EUROPEAN CENTRAL BANK

EUROSYSTEM

Macroprudential stress test of the euro area banking system amid the coronavirus (COVID-19) pandemic

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Contents

1 Executive summary

The macroprudential stress test for 2021-23 aims to provide insights into the resilience of the European banking sector following the coronavirus (COVID-19) crisis. The macroprudential stress test complements the EU-wide stress test run by the European Banking Authority (EBA) and ECB Banking Supervision in three important aspects: (i) it includes the endogenous reactions of banks to stress inherent in macro-financial scenarios (i.e. it adopts a dynamic balance sheet perspective), (ii) it considers relevant amplification mechanisms between bank solvency and funding costs and the feedback between the banking sector and the real economy, and (iii) it incorporates the phasing-out of COVID-19 mitigation policies.

The assessment builds on a macro-micro model with individual euro area economies and significant banks, and the two scenarios from the 2021 EU-wise stress test exercise. The model tracks the evolution of all euro area economies and that of 89 significant banks covering approximately 70% of the euro area banking sector. The modelling of banks' behaviour relies on empirical relationships that represent their reactions in terms of lending volumes, pricing, liability structure and profit distribution. The baseline scenario for 2021-23 is derived from the forecasts of the national central banks at the end of 2020 and reflects a strong rebound in economic activity in 2021. The adverse scenario assumes a prolonged COVID-19 scenario in a "lower for longer" interest rate environment.

In the baseline scenario, the system-wide transitional CET1 ratio goes down from 15.5% in 2020 to its pre-pandemic level of 14.4%. The evolution of CET1 ratios in the baseline scenario is supported by a stable profitability outlook, and its moderate reduction relates to a marked expansion of banks' assets and the payout of dividends. Over the three-year horizon, banks cumulatively pay out 16.5% of CET1 capital as compared with the level in 2020. The relatively high profit distribution amounts link to the phase-out of profit distribution restrictions and relatively low regulatory capital requirements in the assumed absence of replenishment of macroprudential buffers or replenishment of Pillar 2 guidance.

In the adverse scenario, the CET1 ratio drops by 5.2 percentage points from 15.5% in 2020 to 10.3% in 2023. The deterioration in bank solvency pushes about a quarter of stress-tested significant euro area banks (40% in terms of their share of banking sector assets) below their capital buffers, but only six of them, corresponding to 5% of banking system assets, are found to fall below their minimum Pillar 1 and Pillar 2 thresholds.

Macro-financial amplification in the macroprudential stress test results in higher capital depletion in the adverse scenario compared to the EBA/Single Supervisory Mechanism (SSM) stress test. The macroprudential stress test estimates a lower transitional CET1 ratio in 2023 in the baseline scenario (14.4% versus 15.8%) and a slightly higher CET1 ratio in the adverse scenario (10.3% versus 10.1%). However, the higher system-wide CET1 ratio in the adverse scenario

hides higher capital depletion in terms of CET1 losses in 2021-23 (-32% versus -27%).

Bank lending expands in the baseline scenario and shrinks in the adverse scenario. The average annual loan growth to the non-financial private sector between 2021 and 2023 stands at around 5% in the baseline scenario and -1% in the adverse scenario. A decline in lending in the adverse scenario is in line with banks' deteriorating asset quality, profitability and capitalisation. Loan supply tensions in the adverse scenario are also observed in loan pricing. Banks' pass-through of an increase in their funding costs to lending margins is reflected in a greater increase in effective lending rates to the non-financial private sector when compared with the baseline scenario.

The outstanding COVID-19 mitigation policies have a pronounced positive lending effect, especially in the adverse scenario. Compared with lending volumes in the absence of policy measures, lending in cumulative terms is around 1.2 percentage points higher at the end of 2023 in the baseline scenario and 1.6 percentage points higher in the adverse scenario.

The banking sector-real economy feedback loop amplifies the severity of the adverse scenario. The contraction of loan supply in the adverse scenario reduces euro area GDP growth by a further 1.6 percentage points. However, this effect is halved by the positive impact and more intense use of COVID-19 mitigation policies.

The adopted assumption on banks' intentions to use capital buffers can affect the outcomes of the macroprudential stress test. The main results are derived under the assumption that banks remain reluctant to dip into their capital buffers and fall under maximum distributable amount (MDA) restrictions. The outcomes of an analysis which assumes that banks are willing to fall under MDA restrictions when making lending decisions show the annual growth rate of lending volumes to the non-financial private sector between 2021 and 2023 to be 1.5 percentage points and 1.0 percentage point higher in the adverse and baseline scenarios respectively. Importantly, the use of capital buffers barely affects solvency rates in the adverse scenario. On the other hand, buffer replenishment at the beginning of 2023 has hardly any effect on the outcomes of the macroprudential stress test in the baseline scenario, though it could weaken credit supply and banks' solvency in the adverse scenario.

2 Introduction

The European financial system has proven to be resilient during the COVID-19 pandemic, in large part thanks to broad policy support. Fiscal, monetary and supervisory policies have helped to maintain the flow of credit to the economy and keep financial risks at bay (ECB, 2021; Budnik et al., 2021b). Bank capitalisation stood at a relatively high level at the end of 2020, yet financial stability concerns remain elevated. Banks face high credit quality risk due to corporate solvency challenges and the phasing-out of different policy measures. Bank profitability is persistently low and is another key risk for the long-term sustainability of solvency rates.

This paper reports on the outcomes of a macroprudential stress test for the post-pandemic euro area banking sector. The analysis employs a large-scale model of individual euro area banks and economies that captures banks' adjustments and macro-financial amplification mechanisms. The focus of the macroprudential stress test is the evolution of bank solvency, profitability and lending activity in two scenarios that reflect different future outlooks for the macroeconomy. The analysis takes into consideration the impact of COVID-19 mitigation policies which expire in 2021.

The macroprudential stress test applies the most recent version of the Banking Euro Area Stress Test (BEAST) model (Budnik et al., 2020). The BEAST model is a large-scale semi-structural model in which the euro area banking system is represented by 89 significant euro area banks. The model was developed on the back of the 2018 stress test (Budnik et al., 2019) and puts emphasis on the interplay between the banking sector and economies. The model has been substantially extended since 2018, currently featuring an additional amplification mechanism between bank solvency and funding costs, a more realistic dynamic specification of bank liabilities, dividend payouts, and defaulted assets. Furthermore, it includes a comprehensive representation of various prudential and regulatory policies, including the supervisory coverage expectations introduced in 2018.

The two scenarios employed in the macroprudential stress test are aligned with the scenarios from the recently published EU-wide stress test. The baseline scenario outlines an economic recovery. The adverse scenario assumes a prolonged recession coupled with a disadvantageous evolution of the COVID-19 pandemic and weakness of the global financial markets.

Macroprudential stress testing acknowledges that banks adjust their balance sheets in response to shocks and that these adjustments can feed back into the real economy. The macroprudential stress test applies a broad interpretation of a dynamic balance sheet, including not only endogenous adjustments of asset and liability volumes but also endogenous write-offs and profit distribution policies. Additionally, it permits non-zero recovery rates of defaulted assets and removes caps and floors, which in the EBA/SSM exercise ensure a sufficient degree of severity and comparability across banks. As a result, the macroprudential stress test

can be seen as more realistic, while compromising the desire for sufficient severity of individual bank outcomes which is necessarily present in the supervisory exercises.

Furthermore, the macroprudential stress test incorporates the impact of a phasing-out of the mitigating policy measures introduced by ECB Banking Supervision and by national authorities. Banks will either expand or phase out the provision of public-guaranteed loans depending on the duration of the programme and loan demand conditions. Public moratoria are assumed to expire along with the duration of national programmes. Finally, the impact of many supervisory policies can be brought to light only in a dynamic setup. This concerns the effect of profit distribution restrictions which were maintained until September 2021[1] and changes in regulatory and supervisory definitions of the leverage ratio that will be binding in the period 2021-23. Changes to Pillar 2 guidance buffers[2] are maintained until the end of the scenario horizon, however an additional analysis considers the effects of potential buffer replenishment and the final phasing-in of Basel III in 2023.

An additional extension of the macroprudential stress test concerns the assessment of model uncertainty when presenting the results. The parameters of the core model behavioural equations are estimated based on historical data. Therefore, the results are subject to estimation uncertainty. The paper accounts for this estimation uncertainty by indicating the uncertainty bands of the model projections.

A macroprudential stress test can serve to achieve at least one of three objectives. First, it constitutes an alternative metric, in addition to supervisory stress tests, for judging the resilience of the banking sector by additionally including information on credit dynamics and second-round effects. These developments become particularly relevant in times of crisis, when supervisory policy choices need to factor them in along with solvency concerns.[3] Second, a macroprudential stress test encourages banks and regulators to think about the system-wide consequences of banks' most likely decisions in a stress situation. A macroprudential stress test can emphasise the value of coordinated actions and responses, and support communication aimed at circumventing coordination failures.[4] Third, a macroprudential stress test can be used for scenario analysis to assess the reaction of the banking system towards alternative policy paths.

At the current juncture, macroprudential stress testing can assess the ability of the banking system to facilitate economic recovery following the COVID-19 crisis. This concerns the sufficiency of banks' capitalisation but also their ability to

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1 See ECB (2020), "ECB asks banks to refrain from or limit dividends until September 2021", *press release*, 15 December.

2 See ECB (2020), "ECB Banking Supervision provides temporary capital and operational relief in reaction to coronavirus", *press release*, 12 March.

3 For instance, macroprudential stress testing has been applied to assess the situation of the banking system and lending outlook in various contingencies in early 2020 (Budnik et al., 2021). This exercise has shown that with COVID-19 policies in place, the banking system could act as a part of a solution to systemic crises rather than a source of amplification.

4 An example of a related application of macroprudential stress testing is the ECB Banking Supervision's communication on buffer use in 2020 (Enria, 2020).

continue to provide lending even when faced with the gradual phasing-out of remaining COVID-19 mitigation policies.

This paper is structured as follows. The next section summarises our modelling approach. Section 3 briefly presents the baseline and adverse scenarios. Section 4 illustrates the main stress test results. Sections 5 and 6 elaborate on selected aspects of the scenarios from a macroprudential perspective. Section 7 provides a more general discussion of the properties of the macroprudential stress test compared with its constant balance sheet counterpart. The last section concludes.

3 Methodology

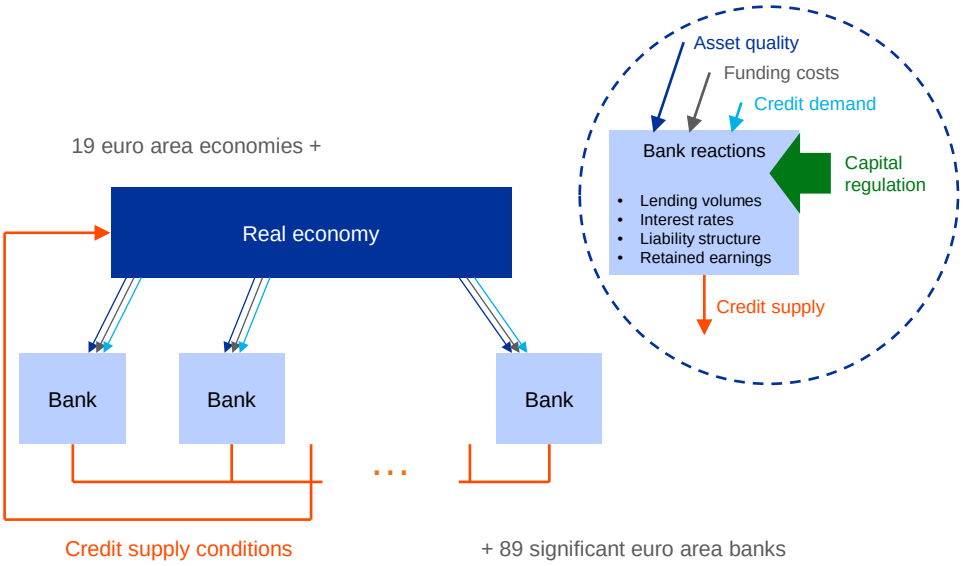
3.1 The Banking Euro Area Stress Test (BEAST) model

The exercise employs a large-scale semi-structural model linking macro and bank-level data. The model features a macroeconomic block for the 19 euro area economies. It captures dynamic interdependencies of aggregate real and financial variables as well as cross-country spillovers via trade linkages. The model also includes a representation of 89 significant banks with their individual balance sheets and profit and loss accounts. Banks in the model cover approximately 70% of the euro area banking sector (Budnik et al., 2020).

Banks assets are incorporated in a sufficiently granular sectoral and geographical breakdown to reflect the main sources of heterogeneities across banks. The asset side of each bank balance sheet distinguishes between loans to non-financial corporates, households, financial sector, governments, equity exposures and securitised portfolios. The model captures flows between the three IFRS 9 asset impairment stages, and assigns a risk weight, for each exposure type. On the liability side of the bank balance sheet, the model distinguishes equity, central bank funding, wholesale funding, and retail deposits. For each bank, the development of profitability and capital is further broken down into the impact of credit and market risk, net interest income and dividend payouts.

Model equations map the pass-through of scenarios into banks' balance sheets and their behavioural responses. The model incorporates two sets of equations. The first set models the impact of macro-financial variables on loan-loss provisioning parameters, risk-weighted assets, net fee and commission income (NFCI) or operational expenses. The second set concerns banks' behavioural responses such as the adjustments of asset and liability volumes, write-offs of defaulted assets and profit distributions. Estimated behavioural relationships also govern the evolution of loan and deposit pricing, and funding costs.

Figure 1
Schematic illustration of the macroprudential modelling approach



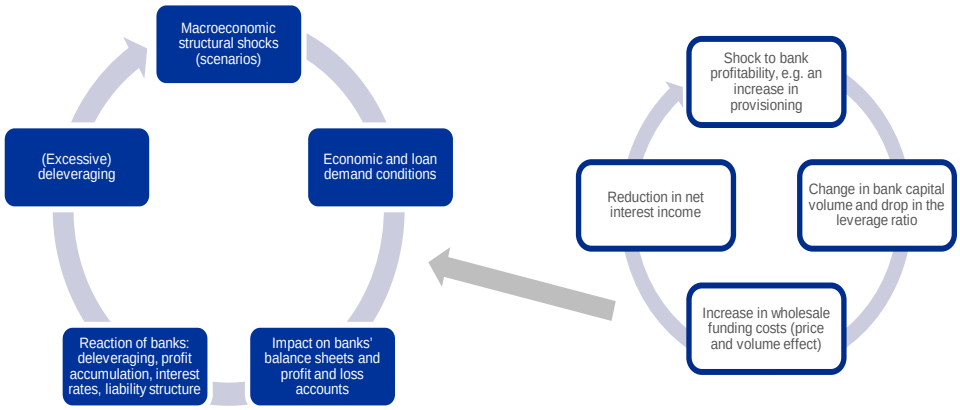
The BEAST incorporates two amplification mechanisms. The first is the feedback loop between the adjustments in bank lending and the real economy. In normal times, banks adjust their lending volumes and interest rates largely in line with the evolution of credit demand. In adverse conditions, banks attempt to restore eroded capitalisation which can have a negative impact on loan supply. Banks' actions aimed at repairing their capital levels take the shape of a negative credit supply shock affecting the macroeconomy. The second feedback loop considers the interaction between bank solvency and funding costs. Relevantly, the model puts all equations together and solves them as a system, thus preserving internal consistency and allowing for simultaneous (same time period) feedback mechanisms.

The feedback loop between the banking system and the real economy can further aggravate the adversity of macroeconomic outcomes. Figure 2 outlines the feedback loop mechanisms of the model. At the beginning of each quarter, the economy is affected by a series of negative (in the adverse scenario) or favourable (in the baseline scenario) shocks. In the adverse scenario, these lead to the deterioration of economic conditions, reflected for example in lower output or inflation. Credit demand, the riskiness and quality of banks' assets as well as the costs of funding and finally their profitability are adversely affected by these developments. In response, banks will aim to restore their profitability and solvency by adjusting the supply of loans, the distribution of profit, and by trying to increase lending margins. The degree of the credit supply response depends on banks' capitalisation levels. If either the initial capitalisation levels of banks are low or the adverse scenario is exceptionally severe, the credit supply response exceeds that which would have been expected in "normal times", when banks' solvency targets were not strained. Under these adverse circumstances, the initial scenario conditions

translate into an additional adverse credit supply shock which adds to the set of adverse shocks in the quarter.

The feedback mechanism between solvency and funding costs can exacerbate the deterioration in bank solvency (Diamond and Rajan, 2005). In a stressed scenario, access to secured funding is diminishing due to increased haircuts on marketable assets. The resulting liquidity gap must then be closed either via unsecured wholesale funding markets or via fire sales. At the same time, a negative solvency shock reflected in an increase in banks' leverage makes institutions more vulnerable to default, the risk of which is priced into banks' unsecured funding costs. A resulting increase in funding costs in turn has an adverse effect on banks' capital by eroding net interest income and leads to further restrictions in access to wholesale funding (see also Box 3).

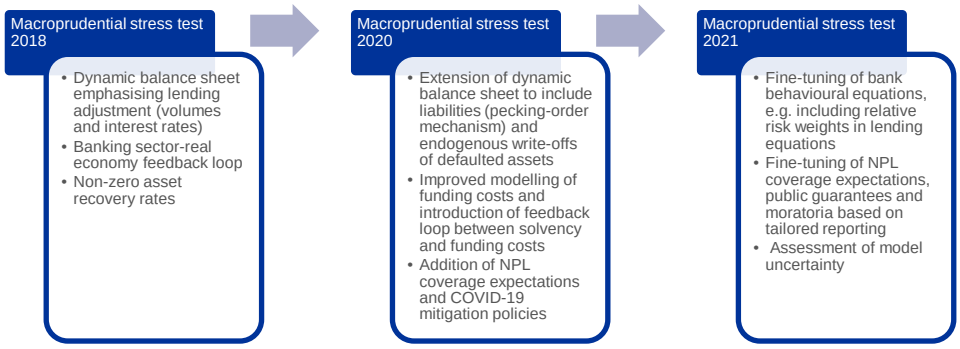
Figure 2
Schematic illustration of the feedback loops



3.2 Changes in macroprudential stress testing since 2018

The main innovation of the ECB's 2018 macroprudential stress test was the integrated and simultaneous treatment of banks' behavioural decisions and macro-financial developments. The 2018 macroprudential stress test (Budnik et al., 2019, 2020) put emphasis on two dimensions of a macroprudential stress test: relaxing the constant balance sheet assumption for banks' assets, and the feedback loop between banks' lending decisions and the real economy. These two elements were combined with a set of equations mapping scenario adversity into asset quality and income components and encapsulated in a semi-structural model. The approach allowed for the simultaneous treatment of a scenario's pass-through into banks' balance sheets and profit and loss accounts, and for the heterogeneous reactions of banks and economies.

Figure 3
Developments in the macroprudential stress testing framework



At the heart of the dynamic balance sheet specification was the interplay of country-specific loan demand and bank-specific loan supply factors. Individual bank lending was linked to the evolution of loan demand in the home and host markets in which the bank was active, making it responsive to the adversity of macro-financial scenarios. However, the loan supply of any two banks active in the same market has been allowed to differ in line with their different solvency, profitability and asset quality situation. Banks' credit supply featured non-linear adjustments triggered by the realisation of capital shortfall relative to their regulatory requirements. This non-linearity, once triggered, was mapped into an additional credit supply shock for the real economy.

The 2018 macroprudential stress test had already loosened several other technical assumptions of the EBA/SSM stress test. Among these were caps and floors on different components of profit and loss, which in the bottom-up exercise aimed to increase the comparability of individual results and ensure their sufficient severity. For example, the macroprudential stress test allowed for a non-zero recovery rate for defaulted assets, which since then has been modelled jointly with other IFRS 9 transition probabilities.

