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Quarterly Report on the Euro Area

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EUROPEAN ECONOMY

Economic and Financial Affairs

The **Quarterly Report on the Euro Area** is written by staff of the Directorate-General for Economic and Financial Affairs. It is intended to contribute to a better understanding of economic developments in the euro area and to improve the quality of the public debate surrounding the area's economic policy.

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Directorate-General for Economic and Financial Affairs

Quarterly Report on the Euro Area

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EUROPEAN ECONOMY

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Boxes

Having regained its pre-pandemic output level in the third quarter of this year, the euro area is now on a path of expansion. With all components of domestic demand contributing positively, euro area real GDP growth is expected to rebound by 5% in 2021 and gradually moderate to 2.4% in 2023. Inflation is forecast to reach 2.4% in 2021 but we expect that it will decline to 1.4% in 2023 as energy prices are set to gradually level out next year and the imbalances between supply and demand solve.

In this context, this issue of the Quarterly Report on the Euro Area (QREA) presents analysis that is of direct policy relevance for the current macroeconomic challenges. In particular, it contains an overview of the EU's main response to the crisis – the Recovery and Resilience Facility (RRF), including a simulation of its likely macroeconomic effects. It also provides estimates of the benefits for the banking systems, and the governments that back them, from the associated large-scale issuance of common debt. In a context of rising public debt, fiscal risks have become an important dimension of the macroeconomic policy debate. The report therefore moves on to highlight some of the fiscal sustainability risks stemming in particular from possible pension policy reversals. Finally, the report presents a general assessment of the macroeconomic benefits and risks related to the introduction of a retail Central Bank Digital Currency (CBDC), a development likely to emerge in response to some of the structural challenges that current payment systems face. The recurrent euro area chronicle provides a brief overview of major policy developments at the euro area level in recent months.

The first section of the Report examines the macroeconomic benefits of the RRF, the new, temporary EU financial support instrument to facilitate both structural reforms and public investments. Economic modelling suggests that the RRF will have a sizeable and persistent positive impact on overall EU GDP and will promote convergence. The analysis further suggests that for Member States to fully benefit from the RRF funding, the planned investments need to be implemented in a timely fashion and complement the pre-existing national public investment plans. These benefits would be reinforced trough the implementation of the structural reforms foreseen in Member States' recovery and resilience plans. Simulations with the Commission's QUEST model that focus on the fiscal stimulus alone highlight the importance of cross-border spill-over effects for stimulating growth. These effects will benefit in particular the more open economies, including those receiving small grant allocations.

The second section assesses the sovereign-bank loop against the backdrop of the ECB asset purchases and the large-scale EU bond issuance related to the COVID-19 policy response at EU level. Stylised simulations suggest that the ECB monetary policy measures and the other initiatives taken at EU level, including the introduction of a common debt instrument, can more than halve potential losses to public finances during a hypothetical banking crisis. These positive effects accrue to all Member States, even after accounting for costs linked to the extension of joint guarantees. This result is due to the positive confidence effects brought about by the EU response package, the de-risking of bank balance sheets facilitated by the introduction of EU bonds, and the easing of fiscal pressures in the more vulnerable Member States benefitting from NGEU grants.

The third section assesses the budgetary implications of pension policy changes through two illustrative policy scenarios. In the first scenario, governments are assumed to undo earlier pension measures that postponed retirement ages. If effective retirement ages remained at their current levels, pension spending would be about 1 pp of GDP higher in the euro area in 2070 compared to the baseline projections that incorporate current legislation, and about 2 pp of GDP higher in some Member States. In the second scenario, governments are assumed to increase pension benefits to preserve the adequacy of public pensions highlighting the existence of trade-offs between high pensions and fiscal sustainability. Indeed, under such a scenario, pension expenditure would increase by 3.2 pps of GDP on average. Overall, to preserve fiscal sustainability, euro area Member States should fully implement the reforms that extend working lives, and

avoid additional pension expenditures, unless they can be sustainably financed.

The fourth section provides a non-technical overview of the macroeconomic benefits and risks related to the introduction of a retail CBDC, with a focus on a 'Digital Euro'. The macroeconomic benefits range from an increased efficiency in payment systems and the support to the ongoing digitalisation of the European economy to the strengthening of the EU's strategic independence from dominant foreign-based payment providers. At the same time, however, the introduction of a retail CBDC may also entail risks stemming from the potential disintermediation of the banking system with possible negative consequences for bank-lending and financial stability. The section concludes that a possible introduction of a CBDC is a complex undertaking that needs to take into account many different aspects, of which the economic dimension is only a part.

Finally, the recurrent euro area chronicle briefly discusses the European Commission's endorsement of the recovery and resilience plans by eighteen euro area Member States, the common issuance to finance the RRF and other programmes under the Next Generation EU, as well as the Council's green light to the first recovery disbursements. It also briefly reviews the ECB Governing council' s decision to launch an investigation on digital euro as well as the results of the ECB's monetary policy strategy review.

To conclude, I believe that the QREA provides research that both contributes to policy making aimed at strengthening the recovery and addressing policy challenges that will impact welfare over a longer horizon.

I. An overview of the economics of the Recovery and Resilience Facility

By Emiel Afman, Steven Engels, Sven Langedijk, Philipp Pfeiffer and Jan in 't Veld

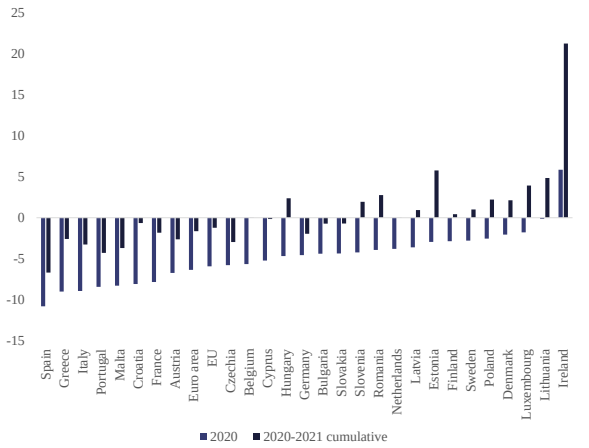
The Recovery and Resilience Facility (RRF) is the centrepiece of Europe's recovery plan, NextGenerationEU, financed by a temporary increase in the EU's budget (the multiannual financial framework, 2021-2027). The macroeconomic package covers both structural reforms and public investment aiming to mitigate the economic and social impact of the COVID-19 crisis and make European economies and societies more sustainable, resilient and better prepared for both the challenges and opportunities of the green and digital transitions. Economic modelling indicates that the RRF will have a sizeable and persistent positive impact on overall EU GDP and will promote convergence. Spillover effects benefit open economies with smaller grant allocations and growth helps reduce debt, also in the long term. In addition to these simulated effects of the fiscal impulse, structural reforms can substantially support medium-term and long-term growth by increasing labour market participation, enhancing allocative efficiency or improving the business environment. The adoption of the RRF - combined with other policy action - has also generated additional benefits by reducing risk premia and by stimulating consumer spending and investment. For Member States to fully benefit from the projected growth effects, the planned high-quality investments must be made swiftly and in a way that amplifies current national public investment plans. It is also essential that Member States meet the ambitious commitments to structural reforms they made in their recovery and resilience plans to reap the full benefit of the RRF ([1]).

I.1. The COVID pandemic: an unprecedented crisis with a deep and asymmetric impact

Ten years after the Great Financial Crisis and the subsequent euro-area sovereign debt crisis, the COVID-19 pandemic swept across the globe leading to loss of lives and major challenges to public health as well as economic and social disruption. The lockdown measures to contain the virus had a huge impact on economic activity; economies came to a standstill in the second quarter of last year. The health crisis thus triggered a major exogenous economic shock affecting all EU Member States. Though the shock itself was symmetric and global, its impact across Member States and regions has been markedly asymmetric. It differed depending on the spread of the virus among the population, the resilience of the healthcare sector, the type and severity of the containment measures, the sectoral composition of the economy and the strength of the economic policy response to the loss in output.

In 2020, GDP fell by over 10% in Spain, by almost 9% in Italy and by 6% on average across the EU. Despite upward revisions in the Commission's most recent growth estimates, GDP levels are expected to remain (well) below pre-crisis levels in 16 of the 27 EU Member States in 2021 (Graph I.1).

Graph I.1: **2020 and 2020-21 cumulative real GDP growth**



Source: European Commission, Autumn 2021 Forecast

I.2. Policy action: crisis repair, containment and prevention

A successful control of the health and economic crisis in any country can be seen as a common good that benefits an integrated economy such as the EU due to integrated value chains, the single market and the monetary union.

([1]) The authors wish to thank colleagues for useful comments, and in particular Alexandru Ciungu and Ruben Kasdorp for their contributions. This section represents the authors' views and not necessarily those of the European Commission. The cut-off date for this section is 17 November 2021.

The initial phase of the crisis was characterised by a high degree of uncertainty and worries that the abrupt halt in economic activity in large parts of the economy could risk triggering a wave of bankruptcies, mass unemployment and possibly stress in the financial sector. Policy makers and financial markets were also concerned that pre-existing fragilities could exacerbate the crisis and deepen economic divergence in the euro area.

The EU monetary and fiscal policy response to contain these risks and the immediate social and economic crisis impact was unprecedented, at both national and EU level. The European Central Bank stepped in to provide large-scale liquidity and the Commission relaxed its State-aid rules and activated the general escape clause in the fiscal governance framework to enable Member States to provide immediate budgetary support at national level. The comprehensive and decisive policy action provided a fast and substantial impulse to EU economies. At European level, the Coronavirus Response Initiative and React-EU led to a fast deployment of available EU funds, while the newly created SURE instrument provided loans to Member States at attractive conditions to fund short-time work schemes and similar measures to safeguard employment. Together with the national support measures, SURE contributed to protecting jobs ([2]). Unemployment in the EU 27 went up, but by substantially less than what could have been expected given the fall in domestic production.

Despite these decisive actions to contain the immediate impact of the crisis, concerns remained that some Member States with little or no policy space would be ill-equipped to meet the economic and social needs of their people and risked getting stuck in a situation of prolonged sluggish growth, high unemployment and a permanently weakened business sector. For the EU as a whole, the crisis entailed high fundamental risks that the level playing field created by the single market could become permanently uneven and that the gap in living standards could widen. Increased divergence within the monetary union would also put at risk the process of economic integration and convergence.

Within this context the European Council on 23 April 2020, agreed to work towards the establishment of a recovery fund, tasking the Commission to "*analyse the exact needs and to come up with a proposal that is commensurate to the challenges we are facing"*. The Council insisted that "*this fund shall be of a sufficient magnitude, targeted towards the sectors and geographical parts of Europe most affected"*. In May 2020, just a few months after the outbreak of the pandemic in Europe, the Commission proposed the legislative package for NextGenerationEU, including the Recovery and Resilience Facility, to set in train a sustainable recovery, provide support for productivity enhancing investment and reforms, to facilitate the green and digital transition, and to support cohesion and convergence. In total, NextGenerationEU will provide up to EUR 750 billion in 2018 prices over the years 2021-2026, with the RRF accounting for the lion's share (almost 90%; EUR 312.5 billion for grants and up to EUR 360 billion for loans) ([3]).

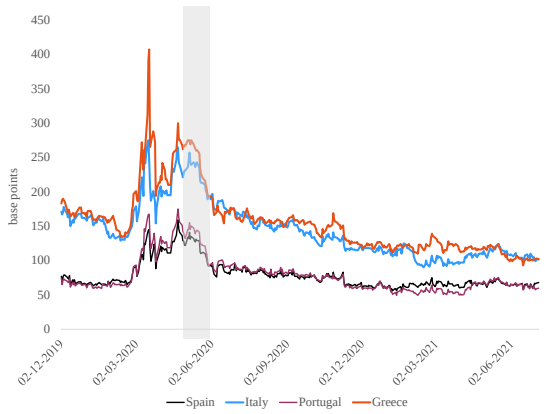
The agreement on NextGenerationEU and the Recovery and Resilience Facility is testament to Member States' commitment to European solidarity. Together with other policy action at both national and European level, the agreement strengthened trust in the monetary union and helped restore confidence and calm financial markets, as evidenced by the bond spreads narrowing (Graph I.2.). The ensuing economic rebound in the second half of last year, supportive policies in the Member States and the adoption of Recovery and Resilience plans (RRPs) gave a further boost to investor confidence ([4]).

([2]) See McDonnell, C., Boussard, J., Justo, I., Mohl, P., Mourre, G. and K. Stovicek (2021), 'The SURE instrument – key features and first assessment', *Quarterly Report on the Euro Area*, Vol. 20 No 2, pp. 41-49

([3]) The respective RRF amounts in current prices are EUR 338 billion for grants and EUR 385.8 billion for loans.

([4]) On 13 July 2021, the Council adopted implementing decisions on the Recovery and Resilience Plans (RRPs) of Austria, Belgium, Denmark, France, Germany, Greece, Italy, Latvia, Luxembourg, Portugal, Slovakia and Spain. On 28 July, Croatia, Cyprus, Lithuania and Slovenia also received approval for their plans. On 8 September, the Council adopted Czechia's and Ireland's plans. On 29 October, the Council has adopted the plans from Estonia, Finland and Romania.

Graph I.2: **10 year government bond yields against German bonds**



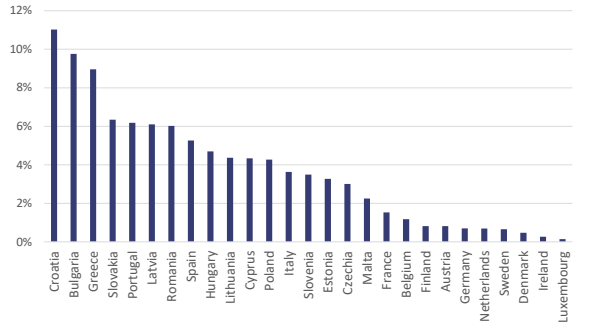
Source: Macrobond

I.3. RRF rationale: an instrument with innovative features

The Recovery and Resilience Facility is a performance-based instrument. In contrast to conventional EU instruments, which reimburse past costs incurred, the RRF provides financing via grants and loans for investments and reforms based on cost estimates. Following an initial pre-financing payment of up to 13% of the total grant and loan envelope, the Facility will only pay out once the agreed milestones and targets related to specific investments and reforms are met. This set-up strengthens incentives to implement major economic, social and environmental reforms. It also ensures that framework conditions are improved in parallel, increasing the effectiveness of the investments.

The Facility stimulates economic convergence via an asymmetric allocation of grants. 70% of all support Member States are entitled to is allocated on the basis of the Member States' unemployment record from 2015-2019, inverse GDP per capita and population share. For the remaining 30% of the total budget, the impact of the crisis is taken into account based on the drop in real GDP in 2020 and, in equal proportion, the cumulative loss in real GDP over 2020 and 2021 (5). This means that poorer economies, with a high rate of unemployment and which suffered a deep negative impact of the crisis will receive a relatively large amount of grants, while richer economies with a more robust growth record will receive comparatively less (Graph I.3 and I.4).

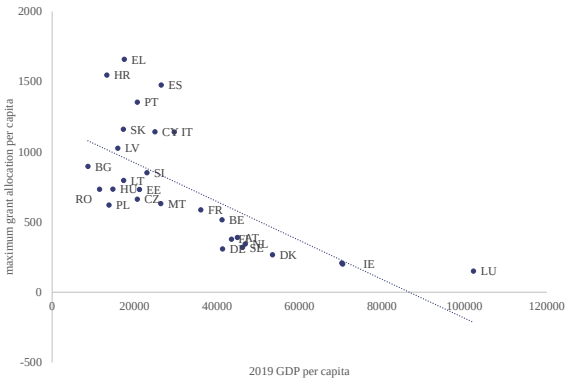
Graph I.3: **RRF grants (% of pre-crisis GDP)**



(1) RRF grant allocation as indicatively based on the European Commission's 2020 Autumn Forecast

Source: European Commission

Graph I.4: **Maximum financial contribution and GDP per capita**



Source: European Commission

To request RRF support, EU Member States are required to develop national Recovery and Resilience Plans with several components, reflecting coherent packages of reforms and investments. To ensure they make a contribution to a sustainable recovery, which also benefits the green transition and the digital transformation, the national plans must meet a number of criteria, set in the RRF Regulation agreed by Council and Parliament which the Commission then assesses (6). For instance, to make sure that the

(5) See for the detailed calculation the Annex I-III in the RRF Regulation (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R0241&qid=1613983930651&from=EN)

(6) The Commission assesses the RRPs on completeness, eligibility of planned investments, and on quality, considering the relevance, effectiveness, efficiency and coherence of each RRP along eleven criteria set out in Regulation (Article 19(3) and Annex V). The 11 criteria are: balanced response; addressing the country specific recommendations; impact on growth, resilience & social impact; the principle to do no significant harm; the green transition; the digital transformation; achieving a lasting impact; monitoring and

reform dimension is well covered, national recovery plans must effectively address all or a significant subset of the challenges identified in the relevant country-specific recommendations adopted by the Council (7). They must also contribute effectively to strengthening the growth potential, to job creation, and to boosting the economic, social and institutional resilience of the Member State. These contributions are to be demonstrated with a detailed impact assessment. On the green transition and the digital transformation, the Regulation sets quantitative expenditure targets: 37% of the total estimated costs of the plan should be allocated to climate action (8), and 20% of the total estimated costs of the plan should contribute to the digital transition.

In addition to the 37% climate target, each individual measure must meet the 'do no significant harm principle' in relation to the environmental objectives as defined in the EU taxonomy and the related acquis. For each measure, the Member State must carry out and present in the plan a detailed assessment based on technical guidance provided by the Commission. This will ensure that the plans are in line with key aspects of climate change adaptation, climate change mitigation, pollution control, water, biodiversity and circular economy principles.

Since payment for results instead of certification of expenditures puts an additional strain on the national audit- and control systems, effective and efficient internal control systems are required to prevent, detect and correct irregularities. In some cases, the Commission identified risks related to internal control systems, which were addressed during bilateral discussions before the plans were submitted. Where manageable risks remain, specific milestones linked to the control and audit systems need to be fulfilled by the Member States before they make the first payment request.

To facilitate the RRF implementation, the Commission engaged in intensive and constructive policy discussions with the Member States before they submitted their respective plan. The aim of these discussions was to jointly identify the most impactful investments and reforms, while facilitating timely implementation. During these informal discussions and the assessment phase after the plans were formally submitted, due attention was paid to issues such as additionality and the sequencing of reforms and investments to maximise economic impact. The Commission and the Member States also jointly agreed on a detailed set of milestones and targets against which they would monitor progress in the implementation of the various reforms and investments.

I.4. A bird's-eye view on the Recovery and Resilience Plans

As indicated above, the RRF Regulation comprises a set of legally-binding criteria against which the Commission assesses the content of the plans, including, for example, the green and digital expenditure targets, compliance with the 'do no significant harm'-principle and the requirement that the plans effectively address all or a significant subset of the relevant country-specific recommendations. Using these assessment criteria, the Member States designed the specific content of their national plans. Taking into account their country-specific circumstances and policy priorities, they chose the reform and investment packages for which they wish to benefit from funding support from the RRF. As a result, the RRPs that have so far been submitted differ both in terms of scope and focus. Nonetheless, there are some common features in the plans.

implementation; cost and impact; control systems; and coherence of the plan. The overall assessment is reflected in the Commission's proposal for a Council Implementing Decision (CID), which approves the assessment of the RRP. Though the RRF Regulation requires the plan to be assessed as a whole, some criteria require assessments of individual measures. In particular for the assessment of 'do no significant harm', the green and digital tagging, and to assess the plausibility of costs estimates.

(7) As part of the regular economic policy surveillance and coordination cycle (the 'European Semester'), each year the Council issues country-specific recommendations (CSRs) on the basis of a Commission proposal. Following a comprehensive analysis of the economic performance of the Member States, these CSRs identify the most pressing reform and investment priorities for next 12 to 18 months. Compared to the usual CSRs, the recommendations issued in 2020 were more narrowly focused on immediate short-term priorities linked to the pandemic and the recovery from it. Therefore, during the assessment of the RRPs, the Commission also looked at how Member States had taken up the 2019 CSRs identifying medium-term structural challenges.

(8) The climate tracking methodology is based on the Rio marker system, which was developed by the OECD. It is the same methodology that is being used to track climate spending under the general EU budget, strengthened by adding some elements from the Taxonomy Regulation

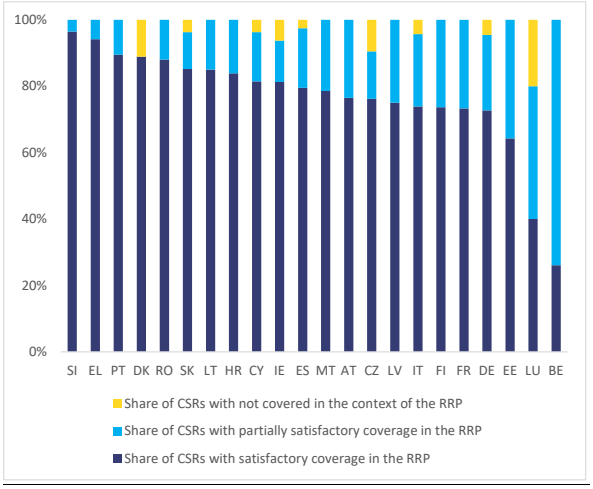
Box I.1: How is the RRF financed?

