy normalisation begins, to clearly communicate the pace of future securities purchases in order to prevent undesirable financial market volatility. Any delay in the adjustment of monetary policy to strong inflation expectations would make the consequences of the subsequent necessary adjustment even direr.

4. The appropriate timing and pace of withdrawal of monetary support. The need for continued fiscal and monetary support remains high both to restart the economies and to avoid a lasting impact of the pandemic crisis on potential output. Recent studies show that "Main Street" QE is much more effective in a pandemic than "Wall Street" QE to address liquidity and financing problems. An early and premature tightening of economic policy may hamper global economic recovery. It is therefore necessary for interest rates to increase in line with the acceleration of economic growth. In this context, however, faster economic growth and rising inflation in the United States or other advanced economies, accompanied by an increase in interest rates and the withdrawal of monetary support from the central bank, would have significant spillover effects and create risks for growth in emerging or other economies that have not yet stabilised after the pandemic.[9] In this light, small and open economies with high debts and other macroeconomic imbalances would need to be shielded and contain country-related risks (and, therefore, their borrowing rates spread) through reforms, a rational medium-term fiscal policy, as well as an overall private debt resolution to boost the economy's resilience to external shocks.

Conclusions

To sum up, the expected increase in inflation, despite differences across economies, is generally low and will mainly materialise in 2021. Over the medium and long term, inflation expectations point to a rise in inflation, but its extent is surrounded by uncertainty and will be determined by developments in the output gap, the credibility of central banks, the timing and pace of monetary policy normalisation and the withdrawal of fiscal support, as well as other cost factors related to global supply chains, world trade and the possibility of partial de-globalisation of production.

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8 Goy, G., M. Hoogland and A. Petersen (2021), "The market-implied effects of the Biden stimulus and the American's new policy framework", VoxEU, 15.3.2021.

9 IMF (2021), 'Shifting gears: Monetary Policy Spillovers during the recovery from COVID-19", *World Economic Outlook*, April.

Box III.1

DEVELOPMENTS IN INTEGRATING THE IMPACT OF CLIMATE CHANGE INTO THE EUROSYSTEM OPERATIONAL FRAMEWORK

On 4 February 2021, the Eurosystem announced the adoption of a common stance[1] among its members, which comprise the ECB and the euro area national central banks (NCBs), for climate change-related sustainable and responsible investment in non-monetary policy portfolios.[2] The objective of the common stance is to mitigate the environmental footprint of the NCBs, also with a view to increasing the share of green securities held in such portfolios. Recognising that each NCB is responsible for managing its non-monetary policy portfolios, the common stance aims at promoting the harmonisation of central banks' efforts to better understand and measure climate risks embedded in their balance sheets. This approach can raise awareness among other investors and lead by example. At the same time, reputational risks linked to a possible non-integration of environmental considerations into the specific portfolios are mitigated.

With this initiative, the Eurosystem contributes to the EU climate goals and supports euro area member countries in their efforts towards a smooth transition to an environmentally-friendly, low-carbon economy.[3]

On the basis of the common stance, over the next two years the Eurosystem will launch an annual publication of climate-related disclosures on specific types of investment portfolios alongside measurement methods, building on the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).[4] The common stance also provides for the publication of reports by NCBs on their investment strategy and environmental objectives.

Given the growing importance of climate change and in order to strengthen its efforts to contribute –acting within its mandate– to the transition towards a greener economy in the euro area, the ECB also decided to set up a new "Climate Change Centre"[5] in early 2021.[6] The Centre will shape and guide ECB's actions in five main directions: (a) financial stability and prudential supervision; (b) macroeconomic analysis and monetary policy; (c) financial market operations and risk management; (d) EU policy and financial regulation; and (e) corporate sustainability.

In the current monetary policy strategy review, the Eurosystem is also considering, among other issues, its possible role –always within its mandate of ensuring price stability in the euro area– in addressing climate change-related risks. Climate change can have an impact on the economy through extreme weather, but also through uncertainty surrounding the transition to a low-carbon economy. The effects of both climate change and climate-related policy can influence price developments. It is important that these factors are taken into account by the Eurosystem in order to ensure that potential risks to price stability are identified in a timely manner. As a first step, the Eurosystem has already started work on the integration of climate risks into macroeconomic models

1 https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210204_1~a720bc4f03.en.html
2 NCBs hold financial instruments, primarily government bonds and covered bonds in euro, for purposes not related to the single monetary policy. They are managed for general investment purposes, i.e. with a view to achieving returns, without prejudice to limits on risk exposure. This ensures the financial independence of the NCBs by holding a reserve to cover potential losses.
3 The first initiatives under the Green Deal include: The European Climate Law, which enshrines in EU law the objective of climate neutrality by 2050, the European Climate Pact, which aims at mobilising citizens and society as a whole towards climate action, the 2030 Climate Target Plan to further reduce net greenhouse gas emissions by at least 55 % by 2030 and a new EU strategy on adaptation to climate change to make Europe a climate resilient society by 2050 (https://ec.europa.eu/clima/policies/eu-climate-action_el).
4 The TCFD, established by the Financial Stability Board, issued recommendations in 2017 for reporting, on a voluntary basis, climate and environment-related risks. The recommendations are addressed to businesses and organisations and aim at achieving comparability and coherence of climate-related financial information (https://www.fsb-tcfd.org/publications).
5 https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210125_1~3fc4ebb4c6.el.html
6 On 15.6.2021 the Bank of Greece announced the establishment of its Centre for Climate Change and Sustainability.

and forecasting tools, and is studying potential macroeconomic consequences for the conduct of monetary policy in the context of pronounced and volatile macroeconomic shocks stemming from climate change. The Governing Council intends to have completed the monetary policy strategy review in the second half of the year, when the role of climate changerelated risks in the revised monetary policy strategic framework will be further clarified.

For its part, the Bank of Greece, in the context of the Eurosystem's initiatives to pursue sustainable and responsible investment practices, is already investing in green bonds issued by sovereigns and supranational institutions. In the course of 2021, the Bank of Greece is expected to invest in debt instruments such as bonds issued by the BIS green bond fund for central banks (Green BISIP). In line with the Eurosystem common stance announced in February, the Bank of Greece intends, over the next two years, to design and implement a comprehensive investment strategy for its nonmonetary policy portfolios, also with a view to increasing the share of green investment and introducing new green investment tools. The Bank of Greece is looking forward to a significant increase in the share of green debt securities in its balance sheet over the coming years.

The Bank of Greece systematically monitors developments and international practices in this area, actively participating in the Network for Greening the Financial System (NGFS) of central banks and supervisors, which has published *inter alia* recommendations for the management by central banks of own funds portfolios. It also participates in BIS working groups dealing with the creation and further development of green investment products, as well as methods that will improve the assessment and measurement of the environmental footprint of investments.

Box IV.1

IMPACT OF THE RECOVERY AND RESILIENCE FACILITY ON THE GREEK ECONOMY

On 27 April 2021, Greece submitted for approval to the European Commission its National Recovery and Resilience Plan (RRP) "Greece 2.0", requesting a total of €30.5 billion over the period 2021-2026, to be used for financing new investment and reforms.[1] The Greek 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. It aims to facilitate the Greek economy shift to a more extrovert and competitive economic model within an improved business environment, while completing the green and digital transitions. This box assesses the potential economic impact of the use of resources and the implementation of reforms under the Greek RRP.

Methodology

To evaluate the impact, we use the Dynamic Stochastic General Equilibrium Model of the Bank of Greece.[2] As detailed below, the model has been expanded to adequately reflect working assumptions regarding the use of resources and the implementation of reforms under the Greek RRP.

The methodological approach follows relevant literature.[3] In particular, expenditures and structural reforms under the Greek RRP are mapped into the model's appropriate exogenous variables as shocks. In order to quantify the potential impact of the Plan, we make specific working assumptions on the size, absorption and use of Recovery and Resilience Facility (RRF) funds,[4] as well as assumptions about the implementation of reforms.

A. Assumptions on expenditures

The working assumption is that Greece will receive €18.1 billion in grants and €12.4 billion in loans from the RRF. It is also assumed that Greece will have the necessary administrative and operational capacity to achieve full absorption of the funds by 2026. In particular, as regards the absorption pace, it is expected that in 2021 there will be disbursement and simultaneous absorption of pre-financing payments provided under the Facility on the basis of the relevant EU Regulation[5] (13% of grants and loans), while the remaining disbursements are evenly allocated over the period 2022-2026.

With regard to the use of the Facility's funds, the additionality principle applies, i.e. all grants and loans under the RRF finance new investments and reforms. In particular, 67% of the (budgetary neutral) grants is allocated to finance public investment and the remaining 33% to finance public consumption. All loans are channeled to the private sector at a very favourable interest rate[6] and with the aim to mobilise additional private funds. Loans increase the public debt in the period 2021-2026 and are assumed to be gradually repaid by the private sector by the end of 2058.[7]

Given the above assumptions, the model treats grants and loans differently in terms of their impact on economic activity and public debt. In particular, grants are treated as budgetary neutral transfers that increase government

1 For more information, see https://www.minfin.gr/web/guest/tameio-anakampses.
2 The model incorporates a number of real and nominal distortions, as well as a wide range of fiscal tools. For details see Papageorgiou, D. and E. Vourvachaki (2017), "Macroeconomic effects of structural reforms and fiscal consolidations: Trade-offs and complementarities", *European Journal of Political Economy*, 48, 54-73; and Papageorgiou, D. (2014), "BoGGEM: A dynamic stochastic general equilibrium model for policy simulations", Bank of Greece Working Paper No. 182.
3 See *inter alia* Uhlig, H. (2010), "Some fiscal calculus", *American Economic Review*, 100, 30-34; and European Commission (2016), "The Economic Impact of Selected Structural Reform Measures in Italy, France, Spain and Portugal", Institutional Paper No. 23, Brussels.
4 These assumptions were based on information from the Ministry of Finance (22.3.2021).
5 Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility; Official Journal of the European Union, L 57/17, 18.2.2021.
6 Given that the EU is rated AAA, the European Commission will be able to borrow from the markets on favourable terms and then pass on this gain to Member States in the form of particularly low-interest loans.
7 Following the end of the period 2021-2026, all expenditures return to their initial levels (2017-2019 average).

expenditures (investment and consumption) without having any impact on public debt. Loans weigh on public debt and are introduced in the model as implicit investment subsidies that reduce the cost of investment for every unit spent by the private sector, thereby reinforcing incentives for private investment. As a result, there are endogenously created incentives to mobilise even higher resources for private investment, in excess of the amount of loans.

B. Assumptions on reforms

In order to quantify the reforms envisaged under the Greek RRP, it is necessary to map these reforms into the model's appropriate exogenous variables or parameters in order to identify the main channel through which a specific reform affects economic outcomes. The size of the shock is set so as to close Greece's gap to average EU practices by at least 50% by 2030.[8] It should be noted that reforms lead to permanent changes in the model's exogenous variables, as opposed to the temporary nature of expenditures.

Moreover, quantitatively assessing ex ante the size of the Greek RRP reforms is presently challenging, as legislative actions and a detailing of structural interventions are still pending. In addition, there is uncertainty as to the speed and successful completion of reform implementation, as well as regarding the time needed for reforms to affect economic outcomes. It follows that the RRP impact assessment is limited to reforms that can credibly be mapped to changes in the model's exogenous variables.

In particular, four different categories of reforms are quantified:

(a) Reforms that enhance competition in product and service markets

This category includes reforms under the fourth pillar of the Greek RRP aimed at improving the business environment and simplifying the regulatory framework, facilitating international trade and reducing the administrative burden and compliance cost. The impact of these reforms is simulated by a permanent reduction in the mark-up of enterprises.

(b) Reforms that support higher labour force participation

The third pillar of the Greek RRP involves measures aimed at enhancing participation in the labour market, such as pension reforms, as well as measures related to active and passive labour market policies. Policies to improve education and training, including actions to facilitate women's participation in the labour market, are in the same direction. The impact of these labour market reforms is simulated by a permanent increase in labour supply.

(c) Reforms that increase the total factor productivity of the economy

This category includes reforms under the fourth pillar of the Greek RRP that improve the business environment and reduce the cost of doing business by enhancing allocative efficiency. It also includes reforms under the second and third pillars that promote digital transformation, e.g. developing an institutional framework for the deployment of 5G networks, as well as e-skill-enhancing reforms. These reforms contribute to a permanent increase in the level of total factor productivity.

(d) Reforms that promote the digital transformation of public administration

Lastly, this category involves interventions under the second pillar of the Greek RRP aimed at improving the efficiency of public administration by digitising processes and services, promoting interconnectivity and interoperability of information systems and enhancing cybersecurity. These reforms are simulated by a permanent reduction in the time allocated to unproductive activities such as red tape.[9] These reforms are quantified and their impact is analysed in the context of an "expanded reform scenario".

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8 A prerequisite is that there are reliable estimates in the literature regarding the sensitivity (elasticity) of the variable under consideration to changes in structural indicators.

9 For the purposes of this simulation, the model is expanded to include the assumption that a share of households' working time is allocated to unremunerated non-productive activities, which reduce households' utility.

It is worth noting that reforms improving the quality of governance, the rule of law and judicial system efficiency are not included in this exercise. Quantifying these reforms is difficult but, according to literature, they can deliver significant additional gains for long-term growth and prosperity.[10]

Simulation results

The RRP impact assessment is summarised in the table. The impact on GDP is expressed as percentage deviations from the steady state values for the years 2021-2026 and a long-term period (10 and 20 years).

Impact of the Greek RRP on GDP

(percentage deviations from the steady state)

		2021	2022	2023	2024	2025	2026	10 years	20 years
A.	**Total impact of expenditures**	**2.2**	**3.3**	**3.7**	**4.0**	**4.3**	**4.3**	**2.1**	**0.6**
	– Grants	1.0	1.3	1.2	1.3	1.3	1.5	0.3	0.3
	– Loans	1.2	2.0	2.5	2.8	2.9	2.9	1.7	0.3
B.	**Total impact of structural reforms under the baseline scenario (a+b+c)**	**0.4**	**0.7**	**1.1**	**1.5**	**2.1**	**2.6**	**4.9**	**6.0**
	(a) enhanced competition	0.1	0.2	0.3	0.4	0.5	0.6	1.0	1.3
	(b) higher labour force participation	0.2	0.3	0.5	0.8	1.1	1.4	2.8	3.5
	(c) higher total factor productivity	0.1	0.2	0.3	0.4	0.5	0.6	1.1	1.2
	(d) digital transformation of public administartion	0.2	0.4	0.6	0.9	1.2	1.6	3.1	3.9
C.	**Total RRP impact (A+B)**								
	– Baseline scenario	2.6	4.0	4.8	5.6	6.3	6.9	7.0	6.6
	– Expanded scenario	2.8	4.3	5.4	6.4	7.5	8.5	10.1	10.5

Source: Bank of Greece estimates.
Notes: The baseline scenario includes the impact of grants and loans (Panel A) and the impact of reforms that increase (a) competition; (b) labour force participation; and (c) total factor productivity. The expanded scenario additionaly includes the impact of reforms concerning (d) the digital transformation of public administration. Sub-components may not add up to totals due to rounding.

The joint impact of grants and loans leads to a 4.3% increase in GDP in 2026 (see Panel A of the table). After 2026, when the disbursement of funds ceases, the economy gradually returns to the initial long-term equilibrium. However, the positive impact on GDP is long-lasting, mainly due to a significant increase in the capital stock during the RRP implementation period.

As regards the channels through which the RRP-backed expenditures have an impact on GDP growth, the main channel at work on the grants side is a rise in aggregate demand, which drives output and employment upwards. At the same time, the increase in public investment also has a favourable supply-side impact, as the accumulation of public capital induces production externalities to the private sector.

It is worth noting that an economic expansion funded by loans to the private sector has a greater impact on GDP than grants. This is explained by a significant increase in the demand for private investment due to lower investment costs, as well as by a rise in the economy's international competitiveness due to lower domestic prices, which boosts exports. By contrast, higher grants lead to inflationary pressures in the short term that have a negative impact on demand for exports and private investment.

10 See, for example, Masuch, K., R. Anderton, R. Setzer, and N. Benalal (eds.) (2018), "Structural reforms in the euro area", ECB Occasional Paper No. 210; Kaufmann, D., A. Kraay, and P. Zoido-Lobaton (1999), "Governance matters", Policy Research Working Paper Series 2196, The World Bank; and OECD (2018), *OECD Economic Surveys: Greece 2018*, Paris.

As regards the quantified impact of structural reforms, the results suggest that, unlike expenditures, reforms are assumed to have a permanent impact over the long term, as they entail a shift to a new equilibrium with stronger productivity, higher labour supply and enhanced allocative efficiency. The reforms have a positive impact on economic activity by reducing production costs and increasing employment and total factor efficiency, thus also strengthening the international competitiveness of the Greek economy and increasing exports. Overall, in the baseline scenario, structural reforms increase GDP by 2.6% in 2026 (see Panel B of the table). The impact of structural reforms on GDP increases in the long run as reforms are fully implemented, reaching 6.0%.

Taken together, the expenditures and reforms under the Greek RRP increase GDP by 6.9% in 2026 according to the baseline scenario (see the table). These gains are long-lasting due to the impact of the reforms. Under the expanded scenario, which also takes into account gains from the digital transformation of public administration and the ensuing improvement in the allocation of resources, GDP increases by 8.5% in 2026 and by 10.5% over the long run. It is worth noting that the gains to the economy in terms of income and employment will only be sustainable in the long run if the planned reforms are fully implemented. Otherwise, the RRP benefits will be short-lived and the economy will gradually return to its pre-RRP state.

Conclusions

The results of the above analysis show that timely and full implementation of the actions envisaged under the Greek RRP will have a significant positive impact on GDP, while shaping the conditions for closing the investment gap and creating new sustainable jobs. Using funds for productive public and private investment and fully implementing the envisaged reforms are essential in order to reap these benefits.

Stronger economic activity is also expected to have favourable effects on government revenue, due to the increase in the tax base, indirectly creating additional fiscal space. To the extent that this space is used for tax rate reductions or expenditure increases, it may have an additional positive impact on growth through a virtuous circle.

Moreover, results highlight the fact that the implementation of envisaged reforms is a necessary and sufficient condition to ensure significant long-term benefits from the RRF, as well as to accelerate economic convergence among EU Member States.

