Macro-financial scenario for the 2020 EU-wide banking sector stress test

This document presents the baseline and adverse macro-financial scenarios that banks are required to use in the 2020 EU-wide stress test exercise coordinated by the European Banking Authority (EBA). In accordance with its mandate, the EBA, in cooperation with the European Systemic Risk Board (ESRB), initiates and coordinates EU-wide stress tests. The aim of such tests is to assess the resilience of financial institutions to adverse financial and economic developments, as well as to contribute to the overall assessment of systemic risk in the EU financial system.

The adverse scenario outlines the evolution of key economic and financial variables in a hypothetical adverse situation capturing the materialisation of relevant risks to which the EU banking system is exposed.The scenario should not be seen as a forecast of the most likely negative shocks to the financial system. A stress test is a scenario-based analysis measuring how the banking sector would fare under hypothetical adverse economic developments.

Scenario variables include the evolution of real GDP, inflation, unemployment rates, real estate prices, stock prices, exchange rates and interest rates. The scenario covers the three years from 2020 to 2022 in line with the EBA methodology. The baseline for EU countries is based on the December 2019 projections from the national central banks.[1] The adverse macro-financial scenario was designed by the ESRB's Task Force on Stress Testing, in collaboration with the ECB.[2]

The scenario was approved by the ESRB General Board on 21 January 2020 and transmitted to the EBA on 23 January 2020.

[1] For non EU-countries the baseline is based mainly on the projections from the October 2019 IMF World Economic Outlook and on the November 2019 OECD Economic Outlook.

[2] Further information on the methodology used to design the scenario can be found in Annex 3.

1 Main risks to the stability of the EU financial sector and calibration of the adverse scenario

The narrative of the adverse scenario for the EU-wide banking stress test reflects a subset of the main financial stability risks to which the EU banking sector is exposed, as identified by the ESRB General Board. In the third quarter of 2019, the ESRB General Board stated that "…markets are expecting that the interest rates remain low for a prolonged period of time. As a result, financial market repricing, the balance sheet vulnerabilities of European Union (EU) financial institutions and unsustainable indebtedness remain the main risks to financial stability in the EU".[3] In a press release following its subsequent meeting, in the fourth quarter of 2019, the General Board said that "the medium-term outlook for global economic growth has remained weak amid elevated political/geopolitical and policy uncertainties, including international trade disputes and decreasing international cooperation" and that "slowing growth momentum and rising risk premia could further test debt sustainability in the public and private sectors across the EU".[4]

The narrative also reflects recent risk assessments by the EBA and other European authorities, including the ECB (see Annex 2).[5]

The 2020 adverse scenario is more severe than those used in previous EU-wide stress tests, reflecting the fact that the EU is assessed to be at an advanced stage of the financial cycle and more extreme tail events have been considered. In terms of calibration, the overall severity of the scenario has increased with respect to previous stress test exercises, reflecting a stage of the financial cycle where risks have built up (which usually leads to stronger downturns) and a higher probability of risk materialisation envisaged in the current risk assessment. This is in line with the increased severity of the scenario of other major institutions globally (see Section 3).The increased severity is also a reflection of a methodological change aimed at ensuring that the scenario is sufficiently severe for all jurisdictions. The design of the scenario for the EBA 2020 EU-wide stress test takes into consideration several of the proposals made in a recent report by the European Court of Auditors on the EU-wide stress test.[6] In particular, the 2020 stress test scenario (i) is based on a more explicit link between the scenario design and the systemic risk assessments

[3] See **Press release of the ESRB General Board meeting of 26 September 2019**.

[4] See **Press release of the ESRB General Board meeting of 19 December 2019**.

[5] The narrative also takes into account the latest risk assessments of the EBA (see "**Risk assessment of the European Banking System**", European Banking Authority, November 2019) and the Joint Committee of European Supervisory Authorities (see "**Joint Committee Report on Risks and Vulnerabilties in the EU Financial System**", Joint Committee of the European Supervisory Authorities, 26 August 2019). The systemic risk assessment of the ECB was also taken into account, as reflected in its Financial Stability Review (see "**Financial Stability Review**", ECB, November 2019) as well as in the ECB Banking Supervision risk assessment (see "**ECB Banking Supervision: Risk assessment for 2020**", ECB, 7 October 2019).

[6] See "**EU-wide stress test for banks: unparalleled amount of information on banks provided but greater coordination and focus on risks needed**", *Special Report*, No 10, European Court of Auditors, 2019

of the ESRB, the ECB and the EBA (see Annex 2); (ii) consists of more severe shocks by design compared to previous exercises, (iii) presents a lower level of dispersion across countries and (iv) presents a narrative which is more focused on domestic risks, consistent with the current risk assessment (see Section 2). Because of these technical overlays, the 2018 and the 2020 scenario are not directly comparable. In particular, as a result of changes (ii) and (iii), in general, those countries that endured smaller shocks in the 2018 scenario have comparatively larger shocks in the 2020 scenario. Furthermore, differences in the narrative of the two scenarios also complicate comparisons.

2 A "lower for longer" adverse scenario

In the scenario, confidence shocks drive expectations of nominal growth significantly below what is currently forecast which leads to a self-fulfilling economic recession in the EU and, commensurately, an ultralow interest rate environment. Pessimism regarding future growth coupled with assumptions of limited room for policy manoeuvre[7] and uncertainty regarding domestic economic policies could drive the EU economy into a recession.

Trade tensions and a slowdown of economic activity in emerging markets may further amplify the economic recession in the EU. An escalation of trade tensions at the global level and uncertainty regarding future global trade policies[8] would exert a large negative effect on global demand at the start of the scenario, further contributing to the decline in domestic economic activity in the EU.

EU real GDP would decline by 4.3%, cumulatively, by 2022 in a long-lasting recession (see Chart 1, left-hand panel)**.** The peak-to-trough decline in real GDP is somewhat less steep than what was observed in the 2008-9 global financial crisis, but the decline is more protracted, resulting in a maximum real GDP decline comparable to that observed in the global financial crisis from 2007 onwards. In the rest of the world, real GDP falls cumulatively by 4.8% in the United States and by 5.1% in Latin America. In Emerging Asia, growth slows from 5.5% in 2019 to an annual average of 2.6% over the scenario horizon (see Chart 1, right-hand panel). The resulting significant decline in global demand would raise deflationary pressures leading to a decline in commodity prices, outweighing potential upward short-term fluctuations in commodity prices due to geopolitical tensions.

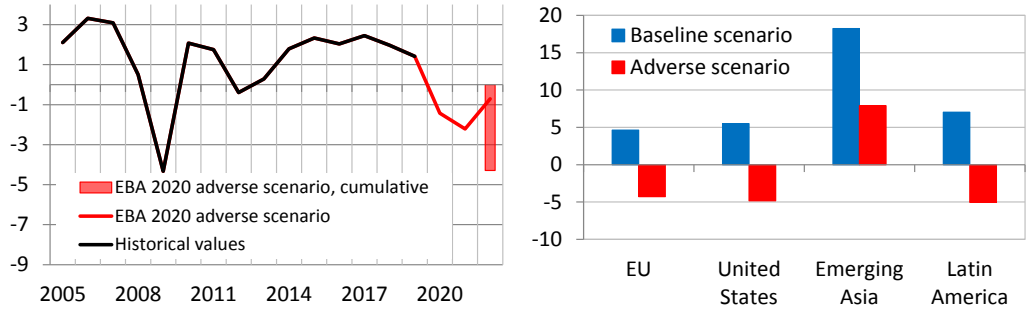
[7] The convention used in the calibration of the scenario was one of "no policy change". This means that short term interest rates follow the expectations implied by the baseline scenario also under the adverse scenario. As a consequence, the economic recession is more pronounced than would be the case if monetary or fiscal policy were relaxed.

[8] Elements of the baseline scenario already reflect the average of a range of possible outcomes from the United Kingdom's trading relationship with the European Union. The adverse scenario encompasses a wide range of macroeconomic risks potentially stemming from Brexit.

Chart 1

Real GDP growth path in the EU (left-hand panel); three-year cumulative real GDP growth for the EU, United States, Emerging Asia and Latin America (right-hand panel)

(percentages)

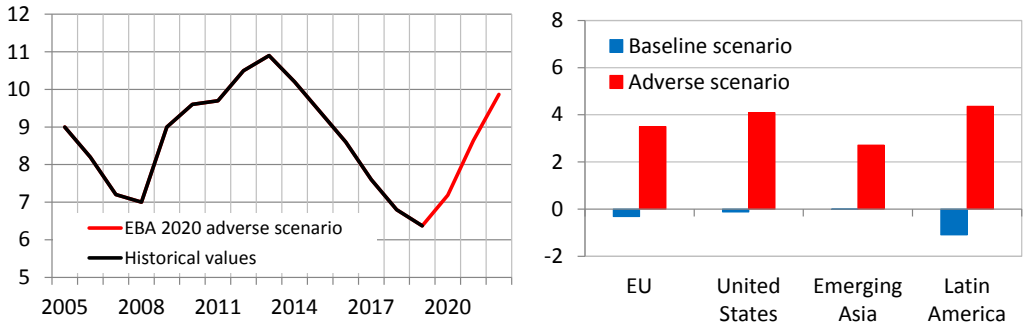


Sources: ECB, October 2019 IMF World Economic Outlook and ECB calculations

The economic recession would also result in a substantial rise of 3.5 percentage points in the EU unemployment rate by 2022. The increase of the EU aggregate unemployment rate is broadly comparable to the increase observed in the global financial crisis (see Chart 2, left-hand panel). In the United States the unemployment rate would increase by 4.1 percentage points, in Latin America by 4.4 percentage points and in Emerging Asia by 2.7 percentage points (see Chart 2, right-hand panel).

Chart 2

Unemployment rate path in the EU (left-hand panel); three-year cumulative increase in the unemployment rate in the EU, the United States, Emerging Asia and Latin America (right-hand panel)



(left-hand panel: percentages; right-hand panel: percentage points) Sources: ECB, October 2019 IMF World Economic Outlook and ECB calculations

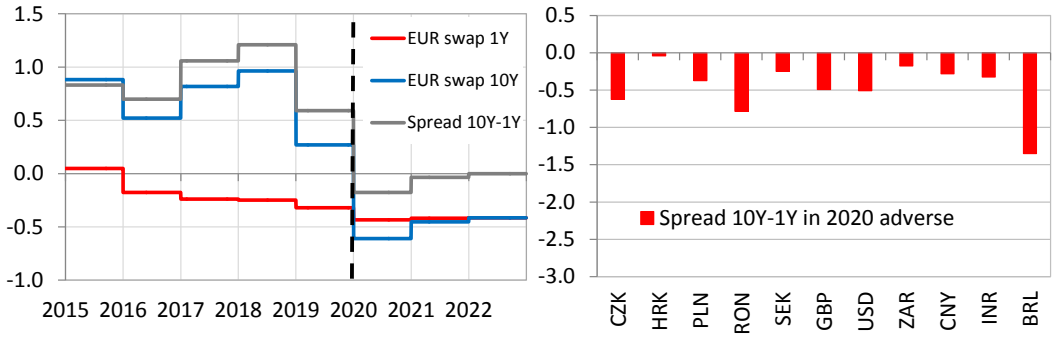
The worsening of economic prospects would be reflected in declining long-term risk free rates globally from an already historically low level, with nominal short and long-term risk-free rates below zero in the EU for the entire scenario horizon.[9] In the euro area, the yield curve would invert in 2020, with one-year euro swap rates remaining at -0.4%, while ten-year euro swap rates would drop to -0.6% (see Chart 3, left-hand panel). In 2021 and 2022, the euro area yield curve would flatten with both short- and long-term rates remaining at -0.4%. Similarly, in the rest of the world the prolonged recession in an environment of low interest rates would lead to either an inversion or a flattening of the curve (see Chart 3, right-hand panel).

The prolonged economic crisis would heighten concerns about public and private debt sustainability. Despite the low level of risk-free rates, credit risk premia on corporate and sovereign debt would significantly increase. In EU countries with high debt sustainability concerns, sovereign credit spreads would increase by 120 basis points in 2022, compared with the starting point (see Chart 4, left-hand panel). In countries where debt sustainability concerns are low there would be a ”flight-to-safety” effect which would reduce rates by 60 basis points in 2022, compared with the starting point. In a similar vein, corporate credit spreads would increase by 130 to 320 basis points in 2022 compared with the starting point across the credit risk spectrum (see Chart 4, right-hand panel). The increase in non-financial corporate financing costs would be reflected in a rise in the user cost of capital, which in turn would have a negative impact on investments.

Chart 3

One-year, ten-year euro swap rates (left-hand panel); spread between ten-year and one-year swap rates of other currencies in 2020 (right-hand panel)[10]

(percentages)



Sources: ECB and ECB calculations

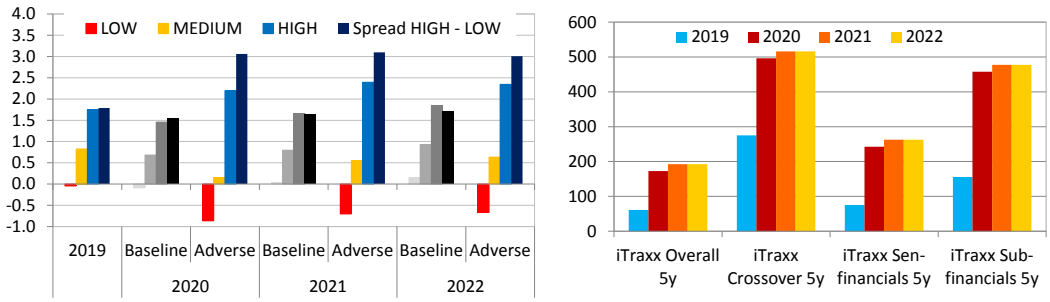
[9] The convention used in the calibration of the scenario was one of “no policy change”. This means that short term interest rates follow the expectations implied by the baseline scenario also under the adverse scenario. As a consequence, the economic recession is more pronounced than would be the case if monetary or fiscal policy were relaxed.

[10] For some countries the baseline projections already entail a declining trend for long-term interest rates, which implies an inversion of the interest rate curve already under the baseline (e.g. for the Czech Republic). The inversion is worsened under the adverse scenario.

Chart 4

10-year government bond yields for "low", "medium" and "high" sovereign risk EU countries, spread between "high" and "low" sovereign risk countries (left-hand panel), iTraxx indices (right-hand panel)

(left-hand panel: percentages; right-hand panel: basis points)



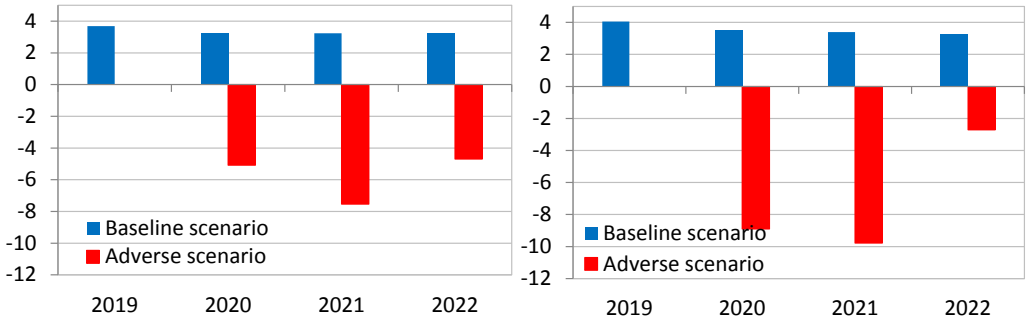
Sources: ECB and ECB calculations.
Note: EU countries were divided into three buckets according to the level of their sovereign risk; see Annex 3 for a description of how the classification was performed.

The elevated asset price valuations in 2019, coupled with a slowdown of the EU and global economy foreseen in the adverse scenario, would lead to a significant repricing of equity and real estate. Despite the low level of interest rates, the severity of the EU economic crisis and global slowdown would result in a sharp decline of asset prices. In 2020, equity prices would fall by 25% in advanced economies and by 40% in emerging economies. While they would recover somewhat during 2021 and 2022, they would remain below the starting point level until the end of 2022. Over the scenario horizon, residential real estate prices would decline by 16%, while commercial real estate prices would decline by 20% (see Chart 5). The cross-country distribution of the adverse real estate price developments reflects the assessment of the current relative level of vulnerabilities in the residential and commercial real estate markets (see Annex 3).