To finance NextGenerationEU, the European Commission, on behalf of the EU, borrows on the capital markets. Thanks to the EU's high credit rating, the Commission is able to borrow at advantageous conditions. The Commission passes this benefit on to the EU Member States directly when providing them loans or to the EU budget in the form of low interest rate payments on borrowing to finance recovery spending. The borrowing is concentrated between mid-2021 and 2026. All borrowing will be repaid by 2058, loans via repayments by the borrowing Member States; grants will be repaid by the EU budget. To help repay the borrowing, the Commission will propose new 'own resources' (sources of revenue) to the EU budget, such as a carbon border adjustment mechanism, the Emissions Trading System and a digital levy, to top up its current resources. The repayment of the Union's debt is guaranteed within the ceilings of own resources, by a dedicated compartment which may only serve that purpose and by additional provisions under which the Member States commit to make available resources up to the maximum amount of borrowing stipulated in the Own Resources Decision, the combined effect of which will constitute an irrevocable, definitive and enforceable guarantee of payment.

The size of NextGenerationEU enables the Commission to borrow up to roughly EUR 150 billion per year on average between mid-2021 and 2026, which will make the EU one of the largest issuers in euro. Given the volumes, frequency and complexity of the borrowing operations, the Commission follows the best practices used by sovereign issuers, by means of a diversified funding strategy. By using diverse funding instruments and funding techniques, the Commission expands the investor base for EU securities, facilitate the smooth repayment of borrowed amounts, and provide all funding required at the most advantageous terms for EU citizens. By end-October the Commission raised EUR 71 billion in long term funding. The long term funding is further complemented by short-term EU-Bills.

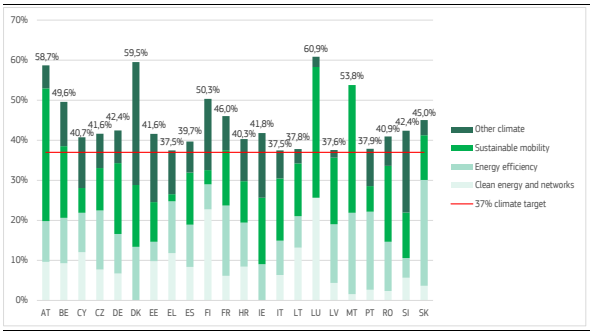
All 22 RRPs that have been adopted by mid-November 2021 effectively address all or a significant subset of the reform and investment challenges identified in the country-specific recommendations. As shown in the chart overleaf, the extent to which the challenges are indeed taken up, however, varies across Member States (Graph I.5.). A breakdown by policy area shows that challenges in the areas of research and innovation, education, skills and life-long learning, energy and climate change as well as transport and the business environment are well covered in the plans. Member States' plans are less in general ambitious in policy areas related to taxation or to the long-term sustainability of public finances. However, this could mean that they are addressing these challenges under different programmes or measures, not under the RRF.

Graph I.5: **Overview by Member State of the extent to which relevant CSRs are addressed in the RRPs**



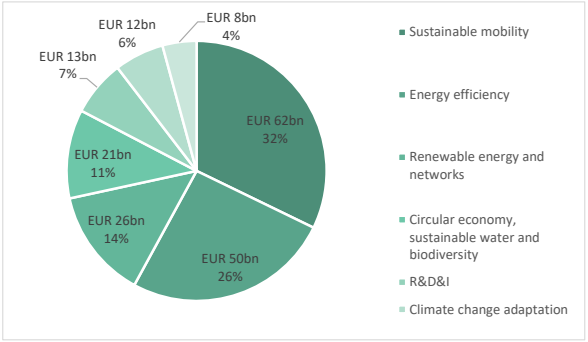
(1) The graph shows the share of 2019 and 2020 CSRs that is addressed (unsatisfactory, partially satisfactory or satisfactory) in the RRPs of the 22 Member States' for which the Council Implementing Decisions have been adopted.
Source: European Commission

Graph I.6: **Climate expenditure (% of allocation)**



Source: European Commission (Mahieu, forthcoming)

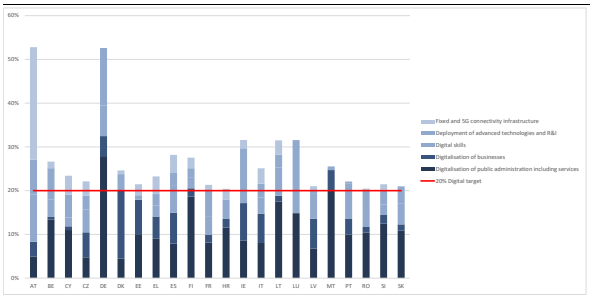
Graph I.7: **Green areas (% of total green expenditure)**



(1) Green includes both climate and environmental expenditures

Source: European Commission (Mahieu, forthcoming)

Graph I.8: **Digital expenditure (% of allocation)**



Source: European Commission

In terms of investments, all the adopted plans meet the quantitative climate target; in some cases by a large margin (Graph I.6). ([9]) Investment supporting sustainable mobility and energy efficiency count for almost 60% of green expenditure in the adopted plans (Graph I.7). Also in terms of their contribution to digitalisation, all the adopted plans meet the quantitative target (Graph I.8), with most emphasis put on digitalising public services and businesses. Other typical investments focussed on rolling out cross-border 5G corridors, or investing in digital skills.

In terms of reforms, the 22 plans far which a Council Implementing Decision was adopted, vary greatly, as could be expected, based on the different country-specific recommendations, and policy preferences.. On public finances and taxation, a number of Member States intend to make more systematic use of spending reviews to improve the composition and efficiency of their public finances (BE, FR, IT). Others plan to use RRF support to bring in environmental tax reforms (AT, DK) or to streamline their tax systems and improve tax collection (IT, CY, LT, SK), including by beefing up the fight against aggressive tax planning (CY, MT, IE) ([10]). On education, labour market and employment policies, noteworthy reforms include the reorganisation and strengthening of public employment services (FR, AT), the rationalisation of employment contracts (ES) and the reform of unemployment benefits to boost incentives to work (FR, SI) as well as education systems reforms, including with respect to early childhood education and care (RO) and revamping school curricula (SI). This comes in addition to investments in education as well as training and skills development which are included in the vast majority of the plans. On public administration and business environment, a number of plans include measures to reduce red tape and to modernise the functioning of the public sector, with some including reform of state-owned enterprises (DE, CY, IT, LV, LT, PT) or reforms to liberalise regulated professions (HR). Other plans comprise reforms of public procurement practices to stimulate private sector investment (IT) and/or measures to tackle anti-money laundering and corruption (EE, EL, LV, FI, SE).

So far, out of the 22 RRPs ,seven have also requested loans on top of the grant allocation. Italy, Romania and Greece have requested the maximum loan allocation of EUR 122.6 billion, EUR 14.9 billion, and EUR 12.7 billion

([9]) For some Member States, like Austria, this also relates to the fact that the plan is relatively ambitious compared to the available allocation (the size, measured by total estimated costs, is far larger than the allocation, implying that the green and digital expenditures weighed by the corresponding estimated costs are also relatively high compared to the final allocation of the plan).

([10]) Despite these measures, only a few Member States have addressed the country specific recommendations in the area of taxation, in particular on reducing the tax burden on labour and broadening tax bases to a satisfactory extent.

respectively, whereas Poland, Portugal, Slovenia and Cyprus requested less than the maximum ([11]).

I.5. A stylised quantitative assessment of NGEU investment:

To produce a quantitative assessment of NGEU's macroeconomic impact, this section summarises the stylised simulations described in Pfeiffer et al. (2021) ([12]) using a model based on the Commission's QUEST model ([13]). QUEST incorporates the main features relevant to fiscal policy transmission, such as Keynesian price and wage rigidities and liquidity-constrained households. We extend this core framework along three main dimensions. First, we incorporate the key features of the NGEU: grant allocations, favourable RRF loan conditions and new debt issued by the EU with stylised (but explicit) repayment assumptions. Second, we include detailed public investment dynamics and factored in construction delays ([14]). Finally, we embed the model into a large-scale multi-country structure, where rich trade linkages and financial markets (e.g. exchange rate movements) connect each of the 27 countries and the rest of the world to all other economies. This approach enables us to make a careful assessment of spillover effects in the EU's highly integrated economy.

Modelling the impact of NGEU requires making several basic assumptions. (i) The total simulated package amounts to around 4% of EU GDP. Expressed in 2019 prices, EUR 396 billion is in grants with country-specific shares mostly following the RRF allocation key ([15]). The simulations account for 166 billion in RRF loans, based on requests by the afore mentioned seven Member States. (ii) The analysis looks at two set time profiles, a four-year "fast" scenario (2021-2024) and a six-year scenario (2021-2016) for all Member States. (iii) The use of all NGEU grants and half of the loans for additional productive public investment compared to the baseline without NGEU, with productivity assumptions in line with the literature ([16]). (iv) All Member States repay the EU-wide debt from 2027 to 2058 based on current GDP shares. Member States receiving RRF loans repay them from 2031 to 2050 ([17]). (v) Importantly, this assessment concentrates on the fiscal stimulus alone and does not factor in the positive impact of reforms on potential growth, which is expected to boost GDP further and in a permanent way (see below).

Based on these assumptions, the simulations highlight the substantial growth effects of NGEU investments, as reported in Graph I.9. Under the fast NGEU scenario (four years), with evenly distributed spending between 2021 and 2024, we find that the level of annual real GDP in the EU can peak around 1.5% higher than it would have without NGEU investments (in 2024). As public capital is productive, the additional investment boosts aggregate demand and increases potential growth. The latter supply-side effects last beyond the implementation phase and may lead to high long-term multiplier effects. Even in 20 years' time, EU GDP could be around 0.5% higher than it would have been without NGEU ([18]).

([11]) The maximum loan allocation is 6.8% of 2019 Gross National Income.

([12]) See Pfeiffer P., Varga J. and in 't Veld J. (2021), Quantifying Spillovers of NGEU investment, *European Economy Discussion Papers*, No. 144.

([13]) See Burgert M. et al. (2020), 'A Global Economy Version of QUEST: Simulation Properties.' *European Economy Discussion Papers*, No. 126.

([14]) In particular, this approach follows Leeper et al. (2010), reflecting that government investment is not immediately productive (e.g. building a bridge takes time) and that not all projects are shovel-ready due to contracting delays. See Leeper, E.M., T.B. Walker, and S-C.S. Yang, 2010, 'Government Investment and Fiscal Stimulus', *Journal of Monetary Economics*, Vol. 57, pp. 1000–12.

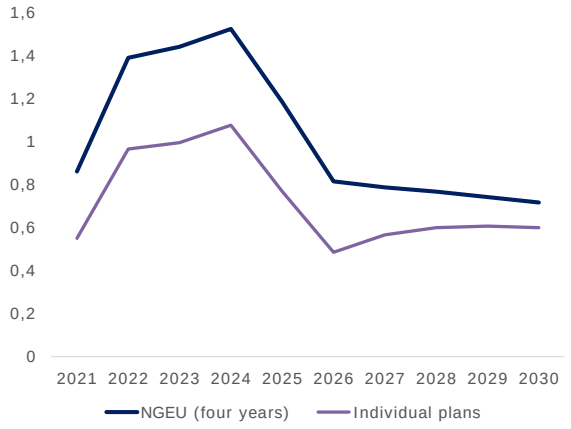
([15]) Besides the RRF grants, the total NGEU grant volume includes other instruments such as ReactEU and the Just Transition Fund (JTF). The allocation across Member States follows the current RRF maximum grant allocation. For ReactEU and the Just Transition Fund, we apply the specific allocation key based on current information. For the other instruments (Horizon Europe, InvestEU, Rural Development, RescEU), we applied the 70%-RRF allocation key.

([16]) In the simulations, non-additional loans finance general spending (which would take place anyway) but are repaid in full (i.e. they are not financed via new national debt), thereby reducing the debt burden eventually. Concerning the productivity assumptions, the main scenarios calibrate the output elasticity of public capital based on a meta-study (0.12). The sensitivity analysis also looks at a lower productivity scenario. See, Bom, P., and Ligthart, J. (2014). 'What Have We Learned From Three Decades Of Research On The Productivity Of Public Capital?' *Journal of Economic Surveys,* Vol. 28, pp. 889-916.

([17]) All repayments follow a linear schedule and are based on lump-sum contributions.

([18]) Despite differences in the modelling approach, these results are broadly in line with previous Commission estimates using the QUEST model, indicating a substantial positive impact on overall EU growth. See, European Commission (2020a), `Identifying Europe's recovery needs', SWD (2020) 98 final; and European Commission (2020b). European Economic Forecast Autumn 2020, *European Economy Institutional Paper*, 136. Similarly, the ECB's analysis based on the EAGLE model finds that NGEU could

Graph I.9: **EU real GDP effects of NGEU for 4 years spending profile (%)**



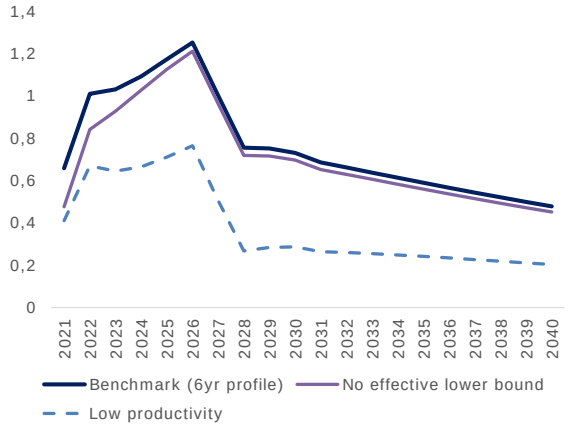
(1) This graph reports the level of real GDP in per cent deviation from a no-policy change (no-NGEU) baseline assuming a high productivity of public investment and under the fast NGEU profile (over four years). The dark purple line shows the results of the modelling for a simultaneous investment stimulus (NGEU). The light purple line indicates a synthetic EU-wide GDP (weighted average) obtained by aggregating stand-alone 27 simulations with unilateral stimulus in each country (on the basis of individual plans).

Source: Pfeiffer et al. (2021).

Improved labour market conditions go hand in hand with favourable GDP dynamics. During its period of operation, NGEU investment is estimated to increase employment by up to 1%, compared to the no-policy change baseline. In the medium-term, substantial and persistent real wage gains reflect improved labour market conditions and productivity gains (around +0.8% in 2030).

What are the reasons for these significant expansionary effects? Importantly, by design, NGEU represents a coordinated expansion. Thus, a considerable part of the expected impact is due to spillover effects, indicative of the benefits of joint action. Simultaneous investment increases the effectiveness of this policy: since all countries are set to grow, this will generate an increase not only in imports but also in exports. According to the modelling, spillover effects could account for around one third of the total growth impulse. Simply aggregating the individual effects of Member State' plans would thus substantially underestimate the macro effects of the NGEU (see the light purple line in Graph I.9 and the breakdown in Graphs I.11 and I.12 below) ([19]).

Graph I.10: **EU real GDP effects of NGEU (%) - Sensitivity analysis**



(1) This graph reports the level of real GDP in per cent deviation from a no-policy change (no-NGEU) baseline for a six-year NGEU profile. The dark (dashed) lines show the results of the modelling for a high (low) productivity calibration; the light line shows the results without effective lower bound-assumptions.

Source: Pfeiffer et al. (2021).

In addition to these spillover effects, several interrelated factors also contribute to the substantial boost to GDP found in the simulations. To help quantify these effects, Graph I.10 presents three additional scenarios as a sensitivity analysis. The first scenario shows that the macroeconomic impact remains substantial for a six-year NGEU plan, reaching 1.2% in 2026 and leading to a similar long-term impact (dark purple line). Second, at the current juncture, the policy interest rate at the effective (zero) lower bound implies at least a partial monetary accommodation, limiting crowding-out effects in private consumption and business investment. ([20]) In 'normal times', away from the lower bound, the short-term output impact would be smaller, according to the simulations (light purple line). Third, assumptions about the productivity of public capital have a high impact on estimates ([21]). While sizeable effects

increase real GDP in the euro area by around 1.5% over the medium term. Both studies have underlined the importance of productive public investment to generate persistent growth effects. See, Bańkowski et al. (2021), The macroeconomic impact of the Next Generation EU instrument on the euro area, *ECB Occasional Paper* No. 2021/255

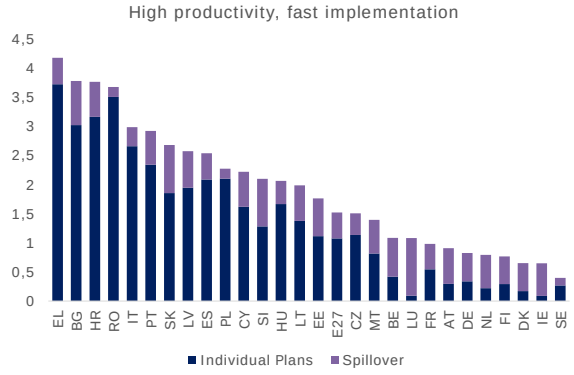
([19]) The simulations do *not* take into account reductions in risk premia or positive confidence effects (as discussed above in Section I.2), which could further increase the growth effects of NGEU. For additional details on the transmission mechanisms captured in the model, see Pfeiffer et al. (2021).

([20]) The effective (zero) lower bound is assumed to hold for six quarters.

([21]) This low productivity calibration applies a reduced output elasticity of 0.05 (compared to 0.12 in the high productivity case),

remain even under more pessimistic assumptions, the growth impact appears substantially lower when public investment is allocated to less productive uses (dashed line). This result is particularly visible in the medium to long term when the productivity effects unfold. Because the output effects in this simulation are smaller in each cluster, lower spillover effects imply a further reduction in the overall impact on growth. This underlines the importance of the focus on high-quality investment.

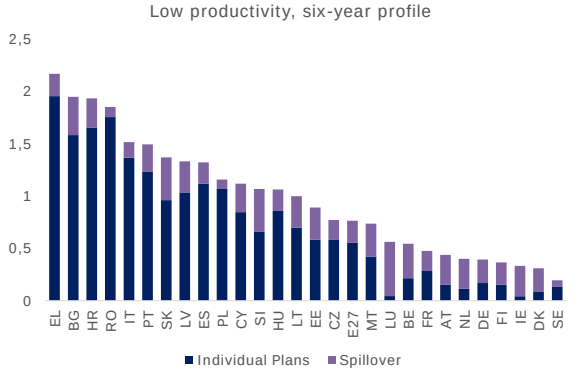
Graph I.11: **Peak annual GDP effects of NGEU (%) across Member States – Four year profile**



(1) The graph shows peak effects on real GDP in 2024 expressed in per-cent deviation from a no-policy change baseline for a fast NGEU profile spanning 2021 to 2024 under the assumption of high productivity. The dark bars show simulation results for a standalone investment stimulus in each Member State (NGEU). The spillover (light bars) is defined as the difference between the coordinated simultaneous NGEU stimulus in all Member States and the standalone simulations of national plans.
Source: Pfeiffer et al. (2021).

Breaking down the GDP effects into direct effects and spillover effects reveals strikingly different patterns across the Member States, as displayed in Graph I.11 and I.12. By design, NGEU strongly supports convergence within the EU economy, thereby counteracting the divergences that the COVID-19 crisis risks unleashing. Given the allocation key, the strongest growth effects appear in economies with below-average GDP per capita, and those hit hardest by the crisis. For example, using the model for a four-year stimulus with high productivity, the expected annual output gains peak in 2024 at more than 4% in Greece, around 3¾% in Bulgaria, Croatia and Romania, and around 3% in Italy and Portugal. For these countries, the relative role of spillover effects is smaller (light bars) because their main trading partners receive smaller allocations and/or their economies tend to be less integrated into international value chains and trade networks.

Graph I.12: **Peak annual GDP effects of NGEU (%) across Member States – Six year profile**



(1) The graph shows peak effects on real GDP in 2026 expressed in per cent deviation from a no-policy change baseline for a NGEU profile spanning six-years under low productivity. The dark bars show results for a stand –alone investment stimulus in each Member State (NGEU). The spillover (light bars) is defined as the difference of the coordinated simultaneous NGEU stimulus in all Member States and the standalone simulations of national plans.
Source: Pfeiffer et al. (2021).

In addition to the direct benefits from their own national allocations of funding, countries will also benefit considerably from the effects of NGEU investments made in other Member States, mainly through trade flows and exchange rate movements ([22]). Spillover effects are central for small open economies with smaller grant allocations. In these cases, the positive effects coming from other Member States' plans account for the bulk of the GDP impact. For some countries, such as Luxembourg and Ireland, positive spillover effects explain almost all of the total impact in the simulations. However, even for larger economies with deep trade integration, such as Germany, spillover effects account for over half of the sizeable GDP effect. As for the EU-wide results, the GDP impact is lower under a low productivity assumption (Graph I.12).