Since 2018 the ECB macroprudential stress testing framework has been continuously evolving. The macroprudential stress test run on the back of the ECB's COVID-19 vulnerability analysis in 2020[5] included several important extensions that also featured in the 2021 stress test. First was the change in the modelling of banks' liabilities. The initial assumption about the adjustment of banks' liabilities was that of a proportional reduction or expansion of individual liability volumes as banks' assets shrink or grow. This has since been replaced by an assumption inspired by the pecking order mechanism, under which banks turn to wholesale markets to close the funding gap arising from insufficient holdings of non-

5 See ECB (2020), "Euro area banking sector resilient to stress caused by coronavirus, ECB analysis shows", *press release*, 28 July.

financial sector deposits and own funds.[6] Second was the introduction of endogenous write-off decisions for defaulted assets (Budnik et al., 2021c). Finally, the model was extended to provide more detailed information on risk weights, largely fostered by the earlier application of the model to the impact assessment of the Basel III finalisation (Budnik et al., 2021b).

The pecking order mechanism for the liability structure was coupled with the introduction of the solvency-funding costs feedback loop (see Section 2.1). The supply of private non-financial sector deposits evolves along with general macro-financial conditions and is not strongly affected by banks' individual situations. Banks first look at their available customer deposit funding and compare it with their funding needs. Any gaps are then closed by funding from central banks and secured interbank funding markets, and lastly unsecured wholesale funding. This pecking order mechanism implies that in periods of stress, when banks experience a drop in customer deposit supply, they are more likely to shift towards unsecured market funding.

Since the 2020 macroprudential stress test, the model has included endogenous write-offs and supervisory coverage expectations. The corresponding model extension recognised the impact of NPLs and related changes in supervisory and regulatory policies on banks' profitability and balance sheets. The supervisory coverage expectations phased in during 2018 asked banks to gradually increase their loan loss provisioning rates on new and legacy NPLs.[7] The coverage expectations partially overlap with later revisions of the Capital Requirements Regulation and the introduction of the backstop rules for new NPLs under Pillar 1. The phasing-in of the NPL coverage expectations is expected to at least temporarily increase loan loss provisioning amounts in the years 2020-23, while it will gradually reduce the NPL burden on banks' balance sheets in the years thereafter (Budnik et al., 2021b).

To enable a timely assessment of COVID-19 mitigation policies, the model has been extended to incorporate the impact of public moratoria and national guarantee schemes introduced in 2020 (Budnik et al., 2021a). National moratoria affect transition rates between IFRS 9 stages and slow down the recognition of credit losses, reflecting the intentions of the ECB Banking Supervision's guidance on calculating IFRS 9 parameters.[8] Public guarantees affect the risk-weighted amounts and profit and loss accounts due to lower sovereign risk weights and loan loss provisioning amounts for the secured parts of loans. Another way in which public guarantees affect profit and loss accounts is through net interest income and the assumption of the full pass-through of guarantee premia into interest rates on loans. Finally, public guarantees influence corporate loan demand and supply, with the actual use of public guarantee programmes becoming an endogenous outcome of

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6 Section 3 in Budnik et al. (2021b) provides more details about the methodology for banks' liability structures.

7 See ECB (2019), "Communication on supervisory coverage expectations for NPEs".

8 See ECB (2020), "ECB Banking Supervision provides further flexibility to banks in reaction to coronavirus", *press release*, 20 March.

the model depending on country-specific eligibility criteria and banks' individual situations.

The 2021 macroprudential stress test further improves the modelling of NPLs and COVID-19-related policies. This improvement has been fostered by improved data availability, allowing better calibration of bank-specific targets for NPL coverage, and an enhanced understanding of the impact of public moratoria on asset quality under IFRS 9.

3.3 Treatment of policies

The macroprudential stress test relies on the no policy-change assumption. The no policy-change assumption means the incorporation of all policies already in place or announced before the end of 2020, where the latter must be legally binding over the stress test horizon with a high degree of certainty and known calibration. It also implies that there is no difference in assumed policy paths between stress test scenarios. The assumption normally covers monetary policy, supervisory and macroprudential requirements and buffers. In the context of the post-COVID-19 situation, it extends to selected COVID-19 mitigation policies implemented in the model.

Monetary policy is represented by short-term interest rates and ECB balance sheet data consistent with the December Eurosystem staff macroeconomic projections at the end of 2020.[9] Additionally, individual banks' exposures to central banks (i.e. their deposits at the central banks) and central bank funding is assumed to remain unchanged from the end 2020 until the end of the stress test horizon.

Banks' capital requirements and buffers remain unchanged from the end of 2020. This means that banks operate with macroprudential buffers and temporarily released Pillar 2 guidance over the full three-year horizon. This notwithstanding, banks see the outstanding combined buffer requirements as binding. The assumptions on Pillar 2 guidance and banks' propensity to operate below the combined buffer requirement (or below the MDA trigger) are discussed in more detail in Section 5.

Public guarantee and moratoria programmes are assumed to last until their expiration date as known in the first quarter of 2021. Furthermore, the eligibility criteria, the sectors targeted by and the funding envelopes available under the public guarantee programmes for 2021 are calibrated based on national sources. The use of public guarantees and moratoria in stress test scenarios is terminated the moment the policies are phased out. This set of assumptions deviates from the EU-wide stress testing methodology[10], where public moratoria are not considered in the calculation of the projections for credit risk exposure amounts and impairments. Further, in the EU-wide stress test, maturing loans falling under the COVID-19 public

9 Eurosystem staff macroeconomic projections for the euro area, December 2020. The ECB balance sheet projection rests on internal ECB forecasts with a similar cut-off date as the Eurosystem staff macroeconomic projections.

10 See EBA (2020a).

guarantee scheme are replaced with guaranteed loans, regardless of whether the scheme is expected to still be in place when the loan expires.

Banks distribute dividends until 30 September 2021, in line with the ECB recommendation on dividend distributions of December 2020.[11] Accordingly, up to and including the third quarter of 2021, banks' dividends remain below 15% of cumulated 2019-2020 profits and do not exceed 20 basis points of the CET1 ratio, with the two restrictions being coded into dedicated model equations and banks paying out the maximum implied by the restriction and their desired level of dividends. From the fourth quarter of 2021, banks pay out dividends according to their native model equations, taking account of regulatory requirements, MDAs and internal capital targets (management buffers). The modelling of profit distributions deviates from the EU-wide stress test methodology, where banks are required to apply a payout ratio based on historical data for dividend payments (or based on their publicly declared dividend policy projections).[12]

3.4 Evaluating the uncertainty of the results

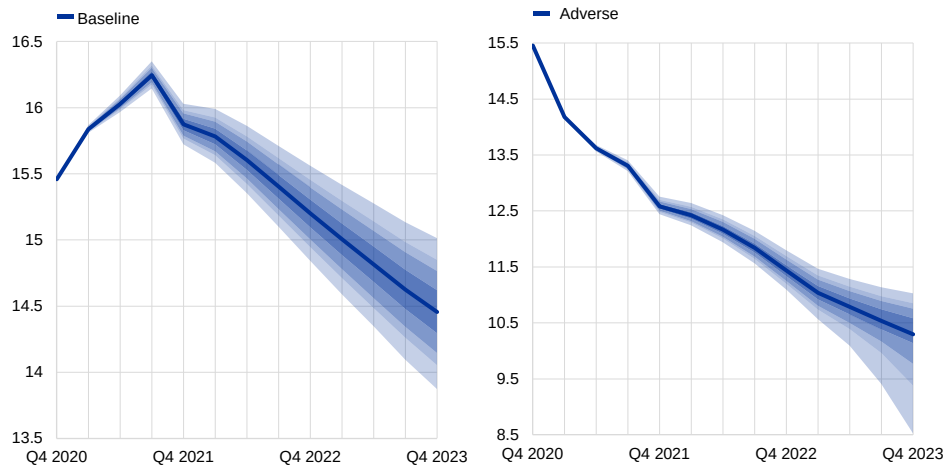
The 2021 macroprudential stress test assesses for the first time the model uncertainty of macro-financial and bank responses. A share of model equations is estimated based on historical data, and as such will project the most likely behaviour of economies and banks based on historical trends. However, as the estimation relies on a finite set of historical datapoints, the results are subject to parameter uncertainty. The impact of this statistical uncertainty on the outcomes of the macroprudential stress test can be evaluated by projecting model variables using the full distribution of estimated model parameters.

11 See ECB (2020), "ECB asks banks to refrain from or limit dividends until September 2021", *press release*, 15 December.

12 The impact of the COVID-19 support measures other than these affecting directly the banking sector such as e.g. temporary unemployment benefits or subsidies for the corporate sector are not modelled, but instead assumed to be reflected directly in the baseline and adverse scenarios underlying the macroprudential stress test.

Chart 1

CET1 ratio projection in the baseline and adverse scenarios



Notes: The shade of blue represent different quantiles of CET1 ratio in each reference quarter.

The assessment of uncertainty relies on Monte Carlo simulations with different values of model parameters. The macro block relies on a vector autoregression specification of individual economies that are estimated in a Bayesian framework (Budnik et al., 2020). The model uncertainty regarding the macro-financial equations is captured by drawing parameters from their posterior distributions. Regarding bank-level equations, these are estimated using frequentist methods, most of the time in a panel framework. The modelling of uncertainty for equations related to bank lending and security holding volumes, deposit volumes, lending and deposit interest rates, wholesale funding costs, bank dividend payouts and write-offs of defaulted exposures follows the Gauss-Markov theorem. The estimated bank-level parameters are assumed to follow a multivariate normal distribution with a mean and variance-covariance matrix from the panel estimates. The model projects the outcomes of the macroprudential stress test for each set of parameters. The results are then consolidated to establish their mean (main result of the macroprudential stress test) and the 5th-percentile and 95th-percentile prediction bands.

Chart 1 illustrates uncertainty around the banking system CET1 ratio in the baseline and adverse scenarios. The fan charts represent the evolution of the path's distribution quantiles for each quarter, with the darkest shades of blue representing the 25th to the 75th percentiles, the lighter shades of blue representing the 10th to the 90th percentiles, and the lightest shades of blue representing the 5th to the 95th percentiles. The uncertainty of estimates tends to increase with the length of the projection horizon, reflecting the accumulating role of model equations. The solvency rate distribution in the adverse scenario is more asymmetric, i.e. skewed towards lower CET1 ratios, than in the baseline scenario. This asymmetry partially relates to model non-linearities such as those arising in the presence of capital shortfall compared with regulatory or internal capital targets, which are more pronounced in the adverse scenario. The uncertainty bands for the system-wide CET1 ratio, and a share of other banking sector variables, are generally broader in

the adverse compared to the baseline scenario. This reflects higher impact of model uncertainty in the macro-financial block on the results in the adverse scenario, where triggers the vicious banking sector-real economy feedback loop. Selected properties of individual bank CET1 ratio results are discussed in Appendix A.

4 Economic scenarios

The macroprudential assessment of the euro area banking sector's performance employs two scenarios from the EBA/SSM stress test exercise.[13] The baseline scenario for 2021-23 is based on the end-2020 Eurosystem staff macroeconomic projections[14]. The adverse scenario draws upon the main financial stability risks for the European Union banking sector identified by the General Board of the European Systemic Risk Board (ESRB).

The baseline scenario reflects a strong rebound in economic activity in 2021 and a return of euro area GDP to its pre-crisis level by mid-2022. The scenario assumes the relaxation of COVID-19 containment measures starting from the second quarter of 2021, along with the increasing availability of medical solutions such as effective vaccines. Only in the first quarter of 2021 does the stringency of containment measures remain similar, on average, to that in the fourth quarter of 2020. The resolution of the health crisis, together with substantial support from monetary and fiscal policies and the ongoing recovery in foreign demand, fosters a broad-based economic recovery in the course of 2021.

The unemployment rate in the baseline scenario decreases to 7.5% at the end of 2023 (Chart 2, upper right-hand panel). It first temporarily increases to 9.3% in 2021 but then falls to its pre-pandemic level by 2023. The baseline scenario features stable growth of house prices by about 2.3% on average annually, persistently low interest rates, with the three-month euro interbank offered rate (EURIBOR) hovering around -0.5%, and ten-year bond yields staying below 0.2% until the end of the scenario horizon.

The adverse scenario reflects a prolonged economic contraction coupled with a "lower for longer" interest rate environment. The adverse scenario sees a decrease in real euro area GDP in all three years of the scenario horizon (Chart 2, upper left-hand panel). The cumulative contraction in 2021-2023 amounts to 3.6%, with GDP remaining 10.6% lower in 2023 than in the pre-pandemic year 2019. The unemployment rate is assumed to increase to up to 12.4%, with the most material increase recorded in the first year (Chart 2, upper right-hand panel).

Market interest rates in the adverse scenario are close to those in the baseline scenario. The three-month EURIBOR is higher by a mere 5 basis points on average when compared with the baseline scenario, reflecting the no-policy-change convention used in the calibration of adverse scenarios for EBA EU-wide stress tests. This means that neither monetary policy nor fiscal policy reactions adapt to the greater severity of the adverse scenario over the stress test horizon. Euro area bond yields increase moderately in 2021 and remain above 0.2% until the end of the scenario horizon.

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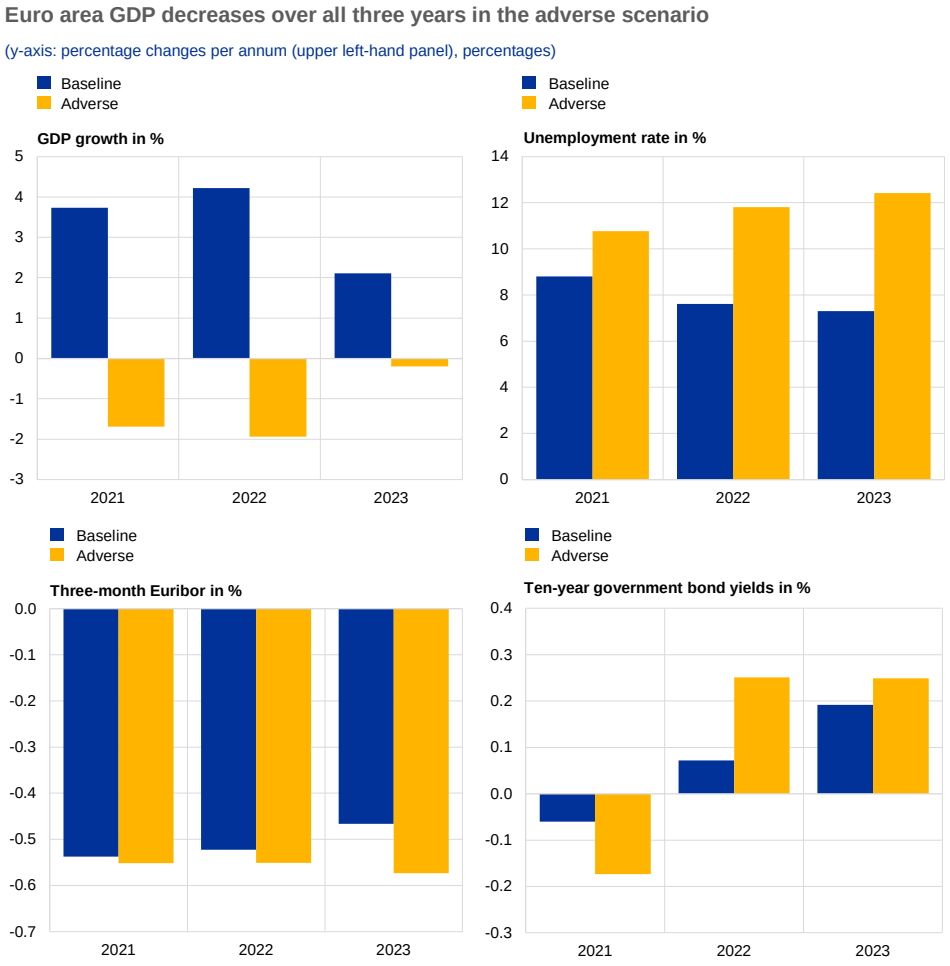
13 See ESRB (2021a).

14 Eurosystem staff macroeconomic projections for the euro area, December 2020.

Chart 2

GDP growth, unemployment rate, house prices and interest rates in the two scenarios of the EBA EU-wide stress test



Notes: The evolution of euro area GDP rata y-o-y, the unemployment rate, the three-month EURIBOR and ten-year government bond yields excludes the impact of the banking sector-real economy feedback loop.

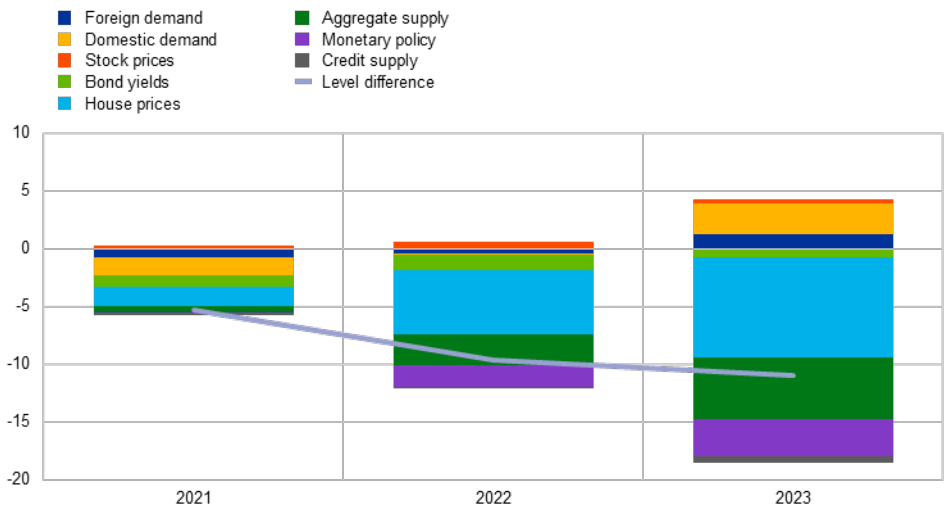
The adverse scenario narrative emphasises confidence shocks as the primary trigger, and the duration of the crisis, the "lower for longer" environment and structural issues as the main vulnerabilities. The confidence shocks relate to the further mutation of the coronavirus, significant setbacks in the distribution or acceptance of vaccines and possible further lockdowns following renewed waves of infections. These are coupled with deteriorating economic prospects and a global decline in long-term risk-free rates from an already historically low level. A drop in corporate earnings and a reassessment of market participants' expectations lead to an abrupt and sizeable adjustment of financial asset valuations as well as a significant decrease in residential and commercial real estate prices. A resulting decline in economic growth and rising risk premia could further challenge debt sustainability in the public and private sectors across Europe.

Chart 3

Decomposition of the difference in the level of euro area GDP between the baseline and adverse scenarios of the macroprudential stress test

Substantial role of asset price revaluation and supply-side shocks in explaining the severity of the adverse scenario

(y-axis: percentages)



Notes: The difference between the level of GDP in the adverse compared to the baseline scenario in percentages of the baseline GDP level. "Monetary policy" includes the impact of conventional and unconventional monetary policy shocks. "Domestic demand" includes the impact of the aggregate demand shock pooled with the impact of non-identified structural shocks. For details of the methodology including shock identification, see Budnik et al. (2020).

The difference between the adverse scenario and the baseline scenario appears to be driven mostly by the revaluation of assets and supply-side developments. The model supports the decomposition of the two scenarios into the contribution of different economic shocks as illustrated in Chart 3. The revaluation of assets, especially house prices and government bonds, accounts for a substantial share of the gap between euro area GDP in the adverse scenario and in the baseline scenario.[15] Another important factor is aggregate supply shocks, which can capture phenomena such as the direct impact of lockdowns or supply chain disruptions. The negative impact of monetary policy reflects the "non-reactiveness" of monetary policy ingrained in the EBA/ESRB scenario methodology. Interestingly, both domestic and foreign demand shocks increase the relative severity of the adverse scenario only in the first two years of the horizon.

Credit supply shocks that are added to the macroprudential stress test increase the relative severity of the adverse scenario most noticeably towards the end of the horizon. The credit supply shocks arise endogenously from the model mechanisms and reflect lending supply tensions driven by the worsening situation in the banking system.

[15] A very small but positive impact of shocks to stock prices on the euro area GDP reflects that the deep contraction in stock prices in the adverse scenario, by 50% in 2021, followed by their limited recovery thereafter, appears fully commensurate (is well explained) with the deterioration of other macro-financial variables.