Chart 5

Residential real estate price growth in the EU (left-hand panel); Commercial real estate price growth in the EU (right-hand panel)

(percentages)



Sources: ECB and ECB calculations

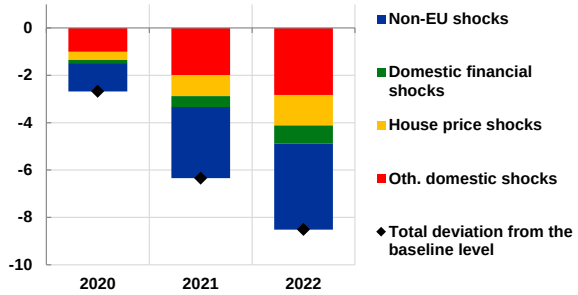
3 Scenario analysis

Domestic vulnerabilities are at the heart of the scenario narrative, as reflected in the decomposition of the main drivers of the decline in real GDP relative to the baseline. As shown in Chart 6, the bulk of the impact on GDP is driven by adverse domestic factors which reduce the level of EU real GDP by 4.9% relative to the baseline by 2022. Consumption and investment shocks, denoted by "Other domestic shocks" in Chart 6, account for about 60% of this decline. The combined impact of interest rate, residential property price and stock price shocks accounts for the remaining 40% of the GDP decline triggered by domestic factors, reflecting a lower aggregate repricing of assets in a low interest rate environment. Non-EU shocks contribute a further 3.6 percentage points to the total 2022 deviation of EU GDP from the baseline, mainly reflecting the assumed increase in global trade tensions.

Chart 6

Decomposition of the deviation of EU GDP level from the baseline by shock type

(percentage points except "Total deviation from the baseline level", which is in percent)



Sources: ECB and ECB calculations.

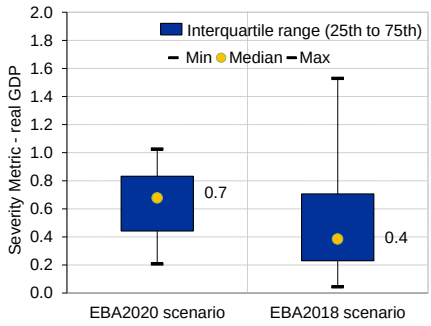
The severity of the scenario has almost doubled with respect to previous EBA stress test exercises, while the cross-country dispersion has declined (see Chart 7). To compare the relative severity of the scenario and therefore evaluate the heterogeneity of the shocks, a severity metric was adopted, based on the maximum decline in real GDP from the starting point.[11] This metric compares the maximum real GDP decline from the starting point in the adverse scenario with the largest real GDP decline since 1995 over a maximum horizon of three-years (see Annex 3 for further explanation). The real GDP declines at the country level were calibrated using this severity metric as main reference.

[11] Note that in the 2018 EBA scenario the severity was analysed mainly in terms of deviation from the baseline.

Chart 7

Severity and heterogeneity of the adverse scenario across EU countries for real GDP using a severity metric

(severity metric)



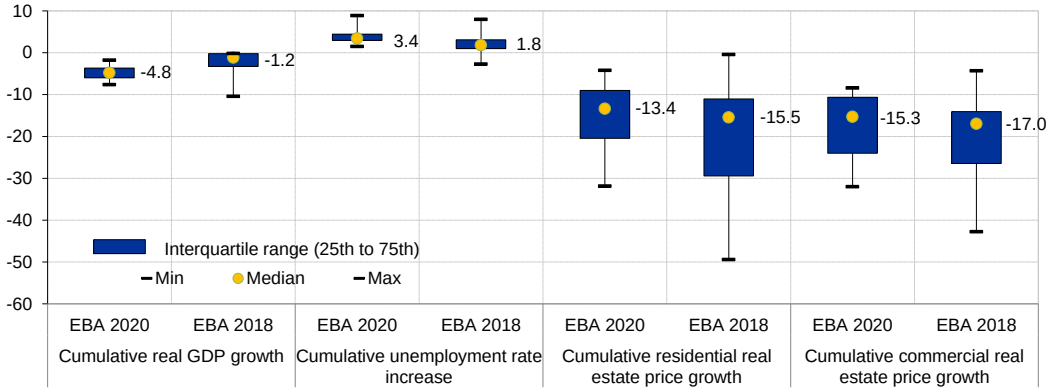
Note: The severity metric is defined as the maximum GDP decline from the starting point in the adverse scenario in relation to the largest real GDP decline since 1995 over a maximum horizon of three years. A value of 1 implies that the adverse scenario is as severe as the largest downturn observed in the recent past. Poland has been deemed an outlier in the evaluation of the heterogeneity of the scenario as it did not experience a crisis over the sample period.

The cross-country heterogeneity across all variables considered declined in terms of cumulative growth. Chart 8 illustrates the difference between the minimum and maximum of the distribution of cumulative changes and the interquartile ranges, comparing the scenarios of the 2018 and 2020 EBA stress tests. Furthermore, in terms of severity, the median impact on real GDP and the unemployment rate is more severe in the 2020 stress test scenario than in the 2018 stress test. In contrast, real estate prices decline by somewhat less in the 2020 stress test scenario, which is in line with the very low interest rates contained in the "lower for longer" scenario narrative.

Chart 8

2020 scenario vs 2018 scenario distribution of cumulative real GDP growth, unemployment rate increase and residential real estate price growth

(percentages for all variables except for the unemployment rate which is in percentage points)



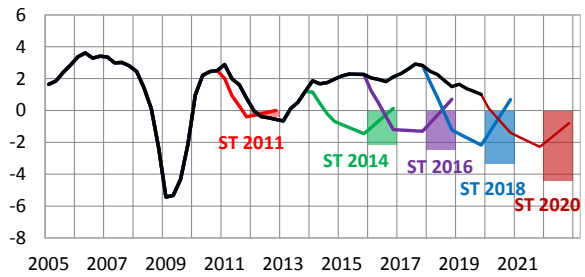
Sources: ECB and ECB calculations.

In terms of real GDP growth, the 2020 scenario is more severe with respect to all previous EU-wide stress tests. Chart 9 compares the scenarios of different EBA stress test exercises in terms of the real GDP growth path and the maximum decline from the starting point. Reflecting the "lower for longer" narrative, the decline in real GDP persists in the third year of the scenario, which implies that the maximum decline from the starting point is greater than in previous EBA stress test exercises.

Chart 9

2020 scenario versus scenario for 2018, 2016, 2014 and 2011 – real GDP

(percentages)



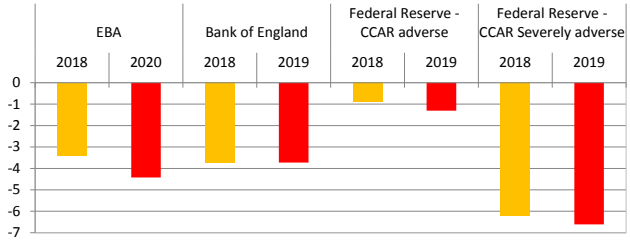
Sources: ECB and ECB calculations.
Note: The bars represent the maximum decline from the starting point. The coloured lines show the adverse growth path.

The scenario is also more severe than the 2019 scenarios of other institutions. In terms of the maximum decline in real GDP from the starting point, the scenario is more severe than the Bank of England's 2019 Annual Cyclical Scenario (ACS) and substantially more severe than the "adverse scenario" of the US Federal Reserve's 2019 Comprehensive Capital Analysis and Review (CCAR), whereas it is milder than the latter's "severely adverse scenario". In all three jurisdictions, the scenario for 2019/20 shows increased severity with respect to previous stress test exercises, reflecting a more advanced position in the financial cycle, which is usually associated with stronger growth reversals (see Chart 10).

Chart 10

EBA versus Bank of England and US Federal Reserve– domestic real GDP

(percentages)



Sources: ECB and ECB calculations, Bank of England and the US Federal Reserve.
Note: The chart shows the maximum decline in domestic real GDP from the starting point in annual terms (e.g. for the US Federal Reserve's CCAR it represents the decline of real-GDP). Quarterly data reported by the Bank of England and US Federal Reserve have been converted to an annual basis to allow a comparison with the EBA scenario, which is published only in annual values.

1 Annex: Detailed tables[12][13]

1.1 Real GDP

		Historical growth (%)	Baseline growth (%)			Adverse growth (%)			Cumulative growth from the starting point(%)	Minimum growth from the starting point growth (%)	Level deviation 2022 (%)
		2019	2020	2021	2022	2020	2021	2022			
Belgium	BE	1.3	1.2	1.1	1.0	-1.5	-1.8	-0.4	-3.7	-3.7	-6.9
Bulgaria	BG	3.4	3.5	3.6	3.5	-2.6	-3.3	-0.7	-6.5	-6.5	-15.7
Czech Republic	CZ	2.6	2.4	2.8	3.0	-2.5	-1.4	0.0	-3.8	-3.8	-11.2
Denmark	DK	1.8	1.5	1.5	1.6	-2.3	-2.8	0.1	-5.0	-5.0	-9.2
Germany	DE	0.5	0.6	1.4	1.4	-2.0	-2.5	-0.6	-5.0	-5.0	-8.1
Estonia	EE	3.4	2.3	2.0	2.2	-2.8	-3.5	-1.4	-7.5	-7.5	-13.3
Ireland	IE	5.1	4.4	4.0	3.7	0.0	-3.7	-2.1	-5.7	-5.7	-16.2
Greece	GR	1.9	2.4	2.5	2.5	-2.2	-3.5	-0.4	-6.0	-6.0	-12.5
Spain	ES	2.0	1.7	1.6	1.5	-0.8	-2.1	-1.0	-3.8	-3.8	-8.2
France	FR	1.3	1.1	1.3	1.3	-0.4	-2.0	-1.2	-3.6	-3.6	-7.0
Croatia	HR	3.0	2.6	2.5	2.5	-1.5	-4.1	-1.7	-7.2	-7.2	-14.0
Italy	IT	0.2	0.5	0.9	1.1	-1.2	-1.7	-0.9	-3.7	-3.7	-6.1
Cyprus	CY	3.0	2.9	2.8	2.7	-0.1	-1.6	-1.2	-2.9	-2.9	-10.6
Latvia	LV	2.3	2.6	2.8	3.0	-0.2	-2.6	-2.0	-4.7	-4.7	-12.3
Lithuania	LT	3.7	2.5	2.4	2.3	-1.2	-3.2	-1.7	-6.0	-6.0	-12.5
Luxembourg	LU	2.8	2.8	3.1	3.3	-0.8	-3.2	-1.0	-4.9	-4.9	-13.2
Hungary	HU	4.5	3.3	3.3	3.3	-1.5	-4.2	-0.9	-6.5	-6.5	-15.2
Malta	MT	5.1	4.1	3.6	3.5	-0.7	-2.3	-0.3	-3.3	-3.3	-13.3
Netherlands	NL	1.7	1.4	1.1	1.2	-0.9	-1.9	-0.7	-3.5	-3.5	-7.0
Austria	AT	1.6	1.1	1.5	1.6	-1.2	-1.9	-0.1	-3.2	-3.2	-7.2
Poland	PL	4.3	3.6	3.4	3.0	-0.2	-1.6	0.1	-1.7	-1.8	-10.9
Portugal	PT	2.0	1.7	1.6	1.6	-0.9	-2.8	-1.7	-5.3	-5.3	-9.8
Romania	RO	3.7	3.3	4.0	3.2	-1.0	-3.4	-1.5	-5.8	-5.8	-15.0
Slovenia	SI	2.6	2.5	2.7	2.7	-0.2	-2.2	-0.7	-3.1	-3.1	-10.3
Slovakia	SK	2.3	2.2	2.5	2.6	-0.7	-4.1	-3.0	-7.6	-7.6	-14.0
Finland	FI	1.3	0.9	1.1	1.3	-1.6	-2.5	0.0	-4.1	-4.1	-7.2
Sweden	SE	1.3	1.2	1.6	1.8	-1.6	-3.4	-1.6	-6.4	-6.4	-10.6
United Kingdom	UK	1.4	1.2	1.8	2.0	-2.6	-2.0	0.0	-4.5	-4.5	-9.1
Euro area	**EA**	**1.2**	**1.1**	**1.4**	**1.4**	**-1.2**	**-2.2**	**-0.9**	**-4.2**	**-4.2**	**-7.9**
European Union	**EU**	**1.4**	**1.3**	**1.6**	**1.6**	**-1.4**	**-2.2**	**-0.7**	**-4.3**	**-4.3**	**-8.5**
Norway	NO	1.9	2.4	1.6	1.6	-1.5	-0.9	-0.2	-2.6	-2.6	-7.9
United States	US	2.4	2.1	1.7	1.6	-2.1	-2.7	-0.1	-4.8	-4.8	-9.8
Japan	JP	0.9	0.5	0.5	0.5	-2.4	-3.0	-0.9	-6.2	-6.2	-7.5
Canada	CA	1.5	1.8	1.8	1.7	-1.9	-0.5	-0.2	-2.6	-2.6	-7.5
Switzerland	CH	0.8	1.3	1.6	1.6	-2.3	-1.1	0.4	-3.0	-3.4	-7.2
Australia & New Zealand	AU	1.8	2.3	2.6	2.7	-0.5	-0.3	-0.1	-0.9	-0.9	-4.4
Turkey	TR	0.2	3.0	3.0	3.0	-2.7	-2.0	-1.3	-5.9	-5.9	-13.9
Russia	RU	1.1	1.9	2.0	2.0	-2.9	-2.4	-0.7	-5.9	-5.9	-11.3
Emerging Asia	AS	5.5	5.6	5.8	5.8	1.8	2.7	3.2	7.9	1.8	-9.2
China	CN	6.1	5.8	5.9	5.7	1.7	3.0	3.3	8.2	1.7	-8.6
India	IN	6.1	7.0	7.4	7.4	2.0	3.1	3.2	8.5	2.0	-12.2
Hong Kong	HK	0.3	1.5	2.5	2.7	-2.7	-1.4	-0.5	-4.5	-4.5	-10.6
Latin America	LA	0.2	1.8	2.4	2.6	-2.5	-1.4	-1.2	-5.1	-5.1	-11.3
Brazil	BR	0.9	2.0	2.4	2.4	-3.6	-1.9	1.8	-3.7	-5.4	-10.0
Mexico	MX	0.4	1.3	1.9	2.1	-2.7	-1.5	0.6	-3.6	-4.2	-8.5
Chile	CL	2.5	3.0	3.2	3.3	-1.9	-1.7	-0.7	-4.2	-4.2	-12.8
Colombia	CO	3.4	3.6	3.7	3.7	-1.8	-0.6	-0.3	-2.6	-2.6	-12.7
Perú	PE	2.6	3.6	4.0	4.0	-2.0	-1.5	-0.2	-3.5	-3.5	-13.9
Rest of the World	WR	3.0	3.4	3.6	3.6	-1.9	-1.2	-0.6	-3.7	-3.7	-13.1

Note: December 2019 projections by the national central banks are used as baseline forecasts for EU countries. For non-EU countries the baseline projections are based on projections from the October 2019 IMF World Economic Outlook.

[12] In all tables the number reported for each year corresponds to the annual average. In all tables Hong Kong refers to Hong Kong SAR.

[13] The Cayman Islands, Marshall Islands and Guernsey should follow the scenario paths of the country "Rest of the world". The only exception is Table 1.10 “Exchange rates” for which Marshall Islands should follow USD currency and Guersney should follow GBP currency. The Cayman Islands exchange rate should follow the path of the “Rest of the world”.