Box IV.2

THE ROLE OF OPENNESS, DIGITAL TRANSFORMATION AND THE SPECIALISATION OF HUMAN RESOURCES IN GROWTH AND PRODUCTIVITY

The main objective of the National Recovery and Resilience Plan "Greece 2.0" is to create an extrovert and competitive economy. The present box uses the latest sectoral national accounts data to estimate the sources of economic growth in Greece during the recovery period (2017-2019), before the outbreak of the COVID-19 pandemic, focusing on export intensity, the specialisation of human resources and the use of information and communication technologies (ICT). The purpose of this analysis is to examine whether investing in the digital transformation of the economy and upgrading the skills of the human capital could contribute to improving competitiveness of the Greek economy.

For the Greek economy, growth in the period before the global financial crisis was largely driven by non-tradable sectors of activity, resulting in loss of competitiveness and a significant deterioration in the current account balance. Part of this loss was recovered in the initial adjustment period (2008-2013) and the recovery continued in the period of relative stabilisation of the economy (2014-2016)[1] through the reallocation of resources towards tradable sectors such as tourism, manufacturing, transport and agriculture. Over 2017-2019, economic activity turned positive, with real gross value added increasing by 1.5% and total factor productivity (TFP) by 2%.

Contribution of inputs to growth

For the calculation of growth by sector, the Cobb-Douglas constant returns-to-scale production function is estimated.[2] The main source of statistical information is ELSTAT's National Accounts data (ESA 2010),[3] which provide detailed annual series for the Greek economy at two-digit level over the period 2010-2019. Growth is estimated as the annual rate of change in Gross Value Added (GVA). Labour input growth is estimated as the annual rate of change in hours worked, while the perpetual inventory method was used to estimate capital stock growth.[4] Finally, labour shares (α_i) at two-digit level are estimated as the ratio of gross wages to gross operating surplus of each sector, adjusted for self-employment.[5]

Results and analysis

Positive growth rates are recorded in the period 2017-2019 in several sectors of the economy (see Chart A), with the highest performance in terms of growth and productivity in tradable goods and services, namely transport

1 For an analysis of the sources of growth in 1995-2017, see Bank of Greece, *Monetary Policy – Interim Report 2015*, December 2015, Special feature IV.2 "Sectoral productivity and export activity", and *Monetary Policy – Interim Report 2018*, December 2018, Special feature IV.3 "The contribution of total factor productivity to economic growth: a sectoral analysis".

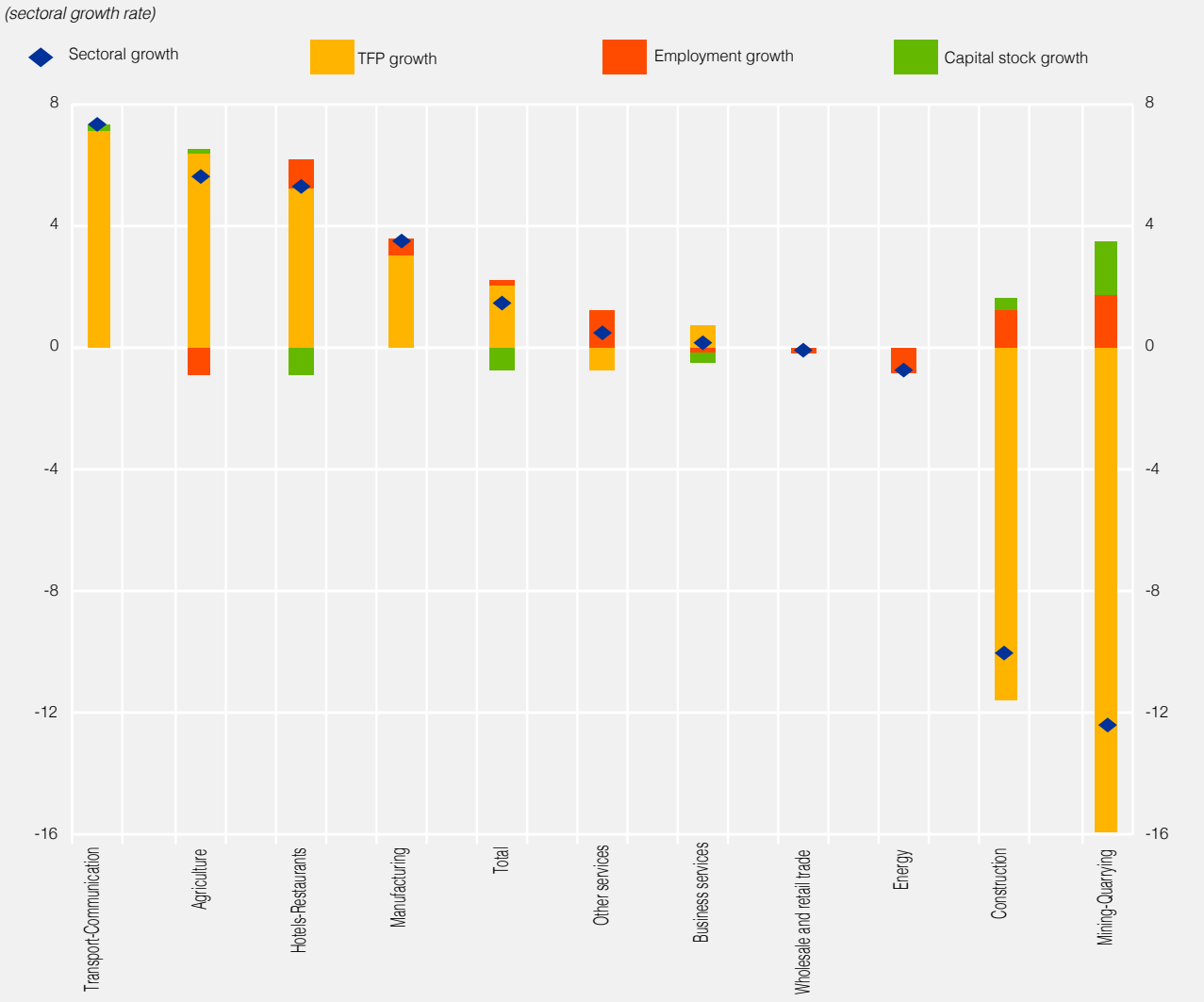
2 The Cobb-Douglas function is: $Y_i = A_i + \alpha L_i + (1-\alpha)K_i$, where for each sector i, Y_i is the rate of output growth, A_i is TFP growth, L_i is the increase in hours worked, K_i is capital stock growth, α_i is the share of employment contribution and $(1-\alpha_i)$ is the share of capital contribution. For a similar analysis, see Gibson, H. (2010), "Sectoral growth in the Greek economy 1995-2003", study 4.2 in *The Greek Current Account: Causes of imbalances and proposed policy solutions* (in Greek), Bank of Greece.

3 New revised annual National Accounts for the years 2010-2019, ELSTAT, October 2020.

4 In particular, the capital stock was calculated according to the following equation: $K_{t,i} = (1-\delta) K_{t-1,i} + \text{ΑΕΠΚ}_{t,i}$, where δ is the depreciation rate, K_t is the initial capital stock at time t and $GFCF_t$ the gross fixed capital formation at time t. Depreciation rates vary by sector and are calculated on the basis of the depreciation rates by sector for two types of investment, in equipment and buildings, from NIESR "Academic Review of Asset Lives in the UK", Discussion Paper No. 474 (2017); then the depreciation rate is extracted for each sector as the weighted average.

5 Labour share is adjusted for self-employment, in line with international literature, based on the assumption that the income of the self-employed is equal to the average wages in the sector. Thus, total labour income is equal to wage income plus the imputed labour income of the self-employed. The remaining income of the self-employed reflects the return on capital of the self-employed (profits or gross operating surplus).

Chart A Sectoral growth and components in the 2017-2019 period



Sources: ELSTAT and Bank of Greece calculations.
Note: See footnote 6 for the correspondence between the broad sectors presented in the chart and two-digit sectors.

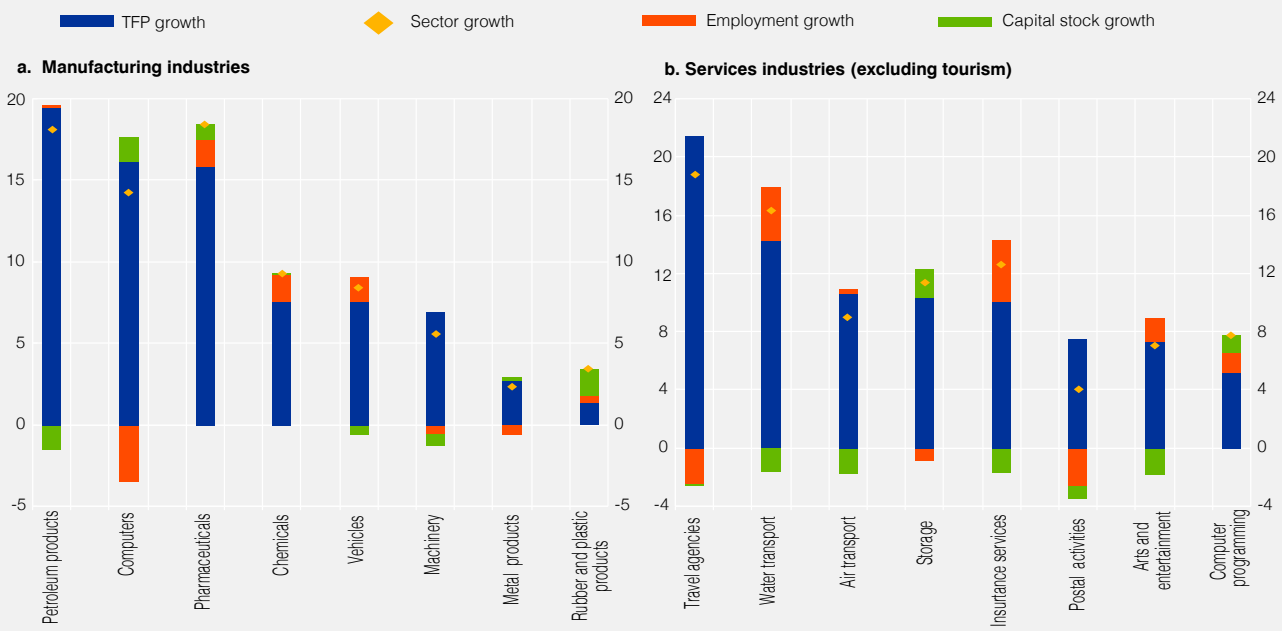
and communication (7.3% and 7.1% respectively), agriculture (5.6% and 6.3% respectively), tourism (5.3% and 5.2% respectively) and manufacturing (3.5% and 3.0% respectively).[6,7]

Chart B presents the highest performing industries in terms of growth and productivity in manufacturing and non-tourism services over the period 2017-2019. In the manufacturing sector (see Chart Ba), significant TFP increases are recorded in "manufacture of coke and refined petroleum products" (19.4%), "manufacture of computer, electronic and optical products" (16.1%) and "manufacture of basic pharmaceutical products and pharmaceutical preparations" (15.8%). These industries have recorded dynamic growth rates in the past few years and have in-

6 The broader sectors shown in Charts A and D correspond to the following two-digit sectors (in parentheses, NACE Rev.2 two-digit codes): Agriculture (01-03), Mining and Quarrying (05-09), Manufacturing (10-33), Energy (35-39), Construction (41-43), Wholesale and Retail Trade (45-47), Transport and Communication (49-53 and 58-63), Hotels and Restaurants (55-56), Business Services (64-66 and 69-82), Other Services (84-99).

7 The analysis does not include the two-digit sector "Real estate activities" (code 68), which relates to income from real estate leases, and therefore it is not possible, in principle, to apply the concept of productivity.

Chart B Manufacturing and services industries with the highest TFP performance in the period 2017-2019



Sources: ELSTAT and Bank of Greece calculations.

creased their export orientation. In non-tourism services (see Chart Bb), the highest growth and TFP increases were recorded in transport, partly as a result of significant tourism growth over this period.

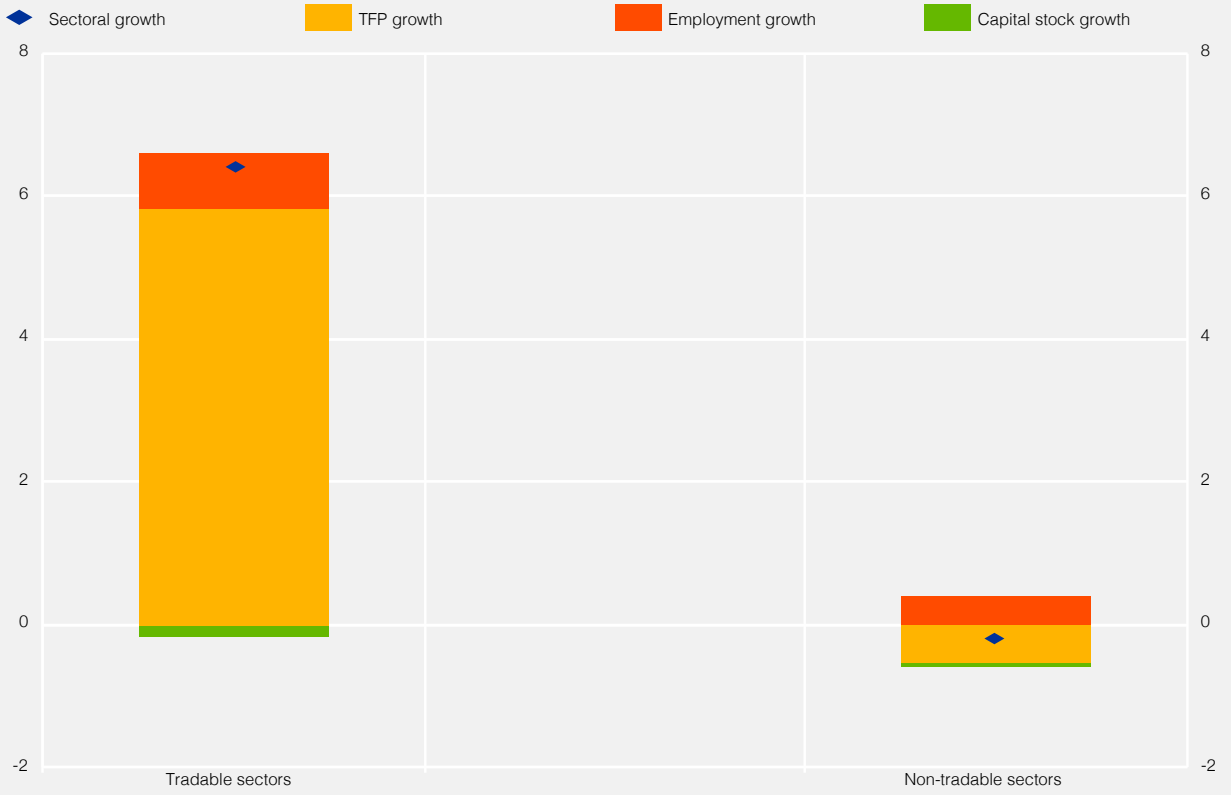
Tradable sectors and productivity

In order to examine the relationship between openness, growth and productivity, two-digit sectors are classified into two categories: tradables and non-tradables.[8] As shown in Chart C, both growth and the increase in TFP are exclusively attributed to tradable sectors in 2017-2019 (6.4% and 5.8% respectively). By contrast, the non-tradable sectors recorded a marginal decrease in GVA and TFP growth by 0.2% and 0.6% respectively.

Higher openness is also confirmed by the evolution of the ratio of exports to gross value of production by sector of activity. The increase in export performance observed since 2010 intensified during the economic recovery (2017-2019), in both goods and services (see Chart D). In addition to the expected increase in tourism extroversion, manufacturing has also recorded noteworthy export performance, with the ratio of exports to gross value of production in 2017-2019 standing at 56%, 12 percentage points higher than in 2010-2016. According to the Recovery Plan for the Greek Economy (Pissarides Report, November 2020), manufacturing products could significantly increase their share in exports, as they comprise a wide range of products, with varying degrees of specialisation in technology and labour, and can contribute to the expansion of the sectoral composition of exported products. Challenges in this respect include modernising technology, boosting innovation through participation in research and development activities and intensifying the involvement of manufacturing in global value chains. In addition, the agri-food sector has the potential to improve its export performance by promoting Greek products more efficiently and increasing the value added of goods produced, which can be achieved by expanding and modernising farms, training and introducing innovation to boost productivity. Moreover, business services have great potential to increase their export share and benefit from the expansion of the digital transformation. Finally, value added of tourism is likely to increase further by extending the tourist season and diversifying the services offered beyond the traditional “sun and sea” model.

8 Tradable industries are defined as those that export more than 20% of the value added they produce (see the Greek Economic Recovery Plan, Pissarides Report, November 2020). Alternative definitions of tradable industries found in the literature do not significantly change the results.

Chart C Growth components in tradable and non-tradable sectors in the period 2017-2019



Sources: ELSTAT and Bank of Greece calculations.

Productivity, specialisation and the role of ICT

Investment in human capital is a key factor for potential output growth.[9] The proportion of highly specialised jobs in each sector (based on the different types of occupations per sector)[10] provides an indication of the degree of specialisation. Sectoral growth outcomes by level of skill show that the largest share of real GVA in the economy (39%) in 2017-2019 comes from low- to medium-skilled sectors, with an average GVA growth rate of 2.4% and an average TFP of 2.2%. Growth and productivity in high-skilled sectors were lower (1.7% and 0.6% respectively), possibly due to the increased weight of service industries in the overall GVA of the Greek economy, which mostly employ low- to medium-skilled employees (especially in tourism, wholesale and retail trade, as well as business and other services). Moreover, according to the results of Eurostat's 2018 Structure of Earnings Survey, job specialisation in almost all sectors of activity in the Greek economy is below the euro area average.