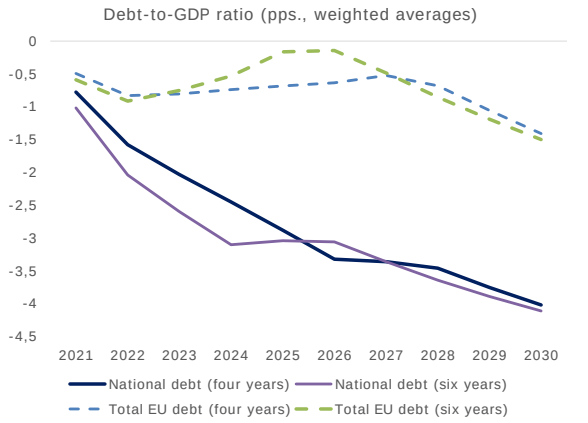
Graph I.13 shows that governments' fiscal positions improve as the growth stimulus increases tax receipts and reduces the need for financial

in line with the lower bound considered in Leeper, E., Todd B. W., and Yang, S. S.Y. (2010), ibid.

([22]) The trade flows in the model are based on a rich trade matrix, highlighting the role of trade openness and specific trade linkages. See also Table 4.2 (p.28) in Pfeiffer et al. (2021).

support to the unemployed. This reduces the national debt ratios over a longer horizon (solid lines).

Graph I.13: **Debt dynamics (EU)**



(1) This graph reports the debt-to-GDP ratios in percentage point deviation from a no-policy change baseline. The solid (dashed) lines show the average debt ratios abstracting from EU debt (explicitly including EU debt used for grant financing). Note that these stylised model-based debt projections can differ from the Commission's Debt Sustainability Assessment, which follows a different methodology.
Source: Pfeiffer et al. (2021).

The model accounts for EU-wide debt associated with NGEU, but does not incorporate the inter-institutional agreement that this debt will be repaid by new own resources. Instead, the simulations assume that contributions by the Member States (based on GDP shares) to repay NGEU grants are financed by lump-sum taxation. After an initial accumulation, debt gradually falls as higher growth boosts tax revenues. This scenario shows a small kink after the spending phase ends (denominator effect in 2025 and 2027, in respectively the 4 and 6 year scenarios) but debt will then continue to fall. On average, the EU debt ratio is set to fall every year, as shown in Graph I.13 ([23]).

I.6. *Effective implementation of reforms may further boost the positive macroeconomic impact of the NGEU*

In sum, the simulations above underline the significant impact of the NGEU and its potential to lift Europe's economies onto a significantly better recovery path in terms of both GDP and labour market conditions. If implemented as agreed, with a strong focus on high-quality public investment and additionality, the NGEU is expected to significantly increase GDP in the recovery phase. Though it is to give a substantial boost to the recovery in all Member States, the allocation of financial support ensures that the funds will flow to where they are needed the most. At the same time, positive spillover effects are likely to be the highest in small and open economies with smaller grant allocations, supporting growth broadly across the EU. The economic modelling also indicates that high-quality public investment can significantly boost potential output beyond the implementation period, thereby helping to address medium-term challenges such as climate change and digitalisation.

The analysis presented here does not go into country-specific details contained in the national RRPs, leaving these important aspects for future research. The modelling framework does not capture the environmental benefits of the green investment either (for example, to promote biodiversity, the use of renewable energy and more energy-efficient buildings). Last, while the simulations cover NGEU investments in a stylised manner, they do not include the positive impact of reforms on potential growth. This is difficult to quantify, but it can be expected to add substantially more to the GDP and employment effects over the long term. In this regard, a model-based benchmarking exercise shows that carrying out reforms that would result in halving the gap vis-a-vis the best performers (measured in terms of structural indicators) could raise GDP substantially in Member States, on average by 11% in 20 years' time. The gains would be higher in Member States that have the most potential to improve, for instance up to 17-18% higher GDP for Italy and Greece in the long run ([24]). This illustrates that the overall gains from NGEU including reforms could be even higher than the gains shown above, depending on effective implementation of the reforms that Member States have committed to in their Recovery and Resilience plans.

([23]) The debt dynamics also depend on the assumed financing of the repayments for RRF loans and grants. We assume that a separate EU budget accounts for the new EU-wide debt, with the repayment assumptions discussed above. Accounting for this EU-wide debt explicitly (based on the Member States' GDP shares), there is an increase in the 'overall' debt ratio for some net contributors. See also the details in Pfeiffer et al. (2021).

([24]) See Varga, J., and in 't Veld, J. (2014). The Potential Growth Impact of Structural Reforms in the EU: A Benchmarking Exercise. *European Economy Economic Papers*, No. 541.

II. COVID-19: the stabilising impact of EU bond issuance on sovereigns and banks

By Mario Bellia, Ludovic Calès, Lorenzo Frattarolo, Daniel Monteiro and Marco Petracco Giudici

This section explores the effects of the large-scale EU bond issuance and the ECB asset purchases in the context of a hypothetical financial crisis that would have been induced by the COVID-19 downturn. Stylised simulations show that the crisis response policies of the EU have strongly mitigated the risks associated with sovereign-bank loops in euro area countries. In particular, monetary policy action together with the introduction of a common debt instrument can more than halve potential losses to public finances from a hypothetical banking crisis. Moreover, these positive effects accrue to all Member States, even after accounting for costs linked to the extension of joint guarantees. The results also suggest that a recovery package offering a mix of both loans and grants to affected countries can be optimal for the euro area as a whole from the perspective of attenuating sovereign-bank loops.

II.1. Introduction

The COVID-19 pandemic was a severe systemic shock that affected the entire world economy. It is unprecedented in the history of the EU. According to Eurostat data, the GDP of the EU dropped by 6% in 2020, which compares with a more contained drop of about 4.2% in the financial crisis year of 2009.

A strong public intervention was deemed necessary in several countries to cope with the pandemic, and its economic and social consequences. A sizeable amount of public funds was devoted to sustain the health system, pay for welfare measures, and support companies suffering the consequences of the pandemic. At the EU level, the policy response has included additional spending programmes financed by the issuance of common EU bonds and new asset purchases by the European Central Bank (ECB). Together with the extension of state-backed loan guarantees and moratoria, the crisis response measures have so far prevented a rise in non-performing loans and a marked deterioration in creditworthiness of borrowers.

This coordinated policy response has ensured macrofinancial stability, avoiding heightened market pressure on public finances and managing potential risks to bank balance sheets. The current economic context is thus different from the 2009 financial crisis, which escalated into a sovereign-debt crisis in 2011-2013, partly due to sovereign-bank feedback loop dynamics ([25]). At that time, several EU governments had to rescue banks with large amounts of public money, putting significant pressure on public finances, deteriorating their sovereign risk profile and affecting the value of banks' holdings of domestic sovereign debt. Given that EU banks had a strong home bias (i.e. they often bought the government debt of the countries where they were based), some banks required further help after the first government interventions. This added to public debt, generating a feedback loop. Since this time, significant regulatory action has been taken to restore confidence in the financial sector, make banks safer and more resilient, and sever the direct links between banks and their domestic sovereigns, notably through a new bank recovery and resolution framework.

In this article, we explore in a stylised setting the impact of key EU measures in the areas of fiscal and monetary policy on reducing the risks associated with sovereign-bank loops in the context of the COVID-19 crisis. To this end, we: (i) employ the micro-simulation SYMBOL model coupled with a sovereign default risk model, ([26]) and (ii) use of bank-level data from the European Banking Authority (EBA) on sovereign exposures, expanding on the work in Bellia et al. (2019) ([27]). The analysis can thus be seen as providing an assessment of the effectiveness of the EU fiscal and monetary response to the

([25]) See Fontana A. and S. Langedijk (2019), 'The Bank-Sovereign Loop and Financial Stability in the Euro Area', *JRC Working Papers in Economics and Finance* 2019/10.

([26]) See De Lisa, R., S. Zedda, F. Vallascas, F. Campolongo and M. Marchesi (2008), 'Modelling deposit insurance scheme losses in a Basel 2 framework', *Journal of Financial Services Research*, Vol 40 and Kok C., S. Ongena, L. Pelizzon, L. Hordijk, D. Kancs, J. Cariboni, W. Heynderickx, S. Maccaferri, A. Pagano, M. Petracco Giudici (2018), 'Review of the SYMBOL model', *JRC Technical Reports* EUR 29233 EN. The sovereign default model is Mody, A. and D. Sandri (2012), 'The Eurozone crisis: how banks and sovereigns came to be joined at the hip', *Economic Policy* 27 (70).

([27]) Bellia M., L. Calès, L. Frattarolo, A. Maerean, D. P. Monteiro , M. Petracco Giudici and L. Vogel (2019), 'The Sovereign-Bank Nexus in the Euro Area: Financial & Real Channels', *European Economy* discussion paper 122.

COVID-19 crisis in terms of enhancing the resilience of sovereigns and banks to a hypothetical banking crisis, while illustrating how this resilience has developed as EU initiatives moved from an initial to a more advanced stage.

We consider three scenarios in our simulations:

1. **a no EU intervention scenario:** this is a purely hypothetical scenario where no intervention is enacted at EU level along the monetary and fiscal dimensions, so that there is no new asset purchase programme by the ECB nor common EU bond issuance, and market pressure remains elevated with respect to the more vulnerable sovereigns;

2. **an EU intervention scenario, where no EU grants are contemplated:** this scenario takes into consideration the new and expanded asset purchase programmes of the ECB as well as EU bond issuances financing the Support to mitigate Unemployment Risks in an Emergency (SURE) and NextGeneration EU (NGEU) programmes, where the latter is assumed to be made up entirely of loans to Member States;

3. **an EU intervention scenario, where NGEU includes both loan and grant components:** this scenario is similar to scenario 2, while considering the fact that a share of NGEU financing to Member States is provided through grants.

The results are presented for the euro-area aggregate as well as for eight euro area (EA) economies (Belgium, Germany, Ireland, Spain, France, Italy, the Netherlands and Portugal), which together represent approximately 78% of EU GNI.

The remainder of this article is structured as follows. Subsection II.2 provides a timeline of the EU's response to the COVID-19 outbreak together with an analysis of changes in credit default swap (CDS) quotes. Subsection II.3 describes the different simulation scenarios and the modelling strategy. Subsection II.4 presents the simulation results and Subsection 0 concludes.

II.2. The EU response to the COVID-19 outbreak and CDS movements: a timeline

Graph II.1 provides a timeline of events related to the evolution of the pandemic crisis during the first half of 2020, while Graph II.2 shows developments in sovereign CDS spreads (five-year maturity) during the same year for our selection of eight EA countries.

Initially affecting the city of Wuhan in China, the COVID-19 outbreak was declared a public health emergency of international concern by the World Health Organization (WHO) on 30 January 2020. In Italy, the authorities ordered a lockdown and social distancing measures in its northern regions on 8 March and in the whole country on 9 March. It was the first Member State to adopt such measures. On 11 March, the WHO declared COVID-19 a pandemic. The severity of the outbreak soon became apparent all over Europe, with this recognition accompanied by sharp increases in CDS spreads.

On 12 March, remarks on the possible widening of government bond spreads during a press conference by President Lagarde of the ECB ([28]) failed to assuage market concerns over the degree of monetary policy support and possible constraints on Member State borrowing, triggering a negative reaction by the markets. Sovereign bond yields and CDS spreads increased substantially in several Member States, despite the announcement at the same time of a EUR 120 bn expansion in net purchases under the ECB's asset purchase programme (APP) until the end of 2020.

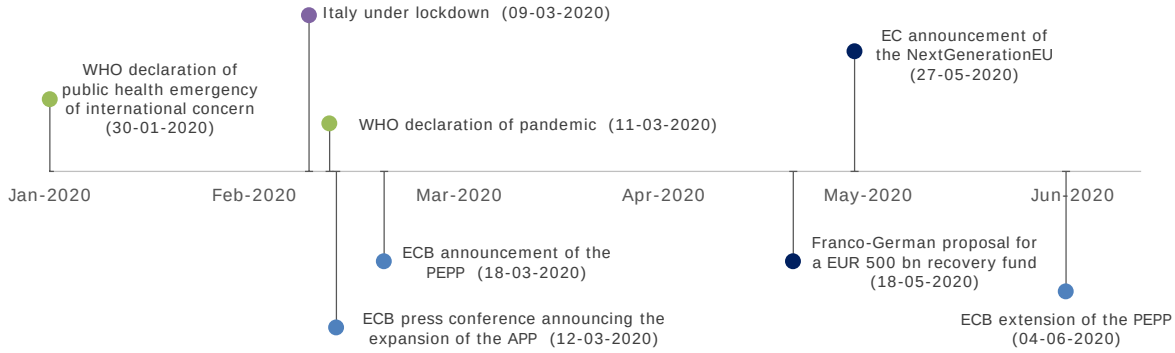
On 18 March, the ECB announced the pandemic emergency purchase programme (PEPP). The PEPP consisted of a temporary asset purchase programme of private- and public-sector assets with an overall size of EUR 750 bn ([29]), which provoked a positive market reaction. While CDS spreads slowly started to narrow following the announcement, the PEPP announcement does not seem to have been enough to ease price pressures in a sustained manner.

On 18 May, France and Germany advanced an ambitious proposal for a EUR 500 bn recovery fund to be distributed in the form of grants to

([28]) '…We are not here to close spreads. This is not the function or the mission of the ECB'. ECB press conference Q&A, available from https://www.ecb.europa.eu/press/pressconf/2020/html/ecb.is200312~f857a21b6c.en.html

([29]) Programme details are available from https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200318_1~3949d6f266.en.html

Graph II.1: **Event timeline**



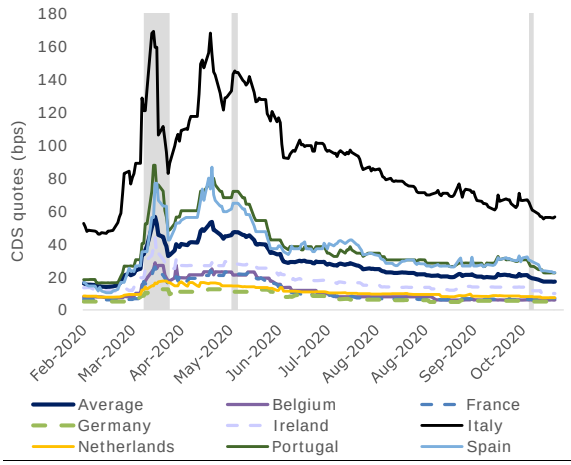
Source: Own presentation.

Member States. The fund would be backed by an increase in the EU's own resources ceiling and financed by joint EU debt issuance. On 27 May, the European Commission announced a recovery plan including a new instrument, NGEU ([30]). This instrument would allow the EU to borrow EUR 750 bn on financial markets and disburse the amounts to Member States in the form of grants and loans. Its aims were mainly to: (i) help Member States carry out investments and reforms; (ii) support the most affected private sector companies; and (iii) strengthen health security. The aforementioned Franco-German and NGEU proposals put CDS spreads firmly on a downward path

On 4 June, the size of the PEPP was increased by EUR 600 bn, resulting in a total of EUR 1 350 bn, available until at least the end of June 2021 ([31]). CDS spreads continued to decline, and stabilised from October 2020 onwards at their pre-crisis level. The second wave of contagion that occurred in most EU countries after the summer of 2020 does not seem to have affected their level, confirming that joint EU action was able to restore market confidence.

Given the difficulties of disentangling the effects of the ECB intervention from the effects of the European Commission's intervention, we consider the two jointly in our model simulations.

Graph II.2: **Changes in CDS spreads for selected EA Member States**



(1) The first shaded area corresponds to the period between 12 March and 26 March, the second to the date of the Commission spring 2020 forecast (6 May) and the third to the date of the autumn forecast (5 November 2020).
Source: Thomson Reuters DataStream.

II.3. Simulation scenarios and modelling approach

Simulation scenarios

All scenarios considered in the simulations are characterised by high government debt levels, which incorporate the large government financing needs brought about by the COVID-19 crisis, as projected in Commission services' forecasts. Fiscal measures are thus taken into account to the extent that they change debt levels, while their effect on

([30]) An overview of the European Commission response, including the SURE instrument worth EUR 100 bn, is available from https://ec.europa.eu/commission/presscorner/detail/en/ip_20_940.

([31]) ECB press release available from https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.mp200604~a307d3429c.en.html

The crisis response measures of the ECB went beyond asset purchases and included large liquidity injections, changes in collateral requirements and supportive supervisory policies.

growth is considered to the extent that it influences market perceptions (as reflected in CDS spreads).

The shock that is applied is the same across all scenarios and reflects a severe banking crisis ignited by losses on banks' private sector exposures (e.g. loan defaults). What differs across scenarios is the presence and nature of the EU crisis response, which will be seen to affect the resilience of sovereigns and banks to the hypothetical banking crisis.

As mentioned in Subsection II.1, we consider three scenarios. These are set out in the three paragraphs below.

1. **No EU intervention**: in this scenario, Member States finance their high debt levels exclusively through national bonds, with banks holding a proportion of these bonds in line with historical shares. The credit risk of Member States is relatively elevated and calibrated on the basis of CDS spreads observed for the period running from 12 to 26 March 2020, when no or limited EU-level intervention was expected by the markets.

2. **EU intervention, but no EU grants:** this scenario includes both the PEPP and the expansion of the APP programme ([32]) assuming that the Eurosystem acquires sovereign debt in the secondary market in proportion to the ECB capital key of the different Member States, thus reducing banks' sovereign exposures. In addition, EU bonds to finance the SURE and NGEU programmes ([33]) are introduced, and partly held by banks. EU issuance is considered riskless as it is guaranteed by all Member States, with the insurance cost distributed among countries according to a GNI key. In this scenario, sovereign risk is calibrated based on the CDS spreads observed on 6 May 2020, the day of the release of the Commission's 2020 spring forecast, a date when expectations by financial markets of common EU issuance were present, but the prospect of NGEU grants was still largely unpriced.

3. **EU intervention, with NGEU grants**: this scenario is similar to the previous one, with a portion of the proceeds from EU bond issuance now transferred to Member States in the form of grants, which do not affect their government debt-to-GDP ratios. Member States receive grants based on the NGEU allocation keys and, so that grant-related EU debt is eventually repaid, see their contribution to the EU budget increase based on their GNI keys. The increased future contribution to the EU budget is translated in the model as an increase in the present value of sovereign debt. The difference between the NGEU allocation and the GNI contribution keys implies that the more vulnerable Member States receive a net positive contribution from the grants, while less vulnerable Member States tend to receive a net negative contribution. We calibrate the model in this scenario using the CDS spreads from 5 November 2020, the day of the release of the Commission's autumn forecast, a time when market expectations had already incorporated the presence of grants and the details of the NGEU allocation.

Modelling approach

The model is simulated based on data and market expectations taken at different points in 2020. More concretely, we assume that the projections for government debt ratios included in the 2020

([32]) The PEPP is a temporary, unconventional monetary policy measure introduced by the ECB in response to concerns about the effectiveness of monetary policy transmission in the context of the COVID-19 crisis. The PEPP is carried out in addition to the existing APP, for a total expected size of EUR 1 350 bn at the date of the calibration of the model. The PEPP includes purchases of private and public financial assets by the ECB. A major difference between the PEPP and the APP is that the APP includes securities issued by the Greek government as well as commercial paper of non-financial corporations. The benchmark allocation across Member States is the ECB's capital key, although purchases are executed with some degree of flexibility and according to market conditions. Only Eurosystem eligible counterparties are allowed to offer assets to be purchased. However, asset managers and other non-bank financial institutions can offer securities through eligible counterparties.

([33]) NGEU is an emergency European recovery instrument aiming to support public investments and reforms. The instrument has a maximum size of EUR 750 bn (2018 prices), broken down as follows:

- grants under the Recovery and Resilience Facility (RRF): EUR 312.5 bn

- loans under the RRF: EUR 360 bn

- grants outside RRF: EUR 77.5 bn

In addition, the EU institutions fast-tracked the introduction of an employment support scheme (SURE) to counter the negative effects of the crisis. Loans to Member States under the SURE programme amount to a maximum of EUR 100 bn. Together with the amounts planned under NGEU, total common debt issuance by the EU can reach a maximum of EUR 850 bn in the coming years.

Commission spring and autumn forecasts materialise, and that a particularly severe banking crisis erupts against such a high-debt background induced by the COVID-19 crisis. In line with previous simulations using the SYMBOL model, the severity of the banking crisis is set equal to that of the 2008 financial crisis.

We use the model to generate a feedback loop between valuation losses on banking assets and potential hikes in sovereign risk premia due to increases in the level of government debt. In particular, the initial model shock produces valuation losses that may lead to government-sponsored recapitalisation of failing banks. ([34]) Such recapitalisations increase government debt which lowers government bond prices and produces further valuation losses on banks' balance sheets. ([35]) Affected banks may in turn require further recapitalisation by the government, thus iterating the loop.

It should be noted that the analysis is a partial equilibrium analysis focusing on the direct links between the government and the banking sector, while abstracting from other economic interactions. In particular, the possible effects of changes in bank balance sheets on lending and the real economy are not considered (although they implicitly contribute to differentiate the three simulation scenarios via the different growth expectations embedded in CDS spreads observed at different moments in time). The outcome of the simulation is: (i) an estimation of the bank-originated losses falling upon the government sector via recapitalisation needs; ([36]) (ii) the final government debt levels of each country reflecting such losses; and (iii) the increase in sovereign risk premia resulting from the increase in government debt ratios, found at the new model equilibrium following the initial shocks. The main implication of the partial equilibrium approach is, however, that the impact of a banking crisis on economic growth is not considered.