1.2 Unemployment rate

		Historical value (%)	Baseline rate (%)			Adverse rate (%)			Cumulative growth from the starting point (p.p.)	Maximum growth from the starting point growth (p.p.)	Level deviation 2022 (p.p.)
		2019	2020	2021	2022	2020	2021	2022			
Belgium	BE	5.5	5.3	5.3	5.3	5.7	7.1	8.5	3.0	3.0	3.2
Bulgaria	BG	4.5	4.3	4.1	4.0	5.8	7.4	8.0	3.5	3.5	4.0
Czech Republic	CZ	2.1	2.1	2.1	2.2	3.3	4.8	5.9	3.8	3.8	3.7
Denmark	DK	4.7	4.2	3.9	3.6	5.6	8.6	10.6	5.9	5.9	7.0
Germany	DE	3.1	3.2	3.2	3.2	4.1	5.2	5.9	2.8	2.8	2.7
Estonia	EE	4.7	5.7	6.1	6.4	7.4	11.0	13.6	8.9	8.9	7.2
Ireland	IE	5.0	4.9	4.8	4.8	5.6	7.1	9.9	4.8	4.8	5.1
Greece	GR	17.5	15.9	14.4	13.1	17.1	17.8	19.9	2.4	2.4	6.8
Spain	ES	14.2	13.8	13.1	12.6	14.0	15.2	17.5	3.3	3.3	4.9
France	FR	8.5	8.2	8.1	8.0	8.6	9.6	10.8	2.3	2.3	2.8
Croatia	HR	6.9	6.3	6.0	5.9	7.6	10.0	12.6	5.7	5.7	6.7
Italy	IT	10.0	9.7	9.6	9.4	10.6	11.5	12.8	2.8	2.8	3.3
Cyprus	CY	7.0	6.0	5.5	5.2	6.4	7.3	9.5	2.5	2.5	4.3
Latvia	LV	6.4	6.3	6.2	6.1	7.1	8.9	10.7	4.2	4.2	4.6
Lithuania	LT	6.2	6.2	6.2	6.2	6.9	8.7	10.4	4.2	4.2	4.1
Luxembourg	LU	5.3	5.2	5.0	4.9	5.5	6.5	6.8	1.5	1.5	2.0
Hungary	HU	3.4	3.3	3.3	3.3	3.9	5.5	6.6	3.2	3.2	3.2
Malta	MT	3.4	3.5	3.7	3.8	4.0	5.2	6.4	3.0	3.0	2.6
Netherlands	NL	3.4	3.6	3.6	3.7	3.9	5.4	7.5	4.1	4.1	3.8
Austria	AT	4.6	4.7	4.8	4.7	5.7	6.9	7.6	3.0	3.0	2.9
Poland	PL	3.6	3.8	4.1	4.3	4.8	7.9	10.2	6.6	6.6	5.9
Portugal	PT	6.3	5.9	5.6	5.6	6.4	7.4	9.4	3.0	3.0	3.8
Romania	RO	3.9	4.0	4.2	4.4	4.7	5.9	6.7	2.8	2.8	2.3
Slovenia	SI	4.2	4.0	3.9	3.8	4.9	6.8	8.6	4.4	4.4	4.8
Slovakia	SK	5.9	6.2	6.3	6.4	6.4	8.1	10.4	4.6	4.6	4.0
Finland	FI	6.7	6.7	6.6	6.4	7.7	9.5	10.0	3.3	3.3	3.6
Sweden	SE	6.8	6.9	7.0	7.1	8.9	11.7	12.6	5.8	5.8	5.5
United Kingdom	UK	3.9	4.0	3.8	3.6	5.9	7.6	7.7	3.9	3.9	4.1
Euro area	**EA**	**7.6**	**7.4**	**7.2**	**7.1**	**8.0**	**9.2**	**10.5**	**3.0**	**3.0**	**3.5**
European Union	**EU**	**6.4**	**6.3**	**6.2**	**6.1**	**7.2**	**8.6**	**9.9**	**3.5**	**3.5**	**3.8**
Norway	NO	3.6	3.5	3.6	3.6	4.6	5.9	6.3	2.8	2.8	2.7
United States	US	3.7	3.5	3.6	3.6	5.2	6.8	7.8	4.1	4.1	4.2
Japan	JP	2.4	2.4	2.4	2.4	3.0	4.6	4.6	2.2	2.2	2.2
Canada	CA	5.8	6.0	6.1	6.3	6.4	6.8	8.7	2.9	2.9	2.4
Switzerland	CH	2.8	2.8	2.8	2.8	3.4	4.5	5.1	2.3	2.3	2.4
Australia & New Zealand	AU	5.0	5.0	4.9	4.9	5.1	5.5	6.3	1.3	1.3	1.4
Turkey	TR	13.8	13.7	12.9	12.3	16.9	17.8	18.5	4.7	4.7	6.2
Russia	RU	4.6	4.8	4.7	4.6	6.8	9.2	10.4	5.8	5.8	5.8
Emerging Asia	AS	3.6	3.6	3.6	3.6	4.9	5.6	6.3	2.7	2.7	2.7
China	CN	3.8	3.8	3.8	3.8	5.8	8.3	9.6	5.8	5.8	5.8
India	IN	2.6	2.6	2.6	2.6	4.7	6.8	8.5	5.9	5.9	5.9
Hong Kong	HK	2.9	3.0	3.0	2.9	5.1	6.0	6.5	3.5	3.5	3.6
Latin America	LA	8.3	7.8	7.4	7.2	11.4	12.5	12.7	4.4	4.4	5.4
Brazil	BR	11.8	10.8	10.0	9.7	14.2	15.4	16.6	4.8	4.8	6.9
Mexico	MX	3.4	3.4	3.4	3.3	5.9	7.1	7.2	3.8	3.8	3.9
Chile	CL	6.9	6.9	6.9	6.7	9.6	10.7	11.0	4.1	4.1	4.2
Colombia	CO	9.7	9.5	9.3	9.1	12.2	13.0	13.1	3.4	3.4	4.0
Perú	PE	6.7	6.7	6.6	6.4	9.5	10.5	10.7	4.0	4.0	4.3
Rest of the World	WR	5.3	5.3	5.3	5.3	7.4	8.3	8.9	3.6	3.6	3.6

Note: December 2019 projections by the national central banks are used as baseline forecasts for EU countries. For non-EU countries the baseline projections are based on projections from the October 2019 IMF World Economic Outlook.

1.3 HICP and other consumption price indices

		Historical growth (%)	Baseline growth (%)			Adverse growth (%)			Cumulative growth from the starting point(%)	Minimum growth from the starting point growth (%)	Level deviation 2022 (%)
		2019	2020	2021	2022	2020	2021	2022			
Belgium	BE	1.3	1.3	1.5	1.7	1.0	-0.3	-0.2	0.5	0.5	-3.9
Bulgaria	BG	2.6	2.4	2.4	2.5	1.8	1.0	1.9	4.7	1.8	-2.5
Czech Republic	CZ	2.8	2.4	2.0	1.8	1.5	-1.3	-0.9	-0.7	-0.7	-6.6
Denmark	DK	0.8	1.0	1.5	1.6	0.6	0.6	0.7	1.9	0.6	-2.1
Germany	DE	1.4	1.3	1.6	1.9	1.0	0.8	0.8	2.6	1.0	-2.1
Estonia	EE	2.3	2.1	1.9	1.8	1.4	0.3	1.1	2.9	1.4	-2.9
Ireland	IE	0.9	1.3	1.3	1.5	0.7	-1.0	-2.6	-2.9	-2.9	-6.7
Greece	GR	0.5	0.5	0.9	1.0	0.2	-0.5	-1.5	-1.8	-1.8	-4.2
Spain	ES	0.8	1.2	1.4	1.6	0.6	-0.1	0.5	1.0	0.5	-3.1
France	FR	1.3	1.1	1.3	1.4	0.6	-0.5	-0.8	-0.6	-0.6	-4.3
Croatia	HR	0.9	1.3	1.4	1.5	1.0	0.2	-1.0	0.3	0.3	-3.9
Italy	IT	0.6	0.7	1.1	1.3	0.4	0.1	-0.1	0.5	0.4	-2.5
Cyprus	CY	0.5	0.9	1.0	1.2	0.6	-0.2	-1.0	-0.6	-0.6	-3.5
Latvia	LV	2.8	2.4	2.0	1.9	1.6	0.2	0.7	2.6	1.6	-3.6
Lithuania	LT	2.3	2.3	2.2	2.2	1.6	0.9	1.9	4.5	1.6	-2.2
Luxembourg	LU	1.7	1.1	1.5	1.7	0.7	0.7	1.6	3.1	0.7	-1.2
Hungary	HU	3.3	3.4	3.3	3.3	2.8	1.9	1.9	6.7	2.8	-3.2
Malta	MT	1.5	1.6	1.8	1.9	1.3	0.8	0.2	2.3	1.3	-3.0
Netherlands	NL	2.7	1.5	1.8	2.0	1.4	1.2	0.4	3.0	1.4	-2.3
Austria	AT	1.5	1.4	1.5	1.6	1.1	0.4	0.6	2.1	1.1	-2.4
Poland	PL	2.3	2.9	2.7	2.4	1.9	-1.1	-1.6	-0.8	-0.8	-8.2
Portugal	PT	0.3	0.9	1.2	1.4	0.3	-1.1	-0.8	-1.6	-1.6	-5.0
Romania	RO	3.8	2.8	3.2	3.3	1.8	0.2	-0.5	1.5	1.5	-7.3
Slovenia	SI	1.7	2.0	2.0	2.0	1.4	0.5	0.6	2.4	1.4	-3.4
Slovakia	SK	2.7	2.5	2.1	1.7	2.1	1.0	0.8	3.9	2.1	-2.4
Finland	FI	1.2	1.2	1.4	1.6	-0.9	-2.6	0.3	-3.2	-3.5	-7.1
Sweden	SE	1.7	1.8	1.8	2.0	-1.1	-1.2	1.5	-0.8	-2.3	-6.1
United Kingdom	UK	1.8	1.4	1.9	2.2	0.6	-0.3	-0.5	-0.2	-0.2	-5.4
Euro area	**EA**	**1.2**	**1.1**	**1.4**	**1.6**	**0.7**	**0.1**	**0.1**	**0.9**	**0.7**	**-3.1**
European Union	**EU**	**1.4**	**1.3**	**1.6**	**1.8**	**0.8**	**0.0**	**0.0**	**0.8**	**0.8**	**-3.8**
Norway	NO	1.9	1.9	2.0	2.0	1.3	0.9	0.5	2.7	1.3	-3.1
United States	US	2.2	2.4	2.4	2.3	1.5	1.7	0.8	4.0	1.5	-3.0
Japan	JP	1.6	0.2	1.4	1.2	-0.3	-0.4	-1.9	-2.6	-2.6	-5.3
Canada	CA	2.2	1.9	2.1	2.2	1.9	1.4	0.6	4.1	1.9	-2.1
Switzerland	CH	0.3	0.9	0.9	0.9	0.2	-0.4	-1.0	-1.2	-1.2	-3.9
Australia & New Zealand	AU	1.9	1.9	2.1	2.4	1.6	1.4	1.3	4.4	1.6	-2.1
Turkey	TR	13.5	12.0	12.0	11.0	9.2	7.8	6.4	25.3	9.2	-10.0
Russia	RU	3.8	3.7	4.0	4.0	3.5	3.1	2.6	9.5	3.5	-2.4
Emerging Asia	AS	2.6	2.8	3.1	3.1	1.3	1.8	2.4	5.6	1.3	-3.4
China	CN	1.9	2.1	2.1	2.1	0.8	1.1	1.3	3.2	0.8	-2.9
India	IN	3.9	4.1	4.0	4.0	1.6	2.1	2.5	6.3	1.6	-5.7
Hong Kong	HK	3.0	2.6	2.6	2.5	2.4	2.0	1.3	5.8	2.4	-2.0
Latin America	LA	7.3	6.0	5.3	4.9	5.7	4.2	3.4	13.9	5.7	-2.8
Brazil	BR	3.7	3.7	3.7	3.7	2.6	2.0	1.7	6.4	2.6	-4.5
Mexico	MX	3.2	3.0	3.0	3.0	2.8	2.3	1.8	7.1	2.8	-2.0
Chile	CL	2.6	2.6	2.6	2.6	2.2	1.2	-0.5	2.9	2.2	-4.6
Colombia	CO	3.9	3.1	3.0	3.0	3.4	2.8	2.1	8.5	3.4	-0.8
Perú	PE	1.9	2.0	2.0	2.0	1.5	0.8	0.2	2.5	1.5	-3.4
Rest of the World	WR	3.5	3.4	3.5	3.4	3.2	2.9	2.2	8.5	3.2	-2.0

Note: December 2019 projections by the national central banks are used as baseline forecasts for EU countries. For non-EU countries the baseline projections are based on projections from the October 2019 IMF World Economic Outlook.

1.4 Residential real estate prices

		Historical growth (%)	Baseline growth (%)			Adverse growth (%)			Cumulative growth from the starting point(%)	Minimum growth from the starting point growth (%)	Level deviation 2022 (%)
		2019	2020	2021	2022	2020	2021	2022			
Belgium	BE	3.3	2.6	2.5	3.3	-8.2	-11.7	-7.8	-25.2	-25.2	-31.1
Bulgaria	BG	7.0	6.5	5.4	4.2	-0.9	-3.5	-2.1	-6.4	-6.4	-19.9
Czech Republic	CZ	6.8	4.6	3.8	3.8	-5.9	-9.4	-6.1	-19.9	-19.9	-28.9
Denmark	DK	2.4	3.5	3.0	2.4	-6.7	-10.1	-7.1	-22.1	-22.1	-28.7
Germany	DE	5.3	4.9	4.5	4.0	-4.0	-7.2	-4.7	-15.1	-15.1	-25.5
Estonia	EE	3.8	3.8	5.0	5.2	-4.7	-6.4	-3.6	-14.0	-14.0	-25.0
Ireland	IE	2.5	0.0	-1.0	-2.0	-3.8	-5.7	-4.6	-13.5	-13.5	-10.8
Greece	GR	7.4	4.8	2.6	2.2	-0.3	-3.5	-2.1	-5.8	-5.8	-14.3
Spain	ES	5.7	4.9	4.3	3.7	-3.0	-5.7	-3.6	-11.9	-11.9	-22.3
France	FR	3.1	3.2	3.2	3.2	-4.6	-6.7	-4.1	-14.6	-14.6	-22.2
Croatia	HR	9.5	7.4	6.2	5.7	-0.8	-4.3	-2.3	-7.3	-7.3	-23.1
Italy	IT	-0.2	0.3	1.1	1.8	-3.6	-3.8	-1.9	-9.0	-9.0	-11.8
Cyprus	CY	2.7	3.0	3.1	3.2	-1.2	-2.2	-0.8	-4.2	-4.2	-12.6
Latvia	LV	8.1	7.6	4.8	2.7	-0.7	-4.9	-3.7	-9.0	-9.0	-21.4
Lithuania	LT	6.7	4.4	4.3	4.0	-2.8	-4.7	-2.6	-9.8	-9.8	-20.4
Luxembourg	LU	8.3	5.6	4.8	4.9	-6.9	-11.7	-8.1	-24.5	-24.5	-35.0
Hungary	HU	8.0	6.0	3.3	3.0	-2.3	-7.0	-4.5	-13.3	-13.3	-23.1
Malta	MT	6.2	4.6	3.6	2.9	-2.3	-6.1	-4.0	-12.0	-12.0	-21.1
Netherlands	NL	6.6	2.6	1.9	2.5	-7.1	-10.4	-6.8	-22.4	-22.4	-27.6
Austria	AT	5.3	4.0	3.8	3.7	-7.4	-10.7	-7.3	-23.3	-23.3	-31.4
Poland	PL	8.1	4.5	1.0	0.4	-0.5	-4.4	-3.1	-7.9	-7.9	-13.0
Portugal	PT	9.9	4.5	3.5	3.4	-4.3	-7.7	-4.9	-16.0	-16.0	-24.9
Romania	RO	1.6	1.4	1.3	1.3	-3.8	-4.8	-3.0	-11.2	-11.2	-14.6
Slovenia	SI	6.6	6.3	4.5	3.4	-0.8	-4.1	-2.6	-7.4	-7.4	-19.4
Slovakia	SK	8.0	4.8	2.5	3.3	-3.4	-7.6	-4.4	-14.6	-14.6	-23.1
Finland	FI	1.2	1.9	2.3	2.4	-4.4	-5.7	-3.4	-12.9	-12.9	-18.5
Sweden	SE	1.6	2.1	2.3	2.4	-10.6	-14.7	-10.7	-31.9	-31.9	-36.3
United Kingdom	UK	1.3	2.6	4.4	5.1	-8.6	-11.1	-7.0	-24.4	-24.4	-32.9
Euro area	**EA**	**4.0**	**3.4**	**3.2**	**3.1**	**-4.3**	**-6.7**	**-4.1**	**-14.4**	**-14.4**	**-22.2**
European Union	**EU**	**3.7**	**3.3**	**3.2**	**3.3**	**-5.1**	**-7.5**	**-4.7**	**-16.4**	**-16.4**	**-24.0**
Norway	NO	3.0	3.0	3.2	3.3	-10	-12	-6	-25.2	-25.2	-31.8
United States	US	6.1	6.1	6.1	6.1	-6	-10	-4	-18.8	-18.8	-32.0
Japan	JP	2.2	2.2	2.2	2.2	-6	-10	-4	-18.8	-18.8	-24.0
Canada	CA	2.4	2.4	2.4	2.4	-6	-10	-4	-18.8	-18.8	-24.3
Switzerland	CH	0.4	0.4	0.4	0.4	-6	-10	-4	-18.8	-18.8	-19.9
Australia & New Zealand	AU	4.6	4.6	4.6	4.6	-6	-10	-4	-18.8	-18.8	-29.0
Turkey	TR	10.5	10.5	10.5	10.5	-6	-10	-4	-18.8	-18.8	-39.8
Russia	RU	-2.2	-2.2	-2.2	-2.2	-6	-10	-4	-18.8	-18.8	-13.3
Emerging Asia	AS	5.5	5.5	5.5	5.5	-6	-10	-4	-18.8	-18.8	-30.8
China	CN	3.2	3.2	3.2	3.2	-6	-10	-4	-18.8	-18.8	-26.1
India	IN	6.9	6.9	6.9	6.9	-6	-10	-4	-18.8	-18.8	-33.5
Hong Kong	HK	6.3	6.3	6.3	6.3	-6	-10	-4	-18.8	-18.8	-32.4
Latin America	LA	7.8	7.8	7.8	7.8	-6	-10	-4	-18.8	-18.8	-35.2
Brazil	BR	-0.9	-0.9	-0.9	-0.9	-6	-10	-4	-18.8	-18.8	-16.7
Mexico	MX	8.0	8.0	8.0	8.0	-6	-10	-4	-18.8	-18.8	-35.5
Chile	CL	4.6	4.6	4.6	4.6	-6	-10	-4	-18.8	-18.8	-29.0
Colombia	CO	8.4	8.4	8.4	8.4	-6	-10	-4	-18.8	-18.8	-36.2
Perú	PE	7.8	7.8	7.8	7.8	-6	-10	-4	-18.8	-18.8	-35.2
Rest of the World	WR	6.3	6.3	6.3	6.3	-6	-10	-4	-18.8	-18.8	-32.4

Note: December 2019 projections from the national central banks are used as baseline forecasts for EU countries. The baseline for Norway was provided by Norges Bank. For other non-EU countries the baseline projections are based on projections from the November 2019 OECD Economic Outlook.