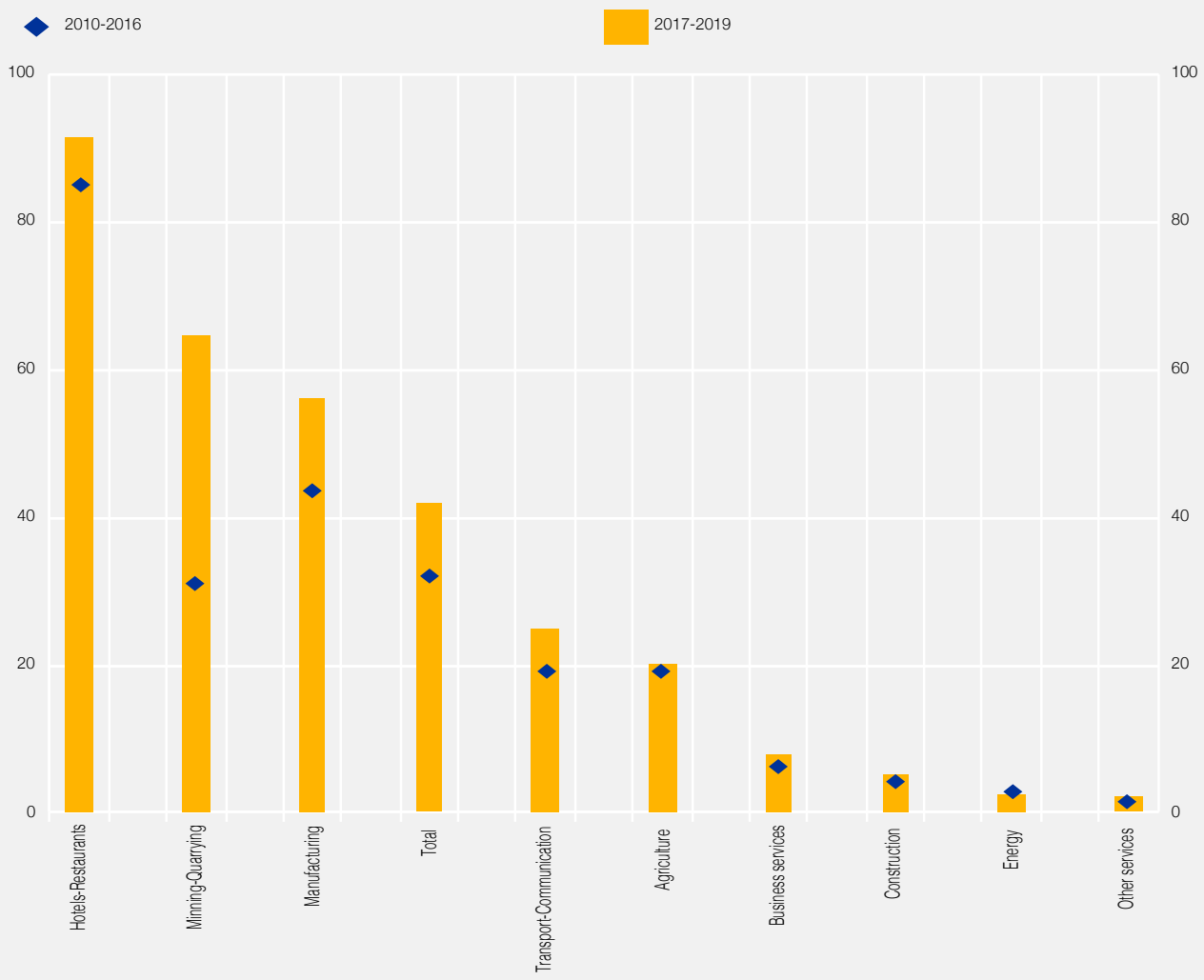
Subsequently, as ICT have brought about significant changes in methods of production and forms of employment and affect the competitiveness of an economy, sectors of activity are classified into sectors that produce and use and sectors that do not use ICT.[11] The conclusion drawn from this classification is that the largest rise in GVA

9 For the role of education in productivity growth, see Sideris, D. (2010), "The role of the product and labour market structure and education in productivity: the Greek evidence", study 4.5 in *The Greek Current Account: Causes of imbalances and proposed policy solutions* (in Greek), Bank of Greece.

10 For the calculation of the proportion of highly-skilled jobs by sector of economic activity, census data are used from the annual entries in the ERGANI IT system of the Ministry of Labour and Social Affairs, which cover all jobs in the private sector. In particular, information is derived from micro-aggregated data and refer, inter alia, to jobs, type of employment (high or low-skilled) and industry.

11 Sectors that produce and use ICT are defined according to the DESI Report 2019 – Integration of Digital technology, European Commission.

Chart D Export perfomance by sector of economic activity in 2010-2019[1]



Sources: ELSTAT and Bank of Greece calculations.
See footnote 6 for the correspondence between broad sectors presented in the charts and two-digit sectors.
1 Export performance = exports per gross output unit.

in the Greek economy and in TFP (2.8% and 2.6% respectively) can be attributed to sectors that produce and use ICT. However, the pace of digital transformation in Greece, as measured by the Digital Economy and Society Index (DESI), remained low compared to the European average, with Greece ranking penultimate among EU Member States in 2019.[12] Investment in the digital transformation of the economy and upgrading the digital skills of human capital are therefore expected to yield multiple benefits in terms of growth and competitiveness.

In order to explore the relationship between TFP growth and the degree of extroversion of the economy, the level of specialisation and the use of ICT, a regression of cross-sectoral data is estimated[13] for the period 2017-2019.

12 See Albani, M., S. Anyfantaki and S. Lazaretou (2019), "How do digital technologies drive Greece's economic growth? Opportunities and challenges", Bank of Greece, *Economic Bulletin*, No. 49, pp. 73-92.

13 The following regression of cross-sectoral data shall be estimated using the least squares method: $dTFP_i = \alpha + \beta_1\ xperf_i + \beta_2\ HS_i + \beta_3\ ICT_i + \varepsilon$, where $dTFP_i$ is the average rate of change in TFP by industry i in the period 2017-2019, $xperf_i$ is the average export performance by industry, defined as the ratio of exports to GVA, HS_i is the degree of specialisation of private sector jobs by sector of economic activity according to ERGANI system data and ICT_i is a dummy variable that takes up the value 1 when the two-digit economic sector uses or produces ICT and 0 when it does not.

The results of the regression for all sectors of activity show that export performance, medium- to high-skilled human capital and use of ICT have a positive impact on the rise in TFP. Finally, higher productivity growth in tradable sectors is supported by a higher degree of skills and greater use of ICT in these sectors than in non-tradable sectors.

It is therefore very important to continue the transformation of the economy towards tradable industries while mobilising resources to increase the skill levels of human resources and the digital transformation of the economy. Investing in the digital transformation of the economy and upgrading human resources in the context of the National Recovery and Resilience Plan are expected to increase levels of specialisation and technological penetration in many sectors of activity and contribute to boosting the structural competitiveness of the Greek economy.

Conclusions

The results of the analysis show that growth and TFP increase in the period of economic recovery (2017-2019) were recorded in tradable goods and services sectors, thereby continuing the restructuring of the Greek economy towards tradable sectors. The analysis also shows that shifting production towards higher-skill sectors, improving the specialisation of sectors of economic activity and increasing ICT penetration could contribute to an improvement in TFP, thereby boosting the country's structural competitiveness.

Investment resources mobilised by the Recovery Fund for the digital transition in the public and the private sector, the strengthening of the digital capacity of education and the modernisation of vocational education and training are expected to have a multiplier effect on the Greek economy in terms of growth and productivity and contribute to the creation of a competitive and extrovert economic model.

Box IV.3

INFLATION AND INFLATION UNCERTAINTY IN THE GREEK ECONOMY BEFORE AND DURING THE PANDEMIC

The downturn in economic activity during the COVID-19 pandemic has led to significant deflationary pressures; as a result, the rate of change of the overall price level in Greece in 2020 and to date has been negative. At the same time, uncertainty about future inflation developments has increased, as evidenced *inter alia* by field surveys for the euro area.[1] Heightened economic uncertainty affects the economic decisions of individuals and firms, potentially having a significant negative impact on economic activity and hampering the conduct of economic policy. Accordingly, uncertainty about inflation may be a hindrance to monetary policy-making, potentially reducing its effectiveness to the extent that it may directly affect the level of inflation.

Current uncertainty about inflation reflects diverging trends in the economy. Both households and businesses show significantly reduced consumption, on the one hand because social distancing measures turn consumption into a challenging task and on the other due to a large drop in incomes in several sectors, part of which may not be temporary. At the same time, savings have risen substantially, due to the containment measures that increased both forced and precautionary savings, with a deflationary impact on the economy. On the other hand, there are concerns that the adoption of numerous one-off expansionary monetary and fiscal policy measures during the pandemic may create inflationary pressures when the economy gradually picks up. Therefore, the question arises as to whether uncertainty about the course of inflation affects inflation as such and, if so, what are the mechanics of this impact.

The relationship between inflation uncertainty and inflation has been repeatedly examined, both theoretically and empirically. Cukierman and Meltzer (1986) were the first to argue that inflation uncertainty may affect the level of inflation.[2] According to their model, the monetary authority aims for some degree of uncertainty, which it then utilises to stimulate economic activity. By contrast, based on Holland (1995), the relationship may be reverse, as the monetary authority may choose to take more drastic measures to bring inflation close to the targeted level when it realises that inflation uncertainty is high, acknowledging its negative impact.[3] These two theoretical hypotheses have been examined empirically, with mixed results.[4] For Greece, the issue has been explored by Balfoussia and Gibson (2010) for the period 1981-2008; they conclude that causality runs from inflation to inflation uncertainty, rather than *vice versa*.[5]

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

2 See Cukierman, A. and A. Meltzer (1986), "A theory of flexibility, creativity and inclusions under dissemination and asymmetric information", *Econometrica*, 54, 1099-1128.

3 See Holland, S. (1995), "Inflation and uncertainty: Tests for temporal ordering", *Journal of Money Credit and Banking*. 27, 82-837.

4 For example, Grier and Perry (1998) conclude that inflation uncertainty reduces the average level of inflation in the United Kingdom, the USA and Germany, confirming the Holland hypothesis (1995). Fountas (2010) identifies a positive relationship for 11 developed economies. However, Grier and Perry (2000), Fountas (2010) and Kontonikas (2004) fail to identify a statistically significant relationship for a number of countries. In a more recent study, Fuest and Schmidt (2017) find a positive relationship between inflation uncertainty and inflation levels for the USA, while Barnett et al. (2020) empirically confirm Holland's hypothesis for some countries, using a sample that also involves periods of deflation (see Barnett, W., F. Jawadi and Z. Ftiti (2020) "Causal relationships between inflation and inflation uncertainty", *Studies in Nonlinear Dynamics & Econometrics*, De Gruyter, vol. 24(5), 1-26; Fuest, A. and T. Schmidt (2017), "Inflation Expectation Uncertainty, Inflation and the Output Gap", RUHR Economic Paper No. 673; Fountas, S. (2010), Inflation, Inflation Uncertainty and Growth: Are They Related?, *Economic Modelling*, 27 (5); 896-899, Grier, K.B. and M.J. Perry (1998), "On Inflation and Inflation Uncertainty in the G7 Countries", *Journal of International Money and Finance*, 17(4), 671-689; Grier, K.B. and M.J. Perry (2000), "The effects of real and nominal uncertainty on inflation and output growth: some GARCH-M evidence", *Journal of Applied Econometrics*, 15, 45-58; Kontonikas, A. (2004), "Inflation and Inflation Uncertainty in the United Kingdom, Evidence from GARCH Modelling", *Economic Modelling*, 21 (3): 525-543; Karanasos, M. and S. Schurer (2008), "Is the Relationship between Inflation and Its Uncertainty Linear?", *German Economic Review*, 9(3), 265-286.

5 See Balfoussia, H. and H. Gibson (2010), "Inflation and nominal uncertainty: the case of Greece", Bank of Greece, *Economic Bulletin*, No. 33, 63-78.

This box examines the relationship between inflation uncertainty and inflation in the Greek economy, both before and during the COVID-19 pandemic. Uncertainty about inflation is not directly measurable. It is often proxied by a simple ex-post calculation of inflation variance over a certain period of time, which however does not reflect any time variation in the degree of uncertainty. Alternatively, one may consider the deviation of inflation from earlier inflation forecasts made by market participants for the period under review (i.e. the forecast error), or the deviation between alternative inflation forecasts. However, these approaches are inadequate, in the sense that they do not reflect fluctuations in inflation uncertainty over the business cycle.[6] A technically preferable approach is to estimate the time-varying inflation uncertainty from the underlying data on inflation.

The methodology used in this box is based on the estimation of a univariate model, in which parameters are time-varying and inflation uncertainty, as proxied by its logarithmic stochastic volatility, is introduced as an explanatory variable in the mean equation of inflation (time-varying parameter stochastic volatility in mean model, TVP-SVM). The model is based on the model of Chan (2017), developed to examine the relationship between inflation and nominal uncertainty, and allows us to estimate time-varying inflation uncertainty using inflation data, while at the same time the estimate of inflation uncertainty is employed as an explanatory variable, driving inflation.[7] Thus, we can examine whether the impact of uncertainty on inflation changes over time, and also focus on the recent period covering the COVID-19 health crisis.

The seasonally adjusted (by the Tramo-Seats method) quarterly harmonised index of consumer prices (HICP) (see Chart A) will be used to estimate the model.[8] The sample spans twenty-five years, from January 1996 to March 2021 and covers all stages of the business cycle, significant shifts in monetary policy and several periods characterised by increased nominal and real volatility.

As seen in Chart A, uncertainty about price developments reaches its highest levels during the global financial crisis and the Greek sovereign debt crisis. After a second period of relatively heightened uncertainty, which peaked with the adoption of capital controls, a rapid decline in inflation uncertainty was registered, with the Greek economy gradually returning to positive growth and inflation recording positive levels. However, this favourable trend was interrupted by the outbreak of the COVID-19 pandemic; this, again, led to a new significant increase in inflation uncertainty which, however, appears to be decelerating during the last months of the sample.

The time-varying estimated coefficient of inflation sensitivity to inflation uncertainty (see Chart B) reflects how a given level of uncertainty affects the rate of increase of the price level.[9] The impact of uncertainty on inflation is mostly statistically non-significant. At the beginning of the sample, the estimated sensitivity coefficient appears to be positive and statistically significant for a limited period of time, arguably reflecting that, prior to the accession of Greece to the EMU, relatively increased inflation uncertainty prevailed, which exerted inflationary pressures. However, a marked structural change seems to have taken place around the global financial crisis, as the coefficient of inflation sensitivity to uncertainty became negative. Over this period, the coefficient is estimated to be statistically significant for two subperiods. The first subperiod extends between the fourth quarter of 2012 and the first quarter of 2016, i.e. before and during the introduction of capital controls, when the economy shrunk

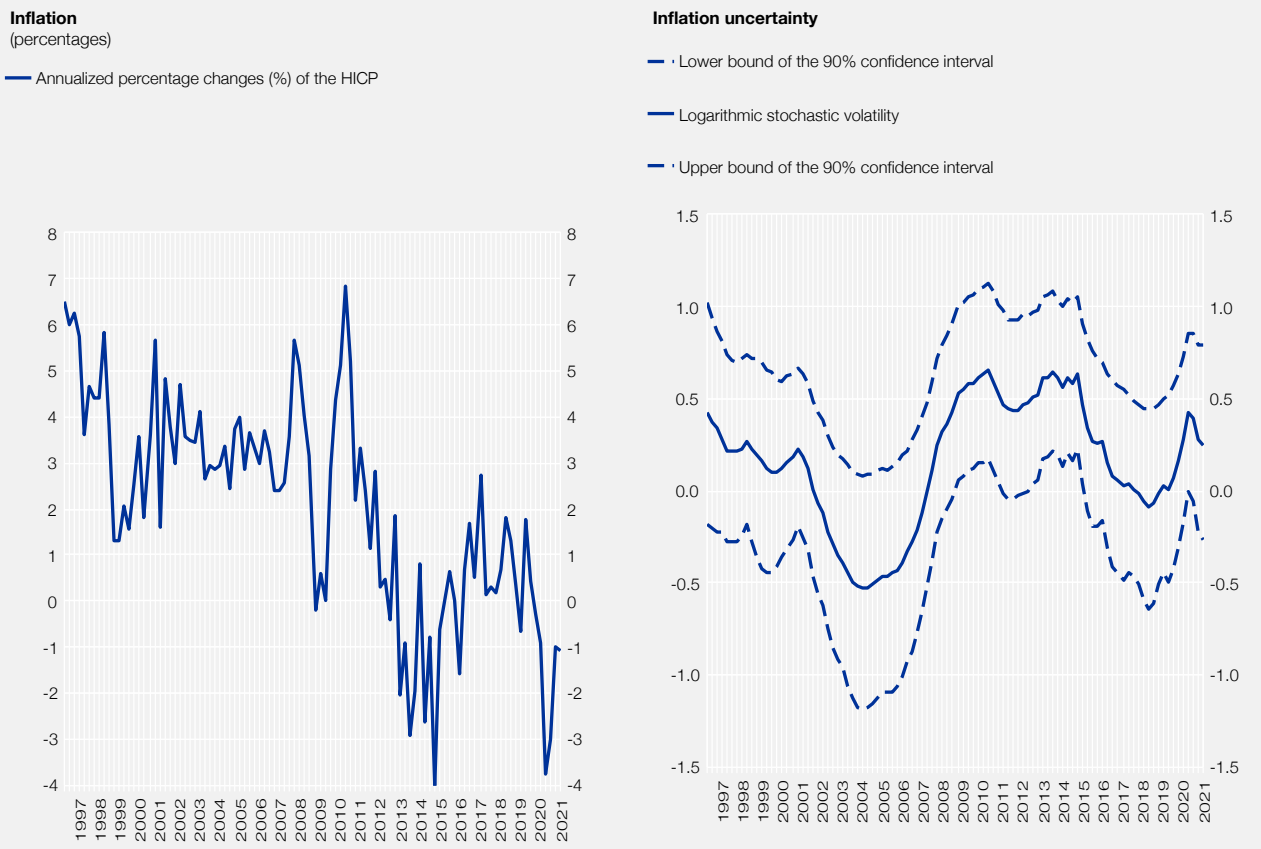
6 See Glas, A. and M. Hartmann (2016), "Inflation uncertainty, disagreement and monetary policy: Evidence from the ECB Survey of Professional Forecasters' Discussion Paper Series, No. 612, University of Heidelberg, Department of Economics, http://dx.doi.org/10.11588/heidok.00020434.

7 See Chan, J.C.C. (2017), "The Stochastic Volatility in Mean Model With Time-Varying Parameters: An Application to Inflation Modeling", *Journal of Business & Economic Statistics*, 35(1), 17-28.

8 In particular, quarterly inflation is calculated using the annualised logarithmic differences in the HICP, i.e. 400×log(pt /pt-1), where pt is the quarterly HICP average at a monthly frequency, as published by ELSTAT.

9 Specifically, the model uses as control variables two time lags in inflation, as well as inflation uncertainty, which is proxied by the stochastic volatility of the residuals, i.e. our model is in the form $p_t = c_t + b_{1,t}\, p_{t-1} + b_{2,t}\, p_{t-2} + \alpha_t\, e^{ln\ uncertainty_t} + \varepsilon_t$. Therefore, a one-point change in uncertainty leads, *ceteris paribus*, to a α_t change in inflation. Based on the estimates presented in the chart, a one-point increase in inflation uncertainty within a quarter may affect, *ceteris paribus*, the rate of change in inflation in the same quarter, with an impact ranging from -2.5 to 1.7 percentage points, depending on the size and the sign of the sensitivity coefficient at the time of the change. It is worth noting that the maximum negative impact is identified in the second quarter of 2020 (-2.5 percentage points).