The modelling approach, the model calibration and the related assumptions are discussed in detail in Box II.1.

II.4. Simulation results

The shock that triggers sovereign-bank loop dynamics across all scenarios is losses on banks' private sector exposures, as generated by the SYMBOL model. These represent a hypothetical financial crisis in a COVID-19-induced high debt context, of a severity similar to the 2008 crisis. Therefore, the simulated financial losses by banks should be understood as hypothetical and merely illustrative. They represent potential losses under very adverse conditions and pessimistic assumptions, both in terms of the magnitude of the shock and the ability of existing crisis resolution mechanisms to absorb this shock.

For these initial SYMBOL losses, the most affected country in our simulation is Ireland, to the tune of 6% of GDP, followed by France and Spain, as shown and discussed in Box II.1. Ireland, however, has the highest ratio of regulatory capital to GDP, which strongly mitigates the impact from the initial shock.

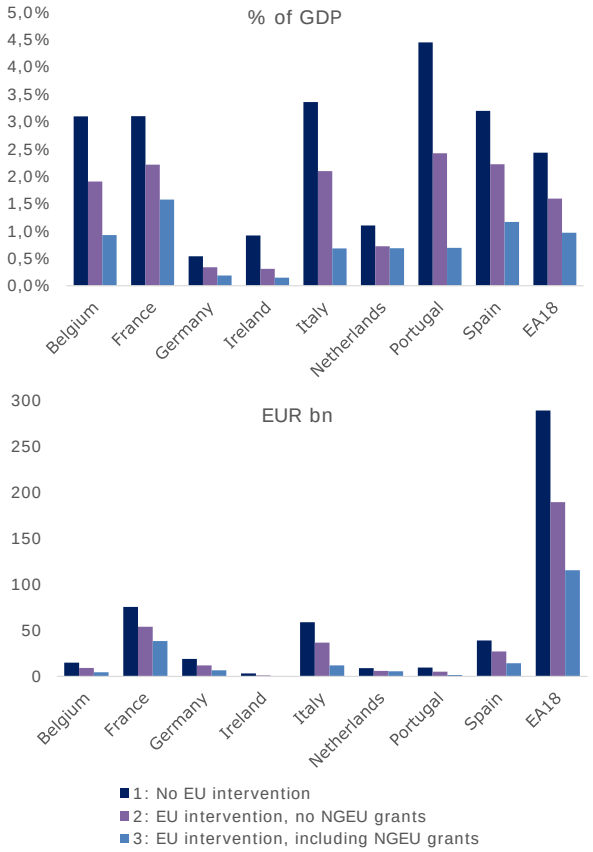
The feedback loop is set in motion through a sequence of knock-on effects that come from increases in sovereign debt (due to the recapitalisation of banks by the government) and valuation losses on sovereign debt held by banks (due to lower bond prices in connection with increases in sovereign debt ratios and risk premia). While the mathematical model underlying the simulations necessarily produces exact results, losses are better read in comparative terms rather than as absolute amounts, given the illustrative and hypothetical nature of the exercise. An overview of the results is presented in Graph II.3, where excess losses are defined as losses incurred by banks that bring their tier 1 capital ratio below an indicative minimum regulatory threshold of 10.5% after accounting for instruments that can be 'bailed-in'.

([34]) Such government interventions are regulated at EU level. In the present exercise, we avoid a discussion of the conditions and limits imposed on such interventions, and focus on abstract 'worst case' scenarios where banks lose market access and sovereigns effectively incur in expenditure due to bank recapitalisation. It should also be noted that model simulations contemplate a bail-in tool in the loss absorption cascade, but not the existence of a resolution fund. This can once more be interpreted as a pessimistic scenario where a resolution fund does not prevent the start of the feedback loop. A similar set-up was used in previous works such as Bellia et al. (2019) and Fontana and Langedijk (2019), *op. cit.*

([35]) The SYMBOL model assumes that due to market pressure mechanisms, all government exposures are *de facto* marked to market.

([36]) Given that the simulations are entirely hypothetical, these losses can be interpreted as contingent government liabilities.

Graph II.3: **Excess losses from a hypothetical financial crisis**



(1) EA18 refers to the results for the full EBA sample covering all EA Member States, except Slovakia.
Source: Own simulations.

Across the euro area, the combined excess losses could account for close to 2.5% of GDP in the no intervention scenario. These losses can be interpreted as additional financial liabilities of the public sector, i.e. they would need to be covered by government recapitalisation if a bank was to continue to operate under a minimum required capital ratio of 10.5%, assuming that no market recapitalisation was feasible. ([37])

The most affected Member State in this no intervention scenario as a share of its GDP is Portugal, and the least affected are Germany, Ireland and the Netherlands. Excluding Germany, all countries are exposed to potential losses that are close to or (well) above 1% of their GDP. Overall, the results are mainly driven not only by the country-specific shock sizes shown in Box II.1, but also by: (i) the initial riskiness of sovereigns (affecting the sensitiveness of risk premia to increases in debt levels); (ii) banks' matrices of exposures to the sovereigns; and (iii), bank capitalisation levels. All else being equal, sovereigns displaying higher initial risk premia and banks that are more exposed to their debt, or that enjoy lower tier 1 capital ratios, are more prone to experiencing excess losses.

The situation changes markedly once we include the effects of EU policy intervention, which lead to a substantial reduction in excess losses across all Member States. The simple average loss reduction is approximately 40% for the selected Member States in scenario 2 (NGEU without grants), increasing to approximately 67% if we also include a portion of NGEU grants (scenario 3). These average figures can vary significantly across Member States, with the highest loss reduction in scenario 3 belonging to Portugal (a decrease of 84%), closely followed by Ireland (84%) and Italy (80%).

The observed reduction in excess losses in connection with EU-level interventions can be interpreted as the result of several forces. Firstly, the interventions generate a positive confidence effect, which lowers the perceived initial riskiness of sovereigns, as captured by the CDS spreads used in the initial calibration of the model. This effect is strongest in scenario 3. Secondly, Eurosystem purchases and EU bond issuance help to de-risk bank balance sheets by effectively substituting central bank reserves and a safe EU asset for (risky) sovereign bonds. Thirdly, in the scenario with grants, the debt ratios of the most vulnerable Member States increase less compared with debt ratios of Member States with the largest fiscal space. This redistribution of sovereign risk across Member States carries positive financial stability implications, particularly given the non-linear impact of debt ratios on government creditworthiness in our model.

Table II.1 displays the change in debt-to-GDP ratios of the selected countries under the different scenarios. Concerning changes in the debt ratio, it is worth stressing that the feedback loop model used in the simulations does not capture growth, the provision of bank credit or other general equilibrium effects associated with the EU intervention. This means that the differences across scenarios relate only to the different impact of the sovereign-bank loop dynamics and to the

([37]) See also European Commission (2014), 'Assessing Public Debt Sustainability in EU Member States: A Guide', *European Economy Occasional Papers* 200, as well as subsequent debt sustainability monitors by the same institution.

different direct budgetary implications of EU intervention.

Table II.1: **Change in government debt-to-GDP ratios from a hypothetical financial crisis (pps.)**

Member State	1. No intervention	2. EU intervention without grants	3. EU intervention with grants
Belgium	3.2	2.2	2.4
France	3.1	2.5	2.7
Germany	0.7	0.7	2.4
Ireland	1.2	0.8	2.3
Italy	3.4	2.4	-0.9
Netherlands	1.1	0.9	2.6
Portugal	4.5	2.7	-3.9
Spain	3.2	2.4	-2.5
EA18	2.5	1.9	1.3

(1) Scenario 3 includes as part of government debt the additional contributions to the EU budget related to NGEU grants.
Source: Own simulations based on European Commission data.

The development of the sovereign debt ratio under a no intervention scenario is the result of the excess losses shown in Graph II.3. In scenarios 2 and 3, besides the respective excess losses, the debt ratio is also influenced by: (i) the possible presence of NGEU grants (which directly reduce the debt of beneficiary Member States, while indirectly increasing it via future contributions to the EU budget); and, to a smaller extent, (ii) costs associated with EU debt mutualisation (as discussed in Box II.1).

It can be seen that scenario 2 (EU intervention without grants) produces lower debt ratios when compared with a no intervention baseline. This is due to the effect of the EU intervention in reducing excess losses and the associated recapitalisation needs in domestic banking sectors. In the presence of an NGEU grant component (scenario 3), this positive effect becomes more marked for certain countries, with grant amounts more than compensating for excess losses (e.g. Portugal, Spain and Italy). At the same time, some Member States see their debt ratios increase more than before in present value terms. This is the case for countries allocated comparatively smaller EU grant amounts, while contributing significantly to the EU budget via their GNI key (e.g. Ireland, the Netherlands and Germany), reflecting the fact that the contributions of these countries are set to rise to repay the grant component embedded in EU bond issuance. Overall, given that grants reduce aggregate excess losses, they also reduce the government debt ratio of the euro area as a whole when compared with scenario 2.

As regards sovereign risk premia, these would tend to be higher in a no EU intervention scenario, reflecting both the relatively low levels of market confidence observed in the second half of March 2020, and the further stress on public finances from a full-blown banking crisis. However, the results reported in Table II.2 suggest that the EU intervention can produce a decrease across the board in sovereign risk premia, which becomes particularly marked once an NGEU grant component is included. This positive effect has to do with the EU intervention lowering government debt ratios, but also (and primarily) with the previously mentioned confidence effects that it generates, as also seen when discussing the evolution of CDS spreads in Subsection II.2. This effect benefits all Member States, including the least vulnerable countries who benefit both directly by partaking in the EU-wide reduction in initial CDS spreads, and indirectly via their bank exposures to the more vulnerable Member States, whose resilience is seen to improve.

Table II.2: **Sovereign risk premia under different scenarios**

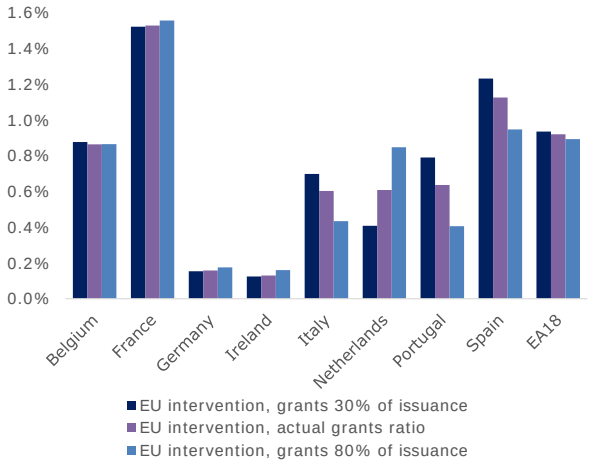
Member State	Five-year CDS spreads		
	1. No intervention	2. EU intervention without grants	3. EU intervention with grants
Belgium	27.0	21.2	6.0
France	24.4	21.9	6.2
Germany	12.5	11.0	5.0
Ireland	37.9	27.9	11.7
Italy	168.1	145.2	60.7
Netherlands	17.6	14.5	8.1
Portugal	87.9	72.1	26.5
Spain	66.6	64.8	29.3

Source: Thomson Reuters DataStream and own simulations.

Finally, we explore the effects of providing different shares of grants under the NGEU scheme. In particular, we consider two purely hypothetical scenarios where this share is set to 80% and to 30% of total EU bond issuance. This compares with a share of 46% assumed so far in

the simulations. ([38]) As can be seen in Graph II.4, increasing the share of grants tends to significantly decrease the amount of losses for those Member States with a grant allocation key that is higher than the EU budgetary contribution key (e.g., Portugal, Italy and Spain). At the same time, losses generally increase slightly for the other Member States (with the possible exception of the Netherlands, where the increase is more pronounced). For the euro area aggregate, although total excess losses do not vary much as a function of the share of grants, they appear to be minimised for higher grant ratios.

Graph II.4: **Excess losses for different shares of NGEU grants**



(1) EA18 refers to the results for the full EBA sample covering all EA Member States, except Slovakia.
Source: Own simulations.

II.5. Conclusion

A hypothetical banking crisis emerging from the COVID-19 downturn could have a considerable impact on EU banking systems via their exposures to sovereigns, and on sovereigns themselves via contingent liabilities linked to bank recapitalisation. Without policy interventions at EU level, hypothetical losses in a pessimistic scenario could be more than 2% of euro area GDP, with considerable variation at country level due to differences in baseline risk levels and in the size of the respective banking systems.

The introduction of EU bond issuance together with the Eurosystem asset purchases have a sizeable effect in reducing the potential impact of government debt hikes on banking sector stability. The effectiveness of EU bond issuance increases markedly when a part of the proceeds is distributed in the form of grants. In particular, the EU intervention package considered in this article – composed of Eurosystem asset purchases and of EU bond issuance under the NGEU and SURE programmes – reduces 'excess' bank losses in a systemic crisis by an average effect of about 40% in a scenario where no NGEU grants are included. With the introduction of grants, this reduction increases to 67% on average, with some countries experiencing reductions of more than 80%. Sensitivity analysis performed by introducing different shares of grants suggests that higher shares can have a modest beneficial effect on the euro area aggregate from a sovereign-bank loop viewpoint.

([38]) A 46% share was obtained by dividing the maximum amount of grants under NGEU (EUR 390 bn) by the maximum amounts of funding contemplated under the NGEU and SURE programmes (EUR 750 bn and EUR 100 bn, respectively).

Box II.1: Modelling approach, calibration and assumptions

The analysis in this section relies on the SYMBOL model of bank portfolio losses combined with a simple model of sovereign default introduced by Mody and Sandri (2012) ([1]), which are used together to generate a loop between bank losses and sovereign risk.

The methodology consists of four main steps: 1) calibrating model parameters; 2) simulating the impact of an exogenous credit-quality shock on the valuation of bank assets (this step is performed using SYMBOL); 3) estimating hikes in sovereign yields due to increases in government debt caused by bank recapitalisation, using the sovereign risk model by Mody and Sandri (2012); and 4) the continuation of the feedback loop until a new equilibrium is reached (i.e. until banks no longer need recapitalisation and government debt prices stabilise).

Table 1: **Government debt for selected EA Member States**

Member State	Government debt 2019 (EUR bn)	Government debt ratio 2019 (% GDP)	New government debt issuance 2020+2021 - spring forecast (EUR bn)	New government debt issuance 2020+2021 - autumn forecast (EUR bn)
Belgium	467	98	65	105
France	2380	98	355	499
Germany	2057	60	484	427
Ireland	204	57	28	31
Italy	2410	135	286	393
Netherlands	395	49	74	121
Portugal	250	117	17	31
Spain	1189	96	201	302

Source: European Commission's spring and autumn forecasts 2020.

Calibration of initial sovereign risk

Because the methodology requires choosing points in time for incorporating expectations that are used to assess baseline sovereign risk, we take the viewpoint of market participants at different moments in 2020. Government debt ratios are calibrated by adding projected government debt issuance for 2020 and 2021 to the 2019 government debt ratios (see Table 1). It should be noted in this connection that new government debt issuance for 2020 and 2021 was revised between the 2020 spring and autumn forecasts, and that this revision is incorporated into the model as a shock to the government debt-to-GDP ratio.

([1]) Mody, A. and D. Sandri (2012), 'The Eurozone crisis: how banks and sovereigns came to be joined at the hip', *Economic Policy* 27 (70).

CDS spreads another crucial input to the model. These spread make it possible to calculate of the implied initial probability of default for each Member State. ([2]) The three shaded areas in Graph IV.2 in the main text represent the three dates used in our model calibration, allowing us to incorporate market expectations at different points in time. The first shaded area represents the period between 12 March and 26 March during which the ECB press conference and the announcement of the PEPP took place. ([3]) The second and the third shaded areas represent the dates of the publication of the Commission's spring and autumn forecasts, which occurred on 6 May and 11 November 2020, respectively. The two forecast publication dates represent different information sets as regards the nature of EU intervention, thereby allowing us to assess the evolution of the effectiveness of EU policies as far as the sovereign-bank loop is concerned. By the spring forecast, ECB intervention was firmly established, common debt issuance was on the table, but the presence of a grant component was considered uncertain. By the autumn forecast, common EU bond issuance was expected and additional details were confirmed, particularly the presence of grants.

Calibration of initial bank risk and sovereign exposures

Bank-level data used in the model calibration are based on the spring 2020 transparency exercise conducted by the EBA and published in June 2020, covering a total of 127 banks. ([4]) The main input variables for bank-level data are regulatory capital, total capital, risk-weighted assets (RWA), total assets and a matrix of sovereign exposures for each bank. Variables aggregated at country level are scaled up to reflect the total size of the domestic banking sector of each Member State, based on data on total banking assets for each Member State provided by the ECB. Bank-level variables influence the simulated gross SYMBOL losses, which represent the shock applied to our model.

([2]) We choose a five-year time horizon for CDS spreads given that the effect of NGEU and other policy interventions is likely to be concentrated in this period, which is also the time interval when government debt ratios are likely to peak (and thus when sovereign risk will arguably be highest). Moreover, the five-year CDS is the most liquid and responsive CDS contract.

([3]) We use the maximum CDS value for this period, excluding values that exceed the 99th percentile of the distribution of each series, as computed over the latter's entire sample.

([4]) See https://eba.europa.eu/risk-analysis-and-data/eu-wide-transparency-exercise

(Continued on the next page)

Box (continued)

These simulated gross SYMBOL losses are the initial losses on private sector assets held by banks that set in motion the sovereign-bank loop. ([5]) Key banking sector data are presented in Table 2.

Table 2: **Key banking sector data**

Member State	No. of banks in sample	Total bank assets / GDP	Regulatory capital / GDP	RWA / Total bank assets	Gross SYMBOL losses / GDP
Belgium	6	212%	15%	26%	2.4%
France	8	364%	22%	33%	5.8%
Germany	15	226%	13%	36%	2.8%
Ireland	3	317%	35%	56%	6.2%
Italy	11	205%	16%	45%	3.7%
Netherlands	5	286%	21%	25%	3.6%
Portugal	5	184%	17%	57%	3.8%
Spain	12	212%	14%	44%	4.3%

(1) Values are scaled up as needed to reflect the size of the domestic banking sector of each Member State.
Source: EBA, ECB, own calculations.

Table 3 shows the matrix of sovereign exposures at year-end 2019, expressed as relative holdings compared to the total holdings summed across the eight countries under analysis. The shaded diagonal highlights the strong degree of home bias evident in all countries.

Table 3: **Pre-COVID-19 matrix of sovereign exposures for selected Member States**

Member State	BE	FR	DE	IE	IT	NL	PT	ES
BE	48%	13%	2%	2%	23%	2%	5%	7%
FR	5%	75%	6%	1%	8%	1%	1%	4%
DE	2%	6%	73%	1%	11%	2%	1%	4%
IE	6%	7%	1%	66%	5%	1%	3%	13%
IT	1%	3%	7%	0%	76%	0%	1%	13%
NL	18%	6%	17%	0%	0%	54%	0%	5%
PT	0%	2%	0%	2%	14%	1%	65%	18%
ES	0%	1%	1%	0%	15%	0%	5%	79%

(1) As at year-end 2019. The first column identifies the banking sector holding the exposures while the first row identifies the sovereign counterpart. Percentages are calculated for the eight Member States shown in the table, so that each row adds up to 100%.
Source: EBA, own calculations.

The 2019 sovereign exposure matrix is updated according to assumptions that seek to capture the impact of COVID-19 on new government debt issuance and how this debt is absorbed by the banking system. ([6]) Generally speaking, we assume that banks absorb newly issued debt (as per the 2020 and 2021 financing needs shown in Table 1) in proportion to their existing bond holdings. In the no intervention scenario, national banking sectors increase their sovereign exposures by between 10% and approximately 21%, depending on the country concerned, as reported in Table 4. These figures represent the additional amount of sovereign debt that each bank has to buy to participate in the absorption of the new debt issued by the Member States.

Table 4: **Change in bank sovereign exposures with and without EU intervention (% change with respect to 2019 levels)**

Member State	Without EU intervention	With EU intervention
Belgium	14%	-8%
France	15%	-6%
Germany	21%	-1%
Ireland	14%	-9%
Italy	13%	-10%
Netherlands	18%	-3%
Portugal	10%	-21%
Spain	16%	-20%
Simple average	15%	-10%

Source: Own calculations.

In the other two scenarios, we assume that the Eurosystem will absorb under the PEPP and the APP up to around EUR 1 350 bn of sovereign debt, consistently with the information set available at the dates chosen for the model calibration. In addition, we assume the presence of an EU bond as a source of indirect financing for Member States. ([7]) These two features result in a reduction of bank exposures to individual Member States, and in new exposures to EU bonds. The reduction in sovereign exposures reflects the relative size of EU bonds outstanding and Eurosystem purchases in excess of government financing needs, both of which are proportionally applied to banks' exposure matrices. In all cases, bonds acquired from banks by the Eurosystem are

([5]) It may be worth noting that the differences in SYMBOL losses as a percentage of GDP are driven by differences in the relative importance of national banking sectors (as measured by bank assets/GDP) and by differences in their initial riskiness (as measured by RWA/total assets).

([6]) This modification does not constitute a shock in the model, but rather sets the initial exposure conditions.

([7]) Although the NGEU funds will be distributed in different payments over the coming years, we assume that the model captures the medium-term effects of this policy, and thus we include the entire EU bond amounts in our calculations.