1.5 Commercial real estate prices

		Baseline growth (%)			Adverse growth (%)			Cumulative growth from the starting point(%)	Minimum growth from the starting point growth (%)	Level deviation 2022 (%)
		2020	2021	2022	2020	2021	2022			
Belgium	BE	2.3	2.3	2.2	-13.8	-16.1	-4.8	-31.1	-31.1	-35.6
Bulgaria	BG	5.1	4.8	4.6	-3.8	-4.0	-1.0	-8.6	-8.6	-20.6
Czech Republic	CZ	3.9	3.8	3.6	-12.3	-14.1	-4.1	-27.7	-27.7	-35.3
Denmark	DK	2.7	2.7	2.6	-13.2	-15.2	-4.5	-29.8	-29.8	-35.1
Germany	DE	4.2	4.1	3.9	-9.2	-10.1	-2.8	-20.6	-20.6	-29.6
Estonia	EE	4.5	4.3	4.1	-4.9	-5.2	-1.4	-11.1	-11.1	-21.6
Ireland	IE	-0.9	-0.9	-0.9	-4.9	-5.1	-1.4	-11.0	-11.0	-8.4
Greece	GR	3.0	2.9	2.8	-4.7	-5.0	-1.3	-10.6	-10.6	-18.0
Spain	ES	3.9	3.8	3.6	-5.8	-6.1	-1.6	-13.0	-13.0	-22.2
France	FR	3.0	2.9	2.8	-8.8	-9.6	-2.7	-19.7	-19.7	-26.3
Croatia	HR	6.1	5.8	5.5	-4.4	-4.6	-1.2	-9.8	-9.8	-23.8
Italy	IT	1.0	0.9	0.9	-5.5	-5.8	-1.5	-12.3	-12.3	-14.8
Cyprus	CY	2.9	2.8	2.8	-3.7	-3.9	-1.0	-8.4	-8.4	-15.8
Latvia	LV	4.8	4.6	4.4	-4.3	-4.5	-1.2	-9.6	-9.6	-21.0
Lithuania	LT	4.0	3.9	3.7	-6.9	-7.4	-2.0	-15.4	-15.4	-24.6
Luxembourg	LU	4.9	4.7	4.4	-10.9	-12.2	-3.5	-24.5	-24.5	-34.1
Hungary	HU	2.5	2.5	2.4	-6.8	-7.3	-2.0	-15.3	-15.3	-22.9
Malta	MT	3.5	3.4	3.3	-3.7	-3.9	-1.0	-8.4	-8.4	-17.1
Netherlands	NL	2.2	2.2	2.1	-10.6	-11.9	-3.4	-23.9	-23.9	-28.6
Austria	AT	3.7	3.5	3.4	-10.9	-12.2	-3.5	-24.5	-24.5	-32.0
Poland	PL	1.8	1.7	1.7	-4.7	-5.0	-1.3	-10.6	-10.6	-15.1
Portugal	PT	3.8	3.7	3.5	-6.8	-7.3	-2.0	-15.3	-15.3	-24.0
Romania	RO	1.2	1.2	1.2	-6.7	-7.2	-1.9	-15.1	-15.1	-18.0
Slovenia	SI	4.5	4.3	4.1	-4.5	-4.7	-1.2	-10.1	-10.1	-20.9
Slovakia	SK	3.3	3.2	3.1	-8.9	-9.8	-2.7	-20.0	-20.0	-27.3
Finland	FI	2.1	2.0	2.0	-7.8	-8.5	-2.3	-17.6	-17.6	-22.5
Sweden	SE	2.1	2.0	2.0	-14.2	-16.6	-5.0	-32.0	-32.0	-36.0
United Kingdom	UK	3.8	3.6	3.5	-14.2	-16.6	-5.0	-32.0	-32.0	-38.9
Euro area	**EA**	**3.7**	**3.5**	**3.4**	**-7.6**	**-8.2**	**-2.2**	**-17.1**	**-17.1**	**-25.3**
European Union	**EU**	**3.5**	**3.4**	**3.3**	**-8.9**	**-9.8**	**-2.7**	**-20.0**	**-20.0**	**-27.7**
Norway	NO	0.5	0.0	0.0	-20.0	-15.0	-10.0	-38.8	-38.8	-39.1
United States	US	6.1	6.1	6.1	-9.0	-10.0	-3.0	-20.6	-20.6	-33.5
Japan	JP	2.2	2.2	2.2	-9.0	-10.0	-3.0	-20.6	-20.6	-25.7
Canada	CA	2.4	2.4	2.4	-9.0	-10.0	-3.0	-20.6	-20.6	-26.0
Switzerland	CH	0.4	0.4	0.4	-9.0	-10.0	-3.0	-20.6	-20.6	-21.6
Australia & New Zealand	AU	4.6	4.6	4.6	-9.0	-10.0	-3.0	-20.6	-20.6	-30.6
Turkey	TR	10.5	10.5	10.5	-9.0	-10.0	-3.0	-20.6	-20.6	-41.1
Russia	RU	-2.2	-2.2	-2.2	-9.0	-10.0	-3.0	-20.6	-20.6	-15.2
Emerging Asia	AS	5.5	5.5	5.5	-9.0	-10.0	-3.0	-20.6	-20.6	-32.3
China	CN	3.2	3.2	3.2	-9.0	-10.0	-3.0	-20.6	-20.6	-27.7
India	IN	6.9	6.9	6.9	-9.0	-10.0	-3.0	-20.6	-20.6	-35.0
Hong Kong	HK	6.3	6.3	6.3	-9.0	-10.0	-3.0	-20.6	-20.6	-35.0
Latin America	LA	7.8	7.8	7.8	-9.0	-10.0	-3.0	-20.6	-20.6	-36.6
Brazil	BR	-0.9	-0.9	-0.9	-9.0	-10.0	-3.0	-20.6	-20.6	-18.5
Mexico	MX	8.0	8.0	8.0	-9.0	-10.0	-3.0	-20.6	-20.6	-36.9
Chile	CL	4.6	4.6	4.6	-9.0	-10.0	-3.0	-20.6	-20.6	-30.6
Colombia	CO	8.4	8.4	8.4	-9.0	-10.0	-3.0	-20.6	-20.6	-37.6
Perú	PE	7.8	7.8	7.8	-9.0	-10.0	-3.0	-20.6	-20.6	-36.6
Rest of the World	WR	6.3	6.3	6.3	-9.0	-10.0	-3.0	-20.6	-20.6	-33.9

Note: Public data are not available for almost any country. For this reason, the starting points are not provided. The baseline for all countries has been projected by ECB staff. The baseline for Norway was provided by Norges Bank.

1.6 Long-term rates

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
Belgium	BE	0.20	0.10	0.25	0.40	-0.01	0.15	0.14
Bulgaria	BG	0.46	0.31	0.33	0.39	-0.54	-0.50	-0.50
Czech Republic	CZ	1.58	1.77	1.92	2.07	1.90	2.45	2.54
Denmark	DK	-0.15	-0.22	-0.13	-0.03	-1.17	-0.97	-0.93
Germany	DE	-0.21	-0.28	-0.19	-0.09	-1.02	-0.87	-0.83
Estonia	EE							
Ireland	IE	0.03	0.34	0.49	0.57	-0.78	-0.62	-0.58
Greece	GR	2.60	1.57	1.68	1.79	3.83	3.99	3.92
Spain	ES	0.70	0.58	0.76	0.94	1.17	1.32	1.26
France	FR	0.12	0.07	0.22	0.36	-0.68	-0.52	-0.48
Croatia	HR	1.27	0.79	1.02	1.06	1.45	1.48	1.39
Italy	IT	1.94	1.54	1.80	2.03	2.48	2.64	2.57
Cyprus	CY	1.15	0.67	0.78	0.89	1.57	1.72	1.66
Latvia	LV	0.39	0.15	0.26	0.37	0.11	0.27	0.25
Lithuania	LT	0.73	0.47	0.58	0.69	0.50	0.66	0.65
Luxembourg	LU	-0.11	-0.19	-0.08	0.02	-0.89	-0.74	-0.70
Hungary	HU	2.59	2.46	2.61	2.75	2.29	2.42	2.35
Malta	MT	0.67	0.44	0.55	0.66	1.14	1.29	1.23
Netherlands	NL	-0.06	-0.10	0.00	0.11	-0.88	-0.72	-0.68
Austria	AT	0.06	0.04	0.17	0.29	-0.75	-0.59	-0.55
Poland	PL	2.44	2.31	2.46	2.60	2.77	3.10	3.08
Portugal	PT	0.80	0.59	0.78	0.97	1.29	1.44	1.38
Romania	RO	4.62	4.49	4.63	4.78	4.50	5.19	5.27
Slovenia	SI	0.42	0.24	0.40	0.57	-0.37	-0.21	-0.18
Slovakia	SK	0.30	0.17	0.28	0.39	-0.49	-0.33	-0.29
Finland	FI	0.07	0.01	0.14	0.25	-0.74	-0.58	-0.54
Sweden	SE	0.08	0.01	0.16	0.30	-0.81	-0.59	-0.54
United Kingdom	UK	0.88	0.70	0.81	0.93	0.02	0.46	0.57
Euro area	**EA**	**0.42**	**0.29**	**0.43**	**0.58**	**0.02**	**0.18**	**0.18**
European Union	**EU**	**0.61**	**0.48**	**0.62**	**0.76**	**0.52**	**0.64**	**0.63**
Norway	NO	1.51	1.38	1.52	1.67	0.68	0.95	1.02
United States	US	2.16	2.31	2.59	2.71	1.96	2.42	2.53
Japan	JP	-0.11	-0.14	-0.08	-0.01	-0.39	-0.24	-0.21
Canada	CA	1.59	1.72	2.10	2.41	1.08	1.52	1.63
Switzerland	CH	-0.84	-0.84	-0.84	-0.84	-1.49	-1.42	-1.40
Australia	AU	1.52	1.40	1.54	2.03	0.85	0.88	0.89
New Zealand	NZ	1.64	1.59	1.96	2.46	1.34	1.52	1.56
Turkey	TR	15.99	13.91	12.72	11.76	13.84	13.31	12.67
Russia	RU	7.68	5.97	6.38	6.32	5.51	6.57	6.83
Emerging Asia	AS	3.60	3.60	3.60	3.60	3.30	3.75	3.87
China	CN	3.20	3.20	3.20	3.20	2.54	2.74	2.84
India	IN	6.95	6.95	6.95	6.95	6.39	6.68	6.75
Hong Kong	HK	1.58	1.58	1.58	1.58	0.65	1.51	1.72
Latin America	LA	6.31	6.31	6.31	6.31	6.42	6.87	6.98
Brazil	BR	7.97	7.97	7.97	7.97	7.24	7.99	8.37
Mexico	MX	7.65	7.65	7.65	7.65	6.44	7.44	7.94
Chile	CL	3.46	3.46	3.46	3.46	2.67	2.88	2.93
Colombia	CO	6.51	6.51	6.51	6.51	5.28	5.35	5.37
Perú	PE	5.09	5.09	5.09	5.09	5.18	5.38	5.48
Ukraine	UA	5.62	5.62	5.62	5.62	5.52	5.72	5.82
Angola	AO	7.00	7.00	7.00	7.00	6.90	7.10	7.20
Macao	MC	3.00	3.00	3.00	3.00	2.90	3.10	3.20
Mozambique	MZ	11.00	11.00	11.00	11.00	10.90	11.10	11.20
Sounth Africa	ZA	8.44	8.44	8.44	8.44	7.87	8.03	8.06
Rest of the World	WR	3.00	3.00	3.00	3.00	2.90	3.10	3.20

Note: Projections based on markets' expectations as of the fourth quarter of 2019 are used as baseline forecasts for EU countries. The baseline for other countries is based on projections from the October 2019 IMF World Economic Outlook. For countries for which no projections were available, the rates were assumed to remain at the same level as at the cut-off date.

1.7 Stock prices

	Deviation from the starting point (%)		
	2020	2021	2022
European Union	**-25**	**-20**	**-4**
Norway	-25	-20	-4
United States	-25	-20	-4
Japan	-25	-20	-4
Canada	-25	-20	-4
Switzerland	-25	-20	-4
Australia & New Zealand	-25	-20	-4
Rest of the World	-40	-32	-6

Note: Under the baseline, stock prices are assumed to remain unchanged.

1.8 iTraxx indices

	Historical level	Baseline level			Adverse level		
	2019	2020	2021	2022	2020	2021	2022
iTraxx Overall 5y	61	61	69	80	172	192	192
iTraxx Crossover 5y	275	275	283	294	496	516	516
iTraxx Sen-financials 5y	75	75	83	94	242	262	262
iTraxx Sub-financials 5y	156	156	164	175	458	478	478

1.9 Foreign demand and commodity prices

	Level deviation from starting point (%)		
	2020	2021	2022
Oil prices	-3.9	-10.0	-4.7
Non-oil commodity prices	-14.5	-12.8	-8.9
Metal prices	-19.5	-8.0	-7.6
EU foreign demand	-7.8	-15.1	-14.6
Euro area foreign demand	-8.1	-15.5	-15.0

Note: Under the baseline, commodity prices are assumed to remain constant as at the cut-off-date.

1.10 Exchange rates

	Historical rates	Baseline rates			Adverse rates		
	2019	2020	2021	2022	2020	2021	2022
EURCZK	25.82	25.82	25.82	25.82	27.26	27.63	27.63
EURDKK	7.46	7.46	7.46	7.46	7.46	7.46	7.46
EURHRK	7.39	7.39	7.39	7.39	7.80	7.91	7.91
EURHUF	327.02	327.02	327.02	327.02	345.34	349.92	349.92
EURPLN	4.35	4.35	4.35	4.35	4.59	4.65	4.65
EURRON	4.73	4.73	4.73	4.73	4.99	5.06	5.06
EURSEK	10.73	10.73	10.73	10.73	10.73	10.73	10.73
EURGBP	0.92	0.92	0.92	0.92	0.92	0.92	0.92
EURNOK	9.97	9.97	9.97	9.97	9.97	9.97	9.97
EURUSD	1.11	1.11	1.11	1.11	1.11	1.11	1.11
EURCHF	1.09	1.09	1.09	1.09	1.09	1.09	1.09
EURTRY	6.29	6.29	6.29	6.29	7.15	7.36	7.80
EURRUB	70.67	70.67	70.67	70.67	80.28	82.68	87.63
EURBRL	4.48	4.48	4.48	4.48	5.09	5.24	5.56
EURMXN	21.91	21.91	21.91	21.91	24.89	25.64	27.17
EURCLP	794.79	794.79	794.79	794.79	902.89	929.91	985.54
EURAUD	1.64	1.64	1.64	1.64	1.64	1.64	1.64
EURCAD	1.48	1.48	1.48	1.48	1.48	1.48	1.48
EURHKD	8.68	8.68	8.68	8.68	8.68	8.68	8.68
EURZAR	16.89	16.89	16.89	16.89	19.19	19.76	20.95
EURBGN	1.95583	1.95583	1.95583	1.95583	1.95583	1.95583	1.95583
EURCOP	3809.75	3809.75	3809.75	3809.75	4327.87	4457.41	4724.09
EURINR	79.13	79.13	79.13	79.13	90.52	93.37	98.91
EURCNY	7.86	7.86	7.86	7.86	7.86	7.86	7.86
EURJPY	118.16	118.16	118.16	118.16	118.16	118.16	118.16
EURNZD	1.73	1.73	1.73	1.73	1.73	1.73	1.73
EURPEN	3.76	3.76	3.76	3.76	4.27	4.40	4.66
EURUAH	28.05	28.05	28.05	28.05	31.87	32.82	34.78
EURAOA	399.65	399.65	399.65	399.65	454.00	467.59	495.57
EURMOP	8.95	8.95	8.95	8.95	10.17	10.47	11.10
EURMZN	69.90	69.90	69.90	69.90	79.41	81.78	86.68
EUR-rest of the world	1.11	1.11	1.11	1.11	1.26	1.30	1.38

The Marshall Islands exchange rate should follow USD currency, the Guersney exchange rate should follow GBP currency, and the Cayman Islands exchange rate should follow the path of the "Rest of the world".

Note: An adverse rate higher than the baseline rate implies an appreciation of the euro.