5 Impact on the banking system and the economy

The system-wide CET1 ratio in the baseline scenario gradually subsides to the levels observed before the COVID-19 pandemic.[16] The system-wide transitional CET1 ratio initially increases to 16% in 2021, settles at 14.4% at the end of the horizon, and lies between 14% and 14.8% within 90% uncertainty bands (see Chart 4). This modest downward trend relates to a marked expansion of banks' assets by 15.8% cumulatively or by around 5% on an annualised basis, which translates into a 2.1 percentage point decrease in the CET1 ratio. An increase in banking system assets is counterbalanced by the favourable evolution of effective risk weights (by 1.3 percentage points, improving the CET1 ratio by 1.5 percentage points) and the accumulation of capital (by 3.5%, improving the CET1 ratio by 2.3 percentage points).

An important factor behind the evolution of the CET1 ratio in the baseline scenario is the payout of dividends (see Chart 5, left-hand panel). Over the three-year horizon, banks cumulatively pay out 16.5% of CET1 capital, which reduces the CET1 ratio by 2.6 percentage points compared with 2020. An initial increase and later moderation of the CET1 ratio are related to the timing of profit distribution restrictions, with banks starting to gradually pay out current and pending dividends from the last quarter of 2021. It is also supported by a low capital target of 9.1% at a system level, covering regulatory requirements and buffers but assuming no rebuilding of macroprudential buffers or replenishment of Pillar 2 guidance (see Box 2 for the discussion of this assumption).

In the adverse scenario, the CET1 ratio falls sharply by 3 percentage points in the first year and decreases by a further 1.8 percentage points in the next two years. The end 2023 system-wide CET1 ratio amounts to 10.3%, and remains between 9.4% and 10.8% with 90% confidence. In the adverse scenario, CET1 capital decreases by 32%, reflecting a 4.3 percentage point decrease in the CET1 ratio compared with 2020. Dividend payouts over the horizon amount to a mere 1.6% relative to 2020 CET1 capital. The change in effective risk weights reduce the CET1 ratio by 0.5 percentage points. The term "Other" in Chart 5 includes additional profit and loss capital effects, including an increase in deferred tax assets, defined benefit pension plans and accumulated other comprehensive income, which amount to a drop of 1.3 percentage points in the adverse scenario.

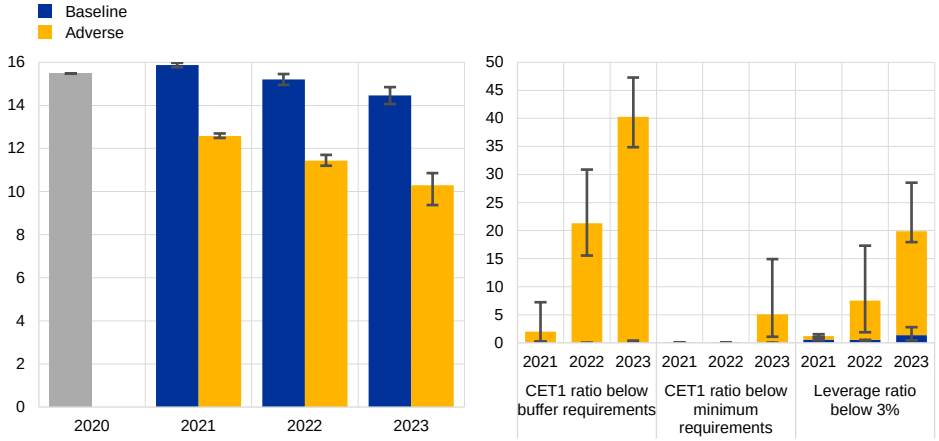
[16] The aggregate CET1 ratio for the same sample of banks in the fourth quarter of 2019 was 14.25%.

Chart 4

System-wide CET1 ratio (left-hand panel) and the share of banks below regulatory thresholds (right-hand panel)

Strong reduction in system-wide solvency in the adverse scenario resulting in 40% of banks falling below their MDA trigger

(y- axis: percentages of RWA (left-hand panel), percentages of total assets (right-hand panel))



Notes: Transitional CET1 ratios. CET1 buffer requirements are defined as the sum of Pillar 1, Pillar 2 minimum requirements and combined buffer requirements. CET1 minimum requirements are defined as the sum of Pillar 1, Pillar 2 minimum requirements. The whiskers around the bars indicate 90% confidence bands representing model parameter uncertainty.

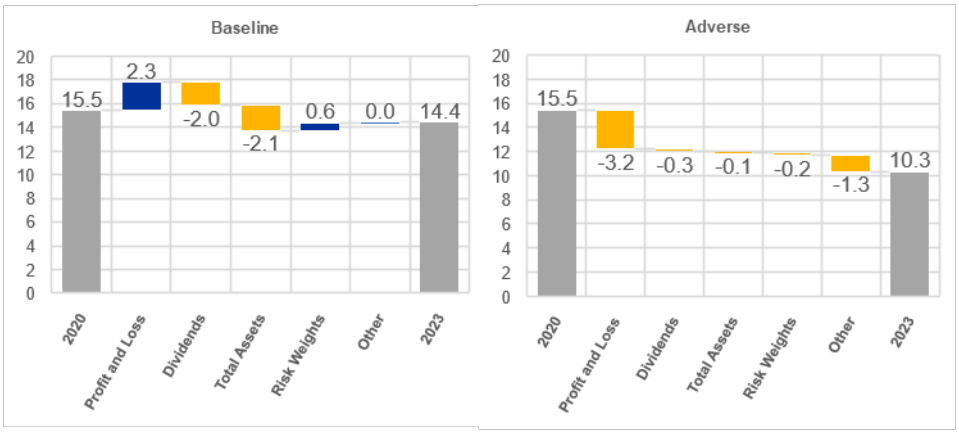
The deterioration in bank solvency pushes 40% (35%-47%) of banks, in terms of their share of banking sector assets, below their capital buffers in the adverse scenario. The number of banks below their MDA trigger in 2023 is 24 (18-31), and only six of them (2-11), corresponding to 5% (1%-15%) of banking system assets, also breach minimum capital requirements (comprising Pillar 1 and Pillar 2 minimum capital requirements). For comparison, in the 2020 macroprudential stress test, 29 banks breached their MDA triggers in the adverse scenario, corresponding to 38% of banking system assets (see Appendix B). Banks corresponding to around 18% of banking system assets breach their leverage requirement at the end of the adverse scenario horizon. However, this result is driven by a few large banks that slip under the 3% threshold only marginally and is surrounded by large uncertainty (16%-27%).

Chart 5

CET1 ratio in 2020 versus 2023

Asset expansion and dividend distribution reduce the CET1 ratio in the baseline scenario, while capital depletion decreases the CET1 ratio in the adverse scenario

(y-axis: percentages of RWA)



Notes: Transitional CET1 ratios. Blue bars indicate a positive contribution to the CET1 ratio, while yellow bars indicate a negative contribution.

Bank profitability improves compared with 2020 in the baseline scenario but remains moderate by historical standards (Chart 6). In the baseline scenario, return on assets (ROA) gradually improves from 0.23% (0.22%, 0.25%) in 2021 to 0.26% (0.2%, 0.29%) in 2023. Bank profitability relies on the stable positive contribution of net interest income, which adds around 1.1 percentage points, and NFCI, which oscillates between 0.7 and 0.8 percentage points. The moderate negative contributions of credit risk reflect the realisation of losses following the phasing-out of COVID-19 mitigation policiesin 2021 and the build-up of loan loss provisions on legacy assets in line with the supervisory coverage expectations (see Section 6.2 for a more in-depth discussion).

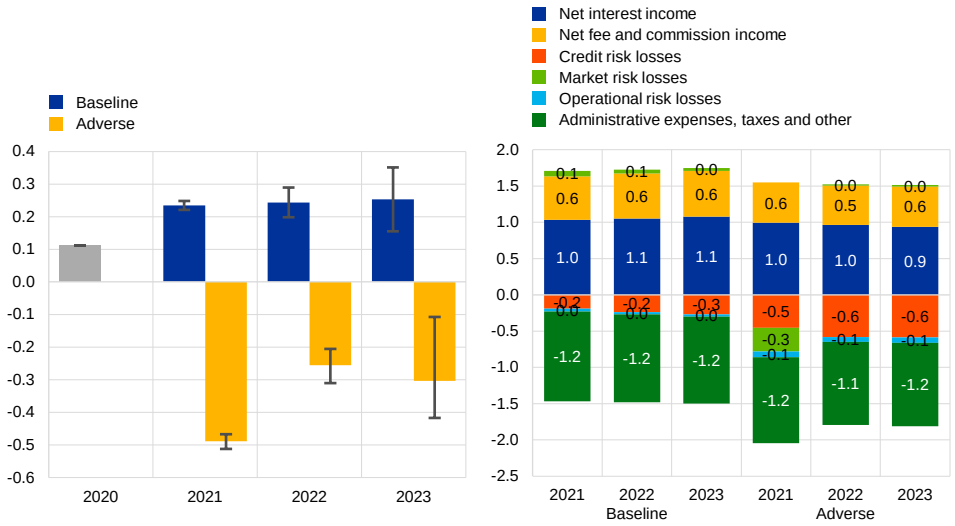
Bank profitability in the adverse scenario remains negative over the full stress test horizon. ROA drops sharply in 2021 to -0.5% (-0.51%, -0.46%) as market risk losses[17], which alone contribute 0.3 percentage points to the outcome, are realised. It then increases moderately to -0.25% (-0.3%, -0.2%) and -0.3% (-0.5%, -0.19%) in the next two years of the stress test. The negative impact of credit losses increases over time as a result of the lasting adverse economic conditions. Net interest income (contributing around 0.1 percentage points to ROA) and NFCI (contributing around 0.6 percentage points) are lower than in the baseline scenario but still serve as a relatively stable source of bank income. The uncertainty of profitability forecasts is substantially higher in the adverse scenario exceeding the uncertainty range in the baseline scenario by 50%.

[17] Market risk impacts is exogenous and realigned the EBA/SSM stress test exercise.

Chart 6
Return-on-assets

Stable and positive profitability outlook in the baseline scenario and negative bank profitability in the adverse scenario

(y-axis: percentages of total assets)



Notes: Credit risk losses in the right-hand panel include loan loss provisions and write-offs. The whiskers around the bars indicate 90% confidence bands representing model parameter uncertainty.

Loan growth to the non-financial private sector in the baseline scenario accelerates compared with 2021 (Chart 7). Loan growth in the first quarter of 2021 is still relatively low but rebounds starting from the second quarter and reaches 3.5% on an annual basis. In 2022 and 2023, it reaches 6.1% and 5.5%, reflecting strong loan demand and a robust loan supply (see Section 6 for more details) and the lagged impact of COVID-19 mitigation policies (see Box 1). Lending expansion is most pronounced for the corporate and consumer credit sectors, which are the most sensitive to the economic situation, with the corporate sector additionally benefiting from the availability of public-guaranteed loans in several euro area countries in 2021.

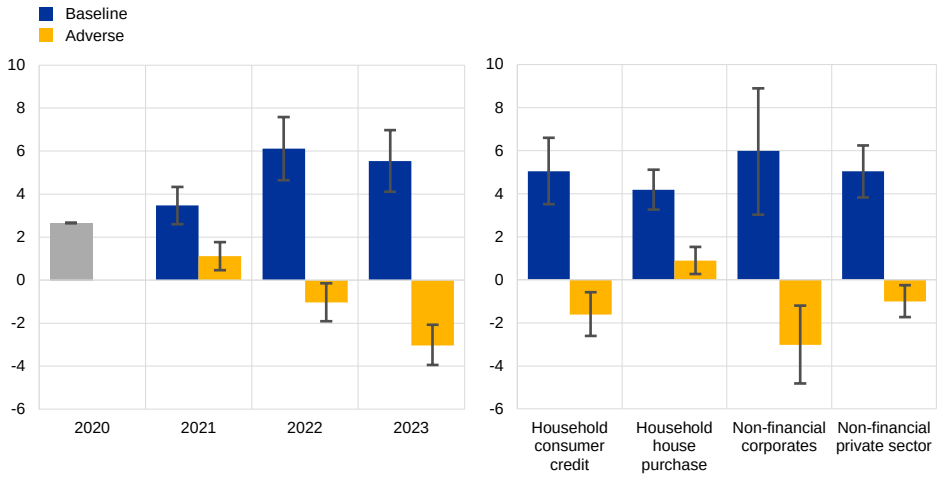
Loan growth to the non-financial private sector in the adverse scenario turns negative over the horizon. The growth rate of lending in 2021 is 1.1% but decreases to -1% in 2022 and -3.1% in 2023. The contraction in lending is strongest for the non-financial corporate sector, with an average annual growth rate of -3.1%, while household consumer credit average decreases by 1.6% annually.

Chart 7

Loan growth

Annual loan growth to the total non-financial private sector (left-hand panel) and across sectors (right-hand panel) differs sharply between the baseline and adverse scenarios

(y-axis: annual or annualised percentage changes per annum)



Notes: The left-hand panel shows the growth rate of bank lending to the euro area non-financial private sector y-o-y. The right-hand panel shows the average annualised percentage loan growth by sector. The whiskers around the bars indicate 90% confidence bands representing model parameter uncertainty.

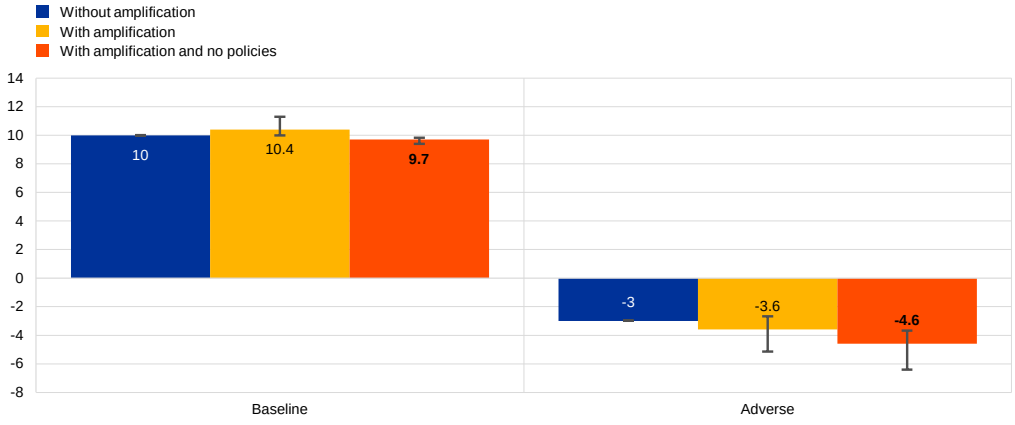
The banking sector-real economy feedback loop amplifies the severity of the adverse scenario (Chart 8). Changes in loan supply conditions have a very marginal impact in the baseline scenario, slightly improving the economic outlook. However, the contraction of loan supply in the adverse scenario reduces euro area GDP growth by a further 1.6 percentage points. This effect is partially offset by the positive impact and more intense use (see Box 1) of COVID-19 mitigation policies, which reduces the negative amplification to 0.6 percentage points.

Chart 8

Evolution of GDP with and without the amplification mechanism

The real economy feedback loop amplifies adverse conditions particularly in the absence of COVID-mitigation policies

(y-axis: cumulative percentage changes)



Notes: The cumulative change of euro area GDP 2021-23 compared to 2020 with and without amplification mechanism. The whiskers around the bars indicate 90% confidence bands representing model parameter uncertainty.

Box 1
The role of COVID-19 mitigation policies

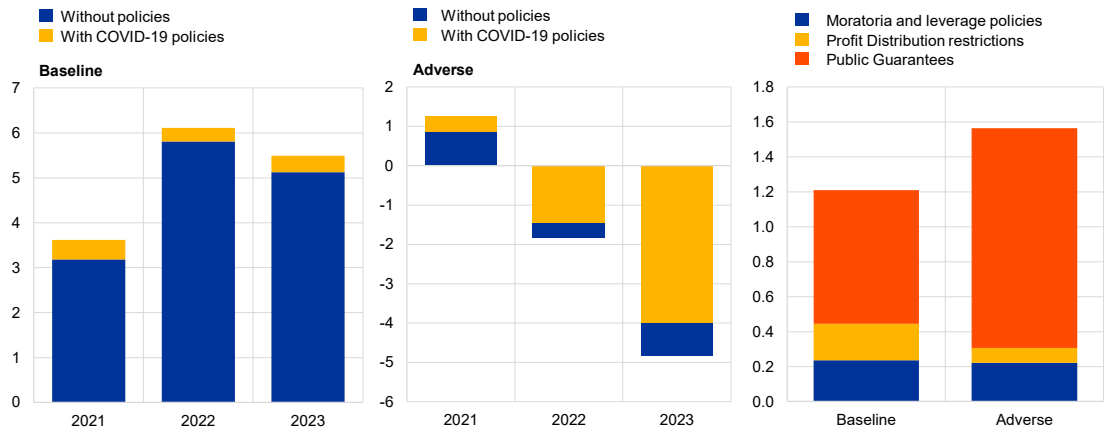
Several COVID-19 mitigation policies are to be phased out in 2021 or later. These include profit distribution restrictions, which ceased at the end of September 2021, the favourable treatment of exposures to central banks, which has been extended until mid-2022, and extensions of public moratoria and guarantee schemes in many euro area jurisdictions. This box elaborates on their marginal impact on lending and other core outcomes of the macroprudential stress test by comparing the results with a counterfactual macroprudential stress test in which most of the COVID-19 mitigation policies are suspended at the end of 2020.

The outstanding COVID-19 mitigation policies have a pronounced positive lending effect, especially in the adverse scenario. The impact of policy measures on lending in the baseline scenario is relatively stable over time, adding between 0.3 and 0.4 percentage points to the annual growth rate of lending to the non-financial private sector in the years 2021-23. The impact increases in the adverse scenario, from 0.4 percentage points in 2021 to 0.8 percentage points in 2023 (Chart A, left-hand panel). Compared with lending volumes in the absence of policy measures, lending is in cumulative terms about 1.2% higher at the end of 2023 in the baseline scenario and 1.6% higher in the adverse scenario. Between 2021 and 2023, in both scenarios, annualised GDP growth is expected to be around 0.2 percentage points higher in the presence of COVID-19 mitigation policies than in their absence.

Chart A
Impact of COVID-19 mitigation policies on lending

Policy measures support lending activity in the baseline and adverse scenarios

(y-axis: percentage changes per annum (left-hand panel) and cumulative percentage changes (right-hand panel))



Notes: The left-hand panel shows the joint contribution of all COVID-19 policies to annual loan growth to the non-financial private sector over time. The right-hand panel shows the individual effects of each policy on cumulative lending to the non-financial private sector 2021-23. The bars are expressed as the difference to the outcome in the absence of policies.

Public guarantees have a particularly strong lending effect in the adverse scenario. Public guarantees add 0.8 percentage points to cumulative loan growth in 2021-23 even in the baseline scenario, and this effect increases to 1.3 percentage points in the adverse scenario. This reflects the higher demand for guaranteed loans in adverse economic conditions along with the higher share of companies meeting eligibility criteria. The proportionally stronger effect of profit distribution restrictions in the baseline scenario (0.2 percentage points) compared with the adverse scenario

(0.1 percentage points) reflects the higher bank profitability in favourable economic conditions, which translates to a higher capital effect of these policies.