(Continued on the next page)

Box (continued)

considered to be ultimately converted into reserves with the central bank, which are risk-free assets.

Since the simulations take the viewpoint of 2020, the assumptions in each simulation seek to be consistent with the information available at that time. In particular, the NGEU total amounts and allocation keys rely on information published in 2020 and on the assumption of full use of the facility (see Table 5 for the NGEU allocation keys, which are assumed to be identical to those of its main component, the RRF). While these assumptions are merely illustrative, they can be understood as representing a case where common issuance reaches its full potential (i.e., all available loans are taken up). We also estimate the gross financing needs of individual Member States for 2020 and 2021 and, if funding provided under NGEU is higher than those funding needs, we assume that the surplus replaces or reduces the existing stock of debt.

Table 5: **Upper bound for EU bond mutualisation costs for selected EA countries**

Member State	RRF keys	GNI Weights	EU bond proceedings (bn)	CDS price (per EUR 1MM)	Gross cost of mutualisation (EUR bn)
Belgium	1.7%	4%	14.5	20 060	0.49
France	11.6%	23%	98.6	18 106	2.58
Germany	7.6%	27%	64.6	13 034	3.68
Ireland	0.3%	2%	2.6	26 805	0.28
Italy	20.4%	17%	173.4	113 989	1.88
Netherlands	1.8%	5%	15.3	21 025	0.85
Portugal	4.1%	2%	34.9	54 346	0.22
Spain	20.6%	11%	175.1	51 437	1.30

Source: Own calculations based on five-year CDS quotes from Thomson Reuters DataStream; projected RRF keys based on the Commission's autumn 2020 forecast.

Calibration of mutualisation costs

We assume that EU bonds are risk-free, so that they will not contribute to the riskiness of banks' balance sheets, but will increase the debt-to-GDP ratios of Member States to the extent that they receive an EU loan or need to contribute to the repayment of the grant component. Changes in the risk of default in each country are driven by the changes in its debt-to-GDP ratio (as per the Mody-Sandri model), which includes the costs of mutualisation of the potential losses on the common debt instrument.

To quantify this implicit cost of guaranteeing joint EU debt issuance against default cost, we determine the credit and budgetary claims of the EU with respect to each individual country. This allows us to compute the expected losses on total EU exposures as the sum of the expected losses on the exposures to each Member State. Total expected losses are then assumed to be guaranteed by Member States, ([8]) with each country liable only to the extent determined by its GNI key. ([9]) This calculation can be understood as providing a conservative upper bound to the (expected) costs of mutualisation, which does not take into account possible diversification gains from pooling together sovereign risk under a EU bond. The cost for the individual Member States is presented in Table 5 and, in the context of the simulation model, is considered to affect the debt-to-GDP ratio and a Member State's riskiness in the same way as new debt. This cost is seen to be of minor macroeconomic significance compared to the magnitude of EU bond issuance and additional government financing needs.

Model shocks

Once the calibration is done, an initial shock is applied to the model, which is assumed to come from losses on banks' private sector exposures (e.g., loan defaults). The SYMBOL model estimates the distribution of such losses for financial crises of different severities. A crisis with a loss magnitude similar to the 2008 crisis is considered in this section. ([10]) A secondary initial shock is also applied to government reflecting the revision in the expected evolution of the government debt ratio between the 2020 spring and autumn forecasts. This shock improves the comparability of the results across the three scenarios.

([8]) Expected losses have a direct correspondence to CDS premia, where we calculate the market value of a hypothetical CDS based on the (EU claim-based) weighted average sovereign CDS quotes observed from 5 June to 24 June 2020 with a coupon equal to 1 bps (thus assuming no coupon payments to have a 'one-shot' price) for EUR 1 MM. During the aforementioned period, there was already the expectation of a large increase in government debt, but no certainties about partial debt 'mutualisation' via the EU budget.

([9]) The GNI share is the variable that is used to calculate the contributions of Member States to the EU budget, which is the basis for providing the debt service on EU bonds. As such, we are implicitly assuming that in the event of a Member State defaulting on an EU loan (or on another financial obligation towards the EU), all Member States would be called upon to fill this financial gap and honour the EU's debt obligations based on additional contributions to the (GNI key-based) EU budget.

([10]) Crisis severity is assessed by the probability of the crisis occurring. Actual losses in excess of capital will be different under current conditions when compared to 2008 given the de-risking and capital increases that took place in the banking system in recent years.

III. The 2021 Ageing Report: pension reform reversal and adequacy risks in the EU

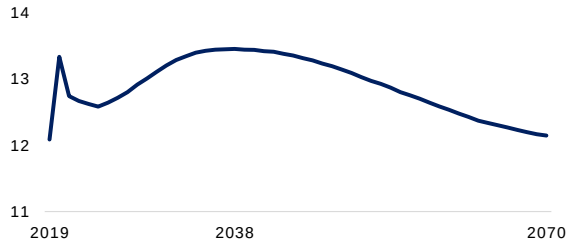
By Eloïse Orseau and Ben Deboeck

The baseline projections in the 2021 Ageing Report incorporate current pension legislation across EU Member States. However, there has been a rising incidence of reform reversals in recent years, with governments undoing earlier pension measures, in particular increases in the retirement age. To account for the budgetary impact of such possible reversals, this article first looks at a policy scenario where effective retirement ages are frozen at their current levels. The cost of withdrawing planned increases in the legal retirement age is sizeable in most countries, underscoring the risks posed by future policy reversals for pension expenditure in some Member States. This section also shows that, at current legislation, the baseline projections point to a quasi-universal decline in pension benefits relative to wages. For this reason, a second policy scenario assumes that governments are compelled to raise pension benefits at some point, by changing parameters such as benefit indexation, the valorisation of contributions, or the level of minimum pensions. If such a scenario were to unfold, the estimates point to a considerable budgetary impact in the long term for the Member States concerned.

III.1. Introduction: the 2021 Ageing Report

The *2021 Ageing Report* provides long-term projections for pensions and other age-related expenditure items for the EU Member States ([39]). Projections are based on a series of macroeconomic and demographic assumptions and reflect current pension legislation ([40]). In the euro area, on average, pension expenditure is expected to follow a bell-shaped time profile – disregarding the temporary hike in the pension expenditure-to-GDP ratio in 2020 because of the pandemic-induced recession (see Graph III.1). Under the baseline assumptions, pension spending would rise from 12.1% of GDP in 2019 to a peak of 13.4% in 2038. It would then decline, falling back to 12.1% of GDP in 2070.

Graph III.1: **Public pension expenditure in the euro area, 2019-2070 (% of GDP)**



Source: 2021 Ageing Report.

([39]) European Commission (DG ECFIN) and Economic Policy Committee (AWG) (2021), 'The 2021 Ageing Report: Economic and budgetary projections for the EU Member States (2019-2070)', *European Economy*, No. 148/2021.

([40]) European Commission (DG ECFIN) and Economic Policy Committee (AWG) (2020), 'The 2021 Ageing Report: Underlying assumptions and projection methodologies', *European Economy*, No. 142/2020.

Under the baseline scenario, public pension spending would rise in 16 Member States by 2070. The largest increases are expected in Luxembourg (+8.7 pps of GDP), Slovenia (+6 pps) and Slovakia (+5.9 pps) (Graph III.2). Among the 11 Member States in which pension expenditure is expected to decline, the largest falls are in Greece (-3.8 pps of GDP) and Portugal (-3.2 pps). However, in some cases the overall decrease in pension spending by 2070 conceals an initial increase. Spending is thus projected to rise in 20 Member States by 2030, after having already increased steadily in many countries in the past 10-15 years.

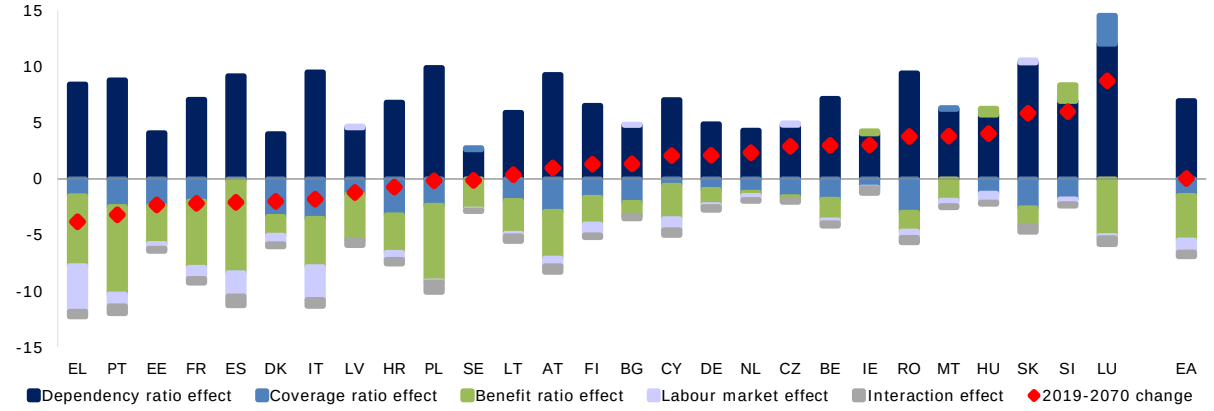
To understand better its dynamic, the total projected change in public pension expenditure by 2070 can be broken down into four components (see Graph III.2):

- The *dependency-ratio effect* quantifies the relative change in the old-age (65+) versus the working-age (20-64) population, with an ageing population leading to a higher ratio with pensions computed on the basis of present rules. By 2070, this demographic factor pushes up pension spending in all countries and by 7% of GDP on average in the euro area.

- The *coverage-ratio effect* measures the total number of pensioners against the old-age population (65+). This ratio provides information about access to pension systems. Lower coverage is expected to mitigate the ageing effect in nearly all countries and by 1.5% of GDP on average in the euro area by 2070.

- The *benefit-ratio effect* indicates how the average pension benefit develops relative to the average

Graph III.2: **Change in public pension spending and main drivers, 2019-2070 (pps of GDP)**



Source: 2021 Ageing Report (see Box II.1.2 for further details).

wage. It measures pension adequacy, reflecting how benefits are calculated and then indexed. Some exceptions aside, benefit ratios are projected to fall, lowering pension expenditure by 3.9% of GDP in the euro area by 2070.

- Finally, the *labour-market effect* captures the impact on pension spending of changes in labour-market behaviour, as captured by the employment rate, the number of hours worked and possible career-prolongation effects. It reduces expenditure in most countries, and by about 1% of GDP in the euro area by 2070.

The overall picture is thus one of stricter eligibility conditions and lower average benefits offsetting higher pension outlays due to ageing populations. The varying impact of the benefit-ratio and coverage-ratio effects mostly reflects the extent to which countries reformed their pension systems.

Given the long-term horizon of the *Ageing Report* projections, there is inherent uncertainty about the demographic and macroeconomic assumptions it makes. This is why the report performs a series of sensitivity tests around the baseline projections by applying uniform shocks to specific parameters, such as fertility and productivity. In addition, the *2021 Ageing Report* includes three policy scenarios that measure the impact of potential policy changes, thus deviating from the no-policy-change assumption of the baseline projections. In keeping with earlier exercises, one policy scenario estimates the impact of linking retirement ages to changes in life expectancy. The two other policy scenarios are new and address policy events that are particularly relevant given recent developments.

- There have been a number of pension reform reversals in the EU in recent years, as discussed in Subsection III.2. By freezing effective retirement ages at current levels, the *unchanged retirement age* scenario acknowledges this implementation risk and assesses the budgetary implications of withdrawing future increases in legal retirement ages that were already legislated. This scenario is discussed in Subsection III.3.

- The baseline projections point to a general decrease in benefit ratios, signalling problems of pension adequacy in some cases. While falling benefit ratios would help contain pension expenditure, excessively low adequacy could compel governments to take corrective measures to raise benefits. The *offset declining pension benefit ratio* scenario, presented in Subsection III.4, assesses the budgetary impact of such measures.

III.2. A rising incidence of reform reversals

In recent decades, most Member States have improved their pension systems' sustainability by limiting pension expenditure increases. Reforms were usually phased-in gradually and will often significantly alter the pension regime over time. Reform measures were wide-ranging. Some tightened eligibility criteria, with higher statutory retirement ages, longer minimum contributory periods and more limited early retirement pathways. Others changed the calculation of pensionable earnings; phased out special pension schemes; introduced penalties for early retirement and bonuses for late retirement; or made pension indexation rules less favourable. Some countries have armed their pension systems against demo-

graphic ageing by adopting automatic adjustment mechanisms, including: (i) automatic balancing rules that lower indexation or raise contributions; (ii) sustainability factors that adjust pension benefits to gains in life expectancy; and (iii) automatic links between the retirement age and life expectancy. In addition, several Member States radically redesigned their public pension system, for example by moving from a defined benefit to a notional defined-contribution scheme (NDC) or by introducing a statutory, funded defined-contribution pillar (FDC) ([41]).

The 2008 financial crisis and the subsequent euro area debt crisis accelerated the intensity of reforms. This led to the adoption of prompt, temporary and additional structural measures, as discussed in Carone et al. (2016) ([42]). Legal retirement ages rose in nearly every Member State following the crisis, so that the average statutory retirement age in the EU in 2030 is set to increase by 1.8 years for men and by 3.3 years for women, compared to 2010. Since 2010, 10 Member States have adopted at least one of the three automatic adjustment mechanisms described above, mostly in the period 2010-2013. Currently, 15 Member States apply such mechanisms.

Around 2015, the focus of pension reforms started shifting away from fiscal sustainability towards fairness and benefit adequacy. As a result, certain crisis-induced reforms were adjusted, for example by phasing in measures more gradually, or by taking additional measures to address adequacy concerns. In other cases, governments fully or partially reversed earlier reforms, in particular reforms that had already been enacted, or pending increases in the legal retirement age. However, too low an effective retirement age may exacerbate issues of old-age income adequacy as people retire before obtaining full pension rights.

Some revisions were made necessary by court rulings. This was the case in Portugal, where the Constitutional Court considered several pension reforms unconstitutional, such as the alignment of the civil servants' scheme with the general scheme, or suspensions of 13th and 14th monthly pension payments. In Greece, the legality of some benefit cuts was successfully challenged in court.

The first major reversals of structural pension reforms took place in two non-euro area countries: Poland (2016) and Czechia (2017).

- In 2012, the Polish Parliament approved an increase in the retirement age for both sexes, increasing it gradually from 65 to 67 years by 2020 for men and from 60 to 67 years by 2040 for women. The reform was repealed at the end of 2016, returning to a statutory retirement age of 65 for men and 60 for women. The annual budgetary cost of this reversal was estimated at 0.8-1% of GDP in 2020-2040, in addition to lower adequacy given shorter average careers and the impact of the sustainability factor embedded in Poland's NDC system ([43]).

- In 2011, Czechia linked the statutory retirement age to changes in life expectancy. However, in 2017, a cap at 65 years was reintroduced, which will be reached in 2030 and is estimated will cause an additional increase in pension expenditure of 1.7 pps of GDP by 2070 ([44]). Although the law still requires the government to monitor developments in life expectancy, the government did not propose any changes beyond 2030 at the time of the first possible revision, in 2019.

More recent examples of pension reform reversals include Slovakia (2019), Croatia (2019), the Netherlands (2019) and Ireland (2020).

- Slovakia adopted a link between pension age and life expectancy in 2012 and applied this link as of 2017, using a starting point of 62 years for both men and women. In 2019, however, the link was abolished after a constitutional amendment stipulated that the retirement age cannot

([41]) Under defined contribution schemes (either notional or funded), the pension benefit depends on the contributions made as well as other parameters such as remaining life expectancy. NDC schemes are pay-as-you-go with only a 'notional' capital being accumulated since the contributions are never actually invested. In the case of FDC schemes, the contributions are invested to finance the corresponding pension rights in the future.

([42]) Carone, G., Eckefeldt, P., Giamboni, L., Laine, V. and S. Pamies (2016), 'Pension reforms in the EU since the early 2000s: Achievements and challenges ahead', *European Economy*, No. 42/2016.

([43]) Country fiche on Polish pension projections, accompanying the *2018 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/final_country_fiche_pl.pdf.

([44]) Country fiche on Czech pension projections, accompanying the *2018 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/final_country_fiche_cz.pdf. Higher indexation added 0.3 pps of GDP in pension spending by 2070.

exceed 64. This maximum retirement age of 64 is reduced for mothers by 6 months for each of the first three children. The amendments prevent any further increases beyond circa 2030. It is estimated that this reversal will raise pension expenditure by 2.2 pps of GDP by 2070 ([45]).

- In 2018, Croatia brought forward the planned full convergence of women's retirement ages to those of men – from 2030 to 2027 –, followed by a gradual increase in the statutory retirement age to 67 by 2033, 5 years earlier than planned. Croatia also increased penalties for early retirement. However, these measures prompted strong resistance from the trade unions, who collected enough signatures to call a referendum. The government therefore annulled some of the measures, setting the statutory and early retirement ages back to 65 and 60, compared to 67 and 62 under the short-lived legislation. The annual budgetary impact of this reversal was estimated at 0.4 pps of GDP by 2040 ([46]).

- In the Netherlands, the 2012 reform involved a gradual increase in the statutory retirement age to 67 by 2023 and a full link to gains in life expectancy thereafter. In 2019, the target year was postponed from 2023 to 2024, and the link to life expectancy was limited to two thirds of the gains. This weaker link will push up pension expenditure by 0.8 pps of GDP by 2070, according to the *2021 Ageing Report* ([47]).

- Under the 2011 social welfare bill, the Irish state pension age was to rise from 66 years to 67 in 2021 and 68 in 2028. However, on taking office in mid-2020, the new government announced that it would keep the retirement age at 66. This raised the estimated increase in pension spending by 0.5 pps of GDP by 2050.

In Italy and Spain, rules that were introduced to limit pension spending were temporarily suspended in recent years. However, if temporary suspensions are repeatedly extended, they risk becoming the norm.

- In Italy, a new temporary scheme was introduced in 2019 to allow early retirement for people who were at least 62 years old in 2019-2021 and had a career of 38 years ('Quota 100'). The possibility for women aged at least 58 to retire after a career of 35 years ('Opzione donna') was supposed to expire in 2015 but has been renewed every year since then. For people exiting work through these schemes, pension benefits are reduced given Italy's NDC system. Nevertheless, as the measures have increased the number of new pensioners, the budgetary impact amounted to 0.4% of GDP in 2020 ([48]).

- As part of its 2013 pension reform, Spain adopted two automatic adjustment mechanisms. The first mechanism was the index for pension revaluation (IPR), which adapts annual benefit indexation to the projected financial situation of the pension system, with a minimum indexation of 0.25% and a maximum increase of consumer prices (CPI) +0.5%. In 2018-2019, however, the IPR was suspended and replaced by CPI indexation. This suspension was extended in 2020 and again in 2021. Moreover, there is broad political support for permanently replacing the IPR by CPI indexation, with legislation to this effect pending at the moment of writing. According to the *2021 Ageing Report*, applying CPI indexation instead of the IPR would increase pension expenditure by 1.4 pps of GDP in 2030, rising to 2.7 pps in 2050 ([49]). The second mechanism introduced in the 2013 reform was a sustainability factor to adjust new pensions for changes in remaining life expectancy at the age of 67, the statutory retirement age as of 2027. Its entry into force, initially planned for 2019, was postponed to 2023 at the latest. If the sustainability factor were never to be applied, this would cause pension spending to be 0.8 pps of GDP higher in 2050 and 1.4 pps higher in 2070 ([50]).

([45]) Updated country fiche on Slovak pension projections, accompanying the *2018 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/update_of_the_country_fiche_on_public_pensions_for_the_ageing_report_2018_-_slovakia.pdf.

([46]) Country fiche on Croatian pension projections, accompanying the *2021 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/hr_-_ar_2021_final_pension_fiche.pdf.

([47]) Country fiche on Dutch pension projections, accompanying the *2021 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/nl_-_ar_2021_final_pension_fiche.pdf.

([48]) Updated country fiche on Italian pension projections, accompanying the *2018 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/country_fiche_it-2019_peer_review.pdf.

([49]) Country fiche on Spanish pension projections, accompanying the *2021 Ageing Report*, https://ec.europa.eu/info/sites/default/files/economy-finance/es_-_ar_2021_final_pension_fiche.pdf.

([50]) *Ibid.*

Box I.2.2 of Volume 1 of the *2021 Ageing Report* provides an overview of pension reforms legislated by Member States in recent years. As most of the observed reversals relate to increases in the retirement age, the *2021 Ageing Report* includes a new scenario that freezes legal and effective retirement ages at their current levels. This scenario is presented in the next subsection.

III.3. What if effective retirement ages do not rise as planned?

Retirement ages in the baseline projections

The baseline projections of the *2021 Ageing Report* incorporate legislated changes in legal retirement ages. In line with the no-policy-change assumption, the baseline scenario considers that all adopted measures will effectively be implemented. The measures increase both early and statutory retirement ages, in some cases by linking them to gains in life expectancy, with an overall impact of around 2 years on average (Table III.1).