1.11 Swap rates

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
EUR	1M	-0.32	-0.41	-0.40	-0.32	-0.41	-0.41	-0.41
	3M	-0.32	-0.41	-0.40	-0.32	-0.41	-0.41	-0.41
	1Y	-0.32	-0.36	-0.33	-0.24	-0.43	-0.42	-0.41
	2Y	-0.31	-0.30	-0.26	-0.17	-0.45	-0.42	-0.41
	3Y	-0.27	-0.25	-0.19	-0.09	-0.47	-0.43	-0.41
	5Y	-0.14	-0.14	-0.05	0.06	-0.51	-0.43	-0.41
	7Y	0.02	-0.03	0.08	0.21	-0.55	-0.44	-0.41
	10Y	0.27	0.14	0.29	0.43	-0.61	-0.45	-0.41
	20Y	0.73	0.38	0.78	1.16	-0.61	-0.45	-0.41
	30Y	0.79	0.41	0.84	1.26	-0.61	-0.45	-0.41
CZK	1M	2.03	2.22	1.93	1.93	2.03	2.03	2.03
	3M	2.11	2.31	2.01	2.01	2.03	2.03	2.03
	1Y	2.12	2.26	2.01	2.02	1.96	2.01	2.03
	2Y	2.04	2.21	2.00	2.03	1.89	2.00	2.03
	3Y	1.93	2.16	1.99	2.04	1.82	1.98	2.03
	5Y	1.76	2.06	1.98	2.06	1.68	1.96	2.03
	7Y	1.66	1.95	1.97	2.07	1.54	1.93	2.03
	10Y	1.61	1.80	1.95	2.10	1.33	1.89	2.03
	20Y	1.71	1.91	2.07	2.23	1.33	1.89	2.03
	30Y	1.73	1.93	2.09	2.25	1.33	1.89	2.03
DKK	1M	-0.44	-0.47	-0.45	-0.37	-0.47	-0.47	-0.47
	3M	-0.38	-0.47	-0.45	-0.37	-0.47	-0.47	-0.47
	1Y	-0.24	-0.40	-0.37	-0.28	-0.49	-0.47	-0.47
	2Y	-0.22	-0.33	-0.28	-0.19	-0.52	-0.48	-0.47
	3Y	-0.17	-0.25	-0.20	-0.10	-0.54	-0.48	-0.47
	5Y	-0.03	-0.11	-0.03	0.08	-0.59	-0.49	-0.47
	7Y	0.13	0.03	0.14	0.27	-0.64	-0.50	-0.47
	10Y	0.38	0.25	0.40	0.54	-0.71	-0.52	-0.47
	20Y	0.82	0.54	0.86	1.16	-0.71	-0.52	-0.47
	30Y	0.86	0.57	0.90	1.23	-0.71	-0.52	-0.47
HRK	1M	0.17	0.27	0.38	0.46	0.17	0.17	0.17
	3M	0.17	0.27	0.38	0.46	0.17	0.17	0.17
	1Y	0.17	0.34	0.46	0.54	0.17	0.17	0.17
	2Y	0.22	0.41	0.54	0.61	0.17	0.17	0.17
	3Y	0.34	0.47	0.62	0.69	0.16	0.17	0.17
	5Y	0.64	0.61	0.78	0.84	0.15	0.17	0.17
	7Y	1.04	0.75	0.94	0.99	0.14	0.17	0.17
	10Y	1.44	0.95	1.18	1.22	0.13	0.17	0.17
	20Y	1.44	0.95	1.18	1.22	0.13	0.17	0.17
	30Y	1.44	0.95	1.18	1.22	0.13	0.17	0.17
HUF	1M	0.16	0.16	0.16	0.16	0.16	0.16	0.16
	3M	0.19	0.19	0.19	0.19	0.16	0.16	0.16
	1Y	0.37	0.33	0.34	0.35	0.15	0.16	0.16
	2Y	0.60	0.46	0.49	0.52	0.13	0.16	0.16
	3Y	0.80	0.60	0.64	0.68	0.11	0.15	0.16
	5Y	1.14	0.87	0.94	1.01	0.08	0.15	0.16
	7Y	1.43	1.14	1.24	1.34	0.05	0.14	0.16
	10Y	1.68	1.55	1.70	1.84	0.00	0.13	0.16
	20Y	2.51	2.31	2.54	2.75	0.00	0.13	0.16
	30Y	2.51	2.31	2.54	2.75	0.00	0.13	0.16

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
PLN	1M	1.54	1.47	1.43	1.49	1.47	1.47	1.47
	3M	1.62	1.55	1.50	1.57	1.47	1.47	1.47
	1Y	1.71	1.59	1.56	1.63	1.43	1.46	1.47
	2Y	1.76	1.63	1.62	1.70	1.39	1.45	1.47
	3Y	1.78	1.67	1.68	1.77	1.35	1.45	1.47
	5Y	1.87	1.75	1.80	1.91	1.26	1.43	1.47
	7Y	1.97	1.83	1.92	2.04	1.18	1.41	1.47
	10Y	2.09	1.96	2.11	2.25	1.06	1.39	1.47
	20Y	2.29	2.15	2.31	2.46	1.06	1.39	1.47
	30Y	2.14	2.00	2.15	2.30	1.06	1.39	1.47
RON	1M	2.81	2.81	2.81	2.81	2.81	2.81	2.81
	3M	2.81	2.81	2.81	2.81	2.81	2.81	2.81
	1Y	3.14	2.85	2.87	2.88	2.72	2.79	2.81
	2Y	3.10	2.90	2.93	2.96	2.64	2.78	2.81
	3Y	3.13	2.94	2.99	3.03	2.55	2.76	2.81
	5Y	3.24	3.03	3.11	3.18	2.37	2.72	2.81
	7Y	3.39	3.12	3.23	3.33	2.20	2.69	2.81
	10Y	3.39	3.26	3.41	3.55	1.94	2.64	2.81
	20Y	3.39	3.26	3.41	3.55	1.94	2.64	2.81
	30Y	3.39	3.26	3.41	3.55	1.94	2.64	2.81
SEK	1M	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
	3M	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04	-0.04
	1Y	-0.02	0.02	0.04	0.05	-0.06	-0.04	-0.04
	2Y	0.01	0.08	0.11	0.14	-0.09	-0.05	-0.04
	3Y	0.07	0.13	0.18	0.22	-0.12	-0.05	-0.04
	5Y	0.22	0.24	0.32	0.39	-0.17	-0.06	-0.04
	7Y	0.40	0.35	0.46	0.56	-0.23	-0.08	-0.04
	10Y	0.65	0.52	0.67	0.81	-0.31	-0.09	-0.04
	20Y	1.07	0.85	1.10	1.33	-0.31	-0.09	-0.04
	30Y	1.09	0.87	1.12	1.36	-0.31	-0.09	-0.04
GBP	1M	0.72	0.69	0.65	0.65	0.69	0.69	0.69
	3M	0.81	0.69	0.65	0.65	0.69	0.69	0.69
	1Y	0.88	0.71	0.68	0.70	0.63	0.68	0.69
	2Y	0.88	0.73	0.72	0.74	0.58	0.66	0.69
	3Y	0.90	0.75	0.75	0.79	0.52	0.65	0.69
	5Y	0.95	0.79	0.82	0.89	0.41	0.63	0.69
	7Y	1.00	0.83	0.89	0.98	0.30	0.61	0.69
	10Y	1.08	0.89	0.99	1.12	0.14	0.58	0.69
	20Y	1.20	0.99	1.11	1.25	0.14	0.58	0.69
	30Y	1.21	1.00	1.12	1.26	0.14	0.58	0.69
NOK	1M	1.35	1.72	1.70	1.67	1.35	1.35	1.35
	3M	1.55	1.97	1.96	1.92	1.35	1.35	1.35
	1Y	1.74	1.95	1.95	1.94	1.32	1.35	1.35
	2Y	1.75	1.93	1.95	1.95	1.29	1.34	1.35
	3Y	1.75	1.91	1.94	1.96	1.25	1.33	1.35
	5Y	1.78	1.87	1.94	1.99	1.18	1.32	1.35
	7Y	1.82	1.83	1.93	2.02	1.12	1.31	1.35
	10Y	1.90	1.77	1.92	2.06	1.02	1.29	1.35
	20Y	2.03	1.89	2.05	2.20	1.02	1.29	1.35
	30Y	2.06	1.92	2.08	2.24	1.02	1.29	1.35

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
USD	1M	2.36	2.51	2.51	2.51	2.36	2.36	2.36
	3M	2.36	2.51	2.51	2.51	2.36	2.36	2.36
	1Y	2.19	2.49	2.52	2.53	2.31	2.35	2.36
	2Y	2.04	2.46	2.52	2.54	2.25	2.34	2.36
	3Y	1.98	2.43	2.52	2.55	2.19	2.33	2.36
	5Y	1.96	2.38	2.52	2.58	2.08	2.31	2.36
	7Y	2.01	2.33	2.52	2.61	1.97	2.29	2.36
	10Y	2.10	2.25	2.52	2.65	1.80	2.25	2.36
	20Y	2.26	2.42	2.72	2.85	1.80	2.25	2.36
	30Y	2.28	2.44	2.74	2.88	1.80	2.25	2.36
CHF	1M	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72
	3M	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72	-0.72
	1Y	-0.72	-0.66	-0.66	-0.66	-0.73	-0.72	-0.72
	2Y	-0.71	-0.60	-0.60	-0.60	-0.74	-0.73	-0.72
	3Y	-0.66	-0.54	-0.54	-0.54	-0.75	-0.73	-0.72
	5Y	-0.53	-0.42	-0.42	-0.42	-0.77	-0.73	-0.72
	7Y	-0.36	-0.30	-0.30	-0.30	-0.79	-0.74	-0.72
	10Y	-0.11	-0.11	-0.11	-0.11	-0.81	-0.74	-0.72
	20Y	0.31	0.31	0.31	0.31	-0.81	-0.74	-0.72
	30Y	0.36	0.36	0.36	0.36	-0.81	-0.74	-0.72
TRY	1M	21.59	19.50	18.30	17.33	19.36	19.36	19.36
	3M	21.44	19.36	18.18	17.21	19.36	19.36	19.36
	1Y	20.51	18.82	17.63	16.67	18.69	18.63	18.57
	2Y	19.57	18.27	17.09	16.12	18.01	17.90	17.78
	3Y	18.64	17.73	16.54	15.58	17.34	17.18	16.98
	5Y	17.67	16.64	15.45	14.49	15.99	15.72	15.40
	7Y	16.71	15.55	14.36	13.40	14.64	14.26	13.81
	10Y	15.99	13.91	12.72	11.76	12.61	12.07	11.44
	20Y	15.99	13.91	12.72	11.76	12.61	12.07	11.44
	30Y	15.99	13.91	12.72	11.76	12.61	12.07	11.44
RUB	1M	7.96	7.46	7.71	7.71	7.46	7.46	7.46
	3M	7.96	7.46	7.71	7.71	7.46	7.46	7.46
	1Y	7.96	7.37	7.64	7.63	7.24	7.35	7.37
	2Y	7.89	7.28	7.56	7.55	7.02	7.23	7.28
	3Y	7.91	7.18	7.48	7.46	6.79	7.11	7.19
	5Y	7.97	7.00	7.33	7.30	6.35	6.88	7.01
	7Y	8.07	6.81	7.17	7.13	5.90	6.64	6.83
	10Y	8.24	6.53	6.94	6.88	5.23	6.29	6.55
	20Y	6.97	5.52	5.87	5.82	5.23	6.29	6.55
	30Y	6.97	5.52	5.87	5.82	5.23	6.29	6.55
BRL	1M	7.97	7.97	7.97	7.97	7.97	7.97	7.97
	3M	7.97	7.97	7.97	7.97	7.97	7.97	7.97
	1Y	7.97	7.97	7.97	7.97	7.82	7.90	7.93
	2Y	7.97	7.97	7.97	7.97	7.67	7.82	7.90
	3Y	7.97	7.97	7.97	7.97	7.52	7.75	7.86
	5Y	7.97	7.97	7.97	7.97	7.22	7.60	7.78
	7Y	7.97	7.97	7.97	7.97	6.92	7.45	7.71
	10Y	7.97	7.97	7.97	7.97	6.47	7.22	7.60
	20Y	7.97	7.97	7.97	7.97	6.47	7.22	7.60
	30Y	7.97	7.97	7.97	7.97	6.47	7.22	7.60

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
MXN	1M	8.30	8.30	8.30	8.30	8.30	8.30	8.30
	3M	8.30	8.30	8.30	8.30	8.30	8.30	8.30
	1Y	8.23	8.23	8.23	8.23	8.03	8.13	8.18
	2Y	8.17	8.17	8.17	8.17	7.77	7.97	8.07
	3Y	8.11	8.11	8.11	8.11	7.51	7.81	7.96
	5Y	7.98	7.98	7.98	7.98	6.98	7.48	7.73
	7Y	7.86	7.86	7.86	7.86	6.46	7.16	7.51
	10Y	7.67	7.67	7.67	7.67	5.67	6.67	7.17
	20Y	7.67	7.67	7.67	7.67	5.67	6.67	7.17
	30Y	7.67	7.67	7.67	7.67	5.67	6.67	7.17
CLP	1M	2.14	2.14	2.14	2.14	2.14	2.14	2.14
	3M	2.48	2.48	2.48	2.48	2.14	2.14	2.14
	1Y	2.44	2.57	2.57	2.57	2.11	2.13	2.14
	2Y	2.50	2.66	2.66	2.66	2.09	2.13	2.14
	3Y	2.62	2.75	2.75	2.75	2.06	2.12	2.14
	5Y	2.90	2.93	2.93	2.93	2.01	2.11	2.14
	7Y	3.12	3.11	3.11	3.11	1.96	2.10	2.14
	10Y	3.38	3.38	3.38	3.38	1.88	2.09	2.14
	20Y	3.62	3.62	3.62	3.62	1.88	2.09	2.14
	30Y	3.81	3.81	3.81	3.81	1.88	2.09	2.14
AUD	1M	1.39	1.05	1.05	1.56	1.05	1.05	1.05
	3M	1.38	1.05	1.04	1.55	1.05	1.05	1.05
	1Y	1.24	1.10	1.12	1.62	1.05	1.05	1.05
	2Y	1.19	1.16	1.19	1.69	1.04	1.05	1.05
	3Y	1.20	1.22	1.26	1.75	1.04	1.05	1.05
	5Y	1.30	1.33	1.40	1.89	1.03	1.05	1.05
	7Y	1.45	1.44	1.54	2.03	1.02	1.05	1.05
	10Y	1.74	1.61	1.76	2.24	1.01	1.04	1.05
	20Y	2.06	1.91	2.08	2.66	1.01	1.04	1.05
	30Y	2.09	1.94	2.11	2.69	1.01	1.04	1.05
CAD	1M	2.00	2.21	2.62	2.95	2.00	2.00	2.00
	3M	2.03	2.24	2.65	2.99	2.00	2.00	2.00
	1Y	1.98	2.23	2.64	2.98	1.94	1.99	2.00
	2Y	1.91	2.22	2.63	2.96	1.89	1.98	2.00
	3Y	1.89	2.21	2.62	2.95	1.83	1.97	2.00
	5Y	1.89	2.20	2.59	2.92	1.73	1.94	2.00
	7Y	1.93	2.18	2.57	2.89	1.62	1.92	2.00
	10Y	2.02	2.15	2.53	2.84	1.45	1.89	2.00
	20Y	2.26	2.40	2.82	3.17	1.45	1.89	2.00
	30Y	2.24	2.38	2.80	3.14	1.45	1.89	2.00
HKD	1M	2.10	2.10	2.10	2.10	2.10	2.10	2.10
	3M	2.10	2.10	2.10	2.10	2.10	2.10	2.10
	1Y	2.03	2.09	2.09	2.09	1.99	2.08	2.10
	2Y	1.95	2.09	2.09	2.09	1.89	2.06	2.10
	3Y	1.92	2.08	2.08	2.08	1.78	2.04	2.10
	5Y	1.92	2.07	2.07	2.07	1.57	1.99	2.10
	7Y	1.95	2.05	2.05	2.05	1.35	1.95	2.10
	10Y	2.03	2.03	2.03	2.03	1.03	1.89	2.10
	20Y	2.13	2.13	2.13	2.13	1.03	1.89	2.10
	30Y	2.13	2.13	2.13	2.13	1.03	1.89	2.10