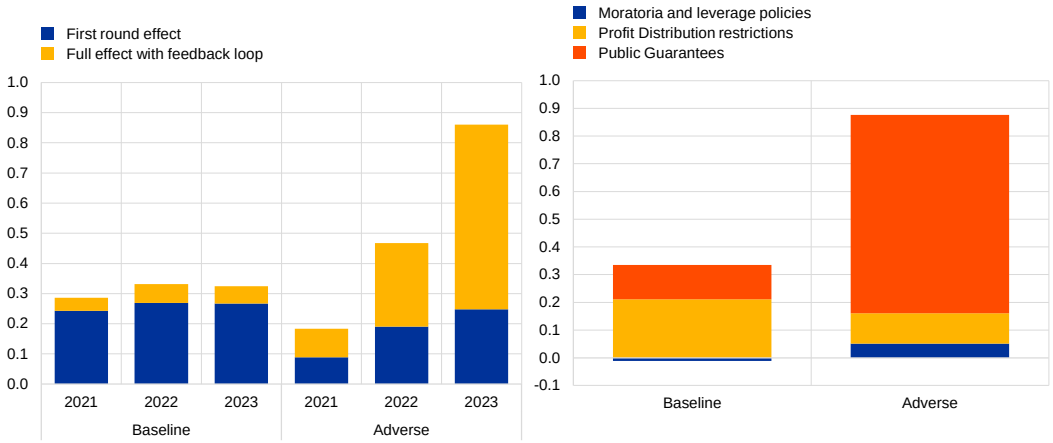
Furthermore, COVID-19 mitigation policies support the build-up of bank capital especially in the adverse scenario. The first-round effect on banks' CET1 ratios, illustrated by the blue bars in the left-hand side panel of Chart B, is slightly more pronounced in the baseline scenario amounting to around 0.25 percentage points on average annually compared to 0.2 percentage points in the adverse scenario. The effect derives from the negative impact of public moratoria and guarantee schemes on credit losses and the direct positive impact of profit distribution restrictions on banks' CET1 capital. The second-round impact of the policies relates to the positive impact of higher banks' capitalization on banks' funding costs and further on lending and economic activity. The second-round effects of policies on bank profitability, and later capitalisation, are clearly more pronounced in the adverse scenario (adding 0.06 percentage points to ROA on an average annual basis, and 0.6 percentage points to CET1 ratio in 2023) than the baseline scenario (0.01 and 0.06 percentage points). Altogether, without supportive policies, the system-wide CET1 ratio would be 0.9 percentage points lower in the adverse scenario.

Chart B

Impact of COVID-19 policies on the CET1 ratio

(y-axis: percentage points of CET1 ratio)

Strong impact of public guarantees on the CET1 ratio in the adverse scenario



Notes: Transitional CET1 ratios. The left-hand panel shows the joint net impact of all COVID-19 policy measures on the CET1 ratio. It shows first-round effects (grey bars) and excludes the banking sector – real economy feedback loop and solvency-funding feedback effects. The full impact including feedback effects is illustrated by the green bars. The right-hand panel shows the individual policy effects on the CET1 ratio in 2023.

Government loan guarantees have the most significant positive impact on banks' CET1 ratio, with an estimated cumulative effect of around 0.6 percentage points in the adverse scenario. In turn, profit distribution restrictions in 2021 have stronger capital impact in the baseline scenario, where they contribute to an increase in the CET1 ratio of around 0.2 percentage points, compared to the adverse scenario.

6 Insights into banking sector dynamics

6.1 Bank lending

The positive evolution of both loan demand and supply supports the growth of lending volumes to the non-financial private sector in the baseline scenario. Breaking down the euro area-wide lending dynamics into the contributions of loan demand and supply factors as in the left-hand panel of Chart 9 shows a persistently favourable impact of loan supply, which contributes to the average annualised credit growth by 0.9 percentage points over the scenario horizon. The relative impact of loan supply factors is strongest in 2021, still reflecting the workings of COVID-19 mitigation policies. The relative impact of loan demand factors increases over time, reflecting stable macro-financial conditions. It on average adds 4.2 percentage points to the annualised growth of the non-financial private sector loan volumes.

Loan supply contracts significantly in the adverse scenario, reflecting banks' weakening capital positions, feeble profitability performance, high funding costs and poor asset quality. The annualised contribution of credit supply factors to the evolution of loan volumes to the non-financial private sector is -0.8 percentage points. Weak loan supply conditions are coupled with decreasing loan demand, reducing lending dynamics by a further 0.4 percentage points on average annually.

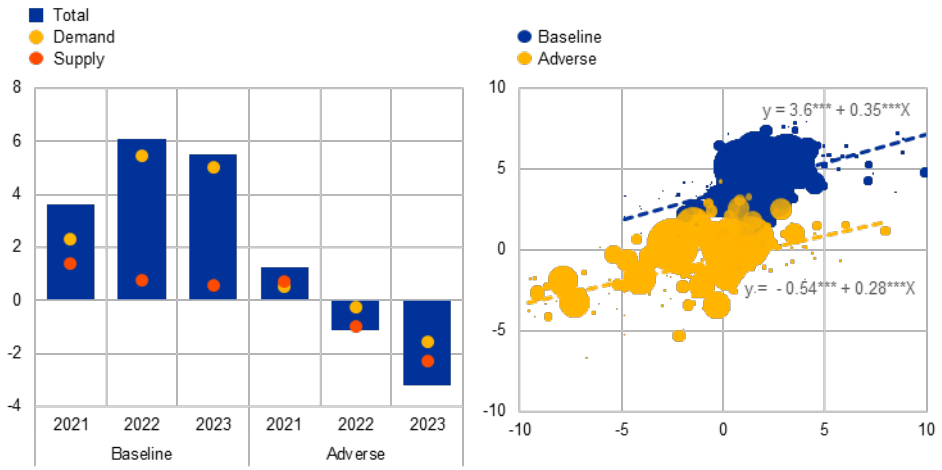
Individual banks' loan demand and supply are positively and strongly correlated in both scenarios. The right-hand panel of Chart 9 shows that the correlation between the annualised contributions of loan demand and supply at a bank level is more pronounced in the baseline scenario (slope coefficient of 0.35), but is also significant and positive in the adverse scenario (slope coefficient of 0.28). The size of the dots represents the relative share of individual banks' banking books (compared with the size of the market) and reveals that a relatively high number of banks with substantial exposures to the non-financial private sector deleverage in the adverse scenario due to the combination of very weak loan supply conditions and low loan demand.

Chart 9

The role of loan demand and supply factors in non-financial private sector lending

Positive impact of loan demand in the baseline scenario, and negative impact of credit supply restrictions in the adverse scenario

(y-axis: percentage changes per annum (left-hand panel), x-axis: cumulative percentage changes depending on loan demand factors, cumulative percentage changes depending on loan supply factors)



Notes: The left-hand panel shows the loan growth to the euro area non-financial private sector and its demand (yellow dots) and supply (red dots) components in percentage points. The right-hand panel shows the relationship between the contribution of loan demand and loan supply factors to the cumulative changes in lending for individual banks in the two scenarios. The size of the dots represents the size of individual banks' loan compared to the size of the market. *, ** and *** denote the significance at the 10%, 5% and 1% levels respectively.

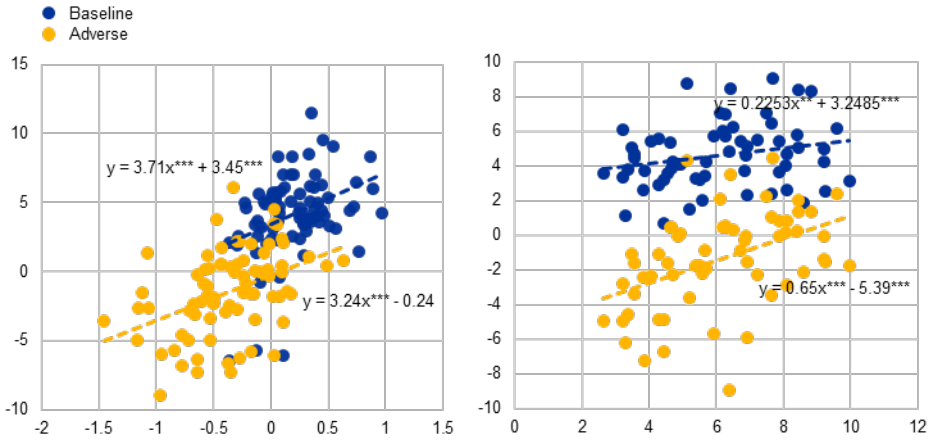
Banks with higher profitability and capitalisation are better positioned to provide lending to the real economy in both scenarios. Profitable banks expand lending to the non-financial private sector by more in the baseline scenario and deleverage by less in the adverse scenario (Chart 10, left-hand panel). The relationship between bank profitability and lending is only marginally stronger in the baseline scenario (slope coefficient of 3.7 versus 3.24 in the adverse scenario). The right-hand panel of Chart 10 shows that banks tend to lend more when they are better capitalised even in 2020. That is, banks with a CET1 ratio well above the regulatory threshold are more willing to expand their lending activity. In this case, the relationship between capital surplus over the regulatory requirement and lending activity in 2021-23 is three times stronger in the adverse scenario (slope coefficient of 0.65 versus 0.22 in the baseline scenario), reflecting the fact that the adverse scenario is more likely to trigger banks' non-linear lending response to shrinking CET1 ratios.

Chart 10

Lending evolution across banks versus initial capitalisation and profitability

Banks' capitalisation and profitability shape credit supply adjustments

(y-axis: annualised loan growth to the non-financial private sector in percent, x-axis: (left-hand panel) ROA and (right-hand panel) capital surplus above MDA in percent)



Notes: The left-hand panel shows the relationship between annualised loan growth to the non-financial private sector over the three-year horizon and the average profitability of a bank represented by ROA both in percentage points. The right-hand panel shows the relationship between annualised loan growth and the capital surplus above MDA requirements in 2020. *, ** and *** denote the significance at the 10%, 5% and 1% levels respectively.

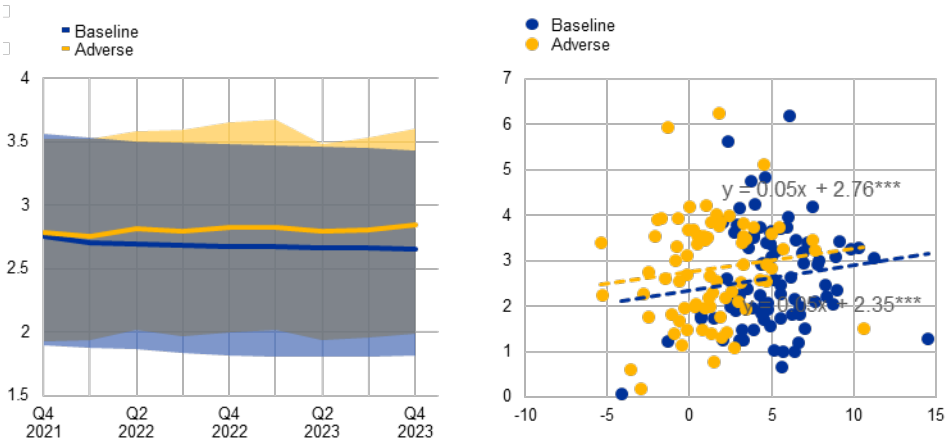
Banks funding distress and weaker capital position in the adverse scenario are reflected in a moderate increase in lending interest rates over time. Effective lending rates to the non-financial private sector are also higher in the adverse scenario when compared with the baseline scenario as shown in the left-hand panel of Chart 11. Interestingly, there is no systematic relationship between banks' adjustments of lending volumes and interest rates in either of the scenarios (Chart 11, right-hand panel). For instance, in the adverse scenario banks are equally likely to increase interest rates and cut their lending supply, as to adapt only one of the strategies.

Chart 11

Lending rates and their relationship with loan dynamics

Increasing lending rates are coupled with a lending reduction in the adverse scenario

(y-axis: average annual lending rate to the non-financial private sector in percent, right-hand panel x-axis: cumulative loan growth in percent))



Notes: The left-hand panel shows banks' annual effective interest rates for the non-financial private sector, where the solid line represents the mean interest rate and the shaded area the 75% interquartile range of the cross-sectional bank sample. The right-hand panel illustrates the relationship between lending rates for the non-financial private sector and banks' cumulative loan growth. *, ** and *** denote the significance at the 10%, 5% and 1% levels respectively.

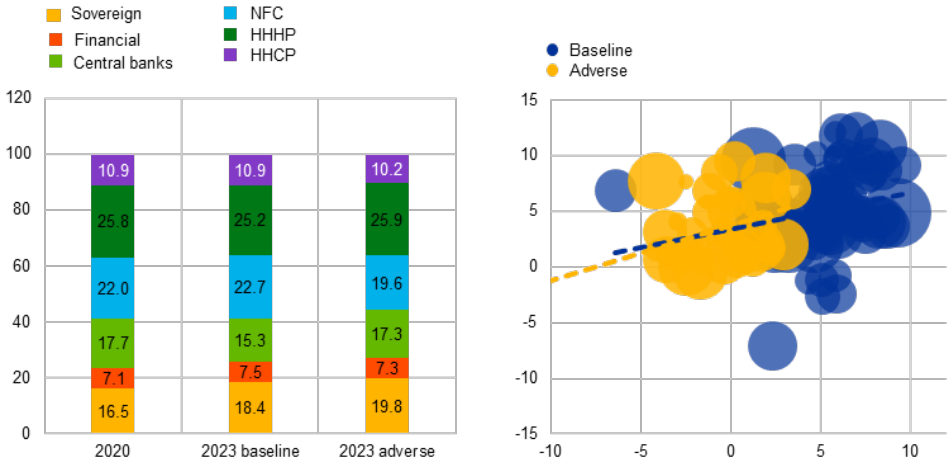
In adverse economic conditions, banks reduce their corporate and non-housing household lending, while increasing their relative exposure to sovereigns. In the baseline scenario, the structure of banking books remains relatively stable. This still hides the replacement of many corporate loans covered by public guarantee programmes with non-guaranteed loans, which translates into an actual increase in banks' exposures to the corporate sector in terms of risk taking. In the adverse scenario, as shown in the left-hand panel of Chart 12, the share of corporate and non-housing household loans decreases compared with 2020, by 2.4 percentage points and 0.7 percentage points respectively. This reflects the historical propensity of less solvent banks to primarily reduce their exposures that are subject to high credit risk charges and have a shorter maturity. This propensity is most pronounced when banks operate either very close to or below their capital targets. At the same time, banks expand their low-risk-weighted sovereign exposures (which have a low risk weight) in the adverse scenario by 3.3 percentage points, from 16.5% to 19.8%

Chart 12

Decomposition of loans in the banking book

Sovereign lending expands at the cost of loans to the non-financial private sector in the adverse scenario

(y-axis: (left-hand panel) share of loan segments in percent, (right-hand panel) y-axis: loan demand, x-axis loan supply in percent)



Notes: The left-hand panel shows the shares of the main loan segments for the starting point, and the decomposition in 2023 for the adverse and baseline scenarios in pp. The right-hand panel shows the relationship between banks' loan demand and loan supply for the adverse and baseline scenarios. The size of the dots represents the size of banks' CET1 capital shortfalls at the end of 2023.

Banks' propensity to expand their lending to the sovereign or housing sector in the adverse scenario can be also seen in bank-level outcomes. The cumulation of dots corresponding with individual banks to the right of zero for the baseline scenario and to the left of zero for the adverse scenario in Chart 12 (right-hand panel) signifies the sensitivity of lending to the corporate and non-housing household sectors to economic conditions. At the same time, changes in lending to the sovereign or housing sector tend to be in a positive range for both scenarios, with banks having a much less pronounced tendency to cut lending to low-risk sectors in adverse economic conditions.

6.2 Asset quality and credit losses

The share of non-performing assets among outstanding loans to the non-financial private sector continues to fall in the baseline scenario but shoots up in the adverse scenario. The euro area NPL ratio for banks' exposures to the non-financial private sector decreases from 3.8% in 2020 to 3.3% in 2023 in the baseline scenario, with relatively low uncertainty surrounding the projected estimate. At the same time, the NPL ratio increases to 6.2% in 2023 for the adverse scenario (Chart 13, left-hand panel). The uncertainty surrounding the NPL ratio by the end of the adverse scenario is larger, ranging from 5.5% to 7.5% at a 5% uncertainty interval.

In the baseline scenario, banks can "grow out" of their NPL ratios, while in the adverse scenario, the high inflow of new defaults, lower write-offs and shrinking loan portfolios all contribute to an increase in NPL ratios. The inflow of new defaulted loans is low and falling in the baseline scenario, contributing around 0.8 percentage points annually (or 0.3 percentage points when netted out with cured

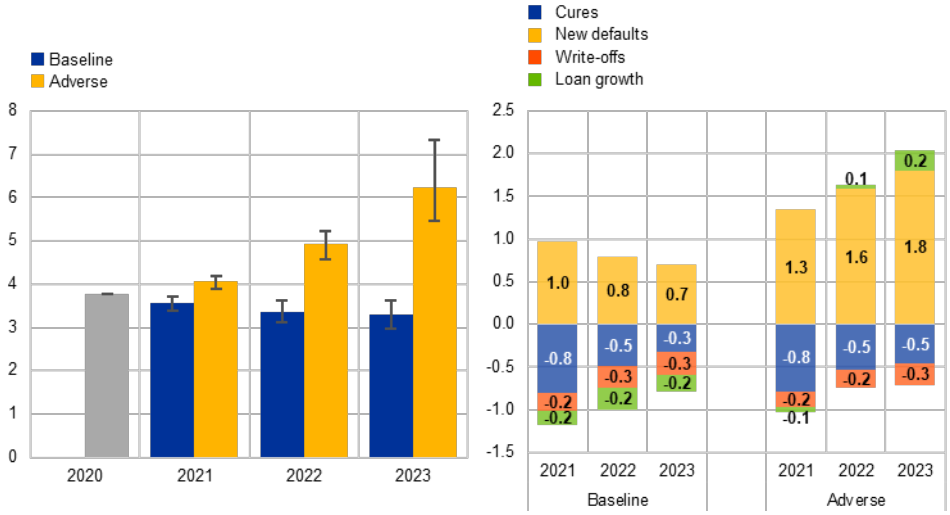
loans) to changes in the euro area-wide NPL ratio for exposures to the non-financial private sector (Chart 13, right-hand panel). Concurrently, the expansion of loans and write-offs deducts 0.5 percentage points annually. In the adverse scenario, the difference between the inflow of new defaults and the outflow of cures progressively opens, contributing around 1 percentage point annually to the increase in NPL ratios. Gradual bank deleveraging, with fewer new loans issued, adds 0.2 percentage points to the increase in the NPL ratio at the end of the scenario horizon.

Chart 13

Development and drivers of the NPL ratio

NPLs increase in the adverse scenario, driven by exposures defaulting over the projection horizon

(y-axis: (left-hand panel) non-performing loan ratio in percent, (right-hand panel) contribution to NPL ratio in percent)

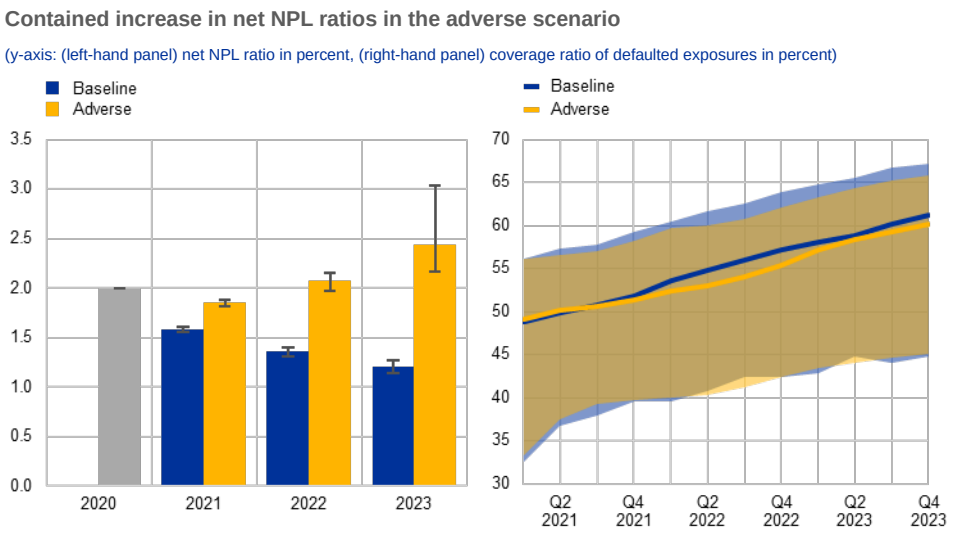


Notes: NPLs for exposures to the euro area non-financial private sector. The whiskers around the bars in the left-hand panel indicate 90% confidence bands representing model parameter uncertainty.