Chart A Inflation and inflation uncertainty



Sources: ELSTAT and Bank of Greece econometric estimations.

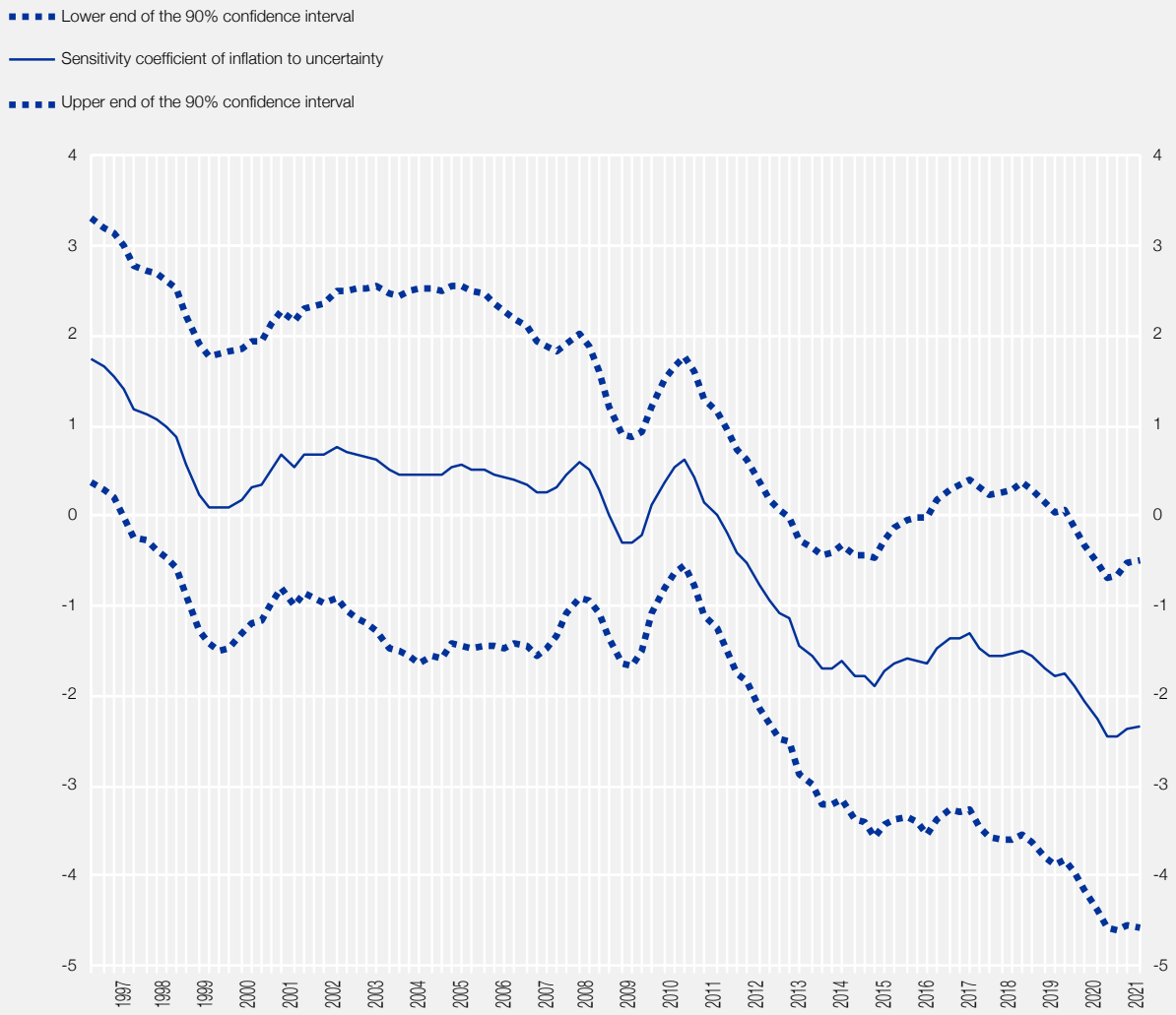
again, and the second, during the current period of the COVID19 pandemic. During these periods, an increase in inflation uncertainty has a statistically significant, negative –i.e. deflationary– impact on the level of inflation.

This finding possibly suggests that recently heightened inflation uncertainty mainly reflects the risk of further deflation (i.e. downside risks) rather than the risk of an unexpected resurgence of inflation, thus triggering a further decline in inflation. The exact mechanism through which inflation uncertainty affects inflation has not been identified, but it might be a feedback mechanism, based on expectations. Acknowledging the risk of further deflation, consumers may function in a way that actually intensifies it, by curbing their consumption and investment spending for precautionary reasons, as they foresee a possible fall in prices and thus an economic contraction. Such a financial behaviour could explain the negative and statistically significant inflation sensitivity coefficient detected in recent crisis periods. Interestingly, such a mechanism can only be seen at work in times when conditions in Greece were characterised by a rapid downturn in economic activity and very negative expectations, rather than in 2008-2009, when the downturn was slower.[10]

Therefore, Eurosystem's systematic effort to steer inflation expectations and reduce inflation uncertainty is important for inflation developments and, in times of strong negative real and nominal expectations, may help prevent a further deterioration of existing recessionary and deflationary conditions. Limiting inflation uncertainty, i.e. establishing confidence in the monetary authority, is in itself a form of expansionary monetary policy against

10 These estimates are in line with relevant earlier findings (see Box IV.1 "Uncertainty and economic activity in Greece", *Bank of Greece Governor's Report for 2020*, p. 108-113) according to which during these periods economic uncertainty contributed to a further decline in economic activity.

Chart B Time-varying coefficient of inflation sensitivity to uncertainty changes



Source: Bank of Greece estimations.

stagnation and deflation, which facilitates the stabilisation of the price level. Therefore, the one-off monetary policy measures taken by the Eurosystem during the pandemic to preserve bank liquidity and the provision credit to the real economy may also be operating by reducing inflation uncertainty. Indeed, they may have contributed to lower uncertainty, but also to the slight decline in inflation sensitivity registered in recent months.

Conclusions

To sum up, inflation uncertainty may at times affect the level of inflation and the impact is time-varying. Inflation uncertainty increased strongly during the pandemic, with a deflationary effect. The introduction of accommodative monetary policy measures by the Eurosystem, coupled with the expansionary fiscal policy measures adopted by the Greek government, appears to have had a positive effect as, recently, a gradual decline in inflation uncertainty is registered, at a time when inflation sensitivity to uncertainty is statistically significant and negative. However, the disruption of economic activity due to the COVID19 pandemic and the resulting uncertainty are expected to persist for several months. While the inflation is expected to gradually start recovering, uncertainty may continue to exert deflationary pressures in the near future.

Box IV.4

THE IMPORTANCE OF SELECTED STRUCTURAL COMPETITIVENESS INDICATORS FOR GREEK EXPORTS: A COMPARATIVE ANALYSIS

Further improving the country's competitiveness is crucial for accelerating growth. In the period 2007-2019, the competitiveness of the Greek economy improved in terms of both relative prices and labour costs because of the policies implemented to address the debt crisis. As a result of this improvement, the country's openness has increased. However, in terms of structural competitiveness, despite the improvement observed in some indicators, Greece still appears to be below the euro area average.

This box presents the evolution of selected structural competitiveness indicators, which record the performance of Greece and euro area countries in various sectors of economic activity over the last decade on an annual basis. It also attempts to empirically explore the relationship between exports and the principal structural competitiveness indicators, according to ranks and scores assigned by international organisations.

Structural competitiveness indicators

a. Trends and recent developments in Greece's main structural competitiveness indicators

When deciding in which country to invest, potential investors, in addition to relative price and unit labour cost competitiveness, also consider qualitative factors that could hinder or facilitate the implementation and profitability of their investment. Such factors include, inter alia, the effective functioning of institutions and justice, economic freedom, market flexibility and corporate taxation. Structural competitiveness indicators reflect the country's current situation, as affected by these factors and the scope of reforms. They also record both the relative ranking and the absolute score of each country. Relative ranking refers to the country's performance in relation to other countries, while the score indicates whether the country's performance is improving or worsening. Moreover, as data collection for the compilation of the indicators is mainly based on business surveys, these indicators are affected by changes in the overall macroeconomic conditions. The structural competitiveness of the Greek economy, although still comparatively low at European and international level, has improved in some areas as, inter alia, business costs for taxation and employer contributions have decreased and the efficiency of the public sector has increased.

For the purposes of this box, indicators were selected based on the extent and frequency of their use in decision making, as well as on data availability.

Structural competitiveness indicators and their sources

- The **World Economic Forum** compiles the composite Global Competitiveness Index (WEF-GCI), organised in 12 pillars (institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labour market, financial system, market size, business dynamism, innovation capability). Although Greece's assessment improved in the latest report for 2019 by 0.5 percentage point, it ranked 59th among 141 countries, two places lower than in the previous report. The best-performing pillars for Greece include health (23rd) and infrastructure (37th), while the weakest ones are still the financial system (115th), due to limited financing to small- and medium-sized enterprises (SMEs) and the situation regarding bank stability and non-performing loans, and the labour market (111th), due to high taxation and limited wage-setting flexibility.

- The **International Institute for Management Development** publishes the composite World Competitiveness Ranking (IMD-WCR) index, consisting of four indicators (economic performance, government efficiency, business efficiency, infrastructure). Greece moved up by 9 positions in 2020, ranking 49th among 63 economies, as the efficiency and, secondarily, the macroeconomic performance and infrastructure indicators improved. The main challenges include broadening the productive base by increasing fixed capital formation, improving firms' access to financing, accelerating digital transformation across the economy, targeted strengthening of dynamic and export-oriented sectors and a more growth-friendly fiscal mix.

- The **World Bank** publishes the composite Ease of Doing Business (WB-EDB) index, consisting of ten pillars (starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, resolving insolvency). According to its latest report (2019), Greece's position deteriorated and it now ranks 79th, from 72nd in 2018. Improvements were recorded in starting a business (WB-SB), protecting minority investors and registering in a business register, while getting credit and enforcing contracts deteriorated.

- The **World Bank's** composite Worldwide Governance Index (WB-WGI) is produced on the basis of six indicators (voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, control of corruption). Greece's performance improved in terms of political stability and absence of violence/terrorism (47th from 51st), as well as regulatory quality (62nd from 75th).

- The **Tax Foundation** compiles the composite International Tax Competitiveness Index (ITCI), which looks at more than 40 tax policy variables. Greece remained at the 29th position, although its performance in absolute terms improved by 2.5 percentage points due to reductions in corporate and dividend tax rates. By contrast, low performance is recorded in consumption and real estate taxes.

- The **Heritage Foundation** compiles the composite Heritage Economic Freedom index, where Greece ranked 100th among 180 countries, up by 6 positions, mainly due to the improvement in government integrity.

- The **Frazer Institute** compiles the composite Frazer Economic Freedom index, which ranks countries based on five major areas (size of government and taxation, private property and the rule of law, sound money, trade regulation and tariffs, regulation of business, labour and capital markets), in which government policies are assessed. Greece's ranking has improved (92nd from 102nd) in the latest report of 2020.

- **Transparency International** compiles the composite Corruption Perceptions Index (CPI), looking at corruption in the public sector (bribery, diversion of public funds, use of public office for private gain, nepotism in the civil service, state capture), where Greece ranked 59th among 180 countries in 2020, climbing one position since last year's report. However, since 2012 it has recorded the highest cumulative improvement (by 14 places). Countries performing well in this index invest more in health services and are less likely to break democratic rules.

- The **Legatum Institute** compiles the composite Legatum Prosperity Index, consisting of twelve pillars (safety and security, personal freedom, governance, social capital, investment environment, enterprise conditions, market access and infrastructure, economic quality, living conditions, health, education, natural environment), in which Greece climbed one place (from 42nd to 41st) according to the latest data for 2020.

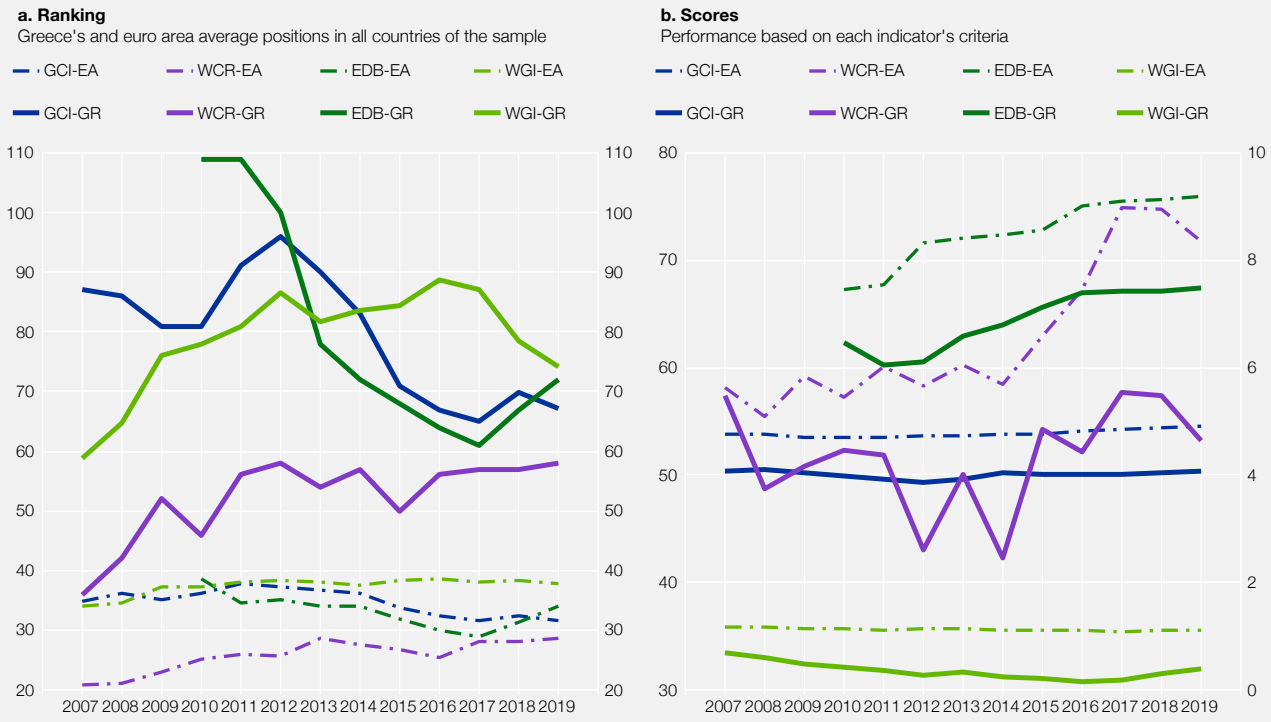
b. Comparison with the euro area average

Over time, Greece has lagged behind other euro area countries in the principal structural competitiveness indicators, with a lower (higher) value corresponding to a better (worse) ranking (see Chart Aa). Actually, while the indicators for euro area countries do not fluctuate sharply on average, in the case of Greece they deteriorated substantially during the financial crisis and recovered gradually thereafter. As expected, euro area countries score higher than Greece, with a higher (lower) value pointing to a better (worse) score (see Chart Ab). Chart B shows Greece's position in the principal structural competitiveness indicators based on its ranking and score in relation to the euro area average, as well as its distance from the country at the top or the bottom. With the exception of governance indicators, Greece's ranking is lower than the euro area average, while in several indicators the country ranks among the last in the euro area, despite the progress made in recent years. The difference between ranking and scoring shows the speedier implementation of reforms in other euro area countries.

Correlation between the evolution of Greek and euro area exports and the main structural competitiveness indicators – empirical analysis using panel regression

The purpose of the analysis that follows is to investigate the impact of the principal structural competitiveness indicators on exports and explain their respective effects. The link between exports (of goods and services) and

Chart A Evolution of the main structural competitiveness indicators for Greece and the euro area average based on their ranking and scores (2007-2019)



Sources: World Economic Forum - The Global Competitiveness Report, Institute for Management Development - The World Competitiveness Ranking, IFC-World Bank Group - Ease of Doing Business, The World Bank - The World Governance Indicators.
Note: GCI: global competitiveness index; WCR: world competitiveness ranking indicator; EDB: ease of doing business index; WGI: worldwide governance indicators.

structural competitiveness was explored by estimating nine equations (as many as the indicators examined).[1] The empirical estimation concerns the 19 euro area countries and the period 2007-2019. At the same time, to ensure comparability, same-type equations were estimated separately for Greece, in order to examine differences in the exports/competitiveness relationship between Greece and the euro area countries.

The empirical analysis adopts a panel regression method. Logarithmic functions are used, so that the coefficients derived from the estimation are elasticities. A general conclusion is that an improvement in the countries' ranking according to composite competitiveness indices has a favourable effect on exports.[2] Chart C shows the estimated structural competitiveness coefficients classified according to ranking (section (a) of the chart) and scoring (section (b) of the chart for the euro area and Greece. The effect is found to be inelastic, as the value of most of the estimated coefficients is below one. In more detail, a given percentage improvement in scoring or ranking leads, with few exceptions, to a lower percentage increase in exports (in the euro area as a whole, but also in Greece). More specifically, an average 1% improvement in the indicators examined for all 19 euro area countries over the reviewed period leads to a 0.8% increase in exports. In other words, the response of exports to improved competitiveness is lower than the initial improvement in the structural competitiveness indicator. For Greece separately, the response of exports, for all indicators on average, is roughly equal to the initial improvement in the

1 In the equations, the dependent variable is export volumes and the independent variables are external demand and a given structural competitiveness indicator. The box only presents the estimated competitiveness indicators' coefficients (see Chart C), since, for the purposes of this box, the analysis focuses on their impact on exports.

2 When ranked according to scores, the indicator is in positive territory (higher score, more exports) while, when ranked according to position, the indicator is in negative territory (farther from the top, less exports). Exceptions include the ease of doing business (WB-EDB) and starting a business (WB-SB) indicators, since the score is defined as the distance from the best score, and the higher the rank, the more entrepreneurship is favoured, thereby reversing the signs of the scoring and ranking coefficients.