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
ZAR	1M	6.83	6.83	6.83	6.83	6.83	6.83	6.83
	3M	7.00	7.00	7.00	7.00	6.83	6.83	6.83
	1Y	6.88	7.08	7.08	7.08	6.81	6.83	6.83
	2Y	6.88	7.16	7.16	7.16	6.79	6.82	6.83
	3Y	6.96	7.25	7.25	7.25	6.77	6.82	6.83
	5Y	7.22	7.42	7.42	7.42	6.73	6.81	6.83
	7Y	7.50	7.59	7.59	7.59	6.70	6.80	6.83
	10Y	7.84	7.84	7.84	7.84	6.64	6.79	6.83
	20Y	8.20	8.20	8.20	8.20	6.64	6.79	6.83
	30Y	8.02	8.02	8.02	8.02	6.64	6.79	6.83
BGN	1M	-0.19	-0.20	-0.08	-0.02	-0.16	-0.16	-0.16
	3M	-0.16	-0.17	-0.06	0.00	-0.16	-0.16	-0.16
	1Y	-0.04	0.03	0.15	0.21	-0.17	-0.16	-0.16
	2Y	0.12	0.25	0.38	0.44	-0.17	-0.16	-0.16
	3Y	0.32	0.47	0.60	0.66	-0.17	-0.16	-0.16
	5Y	0.54	0.69	0.83	0.90	-0.18	-0.17	-0.16
	7Y	0.74	0.86	1.02	1.08	-0.19	-0.17	-0.16
	10Y	1.01	1.10	1.27	1.34	-0.20	-0.17	-0.16
	20Y	2.01	2.22	2.63	2.78	-0.20	-0.17	-0.16
	30Y	1.90	2.12	2.56	2.72	-0.20	-0.17	-0.16
COP	1M	3.91	3.91	3.91	3.91	3.91	3.91	3.91
	3M	4.24	4.24	4.24	4.24	3.91	3.91	3.91
	1Y	4.36	4.36	4.36	4.36	3.90	3.91	3.91
	2Y	4.60	4.60	4.60	4.60	3.89	3.91	3.91
	3Y	4.80	4.80	4.80	4.80	3.88	3.91	3.91
	5Y	5.17	5.17	5.17	5.17	3.86	3.90	3.91
	7Y	5.49	5.49	5.49	5.49	3.84	3.90	3.91
	10Y	5.82	5.82	5.82	5.82	3.82	3.89	3.91
	20Y	5.75	5.75	5.75	5.75	3.82	3.89	3.91
	30Y	5.75	5.75	5.75	5.75	3.82	3.89	3.91
INR	1M	6.35	6.35	6.35	6.35	6.35	6.35	6.35
	3M	6.35	6.35	6.35	6.35	6.35	6.35	6.35
	1Y	6.35	6.35	6.35	6.35	6.31	6.34	6.35
	2Y	6.35	6.35	6.35	6.35	6.28	6.33	6.35
	3Y	6.45	6.45	6.45	6.45	6.24	6.33	6.35
	5Y	6.68	6.68	6.68	6.68	6.17	6.31	6.35
	7Y	6.69	6.69	6.69	6.69	6.10	6.30	6.35
	10Y	6.69	6.69	6.69	6.69	5.99	6.28	6.35
	20Y	6.69	6.69	6.69	6.69	5.99	6.28	6.35
	30Y	6.69	6.69	6.69	6.69	5.99	6.28	6.35
JPY	1M	0.00	-0.03	-0.03	-0.03	-0.08	-0.08	-0.08
	3M	-0.01	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
	1Y	-0.04	-0.07	-0.07	-0.06	-0.10	-0.09	-0.08
	2Y	-0.07	-0.06	-0.05	-0.03	-0.12	-0.09	-0.08
	3Y	-0.08	-0.05	-0.03	-0.01	-0.14	-0.10	-0.08
	5Y	-0.07	-0.03	0.01	0.04	-0.18	-0.10	-0.08
	7Y	-0.02	-0.01	0.04	0.09	-0.22	-0.11	-0.08
	10Y	0.07	0.03	0.10	0.17	-0.27	-0.12	-0.08
	20Y	0.34	0.14	0.51	0.87	-0.27	-0.12	-0.08
	30Y	0.47	0.20	0.69	1.19	-0.27	-0.12	-0.08

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
NZD	1M	1.91	1.90	2.17	2.71	1.74	1.74	1.74
	3M	1.76	1.74	1.99	2.49	1.74	1.74	1.74
	1Y	1.44	1.75	2.01	2.51	1.72	1.74	1.74
	2Y	1.40	1.76	2.03	2.53	1.70	1.74	1.74
	3Y	1.41	1.77	2.05	2.55	1.68	1.73	1.74
	5Y	1.51	1.79	2.09	2.59	1.64	1.72	1.74
	7Y	1.66	1.80	2.13	2.63	1.59	1.71	1.74
	10Y	1.87	1.83	2.19	2.70	1.53	1.70	1.74
	20Y	2.28	2.22	2.67	3.29	1.53	1.70	1.74
	30Y	2.28	2.22	2.67	3.29	1.53	1.70	1.74
PEN	1M	2.50	2.50	2.50	2.50	2.50	2.50	2.50
	3M	2.50	2.50	2.50	2.50	2.50	2.50	2.50
	1Y	2.50	2.50	2.50	2.50	2.43	2.45	2.46
	2Y	2.50	2.50	2.50	2.50	2.36	2.40	2.42
	3Y	2.50	2.50	2.50	2.50	2.29	2.35	2.38
	5Y	2.50	2.50	2.50	2.50	2.15	2.25	2.30
	7Y	2.50	2.50	2.50	2.50	2.01	2.15	2.22
	10Y	2.50	2.50	2.50	2.50	1.80	2.00	2.10
	20Y	2.50	2.50	2.50	2.50	1.80	2.00	2.10
	30Y	2.50	2.50	2.50	2.50	1.80	2.00	2.10
UAH	1M	17.00	17.00	17.00	17.00	17.00	17.00	17.00
	3M	17.00	17.00	17.00	17.00	17.00	17.00	17.00
	1Y	17.00	17.00	17.00	17.00	16.93	16.95	16.96
	2Y	17.00	17.00	17.00	17.00	16.86	16.90	16.92
	3Y	17.00	17.00	17.00	17.00	16.79	16.85	16.88
	5Y	17.00	17.00	17.00	17.00	16.65	16.75	16.80
	7Y	17.00	17.00	17.00	17.00	16.51	16.65	16.72
	10Y	17.00	17.00	17.00	17.00	16.30	16.50	16.60
	20Y	17.00	17.00	17.00	17.00	16.30	16.50	16.60
	30Y	17.00	17.00	17.00	17.00	16.30	16.50	16.60
AOA	1M	15.64	15.64	15.64	15.64	15.64	15.64	15.64
	3M	15.64	15.64	15.64	15.64	15.64	15.64	15.64
	1Y	15.64	15.64	15.64	15.64	15.57	15.59	15.60
	2Y	15.64	15.64	15.64	15.64	15.50	15.54	15.56
	3Y	15.64	15.64	15.64	15.64	15.43	15.49	15.52
	5Y	15.64	15.64	15.64	15.64	15.29	15.39	15.44
	7Y	15.64	15.64	15.64	15.64	15.15	15.29	15.36
	10Y	15.64	15.64	15.64	15.64	14.94	15.14	15.24
	20Y	15.64	15.64	15.64	15.64	14.94	15.14	15.24
	30Y	15.64	15.64	15.64	15.64	14.94	15.14	15.24
MOP	1M	1.79	1.79	1.79	1.79	2.08	2.08	2.08
	3M	2.08	2.08	2.08	2.08	2.08	2.08	2.08
	1Y	2.38	2.38	2.38	2.38	2.04	2.06	2.07
	2Y	2.38	2.38	2.38	2.38	2.00	2.04	2.06
	3Y	2.38	2.38	2.38	2.38	1.96	2.02	2.05
	5Y	2.38	2.38	2.38	2.38	1.88	1.98	2.03
	7Y	2.38	2.38	2.38	2.38	1.80	1.94	2.01
	10Y	2.38	2.38	2.38	2.38	1.68	1.88	1.98
	20Y	2.38	2.38	2.38	2.38	1.68	1.88	1.98
	30Y	2.38	2.38	2.38	2.38	1.68	1.88	1.98

		Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
		2019	2020	2021	2022	2020	2021	2022
MZN	1M	12.75	12.75	12.75	12.75	12.75	12.75	12.75
	3M	12.75	12.75	12.75	12.75	12.75	12.75	12.75
	1Y	12.75	12.75	12.75	12.75	12.68	12.70	12.71
	2Y	12.75	12.75	12.75	12.75	12.61	12.65	12.67
	3Y	12.75	12.75	12.75	12.75	12.54	12.60	12.63
	5Y	12.75	12.75	12.75	12.75	12.40	12.50	12.55
	7Y	12.75	12.75	12.75	12.75	12.26	12.40	12.47
	10Y	12.75	12.75	12.75	12.75	12.05	12.25	12.35
	20Y	12.75	12.75	12.75	12.75	12.05	12.25	12.35
	30Y	12.75	12.75	12.75	12.75	12.05	12.25	12.35
CNY	1M	2.74	2.74	2.74	2.74	2.74	2.74	2.74
	3M	2.82	2.82	2.82	2.82	2.74	2.74	2.74
	1Y	3.12	3.12	3.12	3.12	2.71	2.73	2.74
	2Y	3.12	3.12	3.12	3.12	2.68	2.72	2.74
	3Y	3.12	3.12	3.12	3.12	2.64	2.70	2.73
	5Y	3.12	3.12	3.12	3.12	2.58	2.68	2.73
	7Y	3.12	3.12	3.12	3.12	2.52	2.66	2.73
	10Y	3.12	3.12	3.12	3.12	2.42	2.62	2.72
	20Y	3.12	3.12	3.12	3.12	2.42	2.62	2.72
	30Y	3.12	3.12	3.12	3.12	2.42	2.62	2.72
RoW	1M	2.80	2.80	2.80	2.80	2.80	2.80	2.80
	3M	2.80	2.80	2.80	2.80	2.80	2.80	2.80
	1Y	2.80	2.80	2.80	2.80	2.73	2.75	2.76
	2Y	2.80	2.80	2.80	2.80	2.66	2.70	2.72
	3Y	2.80	2.80	2.80	2.80	2.59	2.65	2.68
	5Y	2.80	2.80	2.80	2.80	2.45	2.55	2.60
	7Y	2.80	2.80	2.80	2.80	2.31	2.45	2.52
	10Y	2.80	2.80	2.80	2.80	2.10	2.30	2.40
	20Y	2.80	2.80	2.80	2.80	2.10	2.30	2.40
	30Y	2.80	2.80	2.80	2.80	2.10	2.30	2.40

For the Long-Term rates of the regions ”Latin America” and “Emerging Asia” the USD swap rate curve should be considered as reference swap rate curve .

Note: Projections based on market expectations as of the fourth quarter of 2019 are used as baseline forecasts for EU countries. The baseline for other countries is based on projections from the October 2019 IMF World Economic Outlook. For countries for which no baseline projections were available, the rates were assumed to be flat as at the cut-off date. For the Bulgarian lev (BGN), the Bulgarian central bank provided values for the swap rates for the purpose of the exercise. For other geographies and maturities swap rate starting points were interpolated / extrapolated whenever not available.

2 Annex: Detailed risk assessments

2.1 ESRB risk assessment

At its meeting on 19 December 2019 the General Board considered a number of vulnerabilities in the EU financial system, including the indebtedness of non-financial corporations, the liquidity of assets in investment funds, and the misconduct costs facing financial institutions.[14] Moreover, the General Board took note of the risks to financial stability which might result from climate change and disruptions in critical financial infrastructures.

In its discussion the General Board considered the general macroeconomic conditions, which remain a source of concern:

- the medium-term outlook for global economic growth has remained weak amid elevated political/geopolitical and policy uncertainties, including international trade disputes and decreasing international cooperation;
- asset prices continue to be subject to the threat of a sudden reassessment of risk premia, possibly leading to sharp corrections, with potential disruptions to market functioning and weakening of economic conditions;
- slowing growth momentum and rising risk premia could further test debt sustainability in the public and private sectors across the EU;
- over time, the macroeconomic environment may pose fundamental challenges to traditional business models in the financial sector, also magnifying existing vulnerabilities in EU banks, insurers and pension schemes.

2.2 ECB risk assessment

The four systemic vulnerabilities identified by the ECB in its latest (November 2019) Financial Stability Review[15] as representing the most material threats to the stability of the EU financial sector in the fourth quarter of 2019 consist of:

- **Signs of asset mispricing suggest potential for future corrections**: Consistent with current economic conditions and the prominent downside risks to growth, the low interest rate environment supports economic activity by encouraging economic risk taking.

[14] See also "**The General Board of the European Systemic Risk Board held its 35th regular meeting on 26 September**", *press release*, European Systemic Risk Board, 2 October 2019.

[15] See also "**Financial Stability Review**", ECB, 2019.

- **Lingering private and public debt sustainability concerns**: Signs of excessive financial risk-taking, including for some non-bank financial institutions, highly leveraged non-financial corporations and real estate sectors, require monitoring and targeted macroprudential policy action.

- **Growing challenges from cyclical headwinds to bank profitability**: The euro area banking sector has increased its resilience in recent years. But slow progress in improving underlying profitability and renewed cyclical headwinds may hamper banks' ability to respond to downside risks to growth.

- **Increased risk-taking by non-banks may pose risks to capital market financing**.

2.3 EBA risk assessment

The EBA's evaluation of the five main risk measures included in its Risk Dashboard,[16] published on 8 January 2020, is as follows:

Asset quality (medium, increasing): "The slowdown in economic growth can adversely affect banks' asset quality. There are also indications of easing lending standards in the Euro area, in particular for lending to enterprises and mortgage lending. Amid increasing cost of risk there are also indications that the reduction in NPLs is slowing down. However, the trends diverge between countries, with some countries seeing an increase in NPL volumes. At the same time banks are increasing their exposures towards riskier loan segments."

Market risk (medium, increasing): "Some optimism about a potential trade agreement between the US and China and the accommodative monetary policy stance contributed to reduced market volatility in the past few months. However, continued bouts of volatility in some market segments and episodes such as the surge of USD repo rates in the US in mid-September illustrate persistent risks and the potential for sudden volatility and illiquidity. Also the outflows and illiquidity observed in selected investment funds highlight ongoing risks."

Liquidity and funding (medium, decreasing): "In the past quarter, risk free rates have slightly increased but spreads have remained tight. Banks continued to issue debt across the capital structure (secured, unsecured, MREL eligible, subordinated) and have started to pre-fund their 2020 needs. More recently, the increase in risk free rates has allowed investors to avoid negative rates in more segments of the primary market. This has translated into higher oversubscription levels for banks' issuances. Primary and secondary markets for secured funding found additional support with the restart of the ECB's asset purchase programme. An increasing number of banks is charging or plans to charge negative rates to corporate and certain amounts of household deposits."

[16] For more details, see "**EU banks face a further contraction of profitability**", *press release*, EBA, 8 January 2020.

Profitability (high, increasing): “Banks' net interest income continues the upward trend initiated in 2018, driven by increasing lending volumes. Despite their focus on rather riskier lending exposures, banks’ margins have not improved, amid the low rate environment and growing competition. They also appear to face challenges to further reduce costs amid necessary expenses related to ICT, governance and compliance. The cost of risk seems to revert the decreasing trend observed in previous years.”

Operational resilience (medium, increasing): “Advanced technology in banking and the reliance on third party providers has become a key topic in the banking sector and pose challenges, e.g. on systems management, data protection and adequate governance. The concentration of third party providers poses particular risks and challenges, e.g. in respect of pricing powers and systemic risk in case of a failure at one provider. Banks remain unabatedly vulnerable to cyber-attacks and data breaches. Moreover, experience also from recent operational risk events, including conduct and AML/CTF events, show that they can entail significant direct costs as well as indirect losses through e.g. the loss of clients, the closing of business segments or subsidiaries and elevated funding costs.”

3 Annex: methodology for the scenario calibration

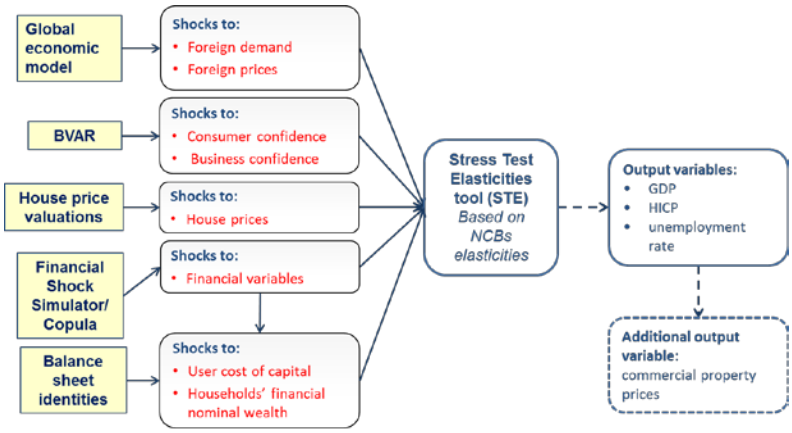
3.1 Calibration methodology overview

The calibration of the EBA 2020 adverse stress test scenario was based on a set of models developed mainly by ECB staff and adopted by the ESRB Task Force on Stress Testing. The set of models has changed and improvements have been made with respect to those adopted for the 2018 stress test scenario.[17]

Chart 11 illustrates the set of models employed for the scenario calibration. A first set of models is used to calibrate shocks to foreign demand, consumer and business confidence, house prices, financial prices, etc. These shocks are then used as inputs for the Stress Test Elasticities (STEs) which are provided by national central banks[18] and in turn produce the final response of macroeconomic variables (real GDP, unemployment rate and HICP) to the generated shocks.