An increase in uncovered NPL risk, measured by the net NPL ratio, is more contained than the increase in the gross NPL ratio in the adverse scenario. The net NPL ratio (depicted in Chart 14, left-hand panel) expresses the share of non-performing exposures minus corresponding loan loss provisions among all non-financial private sector exposures. In the baseline scenario, the net NPL ratio falls noticeably from around 2% in 2020 to 1.2% in 2023. Even in the adverse scenario, the net NPL ratio increases by a mere 0.4 percentage points compared with 2020, despite the observed increase in the gross NPL ratio.

The modest increase in the net NPL ratio in the adverse scenario reflects the workings of the supervisory coverage expectations. In both the adverse and the baseline scenarios, banks increase their provision coverage of defaulted exposures from 50% to around 60% (Chart 14, right-hand panel), thereby contributing to low net NPL ratios.

Chart 14
Evolution of the net NPL ratio and provision coverage



Notes: NPLs for exposures to the euro area non-financial private sector. The left-hand panel shows the NPL ratio after deducting loan-loss provisions on assets in default in pp. The right-hand panel displays the coverage ratio of defaulted exposures, i.e. provisions over defaulted exposures in pp. The bands indicate the interquartile range of outcomes across banks. The whiskers around the bars on the left-hand panel indicate 90% confidence bands for the projections considering model and parameter uncertainty.

Credit losses to be substantially higher in the adverse scenario (Chart 15, left-hand panel). Credit losses incurred from provisioning against defaulted exposures reach around 0.4% of all assets by the end of the projection horizon, versus around 0.15% in the baseline.

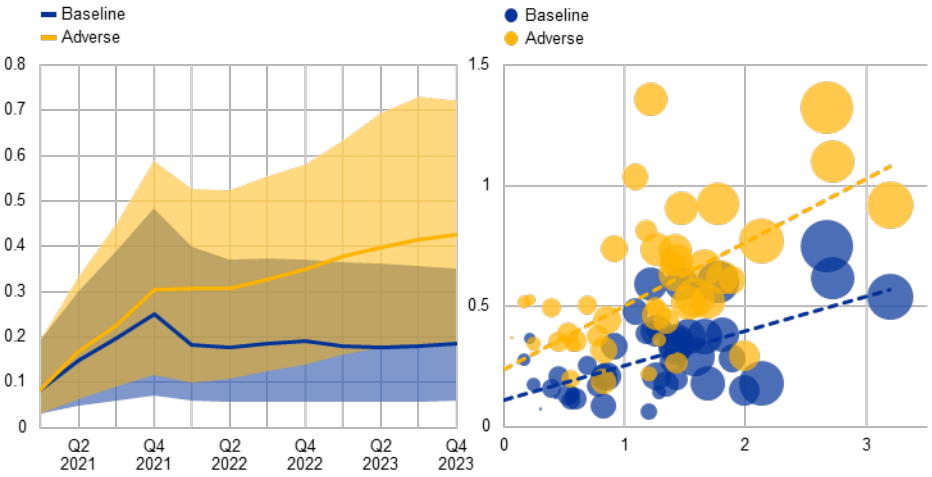
Credit losses are substantially higher in the adverse scenario than the baseline scenario, especially high for banks which have a higher share of NPLs at the beginning of the projection horizon. Credit losses incurred from provisioning against defaulted exposures reach around 0.4% of all assets by the end of the projection horizon, versus around 0.15% in the baseline scenario (Chart 15, left-hand panel).The positive association between banks' credit losses and their share of NPLs at the beginning of the projection horizon holds for both the baseline and the adverse scenario, but is slightly steeper in the latter (Chart 15, right-hand panel). Moreover, the share of unsecured defaulted exposures in total NPLs (represented by the size of the bubbles in Chart 15, right-hand panel) plays a relevant role in this relationship. Along with the supervisory coverage expectations, unsecured loans need to be provisioned faster, and a share of banks need to achieve the full provisioning of unsecured legacy defaulted exposures (loans that defaulted before 2018) by the end of 2023. Consequently, banks with more unsecured NPLs are placed higher in the chart and incur greater credit losses.

Chart 15

Evolution and distribution of credit losses

Credit losses in the adverse scenario are correlated with the initial stock and the share of unsecured defaulted exposures

(y-axis: credit losses in 2023 as a share of total assets in percent, x-axis: credit losses in 2020 as a share of total assets in percent (right-hand panel)



Notes: NPLs for exposures to the euro area non-financial private sector. The left-hand panel displays the median and the interquartile range of credit losses incurred as a result of provisions and write-offs on defaulted loans as a share of total assets. The right-hand panel displays all credit losses incurred as a result of write-offs and provisions on defaulted and non-defaulted exposures, averaged over the projection period. The size of the bubbles denotes the share of unsecured in total NPLs.

6.3 Bank profitability

Most banks experience positive profitability in the baseline scenario. The cross-sectional distribution of banks' ROA in Chart 16 (left-hand panel, blue shaded interquartile range) remains soundly above the zero line for the baseline scenario. The cost/income ratio, the alternative measure of banks' profitability, increases modestly from 64% at the end of 2020 to just under 70% at the end of 2023, with most of the increase taking place in 2021. Looking at profitability across banks' business models (Chart 16, right-hand panel), universal banks are the best performers, followed by diversified lenders and global systemically important banks (G-SIBs).

Bank profitability in the adverse scenario not only deteriorates, but its evolution is also more diverse across banks. For most banks, ROA remains negative for the entire duration of the adverse scenario, while the interquartile range of ROA (yellow shaded area in Chart 16, left-hand panel) highlights a higher variation of profitability outcomes compared with the baseline scenario. The cost/income ratio increases sharply to over 80% at the end of 2020 and stabilises just below 80% afterwards. The reduction in profitability is most pronounced for banks with a focus on corporate banking. This reflects a relatively high impact of the adverse scenario on market risk and on credit risk losses on corporate exposures. The profitability of retail banking is negatively affected by the continued low interest rate environment and low net interest income. G-SIBs and custodian banks experience a smaller reduction in profitability, which relates mostly to credit risk

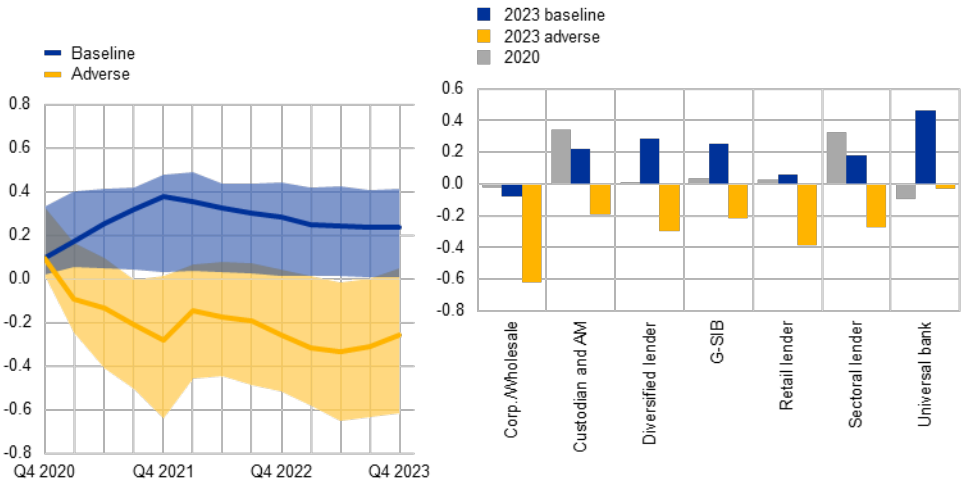
losses for G-SIBs, a reduction in net fee commission income and an increase in funding costs for custodian banks.

Chart 16

ROA across banks and over time

The profitability dispersion widens in the adverse scenario, triggered by an increase in cost/income ratios for some banks

(y-axis: ROA in percent)



Notes: The left-hand panel shows the cross-sectional distribution of bank-level ROA over time. The blue and red shaded areas illustrate the 75% interquartile range of bank-level figures for the baseline scenario and the adverse scenario respectively, while the solid line represents the mean. The right-hand panel shows ROA by business model for 2020 (grey bars), the average in 2021-23 in baseline scenario (blue bars) and the average in 2021-23 in adverse scenario (yellow bars).

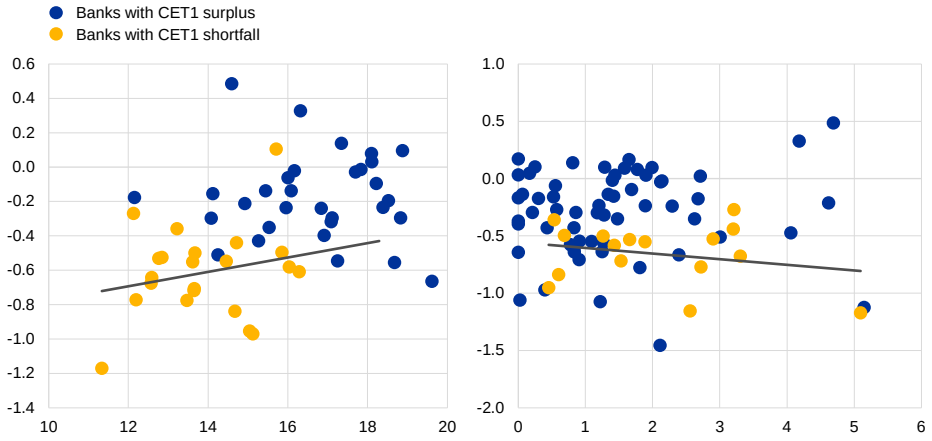
Higher initial capitalisation and lower stocks of NPLs help banks stabilise their profitability in the adverse scenario. The right-hand panel of Chart 17 illustrates the relationship between banks' initial CET1 ratios in 2020 and their average ROA in the adverse scenario and highlights how banks with higher capital buffers (blue dots in the upper right-hand corner) are better able to restore their profitability level. The stock of NPLs in 2020 is another factor correlated with profitability performance in the adverse scenario. Banks with a high initial stock of non-performing assets but low provisioning levels more often end up with lower average profitability and consequentially with capital levels below their regulatory requirements at the end of the adverse scenario (Chart 17, right-hand panel).

Chart 17

Drivers of bank profitability performance in the adverse scenario

Initial capitalisation and lower stocks of underprovisioned NPLs help banks to restore their ROA

(y-axis: average annual return on assets in percent, x-axis: CET1 ratio in Q4 2020 in percent (right-hand panel), net NPL ratio in Q4 2020 in percent (left-hand panel))



Notes: The results for the adverse scenario. Profitability (y-axis) is expressed as the average annual ROA in 2021-23. In the left-hand panel, ROA is plotted against the initial level of capitalisation in 2020. The yellow dots represent banks with a CET1 shortfall, i.e. institutions with a CET1 ratio that fell below their MDA regulatory thresholds at least once during the period 2021-23. The right-hand panel illustrates the relationship between the net NPL ratio and average ROA.

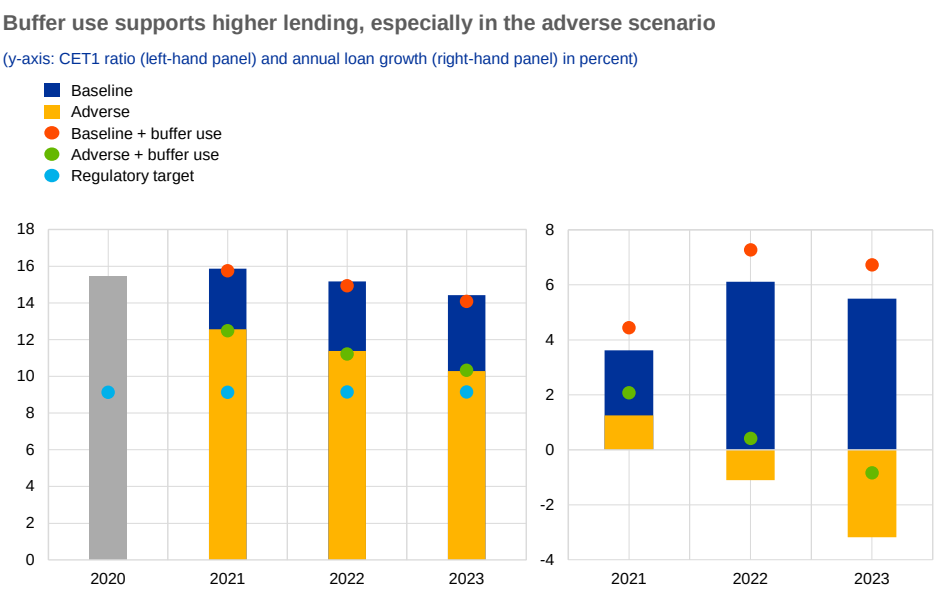
7 Sensitivity check: buffer policies in the macroprudential stress test

An unprecedented capital release package during the COVID-19 pandemic was supported by communication from ECB Banking Supervision (Enria, 2020) and national authorities that encouraged banks to use their capital buffers to expand lending (ESRB, 2021b). This encouragement was based on the recognition that uncertainties about credit losses and weak prospects for profitability can discourage the use of capital buffers. Moreover, even if buffers are designed to be drawn down during periods of systemic stress, there is ample evidence that a bank's capital position matters for valuations, credit ratings and funding costs (Claessens et al., 2018). Nonetheless, from a system-wide perspective, a broad-based use of capital buffers can support the economy and ultimately lead to better banking sector outcomes.

Varying the assumption on banks' intentions to use capital buffers can affect the outcomes of the macroprudential stress test. The main test results are derived under the assumption that banks remain reluctant to dip into their capital buffers and fall under MDA restrictions. Chart 18 contrasts these results with the outcomes of the macroprudential stress test if it is assumed that banks will be willing to fall under MDA restrictions when making lending decisions (meaning their capital targets relevant for lending decisions are lower), while still seeing capital buffers as relevant for profit retention.

Chart 18

Buffer use and its impact on the CET1 ratio and lending



Notes: The bars refer to the main outcomes of the macroprudential stress test as summarised in Section 4. Loan growth refers to lending volumes to the non-financial private sector. The dots summarise the outcomes under the assumption that banks disregard capital buffers when establishing their target capital ratios relevant for lending decisions, even if they still see capital buffers as relevant for their profit distribution policies.

The use of capital buffers barely affects solvency rates in the adverse scenario. There is only a moderate reduction in actual solvency rates triggered by banks' broad-based use of capital buffers in the baseline scenario (by 0.35 percentage points in 2023) when compared with the main results of the macroprudential stress test.

At the same time, the use of buffers has a substantial positive lending effect, especially in adverse economic conditions. The annual growth rate of lending volumes to the non-financial private sector is 0.8 percentage points higher in 2021 in the adverse scenario, 1.5 percentage points higher in 2022 and 2.3 percentage points higher in 2023. The impact of buffer use on lending in the baseline scenario is more contained, amounting to 0.8 percentage points in 2021, 1.2 percentage points in 2022 and 2023. This positive lending effect is strongest for corporate loans, which are 2.5 percentage points higher on average and on an annual basis in the adverse scenario, and 1.5 percentage points higher in the baseline scenario. It is also strong for consumer loans (1.8 percentage points in the adverse scenario and 1.3 percentage points in the baseline scenario) and least substantial for housing loans (0.8 percentage points in the adverse scenario and 0.6 percentage points in the baseline scenario).

Broad-based buffer use triggers positive second-round effects and reduces the impact of the negative banking sector-real economy feedback loop in stressed conditions. The initial consumption of capital buffers promotes higher lending, which triggers the positive countercyclical effect of a 0.1 percentage point increase in the average annual euro area GDP growth rate (or a 0.4 percentage point increase in cumulative terms in 2020-23) in the adverse scenario. The effect is far weaker in the baseline scenario, amounting to an increase of less than 0.01 percentage points in the annual and cumulative growth rate in 2020-23. The higher level of economic activity reduces defaults (the NPL ratio for the non-financial private sector falls by 0.5 percentage points in the adverse scenario and by 0.1 percentage points in the baseline scenario) as well as credit losses and supports banks' profitability. The positive effect of buffer use on ROA is substantial in the adverse scenario, amounting to 0.09 percentage points in 2023, and very modest in the baseline scenario (0.02 percentage points in 2023), thereby helping to mitigate the downward pressure on banks' solvency ratios.

The macroprudential stress test relies on the no-policy-change assumption and only includes policies announced or implemented before the end of 2020 (see Section 2.2). It includes the assumption of no replenishment of Pillar 2 guidance buffers, released in 2020 in response to the COVID-19 pandemic and in combination with ECB Banking Supervision guidance, which are intended to be fully used until at least the end of 2022.[18] The main results of the macroprudential stress test assume that Pillar 2 guidance buffers are released up until 2023, while the outcome of the alternative assumption, according to which they are gradually restored to their initial 2019 levels before the beginning of 2023, is illustrated in Chart 19.

[18] See, for example, Enria, A. (2021).

Buffer replenishment at the beginning of 2023 has hardly any effect on the outcomes of the macroprudential stress test in the baseline scenario. This result should be interpreted with caution, as buffer replenishment is likely to have only a lagged effect on economic activity that is not fully captured over the stress test horizon. In the very short term, however, banks' capital buffers appear sufficient to meet higher supervisory expectations without interrupting the flow of credit to the economy.

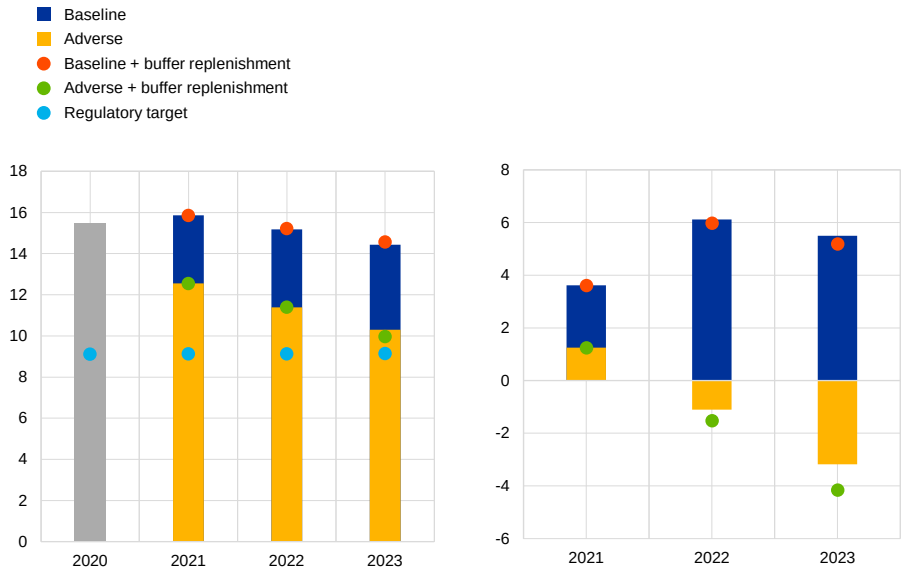
By contrast, buffer replenishment can weaken credit supply and bank solvency in the adverse scenario. The tightening of Pillar 2 guidance requirements taps into banks' capital surpluses and forces some of them to deleverage. Lending to the non-financial private sector is 1 percentage point lower in 2023. This translates to lower economic growth, higher credit losses and lower profitability. Even though the replenishment of Pillar 2 guidance is aimed at enhancing banks' capitalisation, the negative feedback loop between the banking sector and the real economy ultimately reduces banks' capital ratios. Compared with the situation in which Pillar 2 guidance does not need to be replenished, the CET1 ratio is 0.3 percentage points lower in 2023. This result confirms that buffer replenishment should be state-dependent, seeking to preserve lending capacity subject to evolving macroeconomic conditions. In a favourable economic environment, the economic costs of rebuilding Pillar 2 guidance buffers are marginal. However, in deteriorating economic conditions, quick buffer replenishment may discourage lending and impair banks' capital positions.