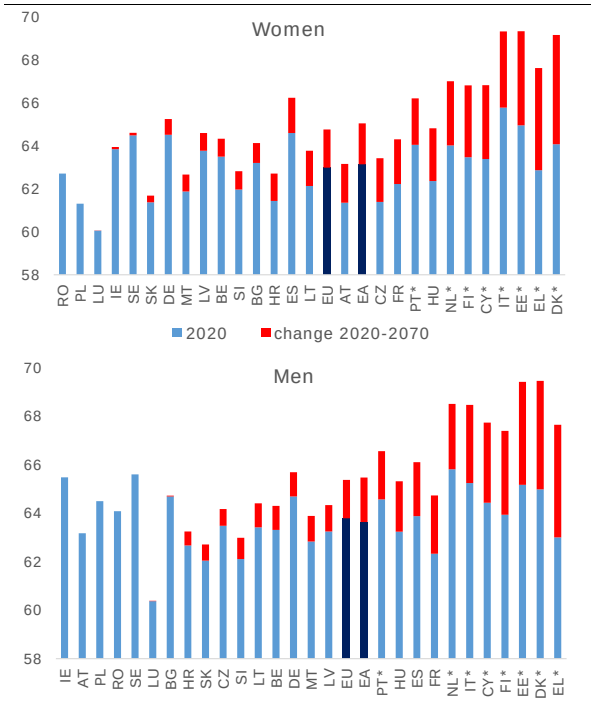
Table III.1: **Legal retirement ages in the baseline scenario**

	Statutory retirement age				Early retirement age			
	Male		Female		Male		Female	
	2019	2070	2019	2070	2019	2070	2019	2070
BE	65	67	65	67	63	63	63	63
BG	64.2	65	61.3	65	63.2	64	60.3	64
CZ	63.5	65	61.2	65	60	60	58.2	60
DK*	65.5	74	65.5	74	63	71	63	71
DE	65.7	67	65.7	67	63	63	63	63
EE*	63.6	69.8	63.6	69.8	60.6	64.8	60.6	64.8
IE	66	66	66	66	66	66	66	66
EL*	67	72.6	67	72.6	62	67.6	62	67.6
ES	65.7	67	65.7	67	63.7	65	63.7	65
FR	66.8	67	66.8	67	61.8	62	61.8	62
HR	65	65	62.3	65	60	60	57.3	60
IT*	67	71	67	71	64	68	64	68
CY*	65	69.9	65	69.9	65	69.9	65	69.9
LV	63.5	65	63.5	65	61.5	63	61.5	63
LT	63.8	65	62.7	65	58.8	60	57.7	60
LU	65	65	65	65	57	57	57	57
HU	64	65	64	65	64.3	65	64.3	65
MT	62.9	65	62.9	65	61	61	61	61
NL*	66.3	69.8	66.3	69.8	66.3	69.8	66.3	69.8
AT	65	65	60	65	60	60	58	60
PL	65	65	60	60	65	65	60	60
PT*	66.4	69.3	66.4	69.3	60	60	60	60
RO	65	65	61.2	63	60	60	56.2	58
SI	65	65	64.5	65	60	60	60	60
SK	62.5	64	62.5	64	60.5	62	60.5	62
FI*	63.5	67.7	63.5	67.7	61	64.8	61	64.8
SE	67	67	67	67	61	62	61	62
EA	65.0	67.3	64.7	67.3	61.9	63.5	61.7	63.5
EU	65.0	67.0	64.1	66.7	61.9	63.5	61.2	63.2

*Countries where the statutory retirement age is legislated to increase in line with life expectancy. Retirement ages for these countries are calculated on the basis of life expectancy in Eurostat's population projections.
Source: 2021 Ageing Report.

These hikes take place in a context of population ageing which puts pension systems under stress. Eurostat's April 2020 long-term demographic projections, which underlie the *2021 Ageing Report*, assume sustained increases in life expectancy at birth. In the euro area as whole, life expectancy is expected to increase by 6.6 years for men between 2019 and 2070 (from 79.9 to 86.5) and by 5.6 years for women (from 85.0 to 90.6). Neither new births nor migration are projected to be enough to offset the ageing trend, with fertility rates remaining below the natural replacement rate of 2.1 in all euro area countries, and net migration inflows stabilising at around 0.2% of the total euro area population per year. As a result, the euro area would move from having 28 working-age people for every 10 people aged 65 or above in 2019 to only 17 in 2070.

Graph III.3: **Average effective exit ages from the labour market, baseline scenario**



* Countries that link the statutory retirement age to gains in life expectancy.
Source: 2021 Ageing Report.

Increasing legal retirement ages and penalising early retirement encourages workers to stay longer in the labour market, translating into higher effective retirement ages. For the age group 55-64, the labour-market participation rate already increased from 38% in 2000 to 62% in 2019 in the EU, mainly due to increases in early and statutory retirement ages. In most countries that have recently adopted pension reforms, the reforms are projected to have

a sizeable further impact on the participation of older workers in coming decades. It is projected that, by 2070, these reforms will lift the participation rate of people aged 55-64 by about 9 pps on average, and by about 8 pps for the age group 64-75. Therefore, the baseline projections point to an increase in effective retirement ages – as proxied by labour market exit ages (Graph III.3) – although they would remain lower than legal retirement ages.

Later exits from the labour market reduce public pension expenditure through the coverage-ratio effect. Because people start to draw pension benefits later, the number of pensioners increases by less than the number of people aged 65 and over, lowering the coverage ratio. Nearly all the countries that plan to increase statutory retirement ages therefore see the coverage-ratio effect reducing their public pension expenditure as a share of GDP (see Graph III.2). Moreover, among the 6 euro area countries in which the coverage-ratio effect is expected to reduce public pension expenditure by at least 2 pps of GDP, 4 have set their statutory retirement age beyond 65 (Italy, Portugal, Estonia and France) and 3 have linked future increases to gains in life expectancy (Italy, Portugal and Estonia).

The 'unchanged retirement age' scenario

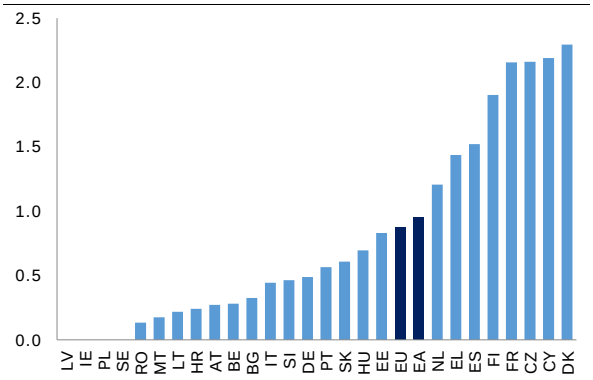
The actual implementation of pension reforms is subject to a significant policy risk. In light of the recent cases listed above, there is a risk that other reforms could be reversed in the future, especially as many of the increases in retirement ages legislated in the past decade have not yet been fully enacted but will be phased in gradually.

The *2021 Ageing Report* assesses the impact of such reform reversals through a specific scenario. This scenario assumes that retirement conditions (statutory and early retirement ages, as well as career-length requirements) are kept unchanged from the starting point onwards, i.e. it assumes that the planned changes that have already been legislated for do not occur. In practice, this means that effective retirement ages remain at their 2020 levels. The scenario focuses on reforms that have already been legislated but are not yet applicable.

Findings

Failing to increase legal retirement ages as planned would increase public pension expenditure in most EU countries. The budgetary impact would be considerable for most of the countries that currently have a link between pensions and life expectancy, especially Denmark, Cyprus, Finland, Greece and the Netherlands (Graph III.4.). There would also be a large impact in three other countries (Czechia, France and Spain), where a freeze in the effective retirement age would push up pension expenditure by at least 1 pp of GDP by 2070 relative to the baseline projections. By contrast, the estimated impact is near zero for the countries that, based on current legislation, have an unchanged retirement age in the baseline, such as Ireland, Poland and Sweden. In the euro area as a whole, pension expenditure would rise by nearly 1 pp of GDP by 2070 relative to the baseline.

Graph III.4: **Unchanged retirement age scenario: impact on public pension expenditure in 2019-2070**
(deviation from the baseline, pps of GDP)



Source: 2021 Ageing Report.

This scenario illustrates the risks of policy reversals for future pension expenditure. Withdrawing plans to increase retirement ages would have adverse long-term implications for both growth (through lower labour input) and public finances. Conversely, fully implementing adopted laws is essential to make economic policy predictable and credible.

For future reforms, gains in life expectancy provide a useful benchmark for the increase in retirement ages. A dedicated policy scenario included in the *2021 Ageing Report* assesses the implications of linking legal retirement ages to gains in longevity. To account for the likelihood that, in practice, more people might retire from the labour market under this scenario through sickness and disability schemes, the scenario increases effective retirement ages by three quarters of the increase in life expectancy. The resulting decline in the number of pensioners makes pension expenditure fall in

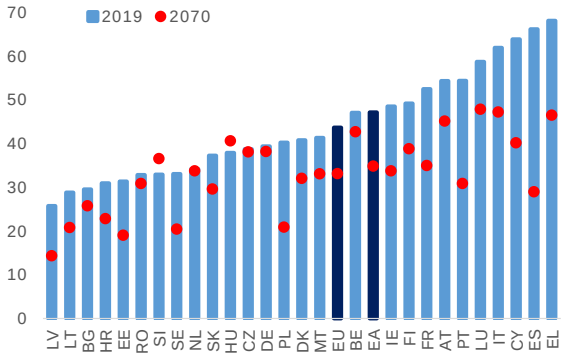
comparison to the baseline – in spite of the fact that longer careers imply higher average benefits, thus also contributing to the adequacy of pensions. In addition, stronger labour activity pushes up economic growth.

III.4. What if governments took measures to prevent pension adequacy from falling?

Adequacy in the baseline projections

Pension adequacy is the extent to which pension benefits can guarantee retirees a decent standard of living. It therefore focuses on the lower end of the income distribution. Adequacy covers three things: (i) the ability to prevent and mitigate old-age poverty; (ii) the ability to replace income earned before retirement; and (iii) the ability to ensure that a reasonable share of a person's life is spent in retirement ([51]). Two important indicators to assess adequacy are the benefit ratio (the average pension benefit compared to the average wage in the economy) and the replacement rate (the average first pension as a share of the average wage at retirement).

Graph III.5: **Earnings-related public benefit ratios: 2070 vs. 2019**
(% of average wage)



Earnings-related pensions are benefits for which entitlements depend on personal earnings/contributions to the old-age and early pension schemes.
Source: 2021 Ageing Report.

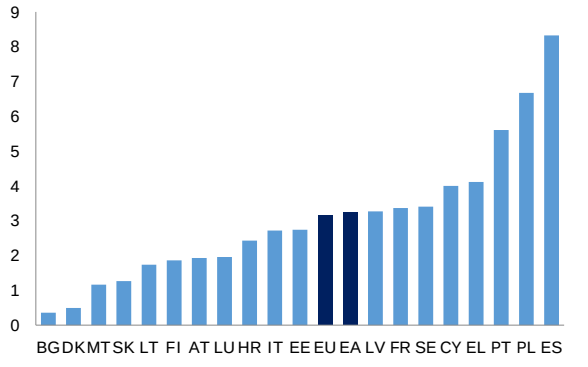
Past measures to preserve the sustainability of pension systems may reduce pension adequacy. As explained in the introduction, changes in the benefit ratio are the main cause of lower pension spending (Graph III.2). In many cases, this is due to reforms adopted in the past decade to strengthen the viability of pension systems. For countries where the current benefit ratio, and therefore pension adequacy, are already relatively low, such adjustments could further weaken pension adequacy. The *Ageing Report*'s baseline projections point to strong and persistent drops in benefit ratios for the public pension schemes, feeding substantial adequacy risks, in particular for countries that currently already have low benefit ratios (Graph III.5).

The 'offset declining benefit ratio' scenario

The projected fall in benefit ratios suggests that social and political pressures may emerge to prevent adequacy from declining too strongly. To account for this possibility, the *2021 Ageing Report* includes a scenario in which the benefit ratio cannot fall below 90% of its base-year value. This scenario is relevant for countries that have a low benefit ratio today, as this initial situation already requires correction. The scenario is also relevant for countries with comparatively high current benefits, because a large perceived loss in purchasing power by a growing cohort of retirees could stir up political pressure.

In concrete terms, the scenario does not allow the earnings-related public benefit ratio to fall below 90% of the base-year level. Reaching that threshold is supposed to trigger measures that freeze the benefit ratio at this lower point for the remainder of the projection period, i.e. apply higher indexation. The year of activation and the level at which the benefit ratio is frozen are country-specific and determined by the baseline projections.

Graph III.6: **Offset declining benefit ratio scenario: impact on change in public pension expenditure in 2019-2070**
(deviation from the baseline, pps of GDP)



Source: 2021 Ageing Report.

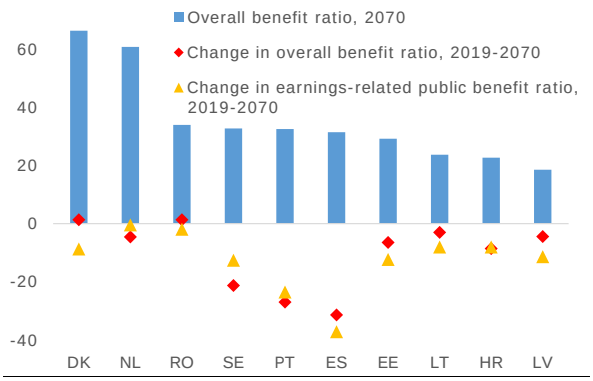
([51]) European Commission (DG EMPL) and Social Protection Committee (2021), '2021 Pension Adequacy Report'.

Findings

Preserving the adequacy of public pensions close to current levels would put large upward pressures on spending over the long term. In the euro area, pension expenditure would increase by an extra 3.2 pps of GDP on average by 2070 (Graph III.6). The euro area countries most affected would be Spain (+8.3 pps of GDP) and Portugal (+5.6 pps). The impact would reach 2-4 pps of GDP in 6 euro area countries (Italy, Estonia, Latvia, France, Cyprus and Greece) and 1-2 pps in 6 other euro area countries (Malta, Slovakia, Lithuania, Finland, Austria and Luxembourg).

Private pension schemes may partially mitigate the decline in public pension benefit ratios. Projections for these supplementary schemes are available for a subset of 10 Member States (Graph III.7). In most cases, they partially compensate for the projected lower generosity of public pensions, cushioning the decline in the total benefit ratio. Still, in some euro area countries such as Estonia, Latvia and Lithuania, low pension adequacy remains an issue, even when accounting for private schemes. Moreover, in some Member States, overall benefit ratios are projected to decline more than public benefit ratios (the Netherlands, Sweden and Portugal).

Graph III.7: **Public and overall benefit ratios**
(% of average wage)



Source: 2021 Ageing Report.

Overall, this scenario illustrates a policy trade-off. All other things being equal, preserving the generosity of the pension system on social grounds comes at the expense of containing developments in pension expenditure. This may create a major challenge for the sustainability of pension systems, unless the additional spending is financed by higher contributions or longer working lives, two measures that can also be socially and politically sensitive.

III.5. Conclusion

Reforms enacted in recent decades generally mitigated fiscal sustainability risks stemming from rising pension expenditure. For instance, effective retirement ages have been rising and the adoption of automatic adjustment mechanisms in some Member States has made pension systems more resilient against ageing. However, the *2021 Ageing Report* points to lasting challenges in a number of Member States, underscoring the importance of monitoring carefully the growth in pension expenditure. This section discussed two types of uncertainty around these baseline projections.

The first type of uncertainty arises because the reform momentum seen in 2010-2015 was partly negated by a string of revisions or even outright withdrawals of past reforms, especially the prospective increases in the legal retirement age. If one were to assume that effective retirement ages are fixed at their current levels, pension spending would be about 1 pp of GDP higher in the euro area in 2070 compared to the baseline projections that incorporate legislated retirement age increases.

In parallel with these reform reversals, measures have been taken to improve the adequacy of pension benefits, a trend that can be expected to continue. Indeed, with unchanged policies, the *2021 Ageing Report*'s projections point to a general decline in pension adequacy. This highlights a second significant policy uncertainty surrounding the baseline projections: in some countries, public pressure might urge authorities to stem the decline in old-age income by raising benefits. If such pressure capped the decline in average pension benefits at 10% of average wages, expenditure would be about 3 pps of GDP higher in the euro area in 2070 than implied by current rules.

IV. The economic consequences of central bank digital currencies

By Ulrich Clemens, Guillaume Cousin, Jean-Baptiste Feller, Daniel Monteiro and Matteo Salto

Abstract: Central bank digital currencies (CBDC) have probably become the most prominent feature in the discussion on the future of payment systems and on money more generally. This section proposes an overview of the macroeconomic benefits and risks of introducing a retail CBDC for non-experts, based on a literature review, with a focus on the euro area and a 'digital euro'. Such a euro-area retail CBDC would be a new form of money. It would tackle a possible decline in the use or acceptance of cash by ensuring the continued provision of public money and improve the functioning of the payment system. It would also support the European economy's digitalisation and the European Union's strategic independence in the context of dominant foreign-based payment providers and the possible emergence of new digital means of payment. However, designing a retail CBDC entails several trade-offs which may have implications for the financial sector. If not properly designed, a retail CBDC may produce disintermediation in the banking system, reduce banks' funding and lead to increased risk-taking, with consequences for lending and financial stability. However, this should be assessed against the current context of excess reserves. Thus, to reap the benefits of a CBDC the trade-off between more efficient payment systems and risks to the banking system needs to be well managed by choosing an appropriate design for the CBDC. The section does not aim at proposing any specific design option for the digital euro, nor does it preempt content of a possible legislative proposal by of the Commission in any manner, as the concrete implications of the introduction of the digital euro will very much depend on the practical design choices made.

Since the beginning of 2021, the Commission and the ECB have engaged in joint technical work to assess a broad range of policy, legal and technical questions emerging from a possible introduction of a digital euro ([52]). The common work goes in parallel with the ECB decision to launch a more structured step of the digital euro project on 14 July 2021 (the 'investigation phase') following the report issued in October 2020 ([53]). This could lead to a legislative proposal based on Article 133 TFEU establishing the digital euro and regulating its essential elements. The aim of this article is to highlight the key macroeconomic issues related to the introduction of a retail central bank digital currency (CBDC). As a central bank liability accessible in digital form for households and firms, a digital euro would be a new form of money. As such, it may compete with other means of payment, including cash and sight deposits. This could have implications for banks' funding and financial stability that need to be analysed. The concrete implications will depend on the design choices made, which are beyond the scope of this section.

IV.1. What is a central bank digital currency?

IV.1.1. Classifying the different types of money

Money is usually defined by its three functions as a medium of exchange, a store of value and a unit of account. Historically, several commodities, such as seashells, salt, silver and gold, played the role of money. Under this physical form, money is an asset for its holder, but it is not the liability of someone else. In the middle of the 17th century, banknotes certifying that a certain quantity of gold was stored in secured vaults became themselves a form of money. Contrary to commodities, banknotes were the liability of their issuer who committed to exchange them upon request against gold. The last link between banknotes and gold ultimately disappeared in 1971 when the international convertibility of the US dollar to gold was suspended. Since then, the values of the different currencies fluctuate, between themselves and against commodities, and nowadays the value of money in all economies is not linked to a specific good. In the euro area, banknotes are a liability of the Eurosystem, and the value of the currency relies on the central bank's commitment to maintain price stability and on their legal tender status. From an economic perspective, banknotes and coins are not the only form of money. As

([52]) Joint statement by the European Commission and the European Central Bank on their cooperation on a digital euro, 19 January 2021

([53]) ECB (2020), Report on a digital euro. The report is available at https://www.ecb.europa.eu/pub/pdf/other/Report_on_a_digital_euro~4d7268b458.en.pdf

money is defined by its three basic functions, other instruments, including overnight ([54]) and term deposits with commercial banks, can play the role of money. These instruments are accounted for in the different monetary aggregates M1, M2 and M3 ([55]) depending on their liquidity. As an example, to provide an order of magnitude, currently overnight deposits held at commercial banks account for more than 60% of the euro-area broad money aggregate M3, while coins and banknotes represent less than 10% of M3 ([56]). The importance of deposits can be explained by their convenience as a means of payment and store of value, especially in an increasingly digitalised economy. However, in recent years, new assets aiming to fulfil the functions of money emerged in the form of stable coins and cryptocurrencies ([57]), while central banks started to investigate the possible issuance of CBDCs (BIS, 2021) ([58]). Classifying the different types of money helps to highlight their differences. In this respect, the following criteria appear useful (BIS, 2017): accessibility (wide versus restricted), form (digital versus physical), issuer (central banks versus other issuers) and transactions (peer-to-peer versus approved by a trusted third party) ([59]). Other features that distinguish the different types of money include their intrinsic value, which can rely on scarcity, use or trust. Although it could share some of the features with other types of money, a CBDC would be a new type of money irrespective of its design.

([54]) In this article, overnight deposits refer to an ECB-defined category comprising mainly sight and demand deposits that are fully transferable.

([55]) In the euro area, these monetary aggregates are defined by the ECB and derived from the consolidated balance sheet of monetary financial institutions. See https://www.ecb.europa.eu/stats/money_credit_banking/monetary_aggregates/html/index.en.html

([56]) Source: ECB, Statistical Data Warehouse, Balance Sheet Items

([57]) Cryptocurrencies are also referred to as crypto-assets. They are cryptographically secured digital assets that can be held and exchanged. Their creation, storage and transfer is recorded on a blockchain. Stablecoins are crypto-assets whose value is pegged to currencies.