Chart B Greece's position in the main structural competitiveness indicators based on ranking and scores in relation to the euro area average and its distance from the top or bottom (2007-2019 average)

Sources: World Economic Forum - The Global Competitiveness Report, Institute for Management Development - The World Competitiveness Ranking, IFC-World Bank Group - Ease of Doing Business, The World Bank - The World Governance Indicators, Heritage Foundation - Index of Economic Freedom, Frazer Institute - Economic Freedom of the World, Transparency International - Corruption Perception Index, The Legatum Institute - Prosperity Index, Tax Foundation - International Tax Competitiveness Index.
Note: WEF-GCI: global competitiveness index; IMD-WCR: world competitiveness ranking indicator; WB-EDB: ease of doing business index; WB-WGI: worldwide governance indicators; WGI-V/A: voice and accountability; WGI-PS/AV/T: political stability and absence of violence/terrorism;, WGI-Geff: government efficiency; WGI-RegQ: regulatory quality; WGI-RuleofLaw: rule of law; WGI-CofCorr: control of corruption; Heritage-Ec.Freed.: Heritage Foundation's economic freedom indicator; Frazer-Ec.Freed.: Frazer Institute's economic freedom indicator; Transp.I-CPI: corruption perceptions index; Legatum-Prosp.I: prosperity index; TaxFound.-ITCI: international tax competitiveness index.

indicators.[3] The comparison of the panel coefficients, for the 19 euro area countries and those calculated for Greece, as demonstrated in Chart C, shows that those corresponding to Greece are higher in absolute terms for all categories of indicators examined. This is explained by the fact that, due to Greece's weak position, any improvement in structural competitiveness has a higher marginal impact on its exports than that in euro area countries whose structural competitiveness is already high. These results show that improved structural competitiveness is linked to growth and openness in euro area countries and, *a fortiori*, Greece. They also confirm the positive contribution of reforms in Greece and facilitate the formulation of recommendations for a national strategy for further innovation and growth.

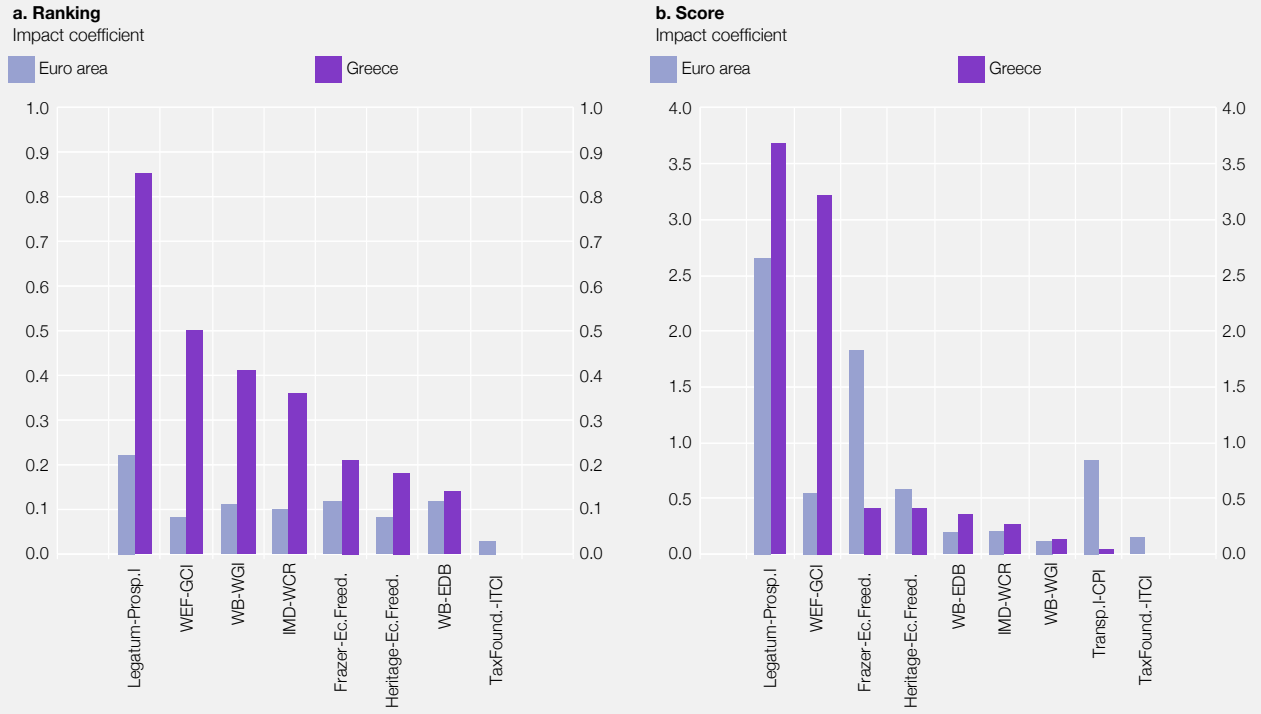
Conclusions – Policy recommendations

The structural competitiveness of the Greek economy, although still low, has improved. However, the pace of implementation of reforms falls short of other euro area countries, so that any improvement does not allow Greece to catch up with its competitors. Especially during the financial crisis, Greece's comparative position declined in many international rankings. Many of the difficulties that prevent business and investment decisions remained in place after the crisis, mainly concerning taxation, non-wage labour costs, energy costs, financing costs and the institutional framework.

The results of the estimates show that exports respond to the principal composite structural competitiveness indices for the euro area as a whole. For Greece in particular, the corresponding export dependence is higher, confirming the improvement in its competitive position, and is linked to higher exports and the increasing openness of the economy. The use of available EU funds through Next Generation EU is an important opportunity

3 This highlights that, for Greece's openness, it is very important to improve the factors measured by the structural competitiveness indicators, thereby reflecting improvements in the business environment and the functioning of institutions.

Chart C Impact coefficients of each structural competitiveness indicator on the volume of euro area's and Greece's exports, 2007-2019



Sources: The Legatum Institute - Prosperity Index, World Economic Forum - The Global Competitiveness Report, The World Bank - The World Governance Indicators, Institute for Management Development - The World Competitiveness Ranking, Frazer Institute - Economic Freedom of the World, Heritage Foundation - Index of Economic Freedom, IFC-World Bank Group - Ease of Doing Business, Tax Foundation - International Tax Competitiveness Index, Transparency International - Corruption Perception Index.
Note: Legatum-Prosp.I: prosperity index; WEF-GCI: global competitiveness index; WB-WGI: worldwide governance indicators; IMD-WCR: world competitiveness ranking; Frazer-Ec.Freed.: Frazer Institute's economic freedom indicator; Heritage-Ec.Freed.: Heritage Foundation's economic freedom indicator; WB-EDB: ease of doing business indicator; TaxFoundation-ITCI: international tax competitivess index; Transp.I-CPI: corruption perceptions index.

that should not be missed. This will accelerate reform efforts, which will also be reflected in structural competitiveness indicators, with a positive impact on exports, import substitution, the country's participation in international value chains and the consequent strengthening of investment and economic growth.

Box V.1

THE EFFECT OF THE EUROSYSTEM'S ASSET PURCHASE PROGRAMME ON EURO AREA SOVEREIGN BOND YIELDS DURING THE COVID-19 PANDEMIC

The Eurosystem's Asset Purchase Programme (APP) is part of a broader set of accommodative non-standard monetary policy measures initiated in mid-2014 by the European Central Bank (ECB) in response to low inflation and weak growth. These asset purchases, often referred to as quantitative easing (QE), were launched against the background of historically low interest rates worldwide following the global financial crisis and have also been used by other major central banks, namely the Federal Reserve, the Bank of England and the Bank of Japan. The APP involves public and private sector securities purchases[1] and aims at strengthening liquidity in the economy in order to facilitate the achievement of the ECB's inflation target of close to, but below, 2%. As the Treaty on the Functioning of the European Union prohibits monetary financing, the purchase of government bonds by the Eurosystem as part of its mandate is possible only on the secondary market and subject to specific rules and restrictions.[2] The ECB has announced that it expects asset purchases to run for as long as necessary to reinforce the accommodative impact of its policy rates, and to end shortly before it starts raising the key ECB interest rates.[3]

In March 2020, the Eurosystem's asset purchase programme was expanded following the COVID-19 outbreak, with the launch of the Pandemic Emergency Purchase Programme (PEPP). The PEPP is a temporary asset purchase programme of private and public sector securities, with an initial envelope of €750 billion, which was subsequently increased by €600 billion in June 2020 and by a further €500 billion in December 2020, bringing the total to €1,850 billion.[4] The programme also includes purchases of Greek government bonds, which are not eligible under the APP.[5] The ECB has announced that it will terminate net asset purchases under the PEPP once it judges that the COVID-19 crisis phase is over, but in any case not before the end of March 2022.[6]

This box explores the effect of the ECB's APP on the 10-year sovereign bond yields of 11 euro area countries.[7] In view of the temporary nature of the APP, quantifying its effects on Member States' borrowing costs is important for assessing the likely implications of its termination.

Empirical investigation method

The analysis is based on time-varying parameter methods, which allow us to zoom in to the period between January and December 2020, covering the outbreak of the COVID-19 pandemic and the launch of the PEPP.[8] Monthly panel data covering the period from September 2004 to December 2020 are used in the analysis.

In particular, 10-year government bond yields are estimated as a time-variable function of the following explanatory variables: the short-term risk-free rate (measured by the EONIA overnight rate); the slope of the yield curve (measured by the spread between the 10-year and the one-year bonds of AAA-rated euro area sovereigns); the debt-to-GDP ratio; the unemployment rate; a global risk factor (measured by the logged VIX index);[9] an indicator capturing the role of liquidity of the assets considered (measured as the volume of gross debt in euro at country

1 Private sector securities purchases include covered bonds, corporate bonds and asset-backed securities.
2 Article 18.1.
3 Press release "Monetary policy decisions", ECB, 12 September 2019.
4 For more information, see Bank of Greece (2021), *Annual Report 2020*, Chapter III.
5 Under the APP, government bonds below investment grade issued by countries that are not subject to an ESM programme are not eligible.
6 Press release "Monetary policy decisions", ECB, 10 December 2020.
7 Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal and Finland.
8 For more information, see Hondroyiannis, G. and D. Papaoikonomou (2021), "The effect of Eurosystem asset purchase programmes on euro area sovereign bond yields during the COVID-19 pandemic", Bank of Greece, Working Paper, forthcoming.
9 Chicago Board Options Exchange (CBOE) Volatility Index.

Decomposition of changes in 10-year sovereign bond yields between January and December 2020

(basis point contributions)

Source: Bank of Greece estimates.
Note: The estimated residuals are too small to be discernible in this chart.

level relative to the euro area total); the aggregate value of securities held by the Eurosystem for monetary policy purposes (APP); and the average credit rating by Moody's, Fitch and S&P.

A positive effect on the 10-year bond yield may generally be anticipated from increases in the risk-free rate, the yield slope, debt and the unemployment rate, while a negative effect can be expected from higher liquidity, increased APP and improved credit rating. The effect of an increase in global risk can be either positive or negative, the latter suggesting a safe haven status for specific government bonds.[10] In contrast to fixed-coefficient models, where the sensitivity of government bond yields to the explanatory variables does not vary over time, the present empirical analysis distinguishes between influences related to fundamentals, on the one hand, and markets' perceptions of risk, on the other.

Results of the empirical investigation

The chart depicts the estimated contribution of each determinant to the change in yields between January and December 2020. The changes in yields, denoted by the blue dots, indicate that during 2020 there was a decline for all countries, which was more pronounced for Italy and Greece, where yields declined by around 80 bps. Positive contributions, mainly from public debt, were more than offset by the downward effect of predominantly the asset purchase programmes, with Greece estimated to benefit the most. In the course of 2020, asset purchase programmes contributed an average of 76 bps to the decline in yields. In December 2020, the effect per unit of asset purchases[11] ranged between 34 bps in Germany and 159 bps in Greece. The APP's stronger downward effects are concentrated in the periphery countries and are estimated to be inversely proportional to credit

10 D'Agostino, A. and M. Ehrmann (2014) report safe haven effects for Germany using a stochastic volatility TVP model of 10-year bond spreads in G7 countries, with time-varying coefficients modelled as driftless random walks. See D'Agostino, A. and M. Ehrmann (2014), "The pricing of G7 sovereign bond spreads – The times, they are a-changin", *Journal of Banking and Finance*, 47, 155-176.

11 The unit of measurement of the APP variable is EUR trillion.

ratings.[12] However, these marginal effects tend to decrease in absolute terms over time. Moreover, the upward effects of the debt-to-GDP ratio in the course of 2020 do not so much reflect increases in the level of debt, but instead indicate an increased market perception of sovereign debt risk. In this respect, it is estimated that markets partly repriced this risk in June and in subsequent months, following the announcement of the extension of the PEPP. Finally, it is confirmed that global risk has heterogeneous effects across euro area countries. The large increases in global risk in February and especially in March had a strong upward effect on yields in the periphery countries and a downward effect in core countries. This effect is estimated to be inversely proportional to credit ratings.[13]

Conclusions

The above findings indicate that the ECB's asset purchase programmes have a downward effect on euro area bond yields. Therefore, a sharp decline in the size of these programmes in the aftermath of the COVID-19 crisis would lead, ceteris paribus, to significant increases in government bond yields, particularly in the periphery countries. In addition, our analysis confirms the importance of continued commitment to improving the fundamentals of the Greek economy, as it can help contain the anticipated upward pressures on borrowing costs as inflation returns close to 2% and the monetary policy stance shifts. A permanent increase in the potential growth rate of the Greek economy, through the efficient use of Next Generation EU (NGEU) funds, could support both a reduction in unemployment and a long-term decrease in the public debt-to-GDP ratio. Moreover, a strengthening of economic fundamentals may lead to a further upgrade in Greece's sovereign credit rating, which is estimated to improve markets' perception of the country's exposure to international shocks.

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12 Findings are consistent with the results presented in a recent event study analysis based on daily data by Fendel and Neugebauer (2020), "Country-specific euro area government bond yield reactions to ECB's non-standard monetary policy announcements", *German Economic Review*, 21(4), 417-474.

13 Risk perception is found to be a statistically significant function of sovereign credit ratings in Georgoutsos, D. A. and P. M. Migiakis (2018), "Risk perceptions and fundamental effects on sovereign spreads", Bank of Greece Working Paper No. 250, and Malliaropulos, D. and P. Migiakis (2018), "Quantitative easing and sovereign bond yields: a global perspective", Bank of Greece Working Paper No. 253.

Box VI.1

DIGITAL FINANCE: THE EUROPEAN COMMISSION'S PACKAGE

The term "Digital finance" indicates the effects of new technologies on the provision of financial services. It is now evident that the future of financial services is digital, with more and more consumers and businesses using new technology to access financial services. Start-ups, existing financial institutions (incumbents) or big-techs using state-of-the-art digital technologies offer new solutions to existing financial problems. The regulatory framework is a key factor in supporting new solutions, insofar as it addresses the emerging risks and challenges. The need for regulatory intervention is all the more evident since it is widely accepted that, during the pandemic, new technologies kept businesses and public services operational, ensured continuity of trade and enabled consumers to access services and goods. It should be also noted that, among pandemic recovery measures,[1] the deepening of the single market digital transformation is predominant.

The European Commission enacted a structured initiative, with the adoption of a Digital Finance Package. This initiative aims to introduce a comprehensive regulatory framework for financial services fit for the digital age, so as to create a competitive EU financial sector that facilitates access to innovative financial products while ensuring consumer protection and financial stability. The aim is to digitally modernise the European economy across sectors and make Europe a global player in digital technology.

The package consists of five pillars: the digital finance strategy,[2] the retail payments strategy,[3] a proposal for a regulation on crypto-assets,[4] a pilot project on market infrastructures using distributed ledger technologies (DLT)[5] and a proposal for a regulation on digital operational resilience for the financial sector.[6]

Digital finance strategy

The Digital Finance Strategy sets out general guidelines on how the digital transformation of finance can be supported, with the following main priorities:

- removing fragmentation in the digital single market;
- adapting the regulatory framework to facilitate digital innovation; and
- promoting data-driven innovation, built on data sharing.

For tackling market fragmentation, the aim is to facilitate consumers' access to cross-border services, e.g. by introducing a framework for managing digital identities in different operating systems across the EU or the extension of "passporting" for digital services not covered by the existing framework (e.g. non-bank lending). With regard to the adaptation of the regulatory framework, the aim is to ensure that new technological tools are reviewed on an on-going basis, that there are no new obstacles for further digitalisation and that are used fairly and equitably. To that end, the strategy is complemented by a specific regulatory framework, such as the new proposal on artificial intelligence.[7]

1 European Commission, (2020), "Europe's moment Repair and Prepare for the Next Generation", May, COM (2020) 456 final.
2 European Commission, (2020), 'Digital Finance Strategy for the EU', September, COM (2020) 591 final.
3 European Commission, (2020), "Retail Payments Strategy for the EU" September, COM (2020) 592 final.
4 European Commission, (2020), "Proposal for a Regulation on Markets in Crypto-assets", September, COM (2020) 593 final.
5 European Commission, (2020), "Proposal for a Regulation on a pilot regime for market infrastructures based on distributed ledger technology", September, COM (2020) 594 final.
6 European Commission, (2020), "Proposal for a Regulation on digital operational resilience for the financial sector", September, COM (2020) 595 final.
7 The European Commission has published a proposal for a regulation on the ethics of artificial intelligence. For example, AI systems that pose a threat to people's safety, living conditions and fundamental rights are considered to create an unacceptable risk and are prohibited. These include, but are not limited to, practices that have a potential to manipulate human behaviour, apps that circumvent free choice, as well as practices that allow "social scoring" by public authorities. Specific strict restrictions apply for the use of certain high-risk AI systems, e.g. biometric identification. See European Commission (2021), "Laying down harmonised rules on artificial intelligence", April, COM(2021) 206 final.

It should be noted that the framework as a whole is based on the principle of technological neutrality, i.e. the establishment of common rules to be applied independently of the provider of the innovative solution, adopting an equal opportunities policy. This is the "same activity, same risk, same rules" principle.

Many proposals are in line with the Capital Markets Union Action Plan,[8] as innovative companies need funding that capital markets can primarily provide, especially as regards start-ups that usually lack the collateral required for bank loans. Another feature of the CMU is the development of infrastructures that facilitate access to available data sources and enhance their interoperability at the EU level. This requires the development of digital skills that enable the promotion and adoption of new technologies and their accessibility, which reinforces the need to deepen the Capital Markets Union. In a broader sense, as the digital financial sector eliminates borders, it allows for a faster integration of financial markets in both the Banking Union and the Capital Markets Union.

Also, many of the proposals are part of the extension of "open banking" towards "open finance", where the possibility for sharing data on payment accounts can be extended to other financial instruments. Acting as a catalyst for "open banking", the Payment Services Directive (PSD2)[9] is a significant step forward on the exchange and use of data, subject to customer approval, by banks and third-party providers in order to create new services. Extending access to customer data enables existing and new providers to offer more individualised services that are better tailored to customer profiles and needs.