Chart 19

Buffer replenishment and its impact on the CET1 ratio and lending

Buffer replenishment has only a minor effect in the baseline scenario but negatively affects the CET1 ratio and lending in the adverse scenario

(y-axis: CET1 ratio (left-hand panel) and annual loan growth (right-hand panel) in percent)



Notes: The bars refer to the main outcomes of the macroprudential stress test as summarised in Section 4. Loan growth refers to lending volumes to the non-financial private sector. The dots summarise the outcomes under the assumption that banks gradually replenish Pillar 2 guidance buffers which become binding at the beginning of 2023.

Box 2
Toward Basel III finalisation

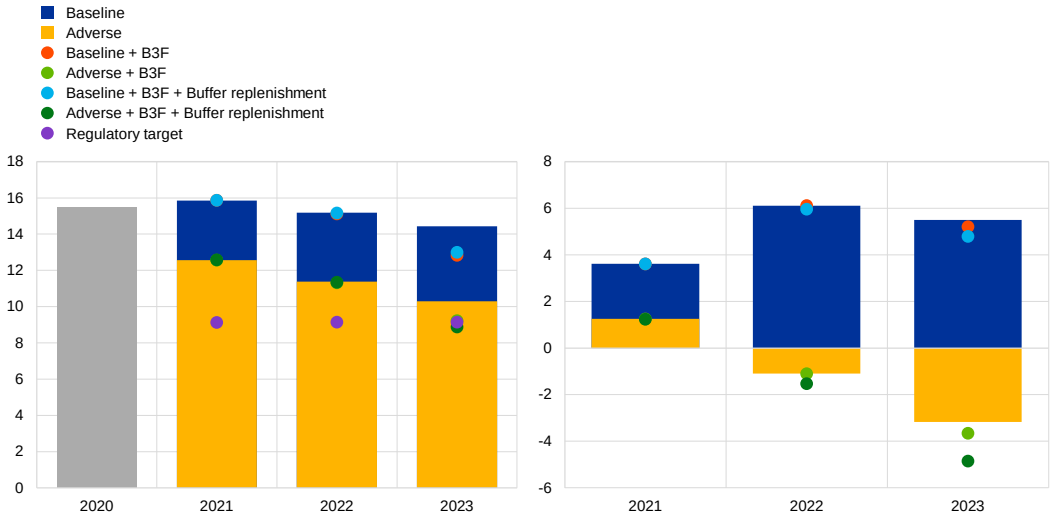
In response to COVID-19 developments, the Basel Committee postponed the introduction of the final elements of the Basel III framework until January 2022.[19] The introduction of the Basel III standards hence overlaps with the last year of the macroprudential stress test horizon. The final Basel III standards involve the revision of the standardised and internal ratings-based approaches for credit risk, the revision of the operational and credit valuation adjustment risk frameworks and the introduction of an output floor, and are expected to increase the risk-weighted assets of the European banking sector by 18.5% and create a capital shortfall of around €52.2 billion (EBA, 2020b).

This box illustrates the impact of the phasing-in of the final Basel III standards on the outcomes of the macroprudential stress test. It assumes that the finalisation of Basel III with the gradual introduction of the unmodified output floor will take place in 2023.[20] Otherwise, the methodology follows the recently published impact assessment of the Basel III finalisation in Budnik et al. (2021d). The analysis serves only as sensitivity assessment of the macroprudential stress test, as the very short-term horizon does not allow either the full macroeconomic costs or the long-term benefits of the reform to be captured; these are instead documented in Budnik et al. (2021d).

Chart A
Basel III finalisation and its impact on CET1 the ratio and lending

The Basel III reform increases capital requirements at the end of the stress test horizon

(y-axis: (left-hand panel) System wide CET1 ratio in percentage, (right-hand panel) Loan growth to the non-financial private sector in percentage)



Notes: The bars refer to the main outcomes of the macroprudential stress test as summarised in Section 4. Loan growth refers to lending volumes to the non-financial private sector. The filled dots summarise the outcomes under the assumption that the implementation of the final elements of the Basel III reform commences in 2023.The empty dots represent the outcomes under the assumption that the implementation of the final elements of the Basel III reform commences in 2023 and overlaps with the replenishment of Pillar 2 guidance buffers which become binding at the beginning of 2023.

[19] See BIS (2020), "Governors and Heads of Supervision announce deferral of Basel III implementation to increase operational capacity of banks and supervisors to respond to Covid-19", *press release*, 27 March.

[20] The analysis relies on the main EU approach, which includes three deviations from the plain vanilla specification of the Basel III finalisation standards: (i) the application of a factor supporting the financing of small and medium-sized enterprises (SMEs) on top of the Basel SME preferential risk weight treatment, (ii) a CVA exemption, and (iii) the exclusion of the bank-specific historical loss component from the calculation of capital for operational risk.

The implementation of the Basel III reform in 2023 leads to a reduction of the floored CET1 ratio. The implementation of the Basel standards commencing in 2023 results in a 1.6 percentage point decrease in the CET1 ratio in the baseline scenario and a 1.1 percentage point decrease in the adverse scenario[21], as marked by the filled dots in the left-hand panel of Chart A. The impact on lending to the non-financial private sector is contained, amounting to a 0.3 percentage point decrease in the annual growth of loans in the baseline scenario and a 0.5 percentage point decrease in the adverse scenario (right-hand panel of Chart A).

The introduction of the final Basel III standards in conjunction with buffer replenishment primarily affects the results in the adverse scenario. The full replenishment of Pillar 2 guidance buffers starting from 2023 leads to an additional decrease in 2023 lending growth by 0.35 percentage points in the baseline scenario and 1.2 percentage points in the adverse scenario. Accordingly, the combination of the phasing-in of Basel III standards and buffer replenishment leads to a greater reduction in lending to the non-financial private sector in the adverse scenario (by around 0.2 percentage points in 2023) than the impact of these factors individually.

[21] The difference in the initial impact on RWAs in the baseline and adverse scenarios relates to the different asset (size and) structure in 2023 under the two scenarios.

8 Interpreting a macroprudential stress test

A macroprudential stress test deviates from constant balance sheet supervisory stress tests by allowing banks to react to scenario severity. Two distinguishing features of the 2021 macroprudential stress test are the dynamic balance sheet perspective, where banks adjust their loans and liability structure, and the presence of amplification mechanisms. This section contrasts the results of the 2021 macroprudential stress test with its supervisory counterpart[22] and helps to disentangle the relative role of individual features of the macroprudential stress test.

Compared with the EBA/SSM stress test, the macroprudential stress test estimates a lower CET1 ratio in 2023 in the baseline scenario and a higher CET1 ratio in the adverse scenario. The system-wide transitional CET1 ratio in the baseline scenario of the EBA/SSM stress test is 15.8% in 2023, while in the macroprudential stress test it is 14.4%, i.e. 1.4 percentage points lower. In the adverse scenario, it is 10.1% in the EBA/SSM stress test and 10.3% in the macroprudential stress test. Same signed differences in CET1 outcomes for baseline and adverse scenarios surfaced in the 2018 (Budnik et al., 2019) and 2020 stress tests (see Appendix B).

Chart 20 tracks the evolution of the system-wide CET1 ratio in 2023 when moving from the EBA/SSM stress test (leftmost bar) to the results of the macroprudential stress test (rightmost bar). Enabling the dynamic response of banks in terms of lending and liability volumes, i.e. the dynamic balance sheet, in the baseline scenario results in a 1.4 percentage point decrease in the CET1 ratio compared with the constant balance sheet EBA/SSM stress test. This reflects the expansion of banks' assets under favourable economic conditions, which leads to a higher denominator for the CET1 ratio. In the adverse scenario, the dynamic balance sheet translates into a 1 percentage point increase in the CET1 ratio compared with the results of the EBA/SSM stress test. This is the outcome of banks shrinking their balance sheets and changing the composition of their lending in response to falling loan demand and deteriorating profitability and solvency prospects.

While banks react to adverse economic conditions by safeguarding their solvency positions, they also trigger severe amplification mechanisms, ultimately leading to a further deterioration of their situation. Moving from the dynamic balance sheet stress test to the stress test that acknowledges the presence of the solvency-funding costs and banking sector-real economy feedback loops does not markedly affect CET1 ratios in the baseline scenario, but significantly counterbalances banks' intentions in the adverse scenario. The system-wide CET1 ratio in a stress test involving the amplification mechanisms triggered by banks' endogenous responses is 1.8 percentage points lower (of which 0.1 percentage

[22] See ECB (2021), "Stress test shows euro area banking system resilient under challenging macroeconomic scenario", *press release*, 30 July.

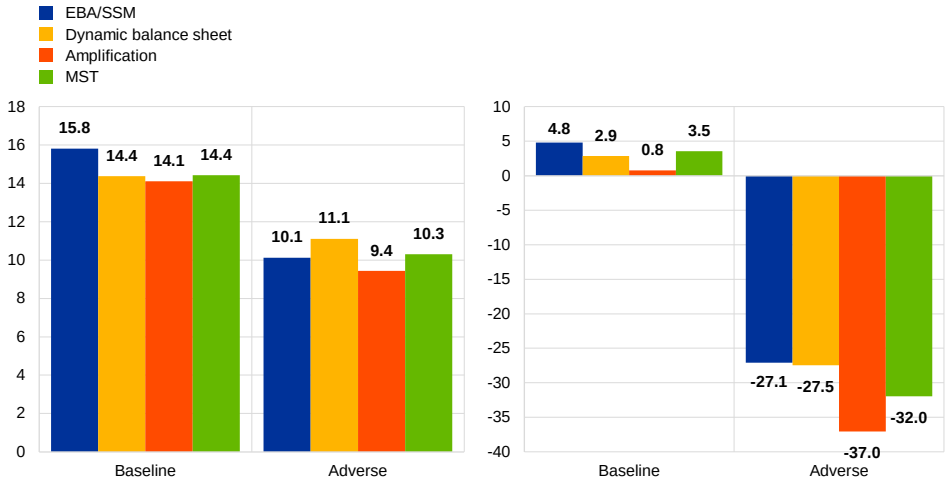
points are attributable to the solvency-funding costs feedback loop) compared with a dynamic balance sheet stress test ignoring these feedback loops, and 0.7 percentage points lower compared with the constant balance sheet EBA/SSM stress test. The effect amplification mechanisms have on CET1 ratios is higher than in earlier macroprudential stress test exercises, likely due to the very high severity of the adverse scenario, which adds to the very adverse economic developments in 2020.

Chart 20

CET1 ratios and CET1 capital depletion compared with 2020

The dynamic balance sheet perspective and the two feedback loops place a wedge between the supervisory and macroprudential stress test results

(y-axis: CET1 capital ratios in 2023 in percent (left-hand panel), CET1 capital stock change 2021-23 in percentage points (right-hand panel))



Notes: Transitional CET1 capital and capital ratios. "Dynamic balance sheet" includes the dynamic response of banks in terms of asset and liability volumes and interest rates, and a top-down assessment of credit risk including the model-specific implementation of NPL coverage expectations. The model-specific interest rate and credit risk modelling explains the 0.2 percentage point difference in baseline CET1 ratios between the EBA/SSM exercise and "Dynamic balance sheet", with the rest falling on the dynamic adjustments of volumes. "Amplification" adds the solvency-funding costs and banking sector-real economy feedback loops to the dynamic balance sheet assessment. "MST" represents the final outcomes of the 2021 macroprudential stress test, including the impact of COVID-19 mitigation policies as discussed in Section 2.2. and Box.1. The right-hand panel shows the percentage change in CET1 capital stocks between 2020 and 2023.

Lastly, enabling COVID-19 mitigation policy measures in the macroprudential stress test leads to an improvement in CET1 capital ratios. The impact of policies is more pronounced in the adverse scenario (as discussed in Box 1), adding 0.9 percentage points to the CET1 ratio compared with only 0.3 percentage points in the baseline scenario.

A higher system-wide CET1 ratio in the adverse scenario of the macroprudential stress test compared with the constant balance sheet stress test hides higher capital depletion in terms of CET1 capital losses in 2021-23. The system-wide CET1 ratio increases by 4.8% compared with the end of 2020 in the baseline scenario of the EBA/SSM stress test, and decreases by 3.5% in the macroprudential stress test. The difference in capital depletion in the adverse scenario is more pronounced, at -27.1% versus -32%. In the absence of COVID-19 mitigation policies, capital depletion in the adverse scenario of the macroprudential stress test is even higher, amounting to -37% compared with the end of 2020 (right-hand panel of Chart 20).

The macroprudential stress test also changes the distribution of bank-level outcomes compared with the constant balance sheet exercise. The results of the macroprudential versus the constant balance sheet stress test are generally positively correlated. The correlation of bank-level capital ratios at the end of 2023 is 96% in the baseline scenario and 90% in the adverse scenario.[23]. The 2020-23 changes in bank-level capital depletion are not as strongly correlated between the two stress test approaches, with baseline scenario correlation equal to 23% and adverse scenario correlation equal to 51%.[24]

The distribution of bank-level CET1 ratios in the baseline scenario of the macroprudential stress test is shifted very slightly leftwards compared with both the starting point and the constant balance sheet stress test. [25] In the macroprudential stress test, the median capital ratio decreases by 1.1 percentage points between 2020 and 2023 (from 16.3% to 15.2%), whereas in the constant balance sheet stress test it falls by only 0.5 percentage points. There is also a subtle increase in the variation of CET1 ratios between banks in the macroprudential stress test. The interquartile range increases from 4.9% in 2020 to 5.4% in 2023, whereas in the constant balance sheet stress test it remains at 5%.[26]

The distribution of CET1 ratios in the adverse scenario is shifted leftwards compared with the starting point and is far broader in the macroprudential than in the supervisory approach. As shown in the right-hand panel of Chart 21, although the CET1 ratio distribution in the EBA/SSM stress test shifts to the left in the adverse scenario, its shape remains nearly the same as in 2020. In stark contrast, the density of CET1 ratios in the macroprudential setting becomes flatter, especially in the adverse scenario. [27] For example, the interquartile range of the bank-level capital ratio under the macroprudential stress test increases from 4.9% to 6.9%, while it stays at 5% under the constant balance sheet approach. As very high bank capital ratios, for example above 25%, become very rare in 2023 in the adverse scenario, both stress test approaches imply a lower asymmetry[28] of CET1 ratio distributions compared with 2020.[29]

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23 Spearman's rank correlation coefficient equalling 74% in the baseline scenario and 68% in the adverse scenario.

24 Spearman's rank correlation coefficient equalling 41% in the baseline scenario and 33% in the adverse scenario.

25 The leftward shift of the distribution bank-level CET1 ratios in the baseline scenario is more pronounced for larger banks (with above median asset size in 2020) than for smaller banks (with below median asset size in 2020 in the sample).

26 The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values for the hypothesis that the distributions of the supervisory and macroprudential stress test correspond in the baseline scenario are 7.8% and 7.9%.

27 The flattening of the distribution bank-level CET1 ratios in the adverse scenario is more pronounced for smaller banks (with below median asset size in 2020) than for larger banks (with below median asset size in 2020 in the sample).

28 Bank-level capital ratio distribution is highly asymmetric in 2020, as measured by the Pearson correlation coefficient of 4.9 (positive skewness). In the baseline scenario, the skewness changes to 5.1 and 4.4 under the supervisory and macroprudential approaches respectively. However, in the adverse scenario, the skewness drops to 3.4 using both stress test approaches.

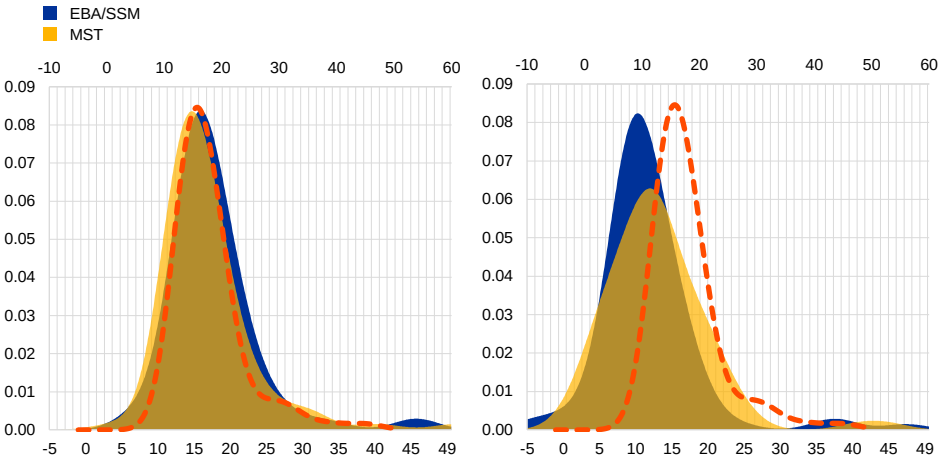
29 The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values for the hypothesis that the distributions of the supervisory and macroprudential stress test correspond in the adverse scenario are 5.2% and 7%.

Chart 21

CET1 ratio distribution in the constant balance sheet and macroprudential stress tests in 2023

The macroprudential stress test delivers more heterogeneous CET1 ratio outcomes, especially in the adverse scenario

(x-axis: CET1 ratio in percent)



Notes: Kernel density functions with bandwidth equal to 3%. The red dashed line represents the CET1 ratio density at the end of 2020.

There is an even greater increase in the variability of bank-level results for CET1 capital depletion in the macroprudential compared to the supervisory stress test in the adverse scenario. The distributional shape of capital depletion between 2020 and 2023 is roughly the same when comparing the supervisory and macroprudential stress test settings in the baseline scenario (see left-hand panel of Chart 22). In the adverse scenario, however, the macroprudential stress test provides a much more varied picture of individual bank-level capital changes (Chart 22, right-hand panel).[30] The interquartile range is 20.4 percentage points for the EBA/SSM stress test and 34.6 percentage points for the macroprudential counterpart. The macroprudential stress test produces not only a flatter but also a more negatively skewed (asymmetric) distribution of capital depletion.[31] For example, large losses in capital (70% or higher) are more probable under the macroprudential framework.[32]

30 The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values for the hypothesis that the distributions of capital depletion in the supervisory and macroprudential stress test correspond in the baseline scenario are 63% and 96%, and 11% and 22% in the adverse scenario.

31 In the adverse scenario, the skewness as measured by the Pearson correlation coefficient for capital depletion is equal to -0.18 and -0.45 under the supervisory and macroprudential stress tests respectively.

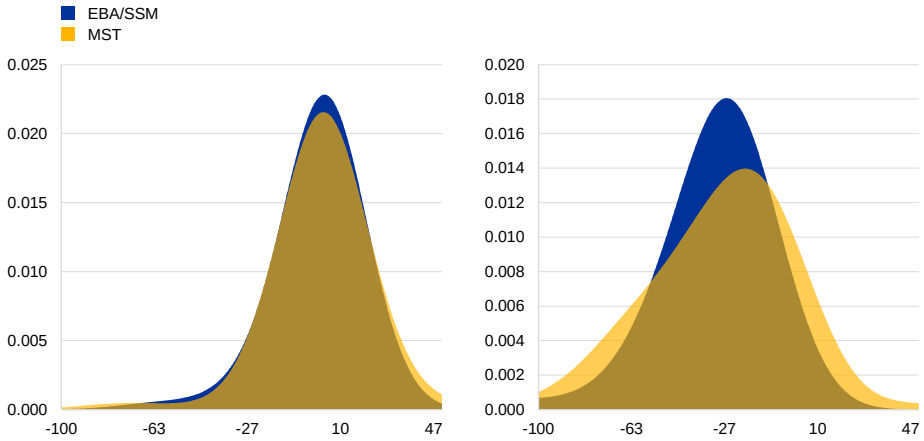
32 This holds in particular for larger banks (with total assets above median in the sample in 2020).