([58]) Boar C., Wehrli A. (2021), Ready, steady, go? – Results of the third BIS survey on central bank digital currency, BIS Papers, N°114

([59]) Bech M., Garratt R. (2017), Central Bank Cryptocurrencies, *BIS Quarterly Review* September 2017, pp.55-70.

IV.1.2. How would a CBDC compare to banknotes, deposits and reserves?

As a CBDC, a digital euro would be a central bank liability accessible in digital form for retail use by households and firms (ECB, 2020) ([60]). Currently, banknotes are the only form of central bank liability accessible to firms and households, but they are not digital. Deposits held by households and firms on their bank accounts, which are accessible in digital form, are liabilities of commercial banks and not of the central bank. They can be referred to as commercial bank money while banknotes are central bank money. The only digital currency holdings that are also a central bank liability are the reserves and deposits held by commercial banks on their accounts at the central bank. However, households and firms have no access to such central bank deposits. A CBDC would allow firms and households to hold a central bank liability in digital form, just as banknotes allow them to hold a central bank liability in physical form. In this respect, the main difference between holding bank deposits and holding a central bank liability relates to the credit risk. While deposits expose their owners to their bank's credit risk, a CBDC bears no credit risk, just like cash. However, deposit insurance schemes offset this distinction for most retail users in the EU, where deposits are fully insured up to 100 000 euros.

Table IV.1: **Different types of money**

	Form	Available for households and firms	Liability of…
banknotes	physical	yes	the central bank
deposits	digital	yes	commercial banks
e-money	digital	yes	e-money institutions (incl. banks), backed by matching funds
reserves	digital	no	the central bank
retail CBDC	digital	yes	the central bank

Source: own presentation

IV.1.3. Reasons for introducing a CBDC

CBDCs are to be issued within the framework of central bank mandates. Central banks serve a public interest in a jurisdiction-specific context. The current CBDC projects and pilots thus reflect local challenges. For instance, promoting financial inclusion and digital payments while reducing the costs of cash management on an archipelago were

([60]) ECB (2020), Report on a digital euro

challenges that the digital version of the Bahamian dollar (the 'Sand Dollar') ([61]) could alleviate. The fact that people in Sweden are finding it increasingly difficult to pay with cash given that most retailers and consumers have switched to digital payments has incited the Swedish central bank to reflect on an e-krona. In China, the dominance of digital payments by an oligopoly of non-bank tech companies (the 'BATX') has posed a threat to political and financial stability and opened the way to the creation of a digital yuan.

In the euro area, challenges that could motivate the EU to legislate the establishment of a CBDC have been identified and analysed by the ECB (*op. cit.)*: 'A digital euro could be issued (i) to support the digitalisation of the European economy and the strategic independence of the European Union ([62]); (ii) in response to a significant decline in the role of cash as a means of payment, (iii) if there is significant potential for foreign CBDCs or private digital payments to become widely used in the euro area; (iv) as a new monetary policy transmission channel; (v) to mitigate risks to the normal provision of payment services; (vi) to foster the international role of the euro; and (vii) to support improvements in the overall costs and ecological footprint of the monetary and payment systems'. This list proposes the reasons that can justify the issuance of a CBDC in advanced economies. Some of these motivations are defensive: they aim at protecting financial stability and the good functioning of payment systems or at preserving the ability of the euro-area institutions to exercise the role set for them in the Treaties. Other motivations are more assertive. A CBDC can help foster the spreading of digitalisation across the economy and bring innovation to money and payments.

However, the adoption of a CBDC by users in an environment offering various alternatives for digital payments will depend on its ability to appear as a neutral, reliable and efficient means of payment, as is the case of cash in the physical world. Therefore, it is probable that not all of the objectives set out by a CBDC will materialise. Central banks, legislators and other stakeholders will probably decide to focus on the few most relevant issues for their jurisdiction that will everywhere include ensuring user confidence (i.e. a design that is highly reliable and attractive for users).

IV.2. What are the potential effects of a CBDC on the banking sector?

IV.2.1. The substitution between CBDC, cash and deposits

Depending on the design choices made, the CBDC could be extensively used. In this case, whether used as a means of payment or as a store of value, the CBDC will, to a certain extent, compete with deposits and cash.

The existing literature on payments stresses that the choice between payment instruments is driven primarily by their characteristics in terms of convenience, safety, privacy, cost and network effects. The interplay between these different characteristics is complex. The cost of a payment instrument can significantly affect its use (Schuh and Stavins, 2011, Koulayev et al., 2015) ([63]). In terms of service to the user, a CBDC can both be a partial substitute and a partial complement to the use of banknotes and existing digital forms of money, including deposits. Design options will play a role in framing these substitution and complementarity effects, in particular when it comes to choosing between an account-based or a token-based one ([64]) or between a centralised or a decentralised ledger ([65]). However, this section highlights how a CBDC would compare to banknotes, deposits and reserves for economic agents without assuming a specific design. In particular, both account and token-based CBDCs could be remunerated, although it may be

([61]) See: https://www.sanddollar.bs/

([62]) By providing an alternative for fast and efficient digital payments in Europe, a digital euro could reduce the dependence on existing foreign payment providers as well as prevent further dependence on new digital means of payment such as privately issued stablecoins with money-like features and foreign-issued CBDC.

([63]) Schuh S. and Stavins J., (2011), How Consumers Pay: Adoption and Use of Payments, FRB of Boston Working Paper, No. 12-2. Koulayev S., M. Rysman, Stavins J., (2015), Explaining adoption and use of payment instruments by US consumers, *RAND Journal of Economics*, vol. 47, issue 2, 293-325.

([64]) Under the account-based option, CBDC ownership is tied to an identity and claims are recorded in a database matching identities and values, equal to today's bank accounts. The token-based approach implies that the assets can be stored locally in compatible devices and e-wallets and the transfer can be made with just a digital signature validation, giving universal access.

([65]) The ledger, on which CBDC payments are recorded, can be decentralised, for instance through the use of distributed ledger technology (DLT), or centralised in one entity, e.g. at the central bank.

technically more challenging with the latter (ECB, 2021) ([66]).

According to the literature, the use of cash appears to be mostly driven by consumers' preferences, especially for small transactions (Wakamori et al., 2015) and by the context in which the payment is made (Koulayev et al., 2015) ([67]). In turn, these preferences are influenced by the characteristics of the payment instrument and the level of acceptance of alternative payment instruments, which can make them appear more costly (Arango-Arango et al., 2018) ([68]). Agur et al. (2019), model the CBDC as different from both cash and deposits, but from a user perspective the CBDC is located somewhere between cash and deposits depending on the design chosen. Hence, the substitution between CBDCs and deposits or cash depends on whether the CBDC has cash-like features, like anonymity, and on the interest differential with respect to bank deposits ([69]). A cash-like CBDC can, on the one hand, cause the decline of cash due to network effects while, on the other hand, a deposit-like CBDC which bears an interest rate can cause an erosion of bank deposits against which banks may increase interest rates on deposits and loans. It should be noted that the increase in interest rates on deposits would not only be driven by the existence of interest rates on the CBDC, but could also be driven by the existence of convenience yields provided by the CBDC. The latter can be related, for example, to factors such as the ease of use and the comparative costs of a CBDC that influence the substitution between it and other means of payments. Moreover, different forms of money also compete regarding their store-of-value function. To this end, quantitative limits, such as limits on individual CBDC holdings or transaction limits, could effectively curb the substitution between CBDC and bank deposits. To avoid that hard limits block payment orders, solutions can be developed based on a "tiering" of CBDC remuneration ([70]) or a waterfall between CBDC holdings and an associated payment account.

IV.2.2. The link between deposits, bank funding and bank lending

In the modern economy, new money is essentially created when banks issue new loans. When banks lend, they create deposits and the creation of deposits is the accounting counterpart of new loans on banks' balance sheets. Therefore, deposits play a crucial role in generating broad money and constitute the main source of funding for most banks. Using the euro area as an example, loans to non-financial corporations (NFC) and households account for nearly three quarters of the broad money aggregate M3 ([71]).

The aggregated balance sheet of euro-area banks highlights the importance of deposits for banks' funding (Graph IV.1). In April 2021, the total aggregated balance sheet of banks in the euro area amounted to EUR 36.4trn, with deposits accounting for 40% of this figure ([72]). In particular, household deposits amounted to EUR 8.5trn and NFC deposits to EUR 3.1trn, representing respectively 23% and 9% of banks' liabilities in the euro area ([73]). Within deposits, overnight deposits are particularly important ([74]) and more likely to be easily substitutable for digital currencies. Overnight deposits from NFC and households represented about half of all deposits recorded in banks' balance sheets and amounted to 21% of their total liabilities, which points to the importance of deposits for the banking system. However, overall, the importance of deposits in banks' liabilities depends also on banks' business models, although even predominantly wholesale-funded banks rely on deposits to a significant extent (Farnè et al., 2017) ([75]).

([66]) ECB (2021), Digital euro experimentation scope and key Learnings.

([67]) Wakamori N., Welte A., (2017), Why Do Shoppers Use Cash? Evidence from Shopping Diary Data, *Journal of Money, Credit and Banking*, vol. 49, issue 1, pp. 115-169.

([68]) Arango-Arango C., Bouhdaoui Y., Bounie D., Eschelbach M., Hernandez L. (2018), Cash remains top-of-wallet! International evidence from payment diaries, *Economic Modelling*, Volume 69, pp. 38-48.

([69]) Agur I., Ari A., Dell'Ariccia G. (2019), Designing Central Bank Digital Currencies, IMF Working Paper, WP/19/252.

([70]) Bindseil U. (2020), Tiered CBDC and the financial system, ECB Working Paper Series, N° 2351.

([71]) Source: ECB, Statistical Data Warehouse, Balance Sheet Items.

([72]) *ibid.* Deposits from non-MFIs excluding general government.

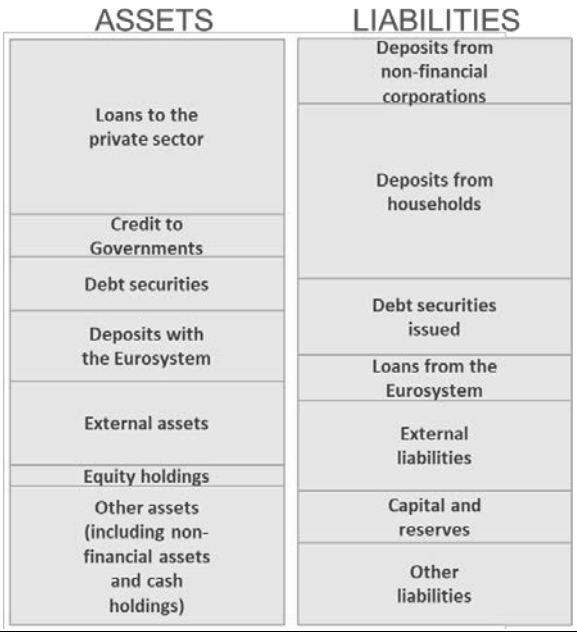
([73]) i.e. of the total aggregated balance sheet (with liabilities defined as including capital).

([74]) Deposits comprise overnight deposits (defined by the ECB as mainly comprising 'sight deposits'), deposits with agreed maturity and deposits redeemable at notice.

([75]) Farnè F., Vouldis A., (2017) Business models of the banks in the euro area, ECB Working Paper Series, N° 2070.

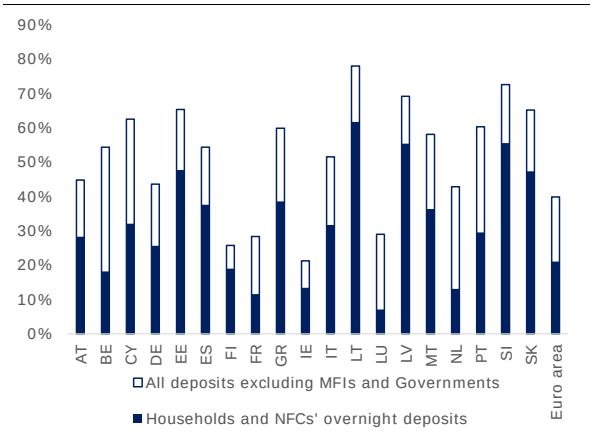
Despite the importance of deposits at the aggregate level, the euro area average masks an important heterogeneity at the country and bank level. Deposits represent more than 50% of banks' funding in twelve countries, a figure that still remains at eight countries if we take into account the sole deposits of households and NFC. The share of deposits in banks' liabilities reaches 78% in Lithuania, 72% in Slovenia, 69% in Latvia, 65% in Estonia and Slovakia. Among the euro area's four largest countries, deposits represent more than 50% of banks' liabilities in Spain and Italy, 44% in Germany but only 28% in France ([76]). Banks rely the least on deposits for their funding in Ireland (21%), Finland, France and Luxembourg (less than 30%).

Graph IV.1: **Simplified aggregated balance sheet of euro area banks**



Source: own presentation based on the Balance Sheet Items statistics of the ECB

Graph IV.2: **Banks' deposit funding as % of their balance sheets**



Source: ECB, Statistical Data Warehouse, Balance Sheet Items statistics. Aggregated balance sheet values of banks licenced in each Member State.

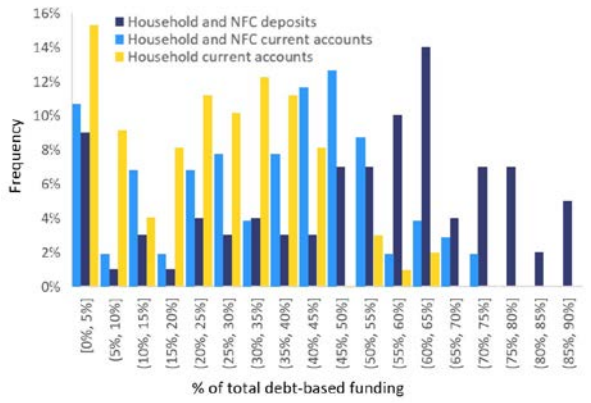
Bank-level data confirms that most euro area banks rely on household and NFC deposits as their main source of funding, i.e. they account for more than half of bank debt in more than half of the banks in our sample (see Graph IV.3). When restricting ourselves to current accounts ([77]), which are more likely to be partly substituted by CBDC, banks' deposit funding dependence is seen to diminish markedly, even if most banks continue to display fairly high figures.

At the same time, bank-level data also illustrates how diverse bank funding models can be, with deposits playing a comparatively small role in a non-negligible share of banks, while representing more than 60% of bank debt in the most deposit-dependent institutions (Graph IV.4). It is this category of banks, highly reliant on retail funding, that is more likely to be put under pressure should an unrestricted CBDC design be chosen.

([76]) Deposits represent a smaller part of the banks' liabilities when banks benefit from a large and liquid market of covered bonds to refinance a significant part of their loan book. The figure for the share of deposits in banks' financing can also be reduced in Member States where banks rely more on intragroup financing inside larger and more complex groups.

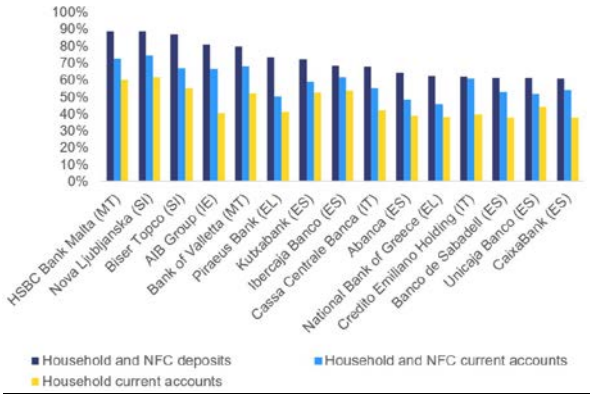
([77]) The current account figures shown in Graphs IV.2 and IV.3 refer to the EBA data item labelled as 'Deposits - of which: Current accounts / overnight deposits'.

Graph IV.3: **Empirical distribution of deposit shares in total bank debt**



(1) As at mid-2020 and based on a sample of 94 euro area banks included in the EBA's transparency exercise; the graph plots the empirical distribution of the share in total debt of three deposit categories, from a narrowly defined one (household current accounts) to broader concepts (total household and NFC deposits).
Source: EBA, own calculations

Graph IV.4: **Deposits as a % of total bank debt: top 15 EA banks**



(1) As at mid-2020 and based on a sample of 94 euro area banks included in the EBA's transparency exercise; banks ordered according to household and NFC deposits as a % of total debt.
Source: EBA, own calculations

Deposits compare favourably to other sources of banks' funding, be it short- and long-term wholesale debt (including securitisation) or equity. In particular, deposits are a widely available and very stable source of funding, thanks to the long-term relations that banks have with their clients. Moreover, their cost is very low, as in general they pay less than other forms of market funding with an equivalent regulatory treatment. Finally, they do not require collateralisation. By comparison, debt securities issued by banks are either collateralised ([78]) or usually pay higher interest rates, and are subject to rollover risk. Banks also have access to central bank funding. Currently, the main refinancing operations of the ECB are offered at 0% with full allotment and the interest rate on TLTRO III can reach -1%, a level which is extraordinarily low by historical standards. Moreover, central bank funding is provided against collateral, and TLTRO III loans are also subject to specific conditions.

IV.2.3. How could banks react to the introduction of a CBDC?

Whatever design is chosen, in the euro area, a digital euro would exist alongside cash and deposits and not replace them (ECB, *op. cit.*) so that, the introduction of a CBDC would not threaten banks' ability to create deposits. However, if a CBDC is successfully issued, households and firms will own it and use it, leading to a partial substitution of their bank deposits. The substitution will most likely be only partial, as it expected to be limited by design choices. As per the balance sheet identity, a decrease in deposits on the liability side needs to be matched either by an increase in other liabilities or by a corresponding decrease in assets. From a macroeconomic perspective, the possible decrease in deposits is a key issue related to the creation of a CBDC. It is worth mentioning that the issue of financial intermediation is not specific to a digital euro. The wide use of any other form of digital money, including stable coins, foreign CBDCs or cryptocurrencies, could disintermediate banks by diminishing the role of deposits as a means of payment and store of value. In this respect, a CBDC would allow policy-makers to define an intermediation design, where in any case actors other than banks may increasingly play the intermediary function.

The literature is not conclusive on the implications of a retail CBDC for banks' deposits but highlights how banks could react to a possible loss of deposits in different manners. Whether a CBDC in the euro area would bear interest is unknown and the extent to which it would compete with deposits would also depend on other features like possible holding limits. In any case, it has to be noted that the key variable for the determination of deposits is

([78]) Covered bonds, which are debt securities issued by banks and collateralised against a pool of mortgage loans or public-sector debt, are a case in point.

not the interest rate on the CBDC itself but the spreads between it and the interest rate on commercial bank deposits and their reserves at the central bank. According to the ECB's Report on a digital euro, the interest rate on a digital euro should not be below 0%, at least within a certain holding limit, and a positive interest-bearing digital euro would pose a risk of large-scale substitution away from deposits.

Banks could try to retain deposits…

Banks could try to avoid deposit outflows by making the remuneration on deposits more attractive. The increase in deposit rates needed to retain at least some of the potential outflows would be higher, the stronger the demand for CBDC, the lower the interest rate elasticity of this demand and would also depend on whether the CBDC is interest-bearing or not. In the case of remunerated CBDC, assuming that the CBDC is a perfect substitute for deposits and that banks are monopolists in the market for deposits, banks would have incentives to match the interest rate on the CBDC as long as it stays below the interest rate on reserves (Andolfatto, 2019) ([79]). Interestingly, introducing a CBDC could then lead to an increase in the supply of deposits because banks would offer a more attractive interest rate. The increase in deposits in turn could lead to a decrease in the lending rate and an expansion in bank lending. Other studies find that a CBDC may expand bank intermediation by introducing more competition in the banking sector, even if it is not used as a means of payment (Chiu et al., 2019) ([80]). This result is interesting, in that it stresses the existence of a competition effect and that banks can respond to deposit losses by increasing rates. However, the result is extreme and model dependent: as indicated above, Agur et al. (2019) show that, in a setting in which deposits and CBDC are not perfect substitutes, the introduction of a CBDC decreases deposits, even if this effect is smaller when banks have market power. This is also the view of practitioners ([81]). Similarly, any increase in deposit rates to avoid large-scale conversion to CBDC may in reality be passed on to lending rates, thus having a contractionary effect on bank lending.

…or adjust their balance sheets

Banks can also choose to adjust their balance sheets in response to a CBDC-induced deposit outflow, be it on the liability or on the asset side.

On the liability side, banks could replace deposits with alternative funding such as market funding or central bank funding. Regarding the latter, the central bank could decide to offset any decrease in deposits by providing substitute central bank funding. In this case, bank funding would not be reduced. Its composition would change but this need not have an impact on credit supply or on the stability of the financial sector (these are the 'equivalence results', see Brunnermeier and Niepelt, 2019) ([82]). However, alternative funding sources can be subject to collateral requirements and might have an impact on profitability and prudential ratios, which would invalidate this equivalence in practice.