Chart 11

Overview of the models used for the calibration of the 2020 EBA scenario



[17] For a review of the models used for the scenario calibration in previous editions, see Henry, J., "Macrofinancial Scenarios for System-wide Stress Tests: Process and Challenges", in Quagliariello, M. (ed.), Europe's New Supervisory Toolkit: Data, Benchmarking and Stress Testing for Banks and their Regulators, Risk Books, London, 2015. An overview of the models used for the calibration of the 2018 stress test scenario is also provided by the European Court of Auditors "**EU-wide stress tests for banks: unparalleled amount of information on banks provided but greater coordination and focus on risks needed**", *Special Report*, No 10, European Court of Auditors, 2019.

[18] The Stress Test Elasticities are basically the elasticities of the main macroeconomic variables to different shocks and are based mainly on the forecast models of the national central Banks of the European System of Central Banks.

3.2 Severity and heterogeneity metrics

An important question when defining a stress scenario is how to measure its severity.[19] This is quite challenging, as stress test scenarios have several dimensions. Moreover, in contrast to scenarios designed by other institutions (e.g. the US Federal Reserve's Comprehensive Capital Analysis and Review scenarios and the Bank of England's Annual Cyclical Scenario), the adverse scenarios for the EBA exercises cover 29 domestic countries (28 EU countries and Norway). Therefore, it is also relevant to establish a measure for the heterogeneity of the scenario severity across countries, accounting for the very different characteristics of all these economies. For the 2020 EBA scenario, the ESRB Task Force on Stress Testing deemed it relevant to agree ex-ante on a severity metric in order to guide the calibration and the scenario analysis.[20] The main objectives of the summary severity metric are:

- provide a more objective comparison of the relative severity of each country's scenario calibration, taking into account differences in countries' historical volatility of key macro-financial variables;
- compare the ranking of the countries based on the severity metric with the cross-country risk assessment;
- evaluate the scenario's cross-country heterogeneity.

Against this background, the maximum decline in real GDP divided by the maximum historical decline in real GDP over a maximum of three years was considered as the main summary metric for evaluating the severity of the EBA 2020 stress test scenario. This choice was based on a number of factors:

- Real GDP is one of the most relevant drivers of the capital depletion and a well-understood benchmark for the public. While other factors such as the unemployment rate, house prices and interest rates might be more relevant explanatory factors for individual risks, real GDP is highly correlated with these variables and easier to communicate.
- The metric takes into account the historical volatility of GDP of each individual country. The maximum (absolute) decline or the cumulative decline in real GDP are not the best

[19] See also Durdu, B., Edge, R. and Schwindt, D., "**Measuring the Severity of Stress-Test Scenarios**", *FEDS Notes*, Board of Governors of the US Federal Reserve System, 2017

[20] This choice was mainly dictated by the fact that a number of studies analysed the 2018 stress test scenario and highlighted issues with cross-country heterogeneity in terms of severity. See for example B. Bianchi, "**The role of country factors in the 2018 EBA stress test**", *Financial Stability Notes*, Vol. 2019, No 1, Central Bank of Ireland, 2019; "**EU-wide stress tests for banks: unparalleled amount of information on banks provided but greater coordination and focus on risks needed**", *Special Report*, No 10, European Court of Auditors, 2019; Haselmann, R. and Wahrenburg, M., "**How demanding and consistent is the 2018 stress test design in comparison to previous exercises?**", *in-depth analysis requested by the ECON committee of the European Parliament*, 2018. These last two reports did not, however, take into account differences in volatility between the economies of EU countries.

metrics to assess the relative severity of the scenario across countries in the EU, as they do not take into account the volatility of each economy, which reflects country-specific economic and financial structures.

- The metric takes into account a country-specific lengths[21] of the historical crises against which the current scenario is compared. It is indeed not trivial to compare the severity of the ”lower for longer” scenario with historical crises as this type of crisis is unprecedented in the history of the EU.

[21] The denominator is the minimum growth of real GDP over a period of 1, 2 or 3 years, where the growth over 1, 2 or 3 years is calculated using quarterly data.

Table 1

Severity metric, scenario and risk assessment in the EBA's 2020 and 2018 stress tests – real GDP

	Real GDP	EBA 2020					EBA 2018					Historical crisis	
		Year-on-year growth at the peak of the crisis	Cumulative growth	Maximum decline from the starting point	Deviation from the baseline	Severity metric: maximum decline in real GDP in the scenario/maximum historical decline	Year-on-year growth at the peak of the crisis	Cumulative growth	Maximum decline from the starting point	Deviation from the baseline	Severity metric: maximum decline in real GDP in the scenario/maximum historical decline	Maximum decline in real GDP - Financial Crisis [flexible length up to 3 years]	Denominator of the severity metric
Severity	AT	-1.9	-3.2	-3.2	-7.2	0.7	-2.5	-2.7	-3.6	-8.6	0.8	-5.3	-4.8
	BE	-1.8	-3.7	-3.7	-6.9	1.0	-2.8	-4.5	-4.5	-8.8	1.2	-3.8	-3.8
	BG	-3.3	-6.5	-6.5	-15.7	1.0	-2.7	-0.2	-3.4	-10.4	0.5	-6.4	-6.4
	CY	-1.6	-2.9	-2.9	-10.6	0.3	-0.8	-0.2	-0.5	-9.3	0.0	-2.5	-10.5
	CZ	-2.5	-3.8	-3.8	-11.2	0.7	-3.1	-3.1	-4.3	-11.9	0.8	-5.9	-5.6
	DE	-2.5	-5.0	-5.0	-8.1	0.7	-2.8	-3.3	-4.6	-8.6	0.7	-7.0	-7.0
	DK	-2.8	-5.0	-5.0	-9.2	0.8	-3.2	-4.1	-5.4	-9.0	0.8	-7.1	-6.7
	EE	-3.5	-7.5	-7.5	-13.3	0.4	-1.0	-1.2	-1.5	-10.4	0.1	-18.5	-19.8
	ES	-2.1	-3.8	-3.8	-8.2	0.7	-1.5	-0.8	-1.8	-7.0	0.3	-4.6	-5.7
	FI	-2.5	-4.1	-4.1	-7.2	0.4	-2.6	-3.3	-3.4	-8.4	0.4	-9.9	-9.3
	FR	-2.0	-3.6	-3.6	-7.0	0.9	-1.4	-1.5	-1.5	-6.4	0.4	-3.9	-3.8
	GR	-3.5	-6.0	-6.0	-12.5	0.3	-2.1	-3.3	-3.4	-10.0	0.2	-15.9	-22.1
	HR	-4.1	-7.2	-7.2	-14.0	0.7	-1.9	-0.2	-3.1	-8.8	0.3	-9.7	-10.6
	HU	-4.2	-6.5	-6.5	-15.2	0.9	-2.1	-0.2	-2.0	-9.7	0.3	-7.1	-7.6
	IE	-3.7	-5.7	-5.7	-16.2	0.4	-1.0	-0.2	-1.4	-11.0	0.1	-12.9	-12.9
	IT	-1.7	-3.7	-3.7	-6.1	0.5	-1.5	-2.7	-2.7	-6.5	0.4	-7.4	-7.2
	LT	-3.2	-6.0	-6.0	-12.5	0.4	-2.1	-1.1	-3.5	-8.7	0.2	-15.5	-16.5
	LU	-3.2	-4.9	-4.9	-13.2	0.6	-2.7	-1.0	-4.2	-11.0	0.6	-8.0	-7.6
	LV	-2.6	-4.7	-4.7	-12.3	0.2	-1.1	-0.2	-1.3	-9.8	0.1	-22.1	-22.7
	MT	-2.3	-3.3	-3.3	-13.3	0.9	-2.2	-0.2	-3.1	-12.9	0.9	-5.0	-3.6
	NL	-1.9	-3.5	-3.5	-7.0	0.8	-2.2	-2.1	-2.3	-8.9	0.5	-4.3	-4.3
	PL	-1.6	-1.7	-1.8	-10.9	2.1	-1.3	-0.2	-0.2	-9.4	0.3	-0.2	-0.9
	PT	-2.8	-5.3	-5.3	-9.8	0.7	-3.0	-4.3	-4.3	-9.7	0.5	-4.3	-7.8
	RO	-3.4	-5.8	-5.8	-15.0	0.5	-1.6	-1.0	-1.9	-10.7	0.2	-8.4	-10.9
	SE	-3.4	-6.4	-6.4	-10.6	0.9	-6.0	-10.4	-10.4	-15.9	1.5	-6.4	-6.8
	SI	-2.2	-3.1	-3.1	-10.3	0.3	-1.7	-0.2	-2.3	-10.5	0.2	-9.5	-9.5
	SK	-4.1	-7.6	-7.6	-14.0	1.0	-1.5	-0.4	-2.0	-12.1	0.3	-8.8	-7.4
	UK	-2.6	-4.5	-4.5	-9.1	0.7	-2.8	-3.3	-5.0	-8.0	0.8	-6.3	-6.1
	EA	-2.2	-4.2	-4.2	-7.9	0.8	-2.0	-2.4	-2.9	-7.8	0.5	-5.8	-5.5
	EU	-2.2	-4.3	-4.3	-8.5	0.8	-2.2	-2.7	-3.4	-8.3	0.6	-5.7	-5.4
Heterogeneity*	STD	0.8	1.5	1.5	3.0	0.2	1.0	2.2	1.9	1.9	0.4	4.8	5.4
	Min	-4.2	-7.6	-7.6	-16.2	0.2	-6.0	-10.4	-10.4	-15.9	0.0	-22.1	-22.7
	25th	-3.4	-6.0	-6.0	-13.3	0.4	-2.7	-3.3	-4.2	-10.6	0.2	-9.6	-10.6
	50th	-2.6	-4.8	-4.8	-10.8	0.7	-2.1	-1.2	-3.1	-9.5	0.4	-7.1	-7.3
	75th	-2.0	-3.7	-3.7	-8.1	0.8	-1.5	-0.2	-1.9	-8.7	0.7	-4.9	-5.7
	Max	-1.6	-1.7	-1.8	-6.1	1.0	-0.8	-0.2	-0.2	-6.4	1.5	-0.2	-0.9
	abs(Min-Max)	2.6	5.9	5.8	10.2	0.8	5.2	10.3	10.2	9.6	1.5	21.9	21.8
	abs(25th-75th)	1.3	2.3	2.3	5.1	0.4	1.2	3.1	2.4	1.9	0.5	4.6	4.9
Severity	OC	-0.5	-0.9	-0.9	-4.4	-0.5	1.5	5.2	1.6	-3.4	0.9	1.7	1.7
	BR	-3.6	-3.7	-5.4	-10.0	0.8	-1.8	2.0	-1.8	-3.4	0.3	-0.1	-6.7
	CA	-1.9	-2.6	-2.6	-7.5	0.9	-0.5	2.4	-0.2	-3	0.1	-2.9	-2.9
	CH	-2.3	-3.0	-3.4	-7.2	1.5	-0.1	2.1	-0.1	-2.5	0.0	-2.2	-2.2
	CL	-1.9	-4.2	-4.2	-12.8	2.7	-0.5	4.6	-0.5	-3.5	0.3	-1.6	-1.6
	CN	1.7	8.2	1.7	-8.6		3.7	15.7	3.7	-3.8		9.4	6.1
	CO	-1.8	-2.6	-2.6	-12.7	0.6						1.2	-4.2
	IN	2.0	8.5	2.0	-12.2		3.6	18.0	3.6	-5.6		8.5	3.9
	JP	-3.0	-6.2	-6.2	-7.5	1.0	-1.1	-1.0	-1.5	-2.6	0.2	-5.4	-6.5
	MX	-2.7	-3.6	-4.2	-8.5	0.8	-0.8	3.5	-0.8	-3.3	0.2	-5.3	-5.3
	NO	-1.5	-2.6	-2.6	-7.9	1.5	-1.1	-1.4	-2.1	-7.4	1.2	-1.7	-1.7
	PE	-2.0	-3.5	-3.5	-13.9	9.0						1.0	-0.4
	RU	-2.9	-5.9	-5.9	-11.3	0.8	-1.9	-0.2	-2.3	-4.7	0.3	-7.8	-7.8
	TR	-2.7	-5.9	-5.9	-13.9	1.0	-0.8	4.6	-0.8	-5.6	0.1	-4.7	-6.0
	US	-2.7	-4.8	-4.8	-9.8	1.8	-0.6	2.2	-0.9	-3.8	0.3	-2.5	-2.7
	HK	-2.7	-4.5	-4.5	-10.6	0.8						-5.9	-5.9

Note: The summary statistics for the heterogeneity of the 2020 scenario are calculated excluding Poland for the reasons mentioned in the main text.

In addition to the summary severity metric, a number of other metrics were used to cross-check the scenario calibration, such as the cumulative growth from the starting point, yearly growth in the scenario compared with the historical year-on-year distribution and deviation from the baseline (see Table 1). In addition, the severity metric was also subject to expert judgement. For example, Poland had no economic crisis over the sample considered and was therefore deemed an outlier. Similarly Greece and Latvia experienced extremely harsh crises, in which real GDP declined by about 20%. Despite this, the real GDP decline in the EBA's 2020 scenario (about 5 - 6% for these countries) is nonetheless considered severe, as in absolute terms and looking at the overall historical distribution of real GDP growth for these countries it still represents a tail value.

Table 1 also compares the summary severity metric described above with the cumulative real GDP growth and the maximum decline from the starting point both for the 2020 and the 2018 scenarios.

In addition, it provides some historical comparison with the decline in real GDP during the global financial crisis and the denominator of the severity metric.[22] Interquartile ranges and standard deviations (STD) are also provided at the bottom of the table to compare the heterogeneity of the scenario.

The country-level calibration was guided by the summary severity metric, with the ranking of the countries based on the severity metric broadly reflecting the ranking of the current cyclical risk assessment. The ECB's internal risk assessment formed the starting point for this assessment of cyclical risks and was complemented by the ESRB's internal Country Risk Analysis Report for other EU non-euro area countries. The severity of the scenario was set for each country in line with the risk level as assessed by the ECB, such that generally countries with a higher cyclical risk level received larger shocks in the scenario. The motivation for this is that, although the EBA exercise is a static balance sheet exercise, the scenario calibration does not completely abstract from amplification effects which have taken place historically and are likely to hit countries in a high position of the financial cycle more strongly. As such, the scenario generally imposes larger negative shocks on countries that are more advanced in their cycle (e.g. where overvaluations are higher) and which as a result are at risk of facing a stronger negative rebound. This approach is similar in spirit to the concept of growth-at-risk,[23] which is currently implemented by the IMF to define the severity of Financial Sector Assessment Program scenarios. It also bears resemblance with the Bank of England's Annual Cyclical Scenario[24] and is close to recent changes in the US Federal Reserve's CCAR scenario design,[25] which increased the countercyclicality of scenario severity. This is important to avoid a procyclical capital depletion and is in accordance with Principle 4 of the Basel Principles on stress testing,[26] which might be more accentuated due to the implementation of IFRS 9. However, the scenario does not focus only on cyclical risks, but also includes the materialization of structural risks, for example a strong repricing of private and public debt due to increased debt sustainability concerns. For this reason, the ranking of the countries does not reflect one-to-one the cyclical risk assessment for all the countries.

[22] For Bulgaria the sample starts after the introduction of the currency board in 1997. The column reporting the maximum decline of real GDP during the GFC is measure over a flexible length over 1 to 12 quarters, the denominator of the severity metric is instead calculated as the lowest between the minimum 1-year, 2-year, 3-year growth rates over the sample considered.

[23] See Adrian, T., Boyarchenko, N., and Giannone, D., "Vulnerable Growth", *American Economic Review*, Vol. 109, No 4, 2019, pp. 1264-89.

[24] See "**The Bank of England's approach to stress testing the UK banking system**", Bank of England, October 2015.

[25] See "**Policy Statement on the Scenario Design Framework for Stress Testing**", *Proposed Rule by the US Federal Reserve System*, 82 FR 59533, 15 December 2017.

[26] See "**Stress testing principles**", Basel Committee on Banking Supervision, October 2018.

3.3 Calibration of real GDP, unemployment rate, HICP paths

The model used to calibrate the adverse paths of real GDP, unemployment rate and HICP stemming from exogenous shocks is called "Stress-Test Elasticities" (STEs). The STEs model is based on a set of elasticities which are estimated by EU national central banks. These elasticities capture the response of a large set of macroeconomic variables (about 50) to exogenous shocks (to real and nominal economic variables and/or to selected financial asset prices) for all the 28 EU countries. Another important feature is that the STE model also incorporates intra-EU trade spillovers. The following sections describe the calibration of the shocks which are used as inputs for the STEs, in particular the demand (consumption and investment) confidence shocks, financial shocks, international shocks, and real estate price shocks.

3.4 Consumption and investment confidence shocks

To derive confidence shocks, a country-specific vector autoregressive model was estimated using a Bayesian framework (BVAR).[27] Following Barsky and Sims (2012) and, more particularly, Lachowska (2016)[28], a household confidence model with six variables was used, including a stock price index, an uncertainty index, the oil price, a confidence indicator, the real disposable income and household consumption. Likewise, a business confidence model was estimated using similar variables, as summarised in Table 2.