Chart 22

CET1 shortfall distribution in the constant balance sheet and macroprudential stress tests in 2023

Although the CET1 shortfall is tilted to the right in the macroprudential stress test, it also has a thicker left tail

(x-axis: CET1 capital change in percent)



Notes: Kernel density functions with bandwidth equal to 15%

An increase in the variability of bank-level CET1 ratios in the macroprudential stress test relates primarily to the dynamic balance sheet mechanisms. The dynamic balance sheet assumption explains most of the modest difference between the constant balance sheet result and the macroprudential stress test in the baseline scenario[33] (Chart 23, left-hand panel).[34] In the adverse scenario, the difference between the constant and dynamic balance sheet assumptions becomes even more pronounced[35], with the latter implying a far higher variance of 2023 results (Chart 23, right-hand panel). The two amplification mechanisms further flatten the distribution of the CET1 ratio.[36]

33 The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values for the hypothesis that the distributions of constant balance sheet results and dynamic balance sheets correspond for the baseline scenario are 5.2% and 8.3%. Further additions of model mechanisms (adding amplification mechanisms and COVID-19 mitigation policies) do not lead to a statistically significant change in distributions.

34 As an alternative perspective, an additional 1 percentage point of bank-level loan growth under the dynamic balance sheet assumption can increase the difference between the supervisory and macroprudential stress tests by a statistically significant amount (0.13 percentage points in terms of the CET1 ratio), controlling for other variables such as capital depletion.

35 The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values of 0.3% and 0.2%.

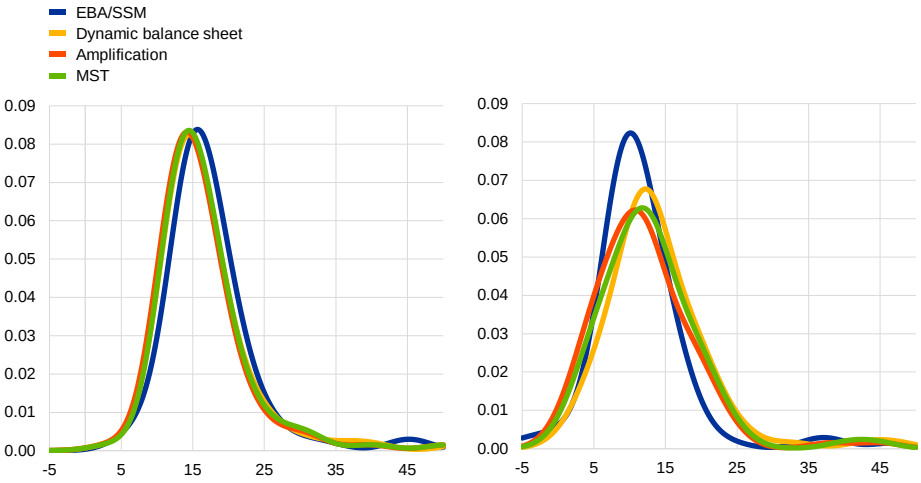
36 Only the Mann-Whitney U-test detects the change in distributions with the dynamic balance sheet only and with the dynamic balance sheet and amplification mechanisms together. The Mann-Whitney U-test p-value is 5.6%, while that of the Kolmogorov-Smirnov test is 22.2%.

Chart 23

CET1 ratio distribution in the bottom-up and macroprudential stress tests: explaining the deviations

The dynamic balance sheet perspective and two feedback loops increase the variability of bank-level capital ratios

(x-axis: CET1 ratio in percent)



Notes: Kernel density functions with bandwidth equal to 3%. Width of interquartile ranges in adverse and baseline respectively (in percent): EBA/SSM: 5 and 5, Dynamic balance sheet: 5.4 and 7.6, Amplification: 5.6 and 8, MST: 5.4 and 6.9.

In terms of capital depletion, both the dynamic balance sheet perspective and amplification mechanisms add to the variability of bank-level results when compared with 2020. For the baseline scenario, the distributions of the constant balance sheet and macroprudential stress test results are very similar. It is only when COVID-19 mitigation policies are added that the distributions are noticeably affected.[37] For the adverse scenario, both the dynamic balance sheet and amplification mechanisms significantly affect the distribution of capital depletion, with the former shifting it rightwards, introducing higher skewness, and flattening it.[38]

[37] The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values for the hypothesis that the distributions of the complete macroprudential stress test , and that without COVID-19 policies, correspond in the baseline scenario, are 5.2% and 5%.

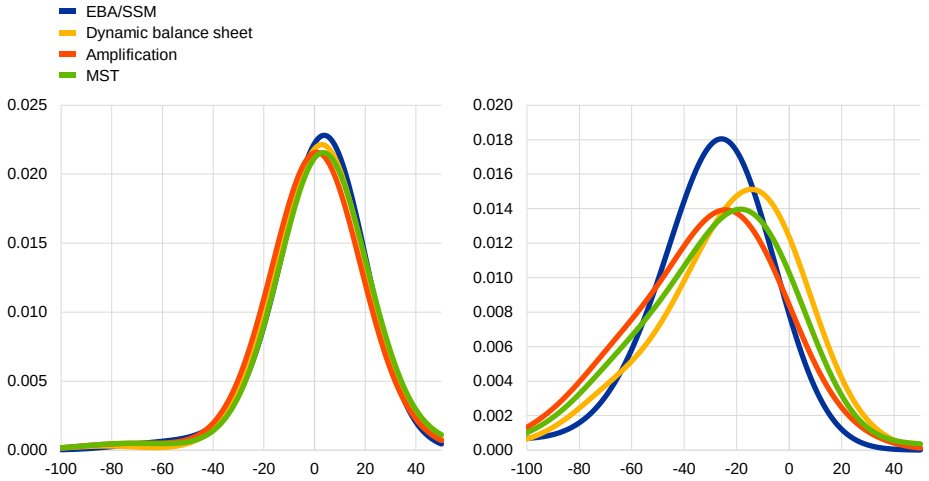
[38] The Kolmogorov-Smirnov test and Mann-Whitney U-test p-values for the two hypotheses that the distributions of constant versus dynamic balance sheet outcomes, and the distributions of the dynamic balance sheet versus the dynamic balance sheet with amplification mechanisms, are identical, are 0.3% and 0.5% for the former, and 3.4% and 1.1% for the latter.

Chart 24

CET1 depletion distribution in the constant balance sheet and macroprudential stress tests: explaining the deviations

… and of CET1 capital depletion, especially in the adverse scenario

(x-axis: CET1 capital change in percent)



Notes: Kernel density functions with bandwidth equal to 3%. Width of interquartile ranges in adverse and baseline respectively (in percent): EBA/SSM: 8.2 and 20.4, Dynamic balance sheet: 8.7 and 31.5, Amplification: 11.4 and 34, MST: 10.7 and 34.6.

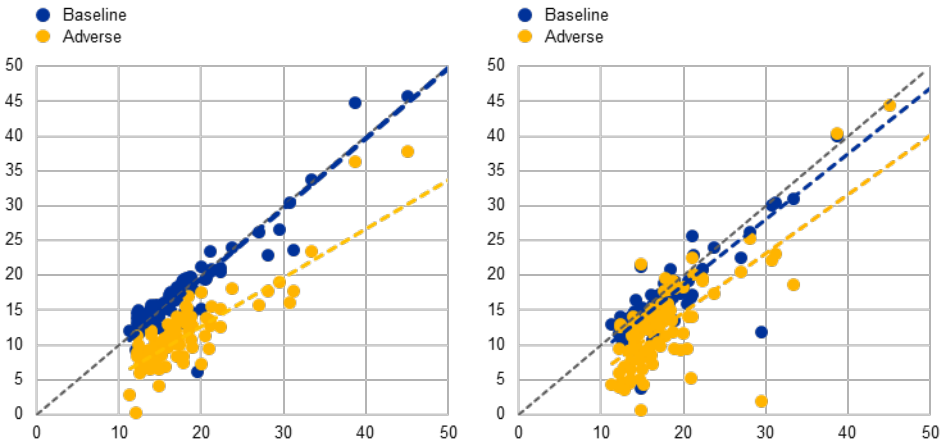
The initial 2020 CET1 ratios are a better predictor of the end point of the stress test in the constant balance sheet compared with the macroprudential approach. As can be seen in Chart 25, the starting capital ratio values are a good predictor of the end point of CET1 ratios in the supervisory stress test. The 2020 CET1 ratios account for 96% (baseline scenario) and 86% (adverse scenario) of the variation in bank capital ratios at the end of the stress test horizon. In the macroprudential setting, these figures drop to 92% (baseline) and 70% (adverse) of the respective end point ratios. Additionally, in both settings the ordering of banks in terms of capital ratios can change between the start and end of the stress test, especially in the adverse scenario. On average, however, banks in the macroprudential stress test tend to vary in their positional rankings to a greater extent (baseline: 10 points, adverse: 18 points) than in the supervisory stress test (baseline: 8 points, adverse: 12 points).

Chart 25

Relationship between starting and end point CET1 ratios in the constant balance sheet and macroprudential stress tests

The starting capital ratios of individual banks are weaker predictors for end-point capital ratios in the macroprudential stress test

(x-axis: CET1 ratio in 2020 in %; y-axis: CET1 ratio in 2023 in %)



Box 3

The role of solvency funding costs feedback loop

Decreases in solvency translate into higher costs of unsecured wholesale funding via the solvency-funding costs feedback loop.[39] As illustrated in Chart A (left-hand panel), changes in banks' leverage ratios affect interest rates on unsecured wholesale funding. The relationship between banks' leverage ratios and the costs of wholesale funding is generally steeper in the adverse scenario (on average, a drop in leverage of 100 basis points implies an increase in unsecured funding costs of around 25 basis points) than in the baseline scenario (where the same drop in leverage implies an increase in funding costs of 12 basis points). The steeper slope in the adverse scenario reflects the higher risk sensitivity of spreads to the same marginal change in banks' capitalisation when the level of risk is already elevated due to unfavourable macro-financial conditions and high uncertainty about banks' asset quality.

The average marginal impact of the solvency-funding costs feedback loop[40] **on the costs of newly issued unsecured wholesale funding in 2023 of the adverse scenario amounts to 75 basis points** (Chart A, right-hand panel). The marginal impact of deteriorating bank solvency on wholesale funding costs is around the same for financial sight deposits and longer-term unsecured debt.

39 See Section 2.1 for a general description of the solvency-funding costs feedback loop.

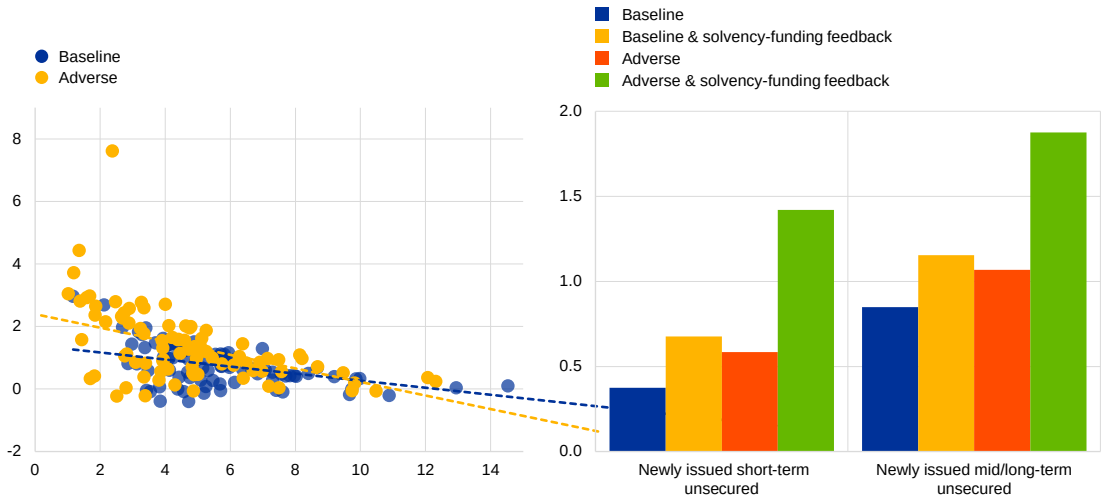
40 The marginal impact is measured by running a counterfactual simulation in which, ceteris paribus, the impact of a bank's capitalisation (in this case, the determining variable is the leverage ratio) on risk spreads is kept constant at initial levels. If the leverage ratio regressor is kept constant, solvency does not dynamically affect funding costs, so the solvency-funding feedback loop is switched off. Comparing this simulation with a simulation where the leverage ratio regressor is allowed to change over time, it is possible to isolate the marginal effect of risk spreads that are sensitive to changes in the capitalisation of a bank.

Chart A

The impact of banks' solvency on their wholesale funding costs

Unsecured wholesale funding costs are more sensitive to decreases in solvency in the adverse scenario

(y-axis: interest rates on unsecured wholesale funding in 2023 in percent, x-axis: leverage ratio in 2023 in percent (left-hand panel))



Notes: The left-hand panel illustrates the relationship between the bank-level leverage ratio and its costs for newly issued wholesale funding in the baseline and adverse scenarios of the macroprudential stress test. The right-hand panel depicts the level of interest rates on newly issued unsecured wholesale funding in the adverse and baseline scenarios in 2023, with and without the marginal impact of the solvency-funding costs feedback loop.

The price effect of increasing wholesale funding costs is exacerbated by increasing demand for wholesale funding in stressed conditions. Unsecured wholesale funding made up around a quarter of banks' debt in 2020.[41] In the adverse scenario, the demand for wholesale funding increases in line with the depletion of own funds and the shrinking supply of non-financial private sector deposits (Chart B, left-hand panel). The supply of non-financial private sector deposits tightens faster than banks' assets by around 1 percentage point annually (while the supply of non-financial private sector deposits keeps pace with the growth of banks' assets in the baseline scenario). Additionally, the loss of capital driven by the scenario adversity adds to the reliance on unsecured wholesale funding. Accordingly, while interest expenses on unsecured wholesale funding make up 56% of interest expenses in the baseline scenario, they account for 67% of interest expenses in the adverse scenario.

The impact of solvency-funding cost feedback on bank profitability and capital can be seen primarily in the adverse scenario. The impact of the feedback loop on average debt funding costs is 11 basis points in the adverse scenario and a negligible 3 basis points in the baseline scenario (Chart B, right-hand panel). Driven by these higher funding costs, the impact of the feedback loop on banks' profitability amounts to 4 basis points of system-wide ROA at the end of 2023 in the adverse scenario and 15 basis points of the system-wide CET1 ratio (red line in Chart C, right-hand panel).

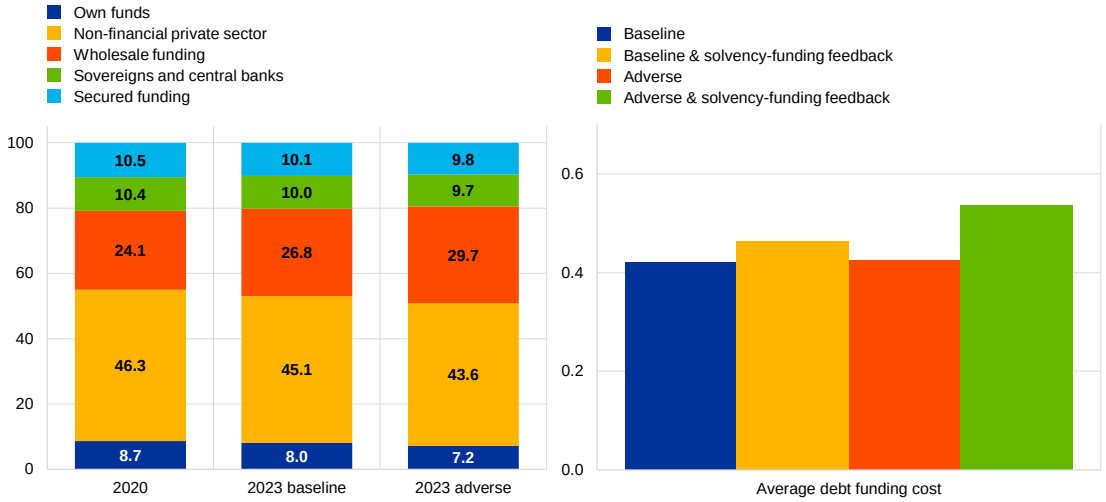
41 Within unsecured wholesale funding, 29% consists of financial sight deposits (typical maturity: within the quarter), 25% consists of financial term deposits (typical maturity as measured by the interquartile range: between 2.5 and ten years) and 46% consists of other securities issued, such as unsecured bonds or hybrid contracts (typical maturity: between five and eight years).

Chart B

Average funding costs and the composition of liabilities

The impact on average funding costs is driven additionally by a volume effect

(y-axis: share on balance sheet in percent (left-hand side), average cost of all debt funding in 2023 (right-hand side))



Notes: The left-hand panel shows the composition of liabilities and equity at the beginning and end of the projections. The right-hand panel depicts the average level of interest rates on all debt funding in the adverse and baseline scenarios in 2023, with and without the marginal impact of the solvency-funding costs feedback loop.

The increases in funding costs are passed through to banks' loan supply.[42] The presence of the solvency-funding costs feedback loop increases lending rates to the non-financial private sector by less than 5 basis points by the end of the adverse projection. The growth rate of lending to the non-financial private sector is slowed by an additional 5 basis points in 2023, beyond the contraction of lending caused by the adverse scenario alone. The growth rate of lending to the financial sector is more markedly reduced, by an additional 25 basis points a year in the adverse scenario in 2023.

The amplification of the adverse scenario via the solvency-funding costs feedback loop is highly heterogeneous among banks. The distribution of the amplification of CET1 outcomes caused by the funding-solvency feedback loop is left-skewed (Chart C, right-hand panel), indicating that the average amplification figures are driven by a few tail cases. The banks in the tail are typically small to medium-sized banks with low initial capitalisation compared to their regulatory requirements and buffers, and significant reliance on financial sight deposits, but not term deposits.[43]

[42] The pass-through of funding costs to future loan supply, and its effect on interest income, has been termed the "front-book effect" by Schmitz et al. (2019).

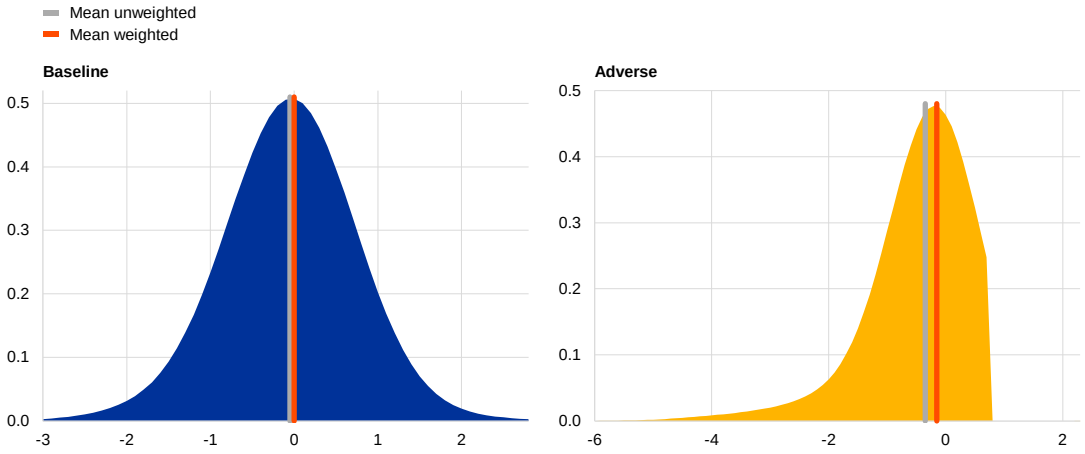
[43] Out of all unsecured wholesale funding instruments, financial sight deposits render a bank especially vulnerable to a strong solvency-funding feedback loop. Since sight deposits roll over continuously, a worsening capital position causes costs to increase for a larger part of the bank's debt. This can easily trigger a runaway effect, where subsequent profitability woes beget more capital trouble.

Chart C

Impact of the solvency-funding costs feedback loop on the CET1 ratio

By the end of the projection horizon, the effect on bank capitalisation is marked, especially for some susceptible banks

(y-axis: kernel density estimate, x-axis: funding-solvency impact on CET1 ratio in 2023 in percent)



Notes: For the baseline (left-hand panel) and adverse (right-hand panel) scenarios respectively, the two panels depict the kernel density estimate of the difference in CET1 ratios in a simulation with funding-solvency feedback versus without funding-solvency feedback. The more negative the impact on the CET1 ratio, the stronger the amplification of the scenario by the solvency-funding feedback. The solid grey line denotes the simple average; the solid red line the asset-weighted average.