On the asset side, banks could decide to draw on their excess reserves to the extent possible, especially when they are partially charged a negative interest rate ([83]). The mechanism would be similar to current cash withdrawals. In the euro area, excess reserves stood at EUR 3.3 trillion euros in April 2021, while households and firms' sight deposits amounted to EUR 7.6 trillion euros. However, the availability of large excess reserves at the euro area aggregate level does not imply that each bank would have sufficient excess reserves to match a deposit withdrawal ([84]). Banks could also

([79]) Andolfatto D. (2019), Assessing the Impact of Central Bank Digital Currency on Private Banks, FRB St. Louis Working Paper No. 2018-25. Note that this also covers the case of a non-interest bearing CBDC, in which case the interest rate would simply be zero.

([80]) Chiu J., Davoodalhosseini M., Jiang JH., Zhu Y. (2019), Central bank digital currency and banking, Bank of Canada Staff Working Paper, N° 2019-20.

([81]) Among many, see Bank of England (2020), Central Bank Digital Currency: opportunities, challenges and design, working paper available at Central Bank Digital Currency: opportunities, challenges and design | Bank of England

([82]) Brunnermeier M., Niepelt D. (2019), On the equivalence of private and public money, *Journal of Monetary Economics*, N°106, pp. 27-41.

([83]) Currently, in the euro area, the interest rate on banks' minimum reserves stands at 0% and excess reserves are subject to a tiered remuneration whose interest rate can reach -0.50%. Therefore, the average remuneration on banks' reserves is negative while the average remuneration of firms and households' sight deposits is close to zero.

([84]) Nonetheless, at the banking sector aggregate level, deposit outflows could be entirely matched by drawing down excess

decide to shrink other assets, for instance by selling securities or by diminishing lending. However, if the literature provides some evidence that banks may adjust lending supply downwards, the overall results are ambiguous as these effects could be mitigated by a reduction in banks' monopolistic power and by central bank intervention. It is also possible that banks would adjust their business models, possibly by securitising loans or acting as intermediaries in the provision of the CBDC, assuming that the latter option would be legally endorsed. Alternatively, the negative effects could be cushioned by the central bank intervening and providing banks with cheap funding to substitute deposits, although this could have repercussions of its own (see also Section IV.3.2. below) ([85]).

For banks, deposits are not only a stable, low-cost source of funding. They also attract customers and support the provision of loans and other financial services, including payment services. These are a source of information for banks when assessing customers' creditworthiness as well as a source of interest and non-interest income. The design of a CBDC and, in particular, its possible intermediation by the private sector as a gatekeeper or settlement agent will be key in gauging its impact on the risk assessment capacities of commercial banks. Indeed, if banks can act as settlement agents on CBDC transactions, they should have access to the same level of information on the operations and incomes of their customers as they have today.

IV.2.4. Possible intermediation designs

Several intermediation designs can handle the day-to-day functioning of a CBDC. First, a direct CBDC would centralise all functions at the level of the central bank. Alternatively, a hybrid CBDC would centralise the issuance of the digital currency, with the central bank playing a supervisory role, while dedicated supervised intermediaries would ensure the know-your-customer regulatory checks, distribute the CBDC to clients and provide them with services allowing the use of the CBDC (Auer and Böhme, 2019) ([86]).

A third kind of intermediation design does not pass the criterion of being a central bank liability ([87]) but offers a service to users fully comparable to a CBDC. In the case of a 'synthetic CBDC', intermediaries ensure the role they have in a hybrid model but are also in charge of issuing, managing and redeeming the digital currencies. To ensure that the credit risk does not weaken the framework, each intermediary should hold reserves at the central bank for an amount equal to the value of the synthetic CBDC it has issued. These reserves could be a wholesale CBDC. This system is a digital version of the scheme used in the United Kingdom for commercial banks to issue the Scottish and Irish pound banknotes.

The question of intermediation design is essential from a legal point of view and will need a policy decision by the legislature but the interface and service options for the end-user will derive more from technological choices than from the intermediation structure. Furthermore, the choice on intermediation does not affect the choice of the principal technological solution (account-based or token-based). It affects the economics of CBDCs only through the question of fees, or alternative ways for intermediaries to monetise their customer relationship and network effects, and of how easily banks may or may not lose a part of their financial intermediation function.

IV.3. What could be the implications of a CBDC for financial stability and monetary policy?

IV.3.1. Effects on financial stability depend on the design

As indicated in the literature, the implications of a CBDC for financial stability depend on a number of factors, such as the demand for it, the degree of substitution with respect to commercial bank deposits, banks' response to the introduction of a CBDC, as well as the easiness of conversion of deposits into a CBDC in case of a crisis. A CBDC

reserves if those reserves were redistributed via interbank markets.

([85]) Note that if the central bank offsets a decrease in deposits, the size of the aggregated balance sheets of commercial banks is unchanged whereas if banks draw on their reserves, their aggregated balance sheet shrinks.

([86]) Auer R. and Böhme R. (2020), The technology of retail central bank digital currency, BIS Quarterly Review, March 2020, pp.85-100.

([87]) BIS et al. (2020), Central bank digital currencies: foundational principles and core features

will have to carefully designed so as to minimise negative impacts. Nonetheless, a few general principles and channels can be identified, distinguishing broadly between those arising from structural bank disintermediation and those connected to decreased stability of bank deposit funding in crisis times.

As regards potentially structurally lower bank deposits resulting from the introduction of CBDC, the financial stability implications depend chiefly on how banks adjust their balance sheets in response. For instance, if banks are able to respond to the decrease of deposit funding by drawing down excess reserve holdings on the asset side, adverse effects for financial stability should be limited ([88]). Conversely, if deposit funding were substituted by other, less stable sources of funding, banks could be more prone to episodes of liquidity stress due to their larger rollover risk. This should also be reflected in mechanical decreases in key regulatory metrics such as liquidity coverage ratios (LCR) and the net stable funding ratio (NSFR) ([89]). Consequently, optimal holdings of high quality liquid assets should increase given that a shift towards less stable funding requires higher coverage, while the presence of a CBDC as an outside option, if not properly designed and framed, may at the same time reduce the stability of the remaining deposits especially in crisis times (see below).

Financial stability risks might furthermore arise in connection with lower bank profitability. This could be the case for instance if banks increase deposit rates to compete with the CBDC, if the decrease in deposits was compensated by more expensive sources of funding and/or if it implied lower fee income (e.g. from debit card usage, payment services, cross-selling of products). Any of those might induce higher bank risk taking in order to keep profit margins stable. If banks' profitability was to be durably affected by the loss of deposits, the traditional trade-off between competition and stability could emerge under a new form, even if the recent literature has shown that this nexus has to be analysed on a case-by-case basis ([90]).

As regards the impact of a CBDC on bank funding in crisis times and the threat of bank runs, results from the available literature are inconclusive. On the one hand, it seems theoretically possible for digital bank runs to happen very quickly, a possibility facilitated by the fact that the technology in principle allows money to be withdrawn from banks into the CBDC with a simple click. Moreover, the very possibility that banks may lose deposits and face more competition in the payments market could leave banks weaker and increase the possibility of bank runs (Williamson, 2020) ([91]). On the other hand, however, there are reasons to believe that the introduction of a CBDC could lower the probability of a run. First, because, in the absence of quantitative limits on CBDC holdings, the central bank would in practice be committing towards depositors that all deposits can be transformed into CBDC very rapidly. If agents are rational, this should have an effect similar to deposit insurance schemes and diminish the reason to panic (Fernández-Villaverde et al, 2021) ([92]). Second, because the central bank can use timely information obtained from demand for a CBDC to intervene faster than in the current system, potential panics could be managed faster by the central bank and be less damaging (Keister and Monnet, 2020) ([93]).

In view of this theoretical ambiguity, a few practical remarks are in order. First, a potential heightened probability of bank runs should mainly apply to the case of systemic banking crises, in which an electronic transfer to another bank account does not eliminate a depositor's risk (as the option of an electronic transfer already exists in

([88]) In the current environment of large excess reserve holdings and negative deposit facility rates, this would even have positive effects on bank profitability.

([89]) LCR and NSFR are part of the liquidity requirements under the Basel III regulatory framework. The LCR is defined as the ratio of High Quality Liquid Assets (HQLA) to a bank's liquidity needs in a 30-day liquidity stress scenario and needs to be at least 100%. The NSFR sets 'Available Stable Funding', which includes deposits but does not include short-term wholesale funding (including interbank lending), in relation to 'Required Stable Funding', which is calculated with respect to banks' asset side. Deposits are a stable, cheap and liquid form of financing for banks. Retail deposits improve liquidity ratios.

([90]) For a discussion, see among many Carletti E. and Hartmann, P. (2002), Competition and stability: what is special about banking? ECB WP no. 146.

([91]) Williamson S.D. (2020), Central Bank Digital Currency and Flight to Safety, University of Western Ontario

([92]) Fernández-Villaverde J., Sanches D., Schilling L.M., Uhlig H. (2021), Central bank digital currency: Central banking for all?, *Review of Economic Dynamics*, vol. 41, pp. 225-242.

([93]) Keister T., Monnet C. (2020), "Central Bank Digital Currency: Stability and Information", mimeo

the status quo). Indeed, Rainone (2021) shows that in idiosyncratic bank stress episodes deposits are mainly shifted to large domestic banks generating a size premium and that under a fixed-rate, full allotment regime, the liquidity drain is mostly offset through open market operations ([94]). Second, such runs in the presence of a systemic crisis clearly represent a tail risk, especially in the presence of European deposit insurance frameworks. In practice, in the euro area context, such systemic withdrawals of bank deposits have only been observed in case of perceived redenomination risk connected to concerns over an exit from the common currency area. Lastly, CBDC design choices such as individual holding limits, transaction limits or tiered remuneration of CBDC holdings can mitigate any remaining risks of bank runs connected with the introduction of CBDC. More generally, any design choice that limits the store of value function for a CBDC and thus limits the extent of potential bank disintermediation should be able to mitigate financial stability concerns.

Financial stability implications of a CBDC should also be assessed against an appropriate counterfactual scenario, which is likely not to be the current status quo. That is, the emergence of new private means of payments such as global stable coins or even foreign-issued CBDC might have implications for financial stability (e.g. disintermediation, credit risk) that a domestically issued CBDC could mitigate. Lastly, regulatory policies are a further important lever to tackle potential financial stability concerns.

IV.3.2. Possible macroeconomic effects of a CBDC

The creation of a CBDC allows the continued strong presence of public money also in the digital era. By ensuring the continued 1:1 convertibility of private payment instruments into legal tender, it therefore safeguards the role of public money as the anchor for the monetary system, which ultimately also supports monetary policy transmission. While a digital euro would in first instance not aim at being used as a monetary policy tool, the literature furthermore considers the benefits for monetary policy of a CBDC that bears an interest rate. In particular, the literature highlights that an interest-bearing CBDC can act as a stabilisation tool if it can circumvent the zero-lower-bound on interest rates, bringing significant improvements for the economy ([95]). However, as tracking the policy rate could imply negative interest rates on the CBDC, most central banks do not consider such a possibility in their design, at least up to a certain threshold of CBDC holdings. Conversely, not tracking the monetary rate would also create concern because, as a safe asset, a CBDC could set a floor for all other interest rates. In the euro area, a non-interest-bearing CBDC could threaten the current monetary policy stance because the risk-free interest rate is currently below -0.5% (ECB, 2020). Hence, the ECB advocates that a CBDC should be a means of payment, while its use as store of value should be limited.

The literature also highlights that introducing a CBDC can have a broad macroeconomic effect. Using a DSGE model calibrated on the United States, Barrdear and Kumhof (2016) find that a CBDC could increase the steady-state level of GDP by nearly 3% under the assumption that a stock of CBDC amounting to 30% of GDP is issued against government debt ([96]). This increase would be driven by lower real rates and the improved efficiency of the economy with a reduction in transaction costs. The latter would compensate for the potential negative impact on the banking system, provided that the central bank intervenes to provide liquidity to the banking system that could lower real interest rates. A further positive element would be the reduction in distortionary tax rates due to the increased demand from the public for the CBDC, which constitutes a monetary form of debt. More modest effects are found by Chiu et al., op. cit. By calibrating their model on the US economy, the authors show that the effects of a CBDC on bank lending and output depend on the CBDC's interest rate, with a maximum increase in bank lending of 3.55% and a related increase in output of 0.5%.

([94]) Rainone E., (2021), Identifying deposits' outflows in real-time, Bank of Italy WP 1319.

([95]) Gross J., Schiller J. (2020), A Model for Central Bank Digital Currencies: Do CBDCs Disrupt the Financial Sector?, *SSRN Electronic Journal*, October 2020

([96]) Barrdear J., Kumhof M. (2016), The macroeconomics of central bank issued digital currencies, Bank of England, Staff Working Paper N° 605

IV.4.Concluding reflections

The decision of whether to establish a CBDC is a complex endeavour that needs to take into account many different motivations, of which the economic motivations, as discussed in this section, constitute only a part.

Ultimately, the economic benefits of the establishment of a CBDC will depend on the capacity of managing well the trade-off between the positive impact from the increased efficiency in payment systems and the risks that this introduction could pose to the banking system.

It is important to notice when analysing the relevant trade-offs that the challenges posed by a CBDC, in particular for the role of the banking sector, may arise anyway in connection with the development of stable coins, foreign-based CBDC and the entry of new large foreign competitors in the payments market.

In practice, an in-depth analysis of the relevant design choices will be necessary before deciding which are the most appropriate for the jurisdiction concerned.

Annex. The euro area chronicle

The European Commission, the Ecofin Council and the Eurogroup regularly take decisions that have a bearing on the functioning of the Economic and Monetary Union (EMU). In order to keep track of most relevant decisions, the QREA features a chronicle of major legal and institutional developments, presented in a chronological order and containing appropriate references. This issue of the chronicle covers developments between the end of May and the beginning of November 2021. In the last few months, the European Commission has been assessing recovery and resilience plans drafted by Member States, and proposed their approval to the Council. Over the summer, the European Commission has started raising funds in the markets to finance the recovery and resilience plans. In June, Ministers of Finance of the euro area Member States concluded that Greece met the conditions necessary for the implementation of further policy-contingent debt measures ([97]).

Further disbursements under SURE. With the latest disbursement on 25 May 2021, the EU has provided nearly EUR 90 billion in back-to-back loans under the temporary Support to mitigate Unemployment Risks in an Emergency (SURE), out of which EUR 74.3 billion reached euro area Member States. On 22 September, the European Commission issued the second bi-annual report on SURE ([98]). SURE is available for Member States that need to mobilise significant financial means to fight the negative economic and social consequences of the coronavirus outbreak. It can provide financial assistance up to EUR 100 billion in the form of loans from the EU to affected Member States. These loans are meant to address sudden increases in public expenditure for the preservation of employment, to help protect employees and self-employed against the risk of unemployment and loss of income. SURE mostly supports short-time work schemes and similar measures. The loans are granted on favourable terms. To finance the instrument, the Commission has been issuing social bonds. Although it is an instrument available to the whole of the EU, SURE has helped to mitigate the impact of the pandemic on euro area unemployment and thereby supported stabilisation of the euro area economy.

Agreement on policy-contingent debt measures for Greece. On 17 June, the Eurogroup welcomed the assessment by the European institutions that Greece met the conditions necessary for the release of the fifth tranche of policy-contingent debt measures, worth EUR 748 million ([99]). In particular, Greece has been rolling out its insolvency reform and taking steps to further reduce non-performing loans, strengthening its tax administration, enhancing its minimum income scheme, and improving management of public investments. Since August 2018, after Greece successfully completed its European Stability Mechanism (ESM) programme, it has been subject to the enhanced surveillance framework. The quarterly reporting enables close monitoring of the economic, fiscal and financial situation in the country and the implementation of the post-programme policy commitments, as agreed by the Eurogroup in June 2018.

Monetary policy strategy review. In July, the ECB released the results of its monetary policy strategy review. The main novelty concerns the adoption by the ECB of a symmetric 2% inflation target over the medium term. In this context, the ECB confirmed that the Harmonised Index of Consumer Prices (HICP) remained the appropriate price measure and recommended the inclusion of owner-occupied housing costs over time. The ECB also acknowledged that especially forceful or persistent monetary policy measures would be required when the economy is close to the lower bound on interest rates. Last but not least, the ECB adopted an ambitious climate-change action plan.

([97]) Annex compiled by Jakub Wtorek. The cut-off date for this annex is 5 November 2021.

([98]) Report on the European instrument for Temporary Support to mitigate Unemployment Risks in Emergency (SURE) following the COVID-19 outbreak pursuant to Article 14 of Council Regulation (EU) 2020/672, SURE: One year on, COM (2021) 596, https://ec.europa.eu/info/files/second-report-implementation-sure_en

([99]) See Eurogroup statement on Greece of 17 June 2021: https://www.consilium.europa.eu/en/press/press-releases/2021/06/17/eurogroup-statement-on-greece-of-17-june-2021/

Launch of an investigation on digital euro. In July 2021, after more than a year of preliminary studies including a technical cooperation with the European Commission staff, the ECB Governing Council decided to launch a more structured step of the digital euro project, called investigation phase. The investigation phase will last 24 months and aims at addressing key issues regarding use cases, design and distribution. The ECB will continue to engage with the European Parliament and other European institutions in order to inform them about its findings and to discuss the possible changes to the EU legislation. The technical work between the ECB and the Commission will be intensified. The ECB will also engage with private stakeholders through a newly established Digital Euro Market Advisory Group (MAG). The investigation phase will involve prototyping but will not prejudge any future decision on the issuance of a digital euro.

Endorsement of the recovery and resilience plans of eighteen euro area Member States. Between June and mid-October, the European Commission adopted positive assessments of the recovery and resilience plans of twenty two EU Member States, including several euro area countries (Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Latvia, Luxembourg, Malta, Portugal, Slovakia, Slovenia and Spain). The Commission assessed the plans based on the criteria set forth in the Recovery and Resilience Facility (RRF) Regulation ([100]). As a rule, the Council has four weeks to adopt the Commission's proposals for the so-called Council Implementing Decision for each plan. Although it is an instrument agreed and applied to the whole of the EU, the RRF will have a significant impact on the functioning of the euro area and is designed with a view to foster economic convergence. In the short to medium term, it will provide sizeable fiscal support to the recovery of the euro area economy. The RRF also reinforces confidence and helps to preserve macro-financial stability, thus supporting the ECB's actions in this area. Beyond its short-term stabilisation function and its role in supporting the recovery, the RRF has the potential to affect the EMU in the longer term. Implementation of structural reforms should increase the euro area's resilience to future shocks, and, additional investment financed under the RRF should raise potential output. Furthermore, the sizeable issuance of euro-denominated debt (see paragraph below) will add depth and liquidity to the market for high-quality euro-denominated debt securities and thereby help to strengthen the euro as an international reserve currency.

Council's green light for first recovery disbursements. On 13 July, EU economic and finance ministers adopted the first batch of Council implementing decisions on the approval of national recovery and resilience plans. Eleven euro area Member States (Austria, Belgium, France, Germany, Greece, Italy, Latvia, Luxembourg, Portugal, Slovakia and Spain) got the green light for the use of EU recovery and resilience funds to boost their economies and recover from the COVID-19 fallout. In July, three additional Council implementing decisions were adopted for euro area Member States (Cyprus, Lithuania and Slovenia), and in September and October three more (Ireland, Estonia and Finland). The adoption of Council implementing decisions on the approval of the plans paves the way for the signing of grant and loan agreements that will allow the disbursement of funds.

Common issuance to finance the RRF and other programmes under the Next Generation EU. A diversified funding strategy to raise around EUR 800 billion at current prices until 2026 will make the EU one of the largest euro bonds issuers. Use of multiple funding instruments (medium and long-term bonds, and EU-bills) will help maintaining flexibility in terms of market access and managing liquidity needs and maturity profile. In 2021, the annual Borrowing Decision ([101]) allows the Commission to issue up to a maximum amount of EUR 125 billion in long-term funding and up to a maximum outstanding amount of EUR 60 billion in short-term funding. As of 15 September 2021, the Commission has borrowed EUR 54 billion through long-term bond issuance via syndicated transactions. From the end of September onwards, the Commission will use monthly bond auctions as a complementary format for mobilising bond proceeds. In order to make all disbursements of RRF pre-financing to Member States without delay

([100]) Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility, OJ L 57, 18.2.2021, p. 17–75. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R0241&from=EN

([101]) Commission Implementing Decision C(2021) 3991 final.

during the course of summer 2021, the Commission has made use of money market transactions to complement the proceeds raised through bond issuance. On 15 September 2021, the Commission launched the first EU-Bill auction, followed by a tap on 22 September 2021. The EU-Bill programme will henceforth represent the favoured route for meeting short-term liquidity needs. On 12 October, the European Commission issued EUR 12 billion in green bonds, the proceeds of which will be used exclusively for green and sustainable investments under the Next Generation EU programme, including the RRF.

OECD review of the economic policies in the euro area. On 11 September, the OECD published the 2021 economic review of the euro area adopted by its Economic and Development Review Committee ([102]). The report finds that the euro area response to the crisis was strong and followed by a swift recovery. It recommends that monetary policy should remain accommodative following the revision of its framework, and that Europe needs to improve its fiscal governance.

([102]) OECD (2021), 2021 economic review of the euro area, 11 September 2021, https://www.oecd.org/economy/euro-area-and-european-union-economic-snapshot

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