Retail Payments Strategy for the EU

The retail payments sector is at the forefront of digital innovation in the financial sector, as the pace of technological change is rapid and large-scale. The strategy aims to broaden the range of the single payments market and develop solutions across borders, so that consumers can benefit from the advantages of digitalisation and mitigate the market power of large technology providers who, taking advantage of their vast customer base, are able to offer solutions that supersede those that are based on national borders.

The action plan is developed in four interlinked pillars covering the main components of the payments ecosystem. The first pillar is related to the promotion of cross-border EU payment solutions. The main strategy is to implement the "instant payments" process, i.e. funds are immediately and irrevocably available to the payee. For instant payments to become the "new normal", they must gain consumers' trust, e.g. being able to address the risk of erroneous transactions or fraud and to increase the range of economic entities accepting digital payments.

The second pillar focuses on the security of payment transactions, which is a key component for consumer confidence. Emphasis is put on strict customer authentication processes whenever a user initiates an electronic payment or accesses their online banking services. The solutions developed are based on the use of two or more of the following elements: either something that only the user knows, or something only the user possesses, or something the user is (e.g. biometrics). However, as new types of fraud keep appearing, along with strong customer authentication, payment service providers should always be at the cutting edge of fraud detection and prevention, to protect themselves against cyber-attacks.

Furthermore, the attractiveness of end-user solutions depends on interoperability and accessibility of infrastructures, which is the subject of the third pillar, and in efficient international payments, which is the subject of the fourth pillar. Payment services providers should be able to offer to all users innovative payment solutions using all relevant technical infrastructures, without undue restrictions and under fair, reasonable and non-discriminatory terms and access conditions. As regards cross-border payments, the aim is to make them faster and more affordable, accessible, transparent and convenient. This will also strengthen the position of euro as a global currency.

8 European Commission, (2020), "A Capital Markets Union for people and businesses – new action plan", September, COM (2020) 590 final.

9 Bank of Greece Annual Report 2019, Box VI.3, "The 2th Payment Services Directive (PSD2) and its potential effects on the financial system".

Digital operational resilience for the financial sector

The Digital Finance Package includes legislative initiatives on digital operational resilience for the financial sector. It essentially refers to the ability of financial institutions to embed the risks stemming from information and communication technologies (ICT risks) into their risk management processes. The proposal is similar to the operational risk approach under the Basel Committee,[10] but is limited to the analysis of digital operational resilience and does not extend to other sources of risk such as those covered in the Basel Committee principles.

Financial entities are required to set-up and maintain a comprehensive and well-documented ICT risk management framework that matches their business model, size and complexity. In doing so, they should identify all sources of risk on an ongoing basis, monitor, classify and document all risk-related business functions and implement management and control policies by deploying the appropriate strategies, policies, processes, protocols and tools. At the same time, they must put in place a comprehensive business continuity policy and disaster and recovery plans, and implement communication policies. They should also carry out digital operational resilience testing and monitor the risks identified in respect of outsourcing of functions (outsourcing risk). In addition, financial institutions should have an ICT-related incidents reporting and management system. Incidents should be classified on the basis of pre-defined criteria and only ICT-related incidents that are deemed major must be reported to the competent regulatory authorities.

Transformative technologies and crypto-assets

The next two proposals of the Digital Finance Package are innovative and focus on the development of transformative technologies, i.e. technologies with a significant impact on the financial market, such as distributed ledger technology (DLT), the regulatory framework on crypto-assets as well as on the regulatory framework on stablecoins.

Distributed ledger technology proposes a new way on how a transaction is processed and finalised, as it does not require a central counterparty (e.g. a bank) for the validation and authentication. On the contrary, it requires a peer-to-peer network of computers (nodes), eliminating hierarchy and central points of control. The network maintains a public ledger where all transactions are recorded and is accessible to all participants in the network. Validation of transactions requires that participants implement a consensus process, on the basis of a protocol. In other words, the network has no central authority with a private ledger, validating and recording transactions.

The most widespread form of distributed ledger technology is blockchain, in which the transactions are held in the form of blocks which are attached into a chain, thus forming a blockchain. The integrity of the system relies on cryptography, i.e. computer-based encryption techniques. Blockchain technology, although originally linked to the creation of the bitcoin cryptocurrency, has subsequently become independent, enabling the trading, sale or exchange of digital assets. The rights or obligations attached on the asset are transformed into a digital units (tokens), thus creating a crypto-asset.

The digitalisation of assets has been a major development in recent years; however, within the European Union, market infrastructures using DLT technology are limited and it is not always possible to determine whether the regulatory framework acts as an impediment to it. To facilitate market developments as well as to advance the further use of technology, it was considered appropriate to create a pilot regime for market infrastructures, i.e. platforms[11] where financial instruments in crypto-asset form are traded and settled, where, under certain limitations, exemptions from certain regulatory framework requirements are allowed. The solution constitutes the so-called “sandbox” approach,[12] where it is examined whether the existing rules hamper the adoption of new

10 Basel Committee on Banking Supervision (2021), “Principles for operational resilience”, March. Operational resilience is defined as the ability of a bank to continue its critical functions in times of stress.

11 Market infrastructures are defined as either a DLT multilateral trading facility or a DLT securities settlement system operated by a “Central Securities Depository”.

12 Regulatory sandboxes enable FinTech providers to test innovative technology solutions with the support of an Authority for a limited period of time in order to be able to validate and test their business model in a safe environment. See European Banking Authority, (2017) Discussion Paper on the EBA’s approach to financial technology (FinTech), August, EBA/DP/2017/02.

technologies. Temporary derogations from existing regulations are allowed in order to gain experience on the use of distributed ledger technology, highlight regulatory gaps and investigate whether investor protection, market integrity and financial stability are ensured. It is an important step towards removing barriers, before more permanent rules are adopted. More generally, this initiative is expected to foster the primary and secondary crypto-assets market, enhance legal certainty for users, facilitate further blockchain platform application by transforming traditional financial instruments into digital tokens, and contribute to the wider use of DLT in financial services.

The proposal for a Regulation on markets in crypto-assets is closely linked to the above.[13] Due to the uncertainty associated with crypto-assets, they cannot unequivocally qualify as financial instruments[14] covered by the existing regulatory framework. The Commission's proposal thus refers to crypto-assets that fall outside the current definition of financial instruments and, therefore, are not currently covered by the EU framework for financial services. These include utility tokens and stablecoins, which have emerged from cryptocurrencies.

Cryptocurrencies are the oldest and best known examples of crypto-assets. They use blockchain technology and are designed as a means of exchange and a store of value within their designated platform. Among the various cryptocurrencies launched, bitcoin is dominant, the most recognisable and with the largest market share. The original expectations of its creators were for it to become a means of exchange, alongside traditional currencies, suggesting a new way of trust among participants without the intermediation of a central bank. However, due to high price volatility, this expectation was not fulfilled. Stablecoins emerged as a new form of cryptocurrencies that aims to maintain a stable value, typically backed by a pool or basket of assets. Stablecoins are complex arrangements and comprise many interdependent functions and legal entities.[15]

For the purposes of the Regulation, crypto-assets are divided into three sub-categories:[16]

– utility token: a type of crypto-asset which is intended to provide digital access to a good or service, available on DLT, and is only accepted by the issuer of that token;

– asset-referenced token: a type of crypto-asset that seeks to maintain a stable value by referencing to currencies that are legal tender, commodities or other crypto-assets;

– e-money token: a type of crypto-asset that maintains a stable value by referencing to one fiat currency.

The issuance of all the above crypto-assets is converted into a regulated activity, which means that it is subject to licensing requirements.

It is proposed that providers of utility tokens be subject to EU law and benefit from passport arrangements. In line with the prospectus requirements for non-DLT securities issuers, before the tokens are offered to the public or admitted to trading on a trading platform, a white paper must be published, containing a detailed description of the issuer and the issue, a detailed description of the offer, the rights and obligations attached to the tokens, information on the underlying technology and a description of the related risks. The white paper must also contain a detailed justification why they do not qualify as financial instruments under MiFID. The difference from the

13 Crypto-assets are digital assets representing a value, a right or an obligation on a blockchain platform. The objective of digital representation is the development of embedded applications so that they can be traded, sold or exchanged. See Bank of Greece, *Annual Report 2019*, Box III.2 "Crypto-assets: Recent developments and potential implications for the financial sector".

14 The financial instruments are clearly defined in Directive 2014/65/EU (MiFID II), which does not include those created by distributed ledger technology. A new definition is proposed in the amendments included in proposal COM (2020) 596 final.

15 The intention of Facebook (Libra and currently Diem) to create a stablecoin by exploiting its vast network effects has mobilised central banks to create a digital currency. The aim is to combine new transformative technologies with the traditional trust in central banks. See European Central Bank 2020, "Report on a digital euro", October.

16 It is implied that the investment token falls within the existing provisions of EU legislative framework and is not subject to further regulation. There is no reference to cryptocurrencies, which remain unregulated.

prospectus is that approval by the competent regulatory authority is not required prior to the publication of the white paper, but it must be notified at least 20 working days before its publication.

Stablecoin issuers are subject to more stringent requirements and specific rules aimed at addressing the associated risks. In addition to the obligation to publish a white paper, licencing by the competent authorities is also required when the outstanding amounts exceed certain limits. Crypto-asset services providers must also comply with capital and corporate governance requirements, establish a complaint handling procedure and rules on conflict of interest, custody of reserve assets, etc. In particular, e-money token issuers are authorised credit institutions or e-money institutions and should publish a white paper and notify it to the relevant competent authority. Moreover, where a provider is classified as systemically significant, it is subject to enhanced regulation and oversight.

Conclusions

The Digital Finance Package is an ambitious effort by the European Commission to accelerate the digital transformation by 2024. It is expected to affect both the regulatory framework and the way financial institutions operate in the coming years. Similar actions have been taken in other developed economies. As the digitalisation of financial services provision is a dynamic phenomenon, it is expected that further interventions will be required. But the path is irreversible and the intended regulatory intervention is expected to have a positive impact on consumers and contribute to financial stability.

Box VI.2

DIGITAL FINANCIAL INCLUSION

The need to promote digital financial literacy

According to literature, financial literacy[1] is a key factor for financial inclusion, which in turn can contribute to lower income inequality and stronger financial stability.[2] However, several studies show that many people do not have adequate basic economic knowledge for e.g. calculating or understanding interest rates, or comprehending inflation and risk diversification.[3] Financial illiteracy, i.e. the lack of such basic knowledge, can prevent consumers from managing their finances, with ultimately negative consequences such as excessive borrowing and financial exclusion. In general, financially literate individuals (a) are less vulnerable to exploitation or fraud; (b) are less prone to excessive borrowing; (c) are more effective in pension planning; and (d) participate more frequently in financial markets.[4]

At the same time, the introduction of new financial technologies has changed the way consumers make their banking transactions and payments of all kinds, make financial decisions or seek financial advice. Increased access to digital financial services and the use of innovative financial products and apps could provide new opportunities for businesses and consumers, enhancing the level of financial inclusion. On the other hand, increased access involves risks unless combined with adequate levels of financial education. The effective use of digital financial products and services therefore requires increased levels of digital financial literacy and this crucially hinges on people's familiarity with new technologies.[5,6]

Financial literacy is becoming increasingly important, and raising its level –along with improving consumers' digital competence to manage issues arising in the context of the digitalisation of the financial sector– has been recognised as a top priority by international policymakers.[7] In 2016, the G20 leaders endorsed the High-Level Principles for Digital Financial Inclusion, with a focus on strengthening digital and financial education and awareness, given the specific characteristics, advantages and risks of digital financial services and distribution channels.[8] The European Commission has recognised the importance of financial literacy for consumers in the context

1 Defined as a combination of financial awareness, knowledge, skills, attitude and behaviours necessary to make sound financial decisions and ultimately achieve individual financial wellbeing. See OECD/INFE (2012), *High-level Principles on National Strategies for Financial Education*, OECD Publishing, Paris.
2 Beck, T., A. Demirgüç-Kunt and R. Levine (2007), "Finance, equality and the poor", *Journal of Economic Growth*, 12 (1), 27-49; Khan, H.R. (2011), "Financial Inclusion and Financial Stability: Are They Two Sides of the Same Coin?", Bancon, Indian Bankers Association and Indian Overseas Bank, Chennai, India; and Morgan, P.J., and V. Pontines (2014), "Financial Stability and Financial Inclusion", ADBI WP 488.
3 Lusardi, A. and O.S Mitchell (2013), "The Economic Importance of Financial Literacy: Theory and Evidence", *Journal of Economic Literature*, American Economic Association, 52 (1), 5-44; Fernandes, D., Lynch, Jr., J.G. and Netemeyer, R.G. (2014), "Financial Literacy: Do People Know the ABCs of Finance?", Global Financial Literacy Excellence Center Working Paper No. 2014-9; and Lusardi, A. (2019), "Financial literacy and the need for financial education: evidence and implications", *Swiss Journal of Economics and Statistics*, 155.
4 See, among others: Lusardi, A. and O. Mitchell (2007), "Baby Boomer retirement security: The roles of planning, financial literacy, and housing wealth", *Journal of Monetary Economics*, 54 (1), 205-24; van Rooij, M.C.J., A. Lusardi and R.J.M. Alessie (2011), "Financial literacy and stock market participation", *Journal of Financial Economics*, 101 (2), 449-72; Lusardi, A. and P. Tufano (2015), "Debt literacy, financial experiences, and overindebtedness", *Journal of Pension Economics and Finance*, 14(4), 332-68; Andreou, P.C. and D. Philip (2018), "Financial knowledge among university students and implications for personal debt and fraudulent investments", *Cyprus Economic Policy Review*, 12, 3-23; and Deuflhard, F., D. Georgarakos and R. Inderst (2018), "Financial literacy and savings account returns", *Journal of the European Economic Association*, 17(1), 131-64.
5 European Banking Authority (2020), *EBA Report on Financial Education 2019/20*.
6 See Andreou, P.C. and S. Anyfantaki (2020), "Financial literacy and its influence on internet banking behavior", *European Management Journal*.
7 OECD (2018), *G20/OECD INFE policy guidance on digitalisation and financial literacy*, OECD Publishing, Paris.
8 GPFI (2016), *G20 High-Level Principles for Digital Financial Inclusion*, Global Partnership for Financial Inclusion.

of their greater participation in the capital market and for small- and medium-sized enterprises in the context of the Capital Markets Union.[9]

OECD survey results show that less than half of the adult population in G20 countries are financially literate.[10] The problem appears to be much more serious among women and young people, as shown by the results of other similar studies.[11] For example, students tend to have inadequate knowledge of debt management issues, such as calculating loan instalments and repayment times, as well as to be more vulnerable to financial fraud.[12] Low financial literacy among young people can be a problem, as people in this group have to make economic decisions early in their lives with significant consequences for the coming decades and with an impact on future wellbeing, wealth and income. In addition, this generation requires fast, cheap and contactless payments and increasingly turns to alternative banking services. It is therefore essential that young consumers, in addition to familiarising themselves with new digital technologies, are also trained in financial matters so that they can make effective use of the products and services offered through electronic channels.[13]

Promoting financial education and enhancing financial literacy will have positive effects on the economy as a whole and financial stability. This is so because, among other things, the bulk of household borrowing is related to mortgages. It is therefore vital, especially for the most vulnerable groups, such as young families, low-income households and first home buyers, to understand the consequences of debt. Moreover, the additional pressure from population ageing on pension systems requires higher levels of financial literacy. People live longer, but save proportionally less, with Greece being among the worst performers in the EU in terms of saving for old age.[14] The lack of proper pension and savings planning means that people are potentially unprepared for the economic challenges of ageing.[15] Moreover, strengthening financial education plays an important role in the EU's inclusive growth strategy. In a changing and complex world, economic literacy is becoming increasingly important for economic efficiency, effective conduct of economic policy and thus financial wellbeing. First, citizens who understand how the economy works are better placed to make optimal choices. Second, they are also more likely to support prudent policies, while strengthening financial literacy also ensures the sustainability of public finances and enhances the efficiency and flexibility of markets.[16]

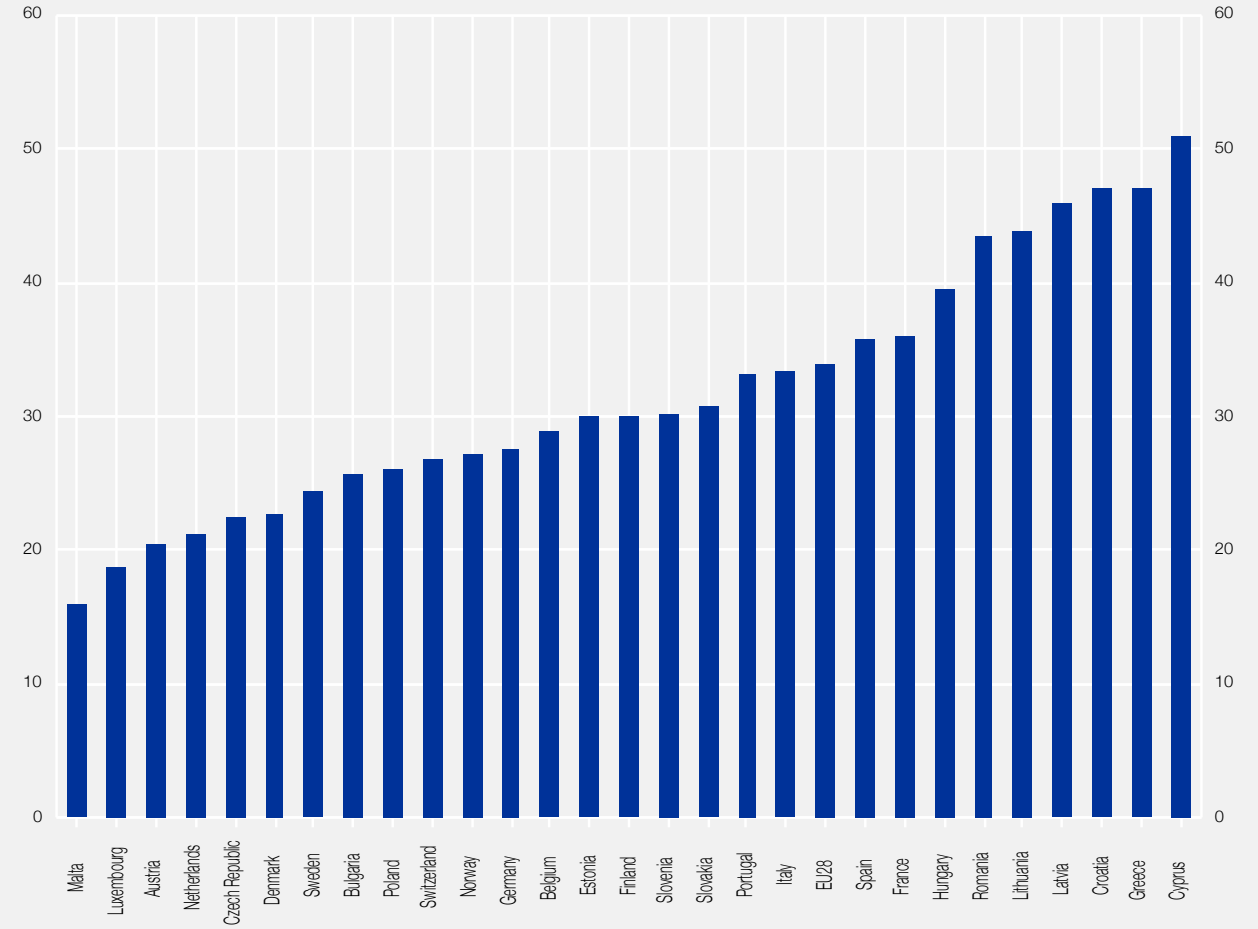
Digital financial literacy and the pandemic