9 Conclusions

This paper summarises the results of a macroprudential stress test of the euro area banking system. The stress test considers the joint performance of 89 significant euro area banks and 19 euro area economies, assessed jointly rather than individually, and with the recognition of banks' likely reactions to stress and economy-wide amplification mechanisms. It has been conducted in a fully top-down fashion, making use of the reported starting points and the same macro-financial scenarios as the EBA EU-wide stress test.

In the baseline scenario, the SSM-wide CET1 capital ratio rises slightly and then returns to roughly where it was in 2020 on the back of robust lending growth. The evolution of the CET1 ratio is marked by a significant expansion of bank assets and restoration of dividend payouts starting from the end of 2021. Lending to the euro area non-financial private sector grows at over 5% annually on average in 2021-23, reflecting sound banking sector conditions and growing credit demand.

In the adverse scenario, the overall capital ratio decreases from 15.5% to 10.3% by the end of 2023, and lending to the non-financial private sector contracts. CET1 capital decreases as high credit and market losses occur, reflected also in declining ROA. Lending to the non-financial private sector turns negative and falls by 1% on average annually, with the most pronounced contraction showing in lending to the non-financial corporate sector (average annual growth rate of -3.1%) and household consumer credit (average annual growth rate of -1.6%).

Accordingly, compared with the EBA/SSM stress test, the macroprudential stress test estimates a lower CET1 ratio in 2023 in the baseline scenario and a slightly higher CET1 ratio in the adverse scenario. The system-wide CET1 ratio in the baseline scenario is 14.4%, i.e. 1.4 percentage points lower than in the constant balance sheet stress test. In the adverse scenario, it is 10.3%, i.e. 0.2 percentage points higher than in the supervisory assessment. Most of the difference between the stress tests in the baseline scenario stems from the application of the dynamic balance sheet perspective, i.e. allowing banks to optimally react to scenario conditions by expanding assets in search of profit margins. In the adverse scenario, the difference arises from the combination of the positive impact of the dynamic balance sheet perspective (which improves the system-wide CET1 ratio in 2022 by around 1 percentage point compared with the constant balance sheet perspective) and the offsetting impact of amplification mechanisms (-1.7 percentage points compared with the dynamic balance sheet perspective which excludes amplification mechanisms).

Compared with the results under the static balance sheet assumption, the macroprudential stress test results in a higher depletion in the system-wide CET1 capital. The reduction in the CET1 ratio compared with 2020 in the adverse scenario amounts to 32% in the macroprudential stress test and 27.1% in the

supervisory stress test. This reduction is even more pronounced in the absence of COVID-19 mitigation policies, increasing to 37%.

Individual bank reactions are heterogeneous, and the end point capital ratios and the amount of bank lending depend on bank characteristics. In general, profitability and capitalisation correlate positively with higher loan supply in the baseline scenario and especially in the adverse scenario. Banks with a lower quality of assets in 2020 are more likely to experience higher credit losses over the scenario horizon.

The banking sector-real economy feedback loop amplifies the severity of the adverse scenario. The contraction of loan supply in the adverse scenario reduces euro area GDP growth by a further 1.6 percentage points. This effect is partially offset by more intense use of COVID-19 mitigation policies, which reduces the negative amplification to 0.6 percentage points.

The outstanding COVID-19 mitigation policies have a pronounced positive lending effect, which is especially noticeable in the adverse scenario. Among such policies, public guarantees have the greatest impact, reflecting the elevated demand for guaranteed loans in adverse economic conditions along with a higher share of companies meeting eligibility criteria. The mitigation policies also positively affect ROA and capitalisation due to lower credit losses realised by banks.

Altogether, the results indicate that the euro area banking system remains resilient at the current juncture. Under the severe yet plausible scenario conditions, about a quarter of stress-tested significant euro area banks, which jointly make up 40% of banking system assets, fall below their combined buffer requirements. Less than 7% of banks, making up 5% of system assets, are found to fall below their minimum Pillar 1 and Pillar 2 thresholds.

The use of macroprudential capital buffers in the adverse scenario has little impact on overall CET1 ratios, but there is a clear positive lending impact on the non-financial private sector. Broad-based buffer use triggers positive second-round effects and reduces the impact of the negative banking sector-real economy feedback loop in stressed conditions. As such, building up capital buffers that can be released in adverse conditions is one way to reduce the impact of banking crises on the real economy.

This paper also shows that the bank-level results of a macroprudential stress test can systematically differ from those of a supervisory exercise. The dynamic balance sheet perspective and amplification mechanisms give rise to a different distribution of bank-level outcomes, with the final bank capital positions being less dependent on the starting CET1 ratio than constant balance sheet assessments. The distribution of bank-level CET1 ratios in the adverse scenario is generally shifted to the right, illustrating how deleveraging mutes the effect of lower capital availability on bank capital ratios, and has a fatter tail than that of the supervisory constant balance sheet stress test. This finding supports the argument that macroprudential stress test exercises are truly complementary to their supervisory counterparts, by uncovering risks and mechanisms absent in the latter.

The 2021 macroprudential stress test includes several new and relevant features compared with its predecessors. These model extensions relate to the dynamic balance sheet perspective, amplification mechanisms, the improved modelling of regulatory requirements (risk weights) and the detailed modelling of COVID-19 mitigation policies. An equally relevant addition is the inclusion of model parameter uncertainty. However, macroprudential stress testing should continue to evolve along with developments in the macroeconomic and policy environment. One such development is climate risk stress testing, which requires the existing modelling framework to be extended to much longer horizons. Another is the ability of the stress testing framework to capture new risks that have surfaced in the post-COVID-19 world, such as highly asymmetric sectoral risks in the real economy, high sovereign indebtedness and the dangers of "*taper* tantrum".

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Appendix A: Uncertainty at the bank level

This appendix illustrates the assessment of model uncertainty using as an example the estimates for bank-level CET1 ratios. Section 2.4 (Chart 1) and later Section 4 (Chart 4) document the model uncertainty surrounding the system-wide CET1 ratio in the baseline and adverse stress test scenarios. Assessing model uncertainty is equivalent to describing the distributions of model outcomes and is all the more relevant if the distributions are flat (high variance of results) or strongly asymmetric (significantly higher probability of favourable versus non-favourable outcomes, or vice versa). In any of the cases, relying on mean estimates inhibits the exactness of conclusions or the optimality of decisions. For instance, if a mean estimate of the system-wide CET1 ratio is soundly above supervisory targets, but the mass of probability below these targets is 40%, the assessment of system-wide risks will be different from using the same mean estimate, with only 10% of the mass of probability below the targets.

This appendix focuses on two properties of distributions: asymmetry (skewness) and the flatness of tails, i.e. the relative probability of extreme events (kurtosis). Chart A.1 plots the skewness and kurtosis of the distributions of individual CET1 ratios at the end of 2023. The skewness of distribution is measured by the Pearson correlation coefficient. It is zero when the distribution is symmetric (vertical orange dashed line). Positive values of skewness in Chart A.1 correspond with situations in which the mean of a distribution is higher than its median, resulting in a positive skew or the right tail of the distribution being longer than the left. Positive skewness translates to a higher probability that the realisation of CET1 ratios is below their means. Accordingly, the negative values of skewness in Chart A.1 mean there is a higher probability that the realisation of CET1 ratios is above their means.

The kurtosis of the distributions of CET1 ratios is considered in relation to their normal distribution. For a normal distribution, the kurtosis is equal to three (horizontal grey dashed line in Chart A.1). A kurtosis higher than three indicates that the distribution has a fatter tail then a normal distribution, implying a relatively higher probability of very positive or very negative realisations of CET1 ratios. Analogously, a kurtosis lower than three indicates that a distribution has a thinner tail, implying a relatively low probability of extreme realisations.

Chart A.1

Banks' CET1 ratios distributions in 2023

CET1 ratio distributions have fat tails in both scenarios, and are negatively skewed in the adverse scenario

(y-axis: Kurtosis; x-axis: Skewness)

Notes: The orange and grey lines represent the skewness (= 0) and kurtosis (= 3) of the normal distribution. Banks in the lowest quartile as measured by balance sheet size are classified as "small banks", banks within the interquartile range are classified as "medium banks", and banks in the highest quartile are classified as "large banks".

The distributions of CET1 ratios are more heterogeneous and deviate more significantly from the normal distribution in the adverse compared with the baseline scenario. In the baseline scenario, a significant share of banks have CET1 ratio distributions that are close to normal, as can be seen from the concentration of individual bank results at the intersection of the horizontal and vertical lines in Chart A.1 (left-hand panel). There is still a significant number of small and medium-sized banks with CET1 ratios that have either fat tails or a degree of skewness. In the adverse scenario, most of the CET1 ratios are left from the intersection of the two lines pinning down the moments of the normal distribution.

The CET1 results for the adverse scenario are predominantly negatively skewed and have fatter tails than the normal distribution. The left tails of the distributions are therefore more stretched compared with the right tails, and the mean is below the median CET1 ratio, implying a higher mass of probability of more positive CET1 outcomes. This notwithstanding, the tails of the distributions are also relatively flat, indicating that the probability of realisation is likely to be very different from the mean estimate. Interestingly, these patterns can also be clearly seen for large banks (which contrasts with their generally symmetrical distributions in the baseline scenario), while they are least pronounced (on average) for small banks.

Lower skewness and higher kurtosis of CET1 results in the adverse scenario reflect the more pronounced role of model non-linearities in severe economic conditions. The original parameter estimates are drawn for multivariate normal distributions. However, the adverse scenario is more likely to trigger non-linearities ingrained in equations representing banks' adjustments, such as the non-linear reaction to the distance from target capital ratios in lending equations, non-linearities in the modelling of banks' environment (e.g. the two amplification mechanisms), or

non-linearities in the activation of regulatory limits (e.g. MDA restrictions, AT1 triggers).

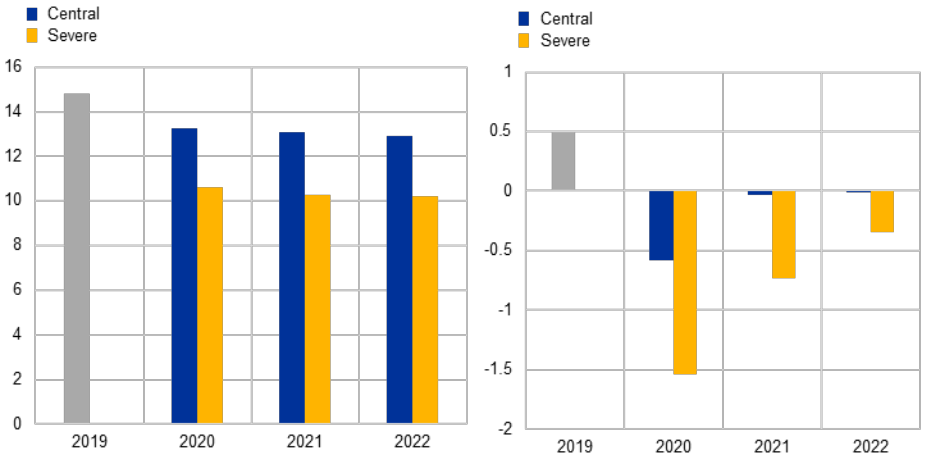
Appendix B: Overview of macroprudential stress test 2020

In 2020, the vulnerability analysis performed by ECB Banking Supervision[44] was shadowed by the 2020 macroprudential stress test. The results of the latter exercise serve as a convenient reference point to assess the results in the main body of this report. The vulnerability analysis and the 2020 macroprudential stress test considered two COVID-19 scenarios: central and severe.[45] The COVID-19 central scenario was anchored to the ECB's staff projections from June. It assumed a drop in GDP of 8.7% in 2020 followed by growth of 5.2% and 3.3% in 2021 and 2022, respectively. The severe scenario, which represented a more adverse development of the crisis, foresaw a real GDP decline of 12.6% in 2020 followed by GDP growth of 3.3% and 3.8% in 2021 and 2022, respectively.

Chart B.1

CET1 ratio (left-hand panel) and ROA (right-hand panel)

(y-axis: (left-hand panel) CET1 ratio in percentage, (right-hand panel) ROA in percentage)



Notes: The left-hand panel shows the development of the CET1 ratio, while the right-hand panel shows the development of ROA.

At the end of 2022, the CET1 ratio in the macroprudential stress test was estimated to be 12.9% in the central scenario and 10.2% in the severe scenario (Chart B.1, left-hand panel). The main driver of the decline in the CET1 ratio was bank losses, which caused CET1 capital depletion of around 10% in the central scenario, whereas in the severe scenario the CET1 capital in 2022 was reduced by more than 35% relative to its 2019 value.

Profitability, measured by ROA, decreased in 2020 to -0.6% in the central scenario and -1.6% in the severe scenario. After 2021, it fluctuates close to zero

44 ECB (2020).

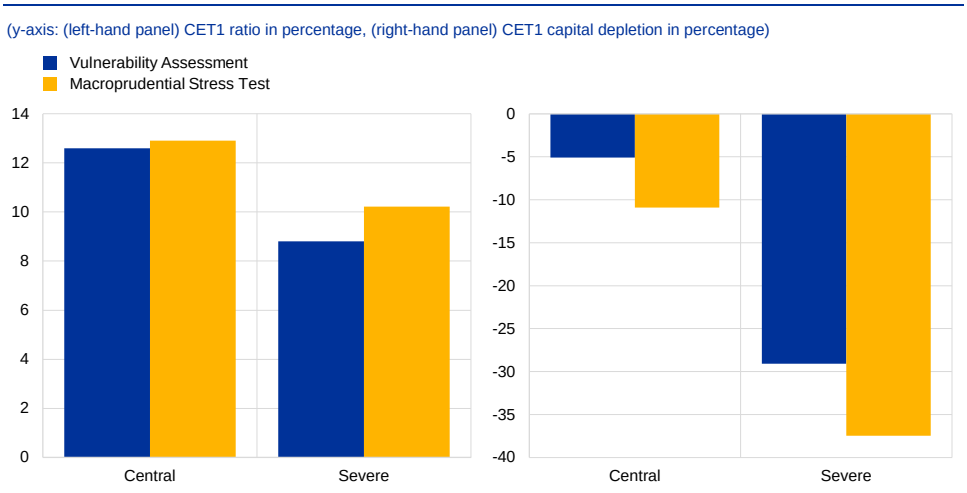
45 The vulnerability analysis involved three scenarios: (i) the baseline scenario, which ignored COVID-19 developments and relied on the ECB projections from December 2019; (ii) the central scenario; and (iii) the severe scenario. The 2020 macroprudential stress test excluded the first of these.

in the central scenario but remains negative until 2022 in the severe scenario (Chart B.1, right-hand panel).

The results of the 2020 macroprudential stress test are consistent with those of the vulnerability analysis conducted by ECB Banking Supervision (ECB, 2020). The ECB vulnerability analysis found that the CET1 capital ratio of banks would decline to 12.6% in the central scenario and 8.8% in the severe scenario (Chart B.2, left-hand panel), despite lower CET1 depletion (Chart B.2, right-hand panel). The difference between the results of the two exercises can partly be explained by the dynamic nature of the macroprudential stress test (see Section 2.1) and by the more comprehensive coverage of fiscal and supervisory relief measures taken in response to the coronavirus crisis.

Chart B.2

CET1 ratio at the end of 2022 (left-hand panel) and CET1 capital depletion relative to 2019 in % (right-hand panel)

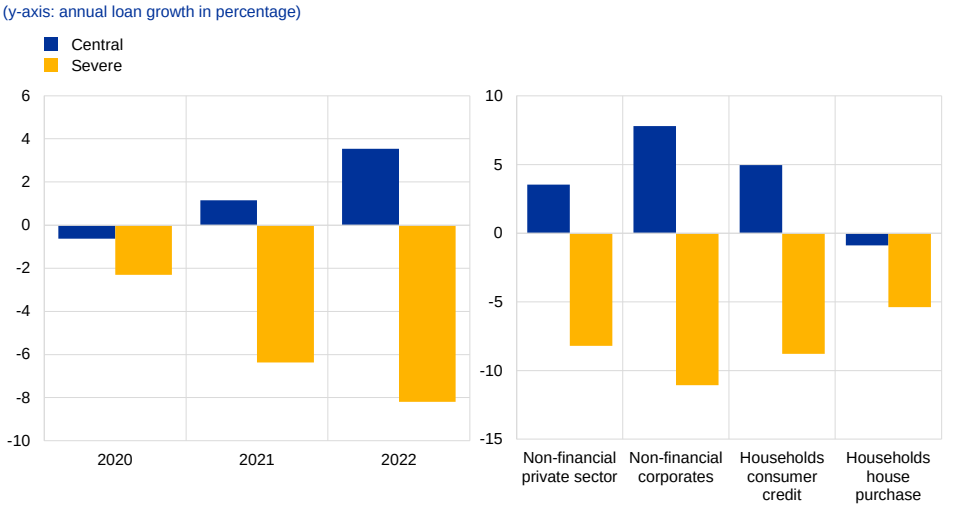


Notes: The left-hand panel shows the development of the CET 1 ratio, while the right-hand panel shows the CET 1 capital depletion relative to 2019 in % under the vulnerability assessment and macroprudential stress test in 2020.

Lending evolution was expected to be negative across all sectors in the severe scenario of the 2020 macroprudential stress test. Loans to the non-financial private sector were projected to increase by 4% in the central scenario and decrease by 8% in the severe scenario (Chart B.3, left-hand panel). The strongest positive dynamic in the central scenario, and negative in the severe scenario, was observed for non-financial corporates (Chart B.3, left-hand panel). In both scenarios, the contraction in lending would be much more severe in the absence of supervisory and national mitigating policies. The estimates showed that the supervisory and national policies had a positive cumulative impact of around 5 percentage points in the central scenario and 4 percentage points in the severe scenario on the cumulative three-year growth of loans to the non-financial private sector.

Chart B.3

Loan growth to total non-financial private sector (left-hand panel) and across sectors (right-hand panel)

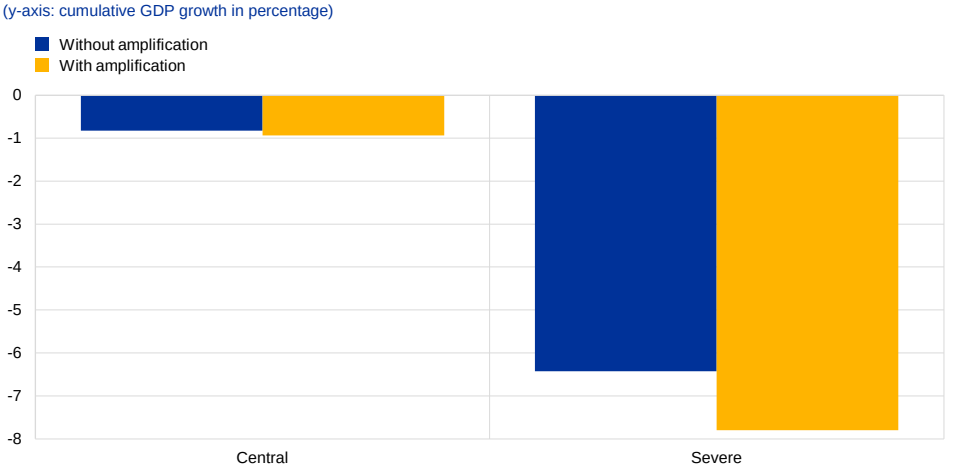


Notes: The left-hand panel shows the development in loan growth to the non-financial private sector, while the right-hand panel shows the cumulative loan growth in percentage points by subsector.

The banking sector-real economy feedback loop amplified the adversity of both COVID-19 scenarios (Chart B.4), but also channelled the positive impact of mitigating policies. In the central scenario, the negative amplification mechanism amounting to -0.7% of GDP was close to fully compensated by the positive impact of mitigating policies of 0.6% of GDP. In the severe scenario, the amplification mechanism was far stronger at -2.6%, and although the impact of policies was also higher (1.2%), the net effect was still negative (-1.4%).

Chart B.4

GDP and the role of amplification mechanisms



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For specific terminology please refer to the ECB glossary (available in English only).

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