The impact of the COVID-19 crisis on household incomes and savings and increased uncertainty make financial literacy even more important to strengthen the financial resilience of households and businesses.[17] According to the Survey on Income and Living Conditions (EU-SILC), in 2019 in Greece 47.7% of households reported financial difficulties, i.e. were financially fragile.[18] Chart A shows that even before the pandemic, more than 30% of house-

9 European Commission (2020), *A new vision for Europe's capital markets*, Final Report of the High-Level Forum on the Capital Markets Union.
10 OECD (2017), *G20/OECD INFE report on adult financial literacy in G20 countries*, OECD Publishing, Paris.
11 See e.g. Lusardi, A., O.S. Mitchell and V. Curto (2010), "Financial literacy among the young", *Journal of Consumer Affairs*, 44 (2), 358-38; and Lusardi, A. and P. Tufano (2015), "Debt literacy, financial experiences, and overindebtedness", *Journal of Pension Economics and Finance*, 14 (4), 332-368.
12 Andreou, P.C. and D. Philip (2018), "Financial knowledge among university students and implications for personal debt and fraudulent investments", *Cyprus Economic Policy Review*, 12, 3-23.
13 See footnotes 5 and 6.
14 See e.g. Demirgüç-Kunt, A., L.F. Klapper and G.A. Panos (2016), "Saving for Old Age", World Bank Group WP 7693.
15 Even in relatively rich economies, people often face financial difficulties as they age. For example, a survey in Germany showed that adults report lower satisfaction with their current income when they retire. See World Bank (2019), "The role of digital financial inclusion in preparation for older age and retirement".
16 Welcome speech by the Governor of the Bank of Greece, Mr. Yannis Stournaras, at the presentation of Professor Nikos Filippas's book on financial literacy "Money doesn't grow on trees!", 31.10.2019.
17 http://aei.pitt.edu/103258/1/PC-15-2020-final.pdf.
18 The question was: "Can your household afford an unexpected required expense of €380 and pay through its own resources?". The amount of the unexpected expense (€380) is the monthly equivalent disposable income of the annual at-risk-of-poverty threshold, regardless of size and composition of the household. https://www.statistics.gr/el/statistics/-/publication/ SFA10/2019.

Chart A Financial inability to meet unexpected expenses (2019)

(% of households)



Source: Survey on Income and Living Conditions (EU-SILC).

holds on average in the EU could not meet unexpected expenses. In the new EU Member States and the countries severely affected by previous economic crises, almost one in two households found it difficult to cope with unexpected expenses (Latvia, Greece, Croatia, Cyprus, Lithuania and Romania).

According to the results of the Eurofound survey conducted during the lockdown in July 2020, 21.1% of households in Greece replied that they had great difficulties making ends meet (EU-27: 10.4%). Likewise, 36.1% replied that they had no savings to fall back on in case of loss of income (EU-27: 26.4%), while only 8.1% would be able to maintain the same standard of living with their savings for more than one year (EU-27: 16.1%).[19] Also, according to the Consumer Conditions Survey 2021, in 2020 71.2% of consumers were concerned about being able to pay bills in the coming months (EU-27: 37.9%) and 62.6% were delaying a major purchase (EU-27: 41.8%).[20]

Importantly, according to the European Consumer Payment Report (ECPR), in 2020 51% of consumers in Greece replied that they were taking steps to improve their financial literacy in order to prepare for the economic uncer-

19 Eurofound (2020), *Living, working and COVID-19*, COVID-19 series, Publications Office of the European Union.
20 https://ec.europa.eu/info/sites/default/files/ccs_factsheet_data_country_level_v2_1.pdf.

tainty caused by COVID-19.[21] Financial education plays an important role in helping people cope with bad times and be capable of weathering macroeconomic shocks. How individuals deal with additional economic pressure during a crisis depends on how well they understand economic concepts such as debt accumulation, risk diversification, etc. Low levels of financial literacy among the population could exacerbate the risk to which certain groups are exposed during an economic shock.

At the same time, the COVID-19 pandemic has highlighted the importance of digital technologies for the resilience of individuals and businesses in times of crisis and increased uncertainty. According to a report by the International Monetary Fund (IMF) which uses a digital financial inclusion index, digital finance leads to increased financial inclusion and is connected with GDP growth.[22] The use of digital technology rose sharply and massively in spring 2020 upon the imposition of social distancing measures. Indicatively, according to a survey by the Small Enterprises' Institute of the Hellenic Confederation of Professionals, Craftsmen & Merchants (IME GSEVEE), almost 4 out of 10 (36.6%) respondents increased their online purchases, while more than 5 out of 10 (54.7%) increased their electronic payments.[23] Therefore, this implies that digital financial inclusion could play an important role in reducing the economic and social impact of the COVID-19 crisis. Households and small businesses can benefit greatly from the progress in FinTech and online banking. However, the pandemic could enhance the pre-existing risks of financial exclusion and create new risks for the FinTech industry itself.

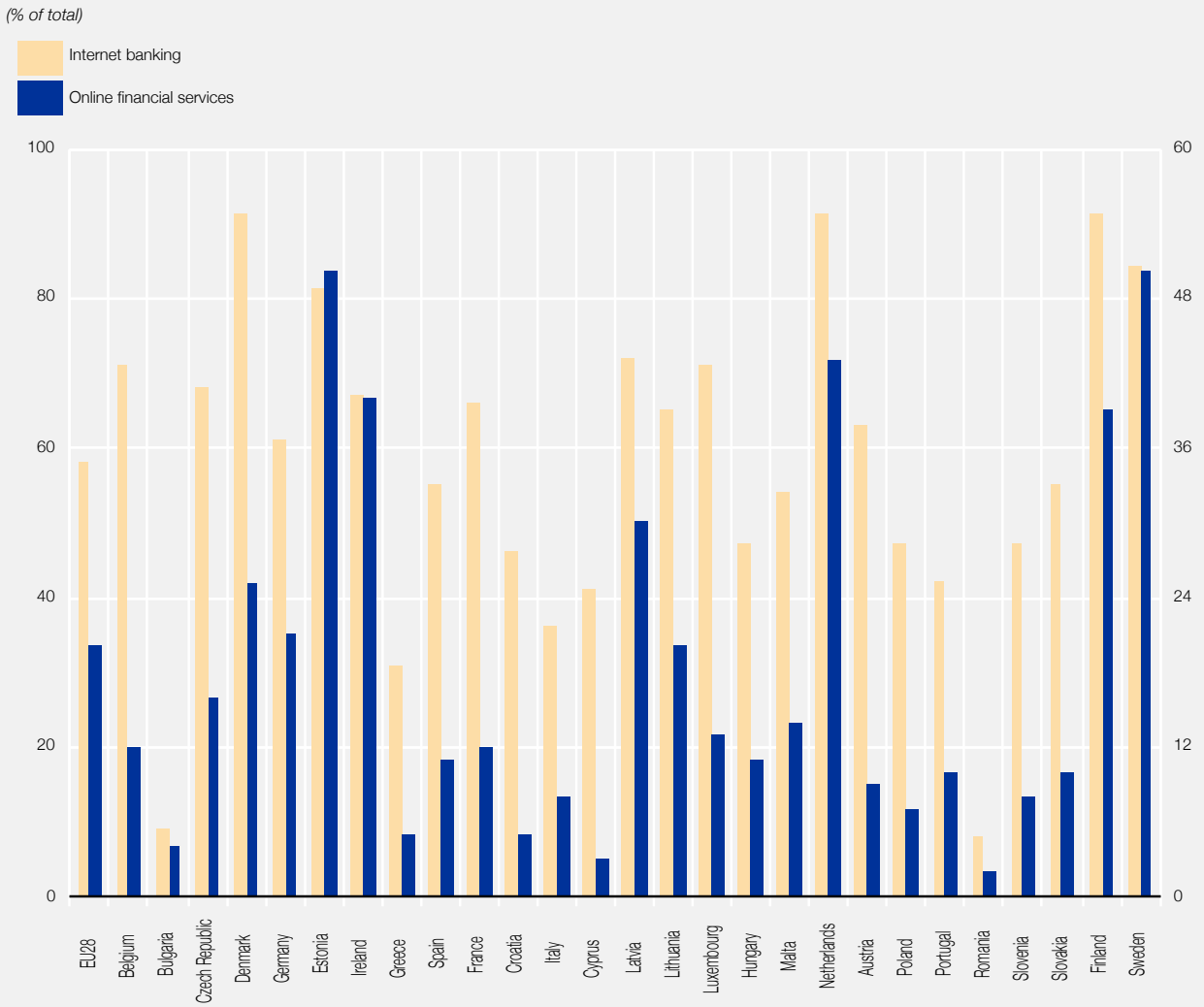
The lay of the land in Greece

Research shows that financial literacy is relatively low even in advanced economies, although there are significant differences across countries. According to the Standard & Poors Global Financial Literacy Survey, in 2014, on average in the EU, 52% of adults were financially literate, with the highest rates being recorded in Northern Europe and the lowest in the South. In Greece, the corresponding figure was 45%. More recently, in the European Consumer Payments Report (ECPR), in 2020 Greece ranked 11th out of 24 countries in terms of financial literacy (as measured by the indicators of this survey), showing significant progress since 2019 (15th), which may indicate that, to prepare for the economic uncertainty caused by COVID-19, the Greeks are taking steps to improve their financial literacy. Alarmingly, however, four out of 10 respondents (41%) replied that they did not save at all, the highest figure in Europe (European average: 38%), while 37% replied that over the past six months they had borrowed money in order to pay their household bills (European average: 21%). Overall, Greece is at the bottom of rankings in the Financial Wellbeing Barometer.[24]

At the same time, Greece is characterised by a strong digital divide, with significant socioeconomic differences in access to and use of digital technologies. Particularly low digital literacy, inadequate digitalisation of the economy and a lag in the uptake of new digital technologies by both households and businesses are observed.[25] In 2020, 37% of people in Greece used online banking (EU-27: 57%), although with significant differences according to age, educational level and professional status, and 5% of individuals had used an online financial service (EU-27: 15%) (see Chart B). According to the Consumer Conditions Survey, 2021, 67% had purchased online (EU-27: 70.9%). Similarly, in 2020 the digitalisation of Greek businesses, despite progress, lagged behind the European average, with Greece ranking 24th in the relevant indicator of the Digital Economy and Society (DESI) index, reflecting the low uptake of cloud computing services (only 7% of businesses, as against 18% in the EU) and the low penetration of small and medium-sized enterprises in e-commerce (only 9% of all SMEs, compared

21 https://www.intrum.com/publications/european-consumer-payment-report/european-consumer-payment-report-2020/.
22 Sahay, M.R., M.U.E. von Allmen, Lahreche, M. A., Khera, P., Ogawa, M. S., Bazarbash, M., and Beaton, M. K. (2020), *The promise of fintech: Financial inclusion in the post COVID-19 era*, International Monetary Fund.
23 Thanopoulos, G. and D. Giakoula (2021), *IME GSEVEE survey on the coronavirus pandemic: Attitudes and perceptions of the impact on the economy and society*, Athens: IME GSEVEE, p. 32.
24 The overall financial wellbeing score for each country is an aggregate ranking that combines scores (1-10) across three pillars: ability to pay bills, saving for the future and financial literacy. "Financial wellbeing" is defined as having the financial security to meet everyday spending needs and be in control of one's finances. See European Consumer Payment Report 2020: Greece, Intrum.
25 See Albani A., S. Anyfantaki and S. Lazaretou (2019), "How do digital technologies drive Greece's economic growth? Opportunities and challenges", Bank of Greece, *Economic Bulletin*, No. 49.

Chart B Use of online financial services (2019)



Source: Eurostat (isoc_ci_ac_i; isoc_ec_ifi).

to 18% in the EU). According to the European Investment Bank's 2020 Annual Report, Greek companies report lower levels of implementation of digital technologies (54%) compared to the EU average (63%). Finally, according to the Hellenic Federation of Enterprises (SEV) Digital Maturity Index for 2018, Greece ranks 26th in the digital maturity aspects of businesses and society (out of 28 countries).[26]

Conclusions and policy proposals

Today's complex financial markets offer a wide range of digital financial products to consumers, who should be equipped with all the necessary knowledge and skills in order to be able to assess the options available and reach the best possible decisions to maximise their long-term financial wellbeing. Improving people's financial knowledge has become a long-term policy priority for many countries, with central banks and supervisors playing an important role in this direction.[27] A National Strategy to promote and strengthen financial education in Greece, in line with other countries' good practices, is key in this respect.

26 https://www2.deloitte.com/content/dam/Deloitte/gr/Documents/technology/gr_SEV_Digital_Transformation_Observatory_noexp.pdf.

27 For a detailed overview of financial literacy strategies in the EU, see EBA (2020), *Financial Education Report 2019/20*.

Overall, national financial education strategies aimed also at improving digital financial literacy can empower individuals and equip them with the necessary financial knowledge and skills, including digital skills, encourage them to seek financial advice from responsible sources, prevent irrational behaviour and strengthen the capacity to assess economic conditions prudently. Actually, digital financial literacy programmes should not only educate and train consumers to make effective use of digital financial products and services, but also empower them to manage digital financial risks more effectively and avoid falling prey to malicious digital activities (e.g. phishing, hacking and unauthorised use of data). The digital age needs digitally smart and financially literate people who are able to participate effectively in the economy in the new conditions.

Policy actions to enhance financial literacy could play an important role in ensuring financial and economic stability and mitigating the risk and impacts of future financial crises by making households more resilient to shocks. Safeguarding financial stability requires a comprehensive approach encompassing not only appropriate regulation and supervision of the financial system, but also financial literacy.[28] The pandemic shows that the trend towards greater digitalisation of financial services is here to stay. To create inclusive societies and tackle growing inequalities during and after the current crisis, the aim is to close the digital divide between and within countries so that consumers can reap the benefits of digital financial services. This entails striking the right balance between developing financial innovation and managing the related risks.

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28 According to the European Banking Authority (EBA), "Financial education arises as a complement to the financial conduct regulation and supervision of the financial system... Consumers who are well educated on finance, through their choice of financial products suited to their risk profiles and needs, help to promote a greater stability of the financial system by increasing sensibility around risks and towards financial inclusion"; EBA (2020), *Financial Education Report 2019/20*.

Box VII.1

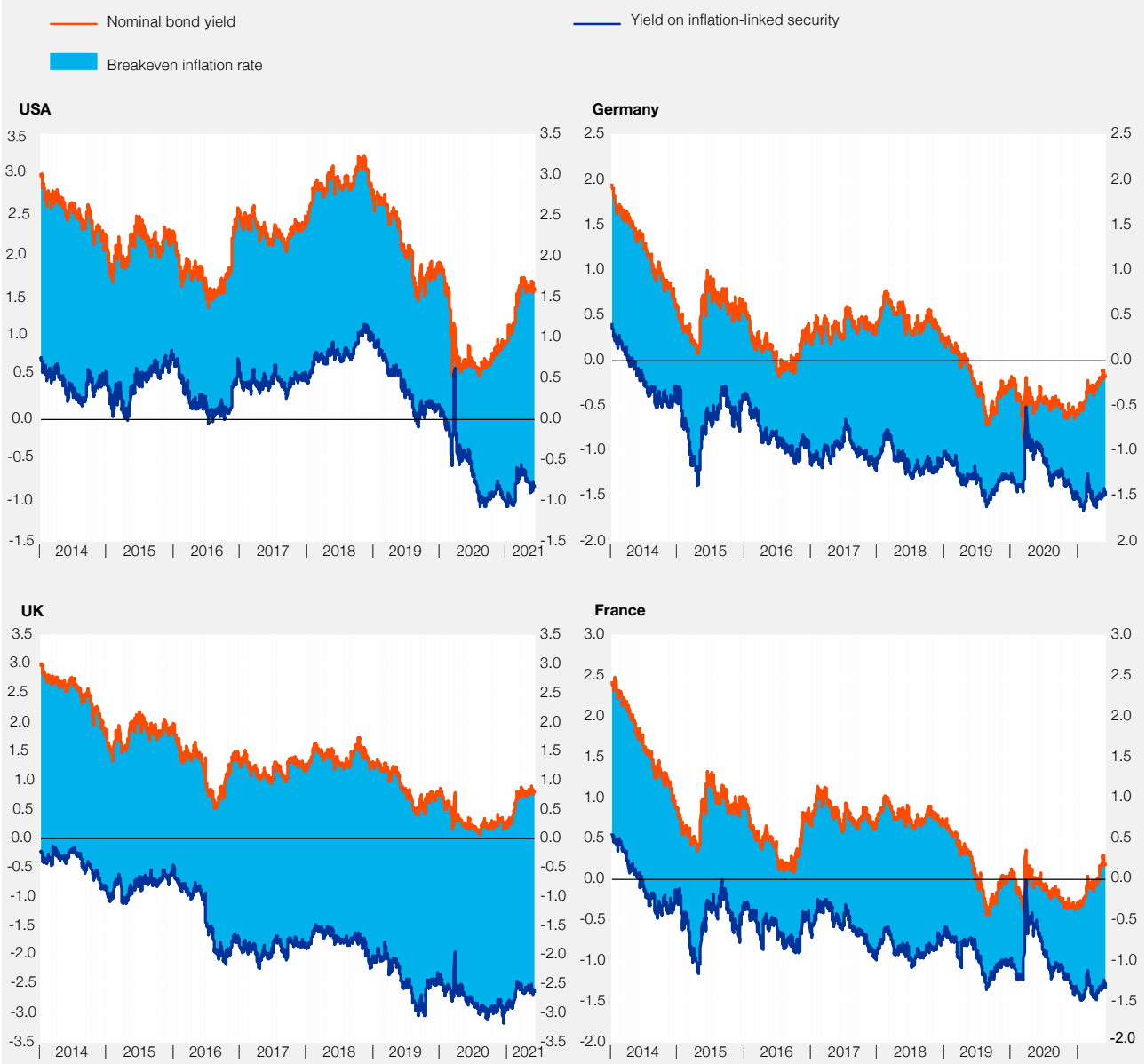
THE IMPACT OF EXPECTATIONS ABOUT ECONOMIC ACTIVITY AND INFLATION ON BOND YIELDS

Expectations and capital markets

According to theory, bond rates incorporate market expectations about growth and inflation dynamics, as well as risk premia. The recent rise in the yields of bonds considered safe, particularly since the fourth quarter of 2020, has been put under scrutiny as to whether it is due to expectations linked to economic recovery and a possible post-pandemic rise in inflation or to heightened uncertainty, as reflected in increased risk premia.

Chart A 10-year nominal and inflation-linked bond yields

(%; daily data; January 2014- May 2021)



Sources: Federal Reserve Bank of St. Louis - FRED database (USA), Refinitiv (France, Germany, UK).
Note: The charts show the yields of 10-year benchmark bonds (orange line) and inflation-linked securities of similar maturity (blue line).The shaded area is the difference between the two, i.e. the breakeven inflation rate.

As macroeconomic expectations are incorporated into the pricing processes of securities, they can be decomposed based on indicators with information for securities prices and yields. For example, inflation-linked bond yields are neutral with respect to inflation rates[1] and therefore mainly reflect factors relating to real economic activity, such as the expected economic growth rate. In this regard, the spread between benchmark (nominal) bonds with similar maturities and inflation-linked ones mainly reflects investors' expectations[2] about inflation rates over their maturity horizon.

Following the shock due to the pandemic outbreak and the subsequent volatility in international capital markets in February-March 2020, nominal yields on safe 10-year benchmark bonds (United States, Germany, United Kingdom and France) initially followed a downward path, before recovering in the fourth quarter of 2020. Over the same period, real yields, i.e. yields on inflation-linked bonds, initially declined much more and then moved upwards, but did not converge towards nominal yields (see Chart A). In other words, the difference between nominal and real yields, known as the "break-even inflation rate", suggests that investors prefer equally safe bonds, which provide security against a possible rise in inflation.

As shown in Chart A above, break-even inflation rates have widened since then, indicating that investors seem to seek higher yields on bonds subject to inflation compensation premium than on index-linked bonds, compared to the period before the pandemic shock. In particular, breakeven inflation rates are higher than in the period before the shock (change in 10-year break-even inflation rates, between May 2021 and January 2020: USA: 75 bps, Germany: 24 bps, France: 42 bps and UK: 21 bps).

Measures of inflation expectations for the next calendar year suggest that, in the United States, inflation is expected to range between 2.4% (Survey of Professional Forecasters (SPF) median in Q2 2021 for inflation expected one year ahead) and 4.6% (May 2021 University of Michigan monthly survey median for US inflation one year ahead). These values were increased by 50 (SPF) to 140 bps compared to those 12 months earlier. On the other hand, the one-year expected inflation rate for the euro area, according to the SPF survey, stands at 1.3% in the second quarter of 2021, i.e. only 10 bps higher than a year ago (see Chart B).

Impact of expectations about economic activity and inflation on US Treasury bond yields

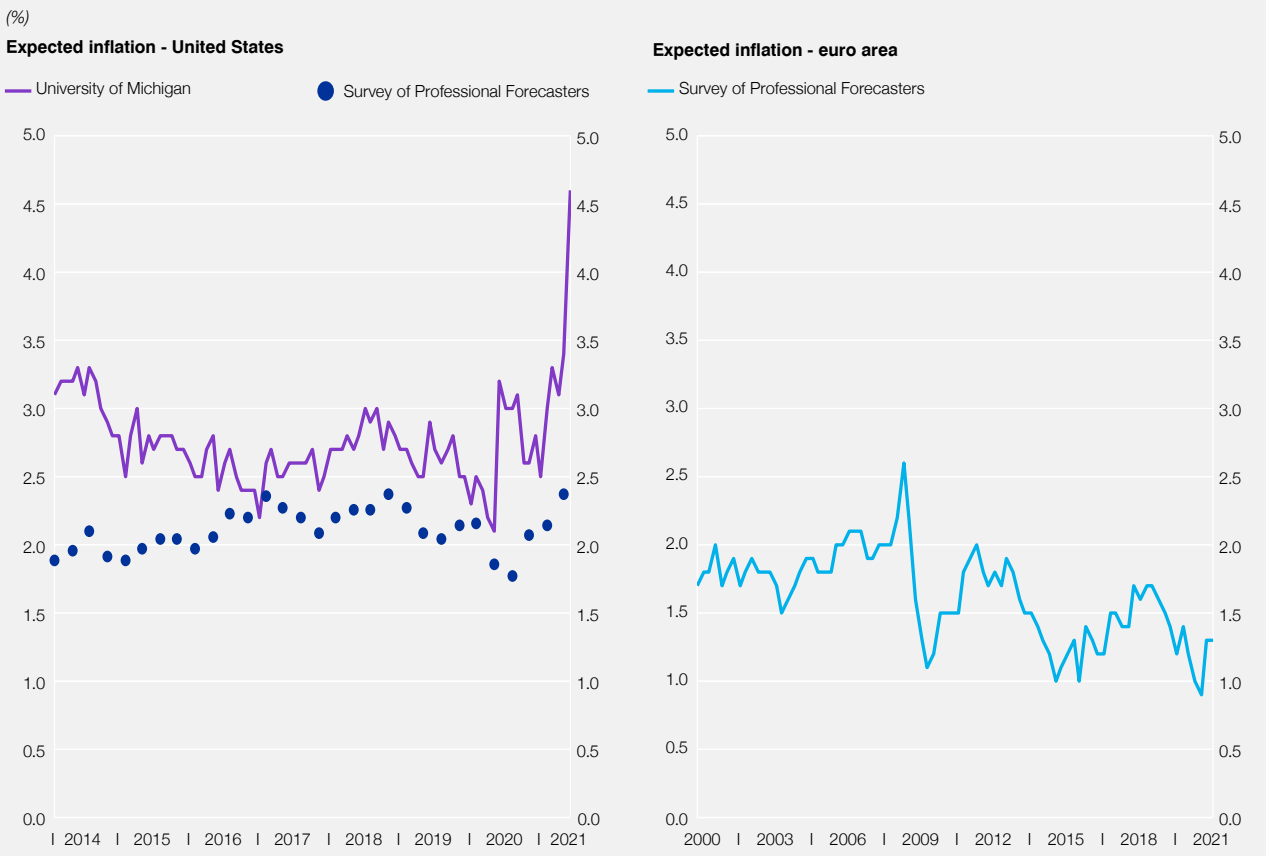
These developments raise the question whether the rise in nominal bond yields, compared with real ones, is due to expectations of rising inflation. In this context, the magnitude of the effects exercised on US Treasury bond yields by expectations for economic activity vis-à-vis those for inflation is estimated.[3] The analysis focuses on 5- and 10-year US Treasury (UST) bonds, first because of the size and importance of this market and secondly be-

1 Coupon payments on inflation-linked securities fluctuate according to the annual inflation rate, as measured by the annual percentage changes in the Consumer Price Index. As a result, these yields are not affected by inflation fluctuations.

2 For the usefulness of the break-even inflation rate, i.e. the spread between nominal and real bond yields, as a measure of future inflation expectations, as well as the reflection of real economic activity expectations on real yields, see Gürkaynak, R., B. Sack and J. Wright (2010), "The TIPS yield curve and inflation compensation" *American Economic Journal*; Macroeconomics 2 (1), 70-92.

3 The relationship that connects interest rates with inflation and economic activity expectations is known as the "Fisher equation". Nominal yields are seen as a function of expected inflation, as estimated by the relationship between breakeven inflation rates and expectations about inflation rates, gauged through the University of Michigan survey, a component measuring inflation uncertainty (difference between expected inflation by the SPF and the University of Michigan) and real yields of similar maturity. Real yields and inflation components are derived from the estimation of the model, the dependent variable being the observed nominal yield and explanatory variables being: (a) real yields, (b) inflation expectations, (c) inflation uncertainty, and (d) a constant term. The estimation was based on monthly data for the period January 2004-May 2021 using co-integration techniques (Dynamic Least Squares, 12 lags, 12 leads, with errors adjusted for heteroscedasticity). The coefficient of determination adj. R2 is 98.4% for 10-year bonds and 99.6% for 5-year bonds. In 10-year bonds, the impact of inflation is calculated as the sum of the impact of expected inflation and related uncertainty, while in 5-year bonds, inflation uncertainty is not statistically significant and therefore the inflation component incorporates only expectations. For an extensive discussion of the theoretical relationship between interest rates and expectations, as well as the econometric model and estimation techniques, see Bauer, M.D. and Rudesbusch (2020), "Interest rates under falling stars", *American Economic Review*, 110 (5), 1316-1354.

Chart B Inflation expectations over the next calendar year



Sources: Federal Reserve Bank of Philadelphia (expected inflation in USA based on the Survey of Professional Forecasters), FRED (expected inflation in USA based in the University of Michigan survey), ECB (expected inflation in the euro area based on the Survey of Professional Forecasters).
Note: Monthly data for the University of Michigan survey (January 2014 - May 2021) and quarterly data for the Survey of Professional Forecasters (USA: QA 2014 - Q2 2021; euro area: Q1 2000 - Q2 2021).

cause the United States have experienced the strongest rise in post-pandemic inflation and inflation expectations among developed economies. At the same time, trends and changes in UST bond yields are expected to have a direct impact on the yields of other safe benchmark bonds worldwide and indirect effects on other government and corporate bond yields.[4]

Based on the results, for the period April 2020-May 2021, expectations about real economic activity are estimated to have contributed -46 bps to nominal yields on 10-year US Treasury bonds (see Chart C). On the other hand, the inflation compensation component contributed 67 bps, while the inflation risk premium increased by 51 bps (estimated total change in 10-year bond yields between April 2020 and May 2021: +72 bps; total observed change: +92 bps).

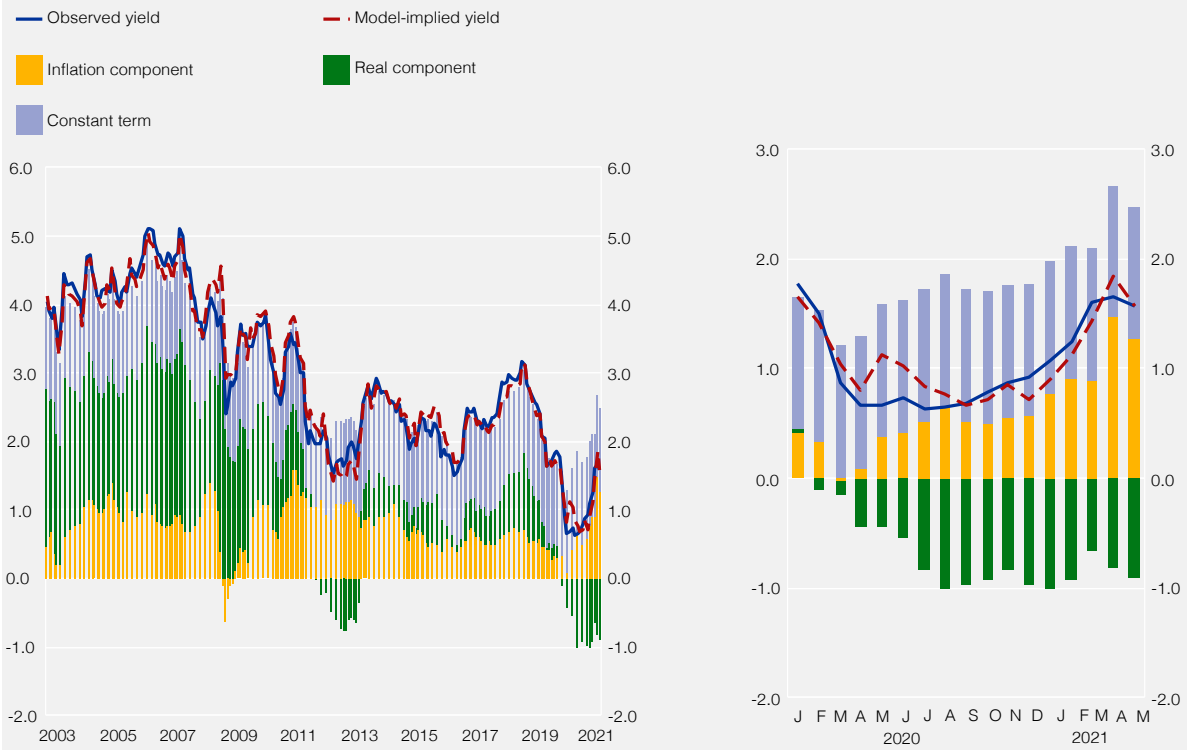
With regard to the 5-year UST bonds (see Chart C), the impact of real economic activity expectations has contributed negatively by 140 bps to nominal yields, while the inflation compensation component has more than offset this effect, contributing to a 195 bps increase (estimated total 5-year change between April 2020 and May 2021: +55 bps; total change observed between April 2020 and May 2021: +40 bps). Finally, based on this econometric analysis, nominal 5-year US bond yields do not incorporate any significant inflation uncertainty component.

4 See, inter alia, Du, W., J. Im and J. Schreger (2018), "The U.S. Treasury Premium", *Journal of International Economics* 112, 167-181.

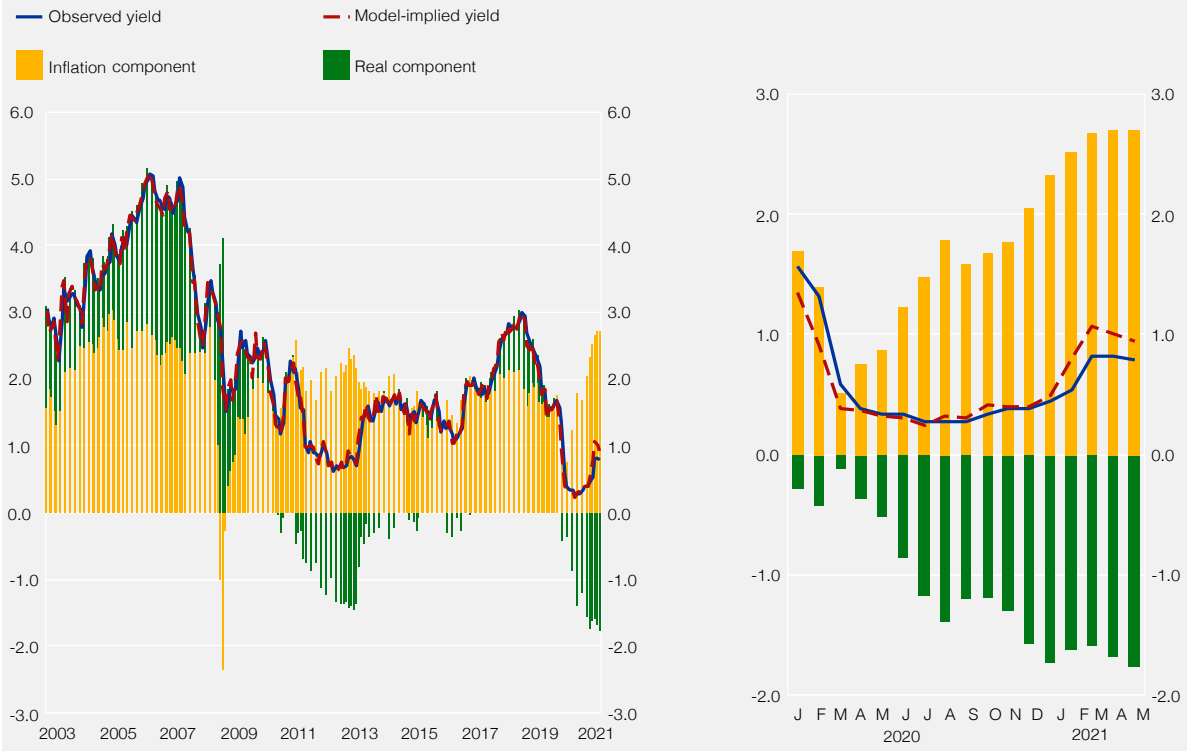
Chart C Estimated and observed US Treasury bond yields

(yields in %; monthly data; left-hand side: January 2003 - May 2021; right-hand side: January 2020 - May 2021)

10-year bonds



5-year bonds



Source: Bank of Greece's econometric estimates.
Note: The chart only shows statistically significant parameters of the estimated sample. See footnote 3 for the estimation methodology.

It appears therefore that the rise in nominal US benchmark bond yields, following the shock induced by the pandemic in international capital markets, is largely explained by inflation expectations.

Medium-term UST bond yields seem to incorporate a higher degree of expected inflation certainty over the medium term. On the other hand, inflation uncertainty, as gauged by 10-year UST bond yields, is strong and implies higher expected inflation uncertainty over a longer horizon.[5] Overall, the recent rise in US Treasury bond yields incorporates higher inflation expectations in the medium term, as well as uncertainty about inflation in the longer term.

Conclusions

In the post-pandemic shock period, expectations of future inflation have increased, especially in the United States. Inflation expectations have a significant impact on bond yields. It is estimated that, coupled with uncertainty about future inflation, these expectations largely account for the recently observed rise in bond yields.

A persistent upward trend in US Treasury bond yields is expected to lead to increases in euro area government and corporate bond yields and may thus weigh on economic recovery. Therefore, until the economic impact of the pandemic is fully eliminated, it is very important to preserve measures supporting the euro area economy, including the Eurosystem's asset purchase programmes, as a backstop against transmission of potential further rises of US bond yields to euro area sovereign and corporate bonds.

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5 The effect of the same factors on the equity risk premium (ERP) was also examined. The equity risk premium is calculated as the inverse of the P/E ratio, for S&P500, minus the yield on the US 10-year benchmark bond. This method of ERP determination is consistent with the dividend discount models (see inter alia Fama, E.F. and K. French (1992) "The equity premium", *Journal of Finance*, 57 (2), 637-659).The model estimates the ERP as a function of inflation and economic activity expectations in the United States, including inflation uncertainty and a constant term. The estimation shows that the expected inflation component has a significant negative impact on the required return on equity, while the inflation uncertainty component significantly affects required returns. The model's coefficient of determination adj. R^2 is 23.1%.