The models were estimated for each of the 28 EU countries using data at quarterly frequency[29] from the ECB Projections database and the ECB Statistical Data Warehouse.[30] European Commission Consumer Confidence and Business Climate indicators were used as measures for, respectively, consumption and business confidence and as uncertainty measure, the average quarterly volatility index VIX was considered. With respect to the estimation sample, the starting date was often dictated by the availability of the data but only information subsequent to the first quarter of 1999 was considered, while the end date was set at the fourth quarter of 2017.

[27] The estimation was conducted using the ECB's **BEAR toolbox**.

[28] See Barsky, R.B. and E. R. Sims, "Information, Animal Spirits, and the Meaning of Innovations in Consumer Confidence", *American Economic Review*, Vol. No 4, 2012, pp. 1343-1377; and M. Lachowska, 2016. "Expenditure and confidence using daily data to identify shocks to consumer confidence", *Oxford Economic Papers*, Oxford University Press, Vol. 68(4), 2016, pp. 920-944.

[29] Owing to this choice, the number of lags of the independent variables was set to four for most of the countries.

[30] The ECB projections database contains the data used in the regular macroeconomic projections exercise as submitted by the national central banks.

As regards a-priori distributions, an independent Normal-Wishart prior was used, while the hyper-parameters were set following the standard literature and optimized from a simple grid search approach.[31]

Table 2

The household and business confidence models

Models

Consumption Model	**Eurostoxx index**	**VIX**	**Oil price - Brent - in euro**	**Consumer confidence index**	**Real disposable income or real GDP**	**Real households' consumption**
Investment Model				**Industrial confidence index**	**Real GDP**	**Business Investment**
Transformation	**Growth rate**	**Ln**	**Growth rate**	**None**	**Growth rate**	**Growth rate**

In both cases, the BVAR's confidence shocks were identified using a sign restriction identification scheme and their contribution to household consumption and business investment, respectively, were computed. As highlighted in Table 3, and following the literature, it was assumed that a household (business) confidence shock triggers, within a quarter, an increase in confidence indicators, in domestic real disposable income (GDP) and in the household consumption expenditure (private business investment). While some studies consider confidence shocks as triggering an increase in stock prices, it was preferred to deviate from this assumption for at least two reasons: first, a domestic confidence shock for a given country, especially for small countries, will barely affect the Eurostoxx index. Second, it was chosen to impose a "no reaction to the stock market index" in the sign restrictions assumptions in order to disentangle the effect of the confidence shocks from the monetary policy shocks, which should have a contemporaneous impact on stock prices.

[31] See, for instance, Canova, F., Methods *for applied macroeconomic research*, Princeton University press, 22 January 2007.

Table 3

Sign restrictions for identifying confidence shocks

	Confidence shocks
Stock prices	0
VIX	0
Oil price	0
Confidence indicator	+
Real Disposable Income/GDP	+
Consumption/Investment	+

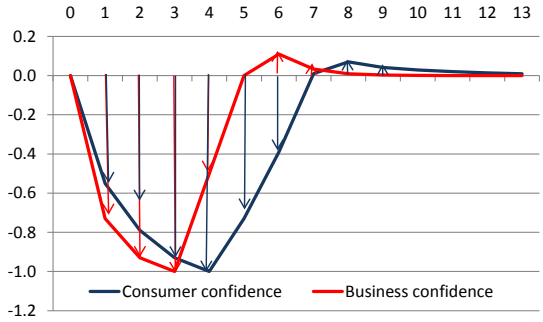
Once the contribution of confidence shocks to historical data for household consumption and business investment growth had been obtained, a risk tolerance value (RTV) was derived as a given percentile of the distribution of the contributions of confidence shocks to the growth rates of household consumption and business investment, respectively. This determines the magnitude of the shocks to consumption and investment as entailed in the STEs tool.[32]

The idea of the RTV is to test whether the banking system is able to withstand the materialisation of adverse confidence shocks experienced in the past. The path of consumption and investment shocks was simulated in line with the narrative of the "lower for longer" scenario: a steady decline in the RTV was considered over the first four quarters for consumption and over the first three quarters for investment, as shown in Chart 12, before a slight recovery followed over the rest of the scenario horizon. Investment shocks were slightly more volatile than consumption shocks, showing a more frontloaded adverse profile as well as a swifter recovery phase after the trough was reached. This reflects the greater rigidity in the behaviour of households compared with firms in reaction to adverse shocks.

[32] For a matter of simplification and clarity, the contribution of confidence shocks was assumed at 0 over the whole simulation horizon (2020-2022).

Chart 12

Shocks to consumption and business investment growth – Illustrative example



Note: The red line indicates that at quarter 1 of the simulation horizon, the RTV for business confidence is set at 73% of its minimum level, in quarter 2 is set at around 93% and at quarter 3 the minimum level is reached. It is thereafter set at on upward-trending path, falling back to close to 0 by quarter 9 of the simulation horizon.

In order to reflect the country level of cyclical risk in the scenario calibration (see Annex 3.2), the RTV percentiles were chosen in accordance with the level of cyclical risk for each country (see Table 4). Chart 13 provides an illustration of the path for each risk level.

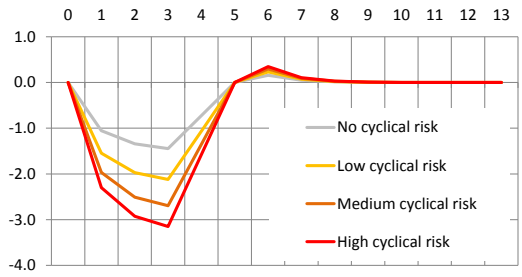
Table 4

The minimum RTV considered and the cyclical risk classification

Cyclical risk assessment	Considered percentile for the minimum RTV
No cyclical risk	23
Low cyclical risk	20
Medium cyclical risk	15
High cyclical risk	10

Chart 13

Confidence shock profiles over the scenario horizon with respect to the cyclical risk classification



3.5 Financial shocks

3.5.1 Overview of the financial market shocks simulations

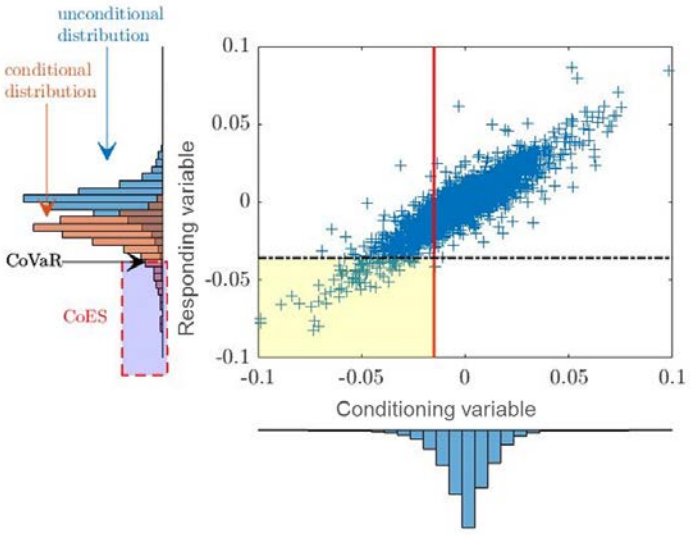
Shocks to financial asset prices (stock prices, long-term rates, swap rates, iTraxx, and foreign exchange) were calibrated using the **Financial Shock Simulator**, a multivariate copula-based tool available at the ECB.

The Financial Shock Simulator aims to capture correlations in the extreme tails of financial return distributions and identify spillover effects across securities and jurisdictions. This makes it particularly suitable for designing stress test scenarios.[33] It is a tool working on a large number of time series (3,000+), allowing the calibration of very granular financial market scenarios which, for the EBA stress tests, deliver consistent shocks to financial variables for the market risk and macroeconomic scenarios.[34]

The Financial Shock Simulator is based on a multivariate copula approach which calibrates the shocks and builds on the concepts of conditional expected returns (CoER) and conditional expected shortfall (CoES) (see Chart 14). This approach takes into account all the outcomes in the entire tail of the distribution and not just the value at a certain percentile, which is the case for Value at Risk (VaR).[35]

Chart 14

Intuitive representation of a bivariate copula model



Several simulations (corresponding to different assumptions on the joint tail probability) were run conditioning on the following factors being stressed:

- the spread between ten-year and one-year swap rates;

[33] See also Bassanin, M. Ojea Ferreiro, J. and E. Rancoita "The MacroFin Copula: a Probabilistic Approach for Scenario Calibration", forthcoming.

[34] The market risk scenario is calibrated consistently and jointly with the macrofinancial scenario, using the same simulations at more granular level and over a shorter window horizon (60 business days instead of 240).

[35] See Acerbi, C. and Tasche, D. (2002), "On the coherence of expected shortfall", Journal of Banking & Finance, Vol. 27, No 7, pp. 1487-1503.

- credit spreads (corporate credit and sovereign credit);
- stock price returns.

One simulation was then selected to match the inversion of the EUR and USD swap curves observed during the global financial crisis. From this simulation the calibration of all shocks described in the following sections were derived. The Financial Shock Simulator was run on granular country-level data, which was in some cases aggregated for the calculation of the final shocks (see Sections 3.5.2 and 3.5.3).

Given that a "lower for longer" scenario is unprecedented from a historical perspective, the calibration of the interest rates' paths was exogenously determined, to depict an inversion of the interest rate curve in 2020 and then a flattening by 2022. In addition, for all jurisdictions short-term interest rates (three-month swap rates) were assumed to be constant over the three-year scenario horizon and equal to the minimum between the 2020 baseline projections and the 2019 level of the three-month and one-month swap rates. The same temporal path was applied to all currencies to reduce the heterogeneity across countries and facilitate the comparisons.

3.5.2 Stock price shocks

Contrary to previous EU-wide stress test scenarios, only two aggregate shocks were calibrated for advanced and emerging economies, respectively. This choice reduces the scenario heterogeneity and is justified by the following observations:

- stock price indices are highly correlated in crisis times across well integrated financial markets;
- there were non-material differences to stock prices shocks of advance economies in previous editions [e.g. in the 2018 scenario];
- emerging economies experienced historically higher stock market volatility than advanced economies.

The calibration of the shocks coincides with the average of country-level conditional expected shortfalls (CoES) obtained from the copula simulation described in Section 3.5.1.

3.5.3 Long-term government bond yields shocks

To reduce the heterogeneity of shocks across countries and to simplify the cross-country comparison, countries were grouped into three buckets based on some measure of "sovereign risk" level. Then the average of the country-level shock of all countries belonging to the same bucket was applied to each country belonging to that bucket.

Buckets were based on four criteria:

(a) steepness of the yield curve (measured as the difference between the ten-year and one-year government bond yields) greater than the EU weighted average;

(b) rating below AA2 (Moody's)/AA (S&P)/ AA (Fitch) from at least one rating agency;

(c) debt-to-GDP ratio higher than the EU weighted average;

(d) level of long-term interest rates in 2019 higher than the EU weighted average.

A country was assigned to the:

- high risk bucket, if it fulfilled at least three criteria;
- medium risk bucket, if it fulfilled two criteria;
- low risk bucket, if it fulfilled less than two criteria.

While the output of the Financial Shock Simulator was used to calibrate the change in 2020 from the starting point, the increase in 2021 follows one-to-one the increase in the reference swap rate, and for 2022 it was assumed that the spread between long-term government bond yields and swap rates would narrow following an improvement in the macroeconomic situation. The size of the spread decline is about 10 basis points and was calculated on the basis of the estimated tail correlation between real GDP and sovereign credit spreads. These estimates were based on the application of the copula model to real GDP and sovereign credit spreads.[36]

Table 5
Average shocks in the scenario for each country group

Level of sovereign risk	Starting point rates (%)	Baseline rates (%)			Adverse rates (%)		
	2019	2020	2021	2022	2020	2021	2022
High (weighted average)	1.86	1.47	1.67	1.86	2.19	2.39	2.34
Medium (weighted average)	0.85	0.66	0.78	0.91	0.12	0.54	0.64
Low (weighted average)	-0.02	-0.09	0.03	0.14	-0.86	-0.70	-0.66
Spread High- Low	1.88	1.56	1.65	1.72	3.06	3.10	3.01

3.5.4 Household net worth shocks

Household net worth coincides with financial assets in the STE models. First, **data from Eurostat** was used to reconstruct the assets side of the balance sheet for households. Then the shares of equities (listed and unlisted), loans (assets), debt securities and pension fund entitlements were calculated. For all variables except non-listed equities a decline of nominal values in line with the

[36] See also Bassanin, M. Ojea Ferreiro, J. and E. Rancoita "The MacroFin Copula: a Probabilistic Approach for Scenario Calibration", forthcoming.

stock prices shocks was applied. To unlisted equities, a depreciation was applied in line with the domestic level of cyclical risks. In particular:

- a shock of -45% was applied to unlisted equities in countries with a high cyclical risk level;
- a shock of -30% was applied to unlisted equities in countries with a medium cyclical risk level;
- a shock of -20% was applied to unlisted equities in countries with a low cyclical risk level.

This is in line with the average conditional expected shortfall of equity prices at the 1%, 5% and 10% probability level, respectively.

3.6 International shocks

The calibration of the scenario for non-EU countries follows an approach similar to that used for the calibration of the EU scenario. This allows both non-linearities of financial shocks to be better captured and also greater granularity. More precisely, a two-stage approach is followed.

(a) A set of satellite models is used to calculate exogenous shocks for the 15 non-EU countries included in the scenario:

  (i) a threshold BVAR (T-BVAR) is used to calibrate shocks to production;

  (ii) the GDP growth-at-risk (GaR) model is used to calibrate the expected tail decline in real GDP;

  (iii) financial shocks are derived from the Financial Shock Simulator (see Section 3.5).

(b) A large-scale, semi-structural global model (the Oxford Model[37]) uses the shock to production and to financial prices as input and targets the real GDP decline derived from the GaR, which yields as final outputs shocks to foreign demand and imports/exports.

The T-BVAR model was used to capture the non-linear relationship between global uncertainty and economic activity. The T-BVAR model includes an explicit threshold which allows two different regimes to be disentangled: a “distressed” regime and a “low stress” regime. The T-BVAR includes the VIX[38], national industrial production (IP) and a business confidence indicator (the Purchasing

[37] The Global Economic Model developed by Oxford Economics.

[38] The VIX, measuring expectations of volatility implied by the S&P 500, is a reasonable proxy for equity market uncertainty. Using alternative internal measures of macroeconomic uncertainty (based on forecast errors) would yield similar results.

Managers' Index). The VIX was assumed, as threshold variable, to determine the regime and four lags were included in the model.

The GaR model was used to capture the potential tail decline in real GDP, which was then used as target for the real GDP decline in the Oxford model. The GaR approach is used in order to quantify the non-linear effects of financial stress indicators for advanced and emerging economies at the extreme lower quantiles of real economic activity.

Conditional forecasts were then based on the Oxford model using the T-BVAR simulation as its main input. With this aim, a generalised version of the methodology proposed by Waggoner and Zha (1999) was used, in which shock-specific conditional forecasts were generated, and the difference between the effects on industrial production generated in the conditional and unconditional forecasts input in the Oxford model.

3.7 Residential real estate price shocks

The scenario entails an adverse adjustment of residential real estate prices. This assumption is consistent with a narrative where, despite the low level of interest rates, a repricing of assets is envisaged due to both an adverse demand effect and an increase in risk aversion. The calibration of the shocks to residential real estate prices started from a measure of over/undervaluation of residential real estate prices with respect to their fundamentals as evaluated by ECB staff.[39] The main valuation measure is the average of four indicators of house price valuations.[40] These measures were calculated on the basis of models and a comprehensive house price dataset provided by the ECB.[41] This choice is consistent with the ECB's internal assessment of residential real estate risks and it is also aimed at aligning the size of the shocks with the ESRB's risk assessment of the residential real estate market.

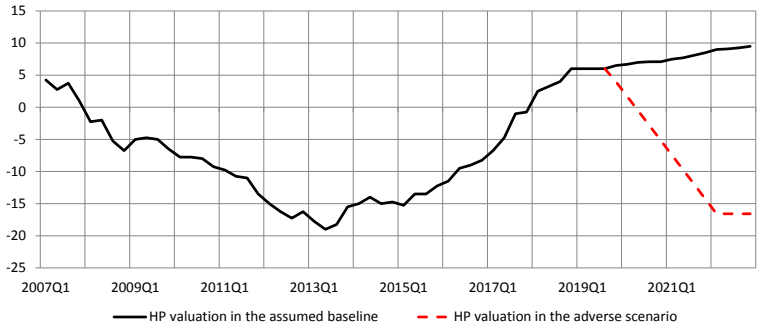
[39] The data considered are public and can be found in the **Statistical Data Warehouse**. Pre-2007 data available at the ECB was also used in the calibration.

[40] In a few cases, alternative house price valuations measures, also from the ECB Statistical Data Warehouse, were considered in order to improve the alignment of the house price shock with the ESRB's risk assessment of the residential real estate market.

[41] Further methodological details are given, for instance, in "**Financial Stability Review**", ECB, May 2018 and further sources cited therein.

Chart 15

Calibration of residential real estate price shocks – Illustrative example

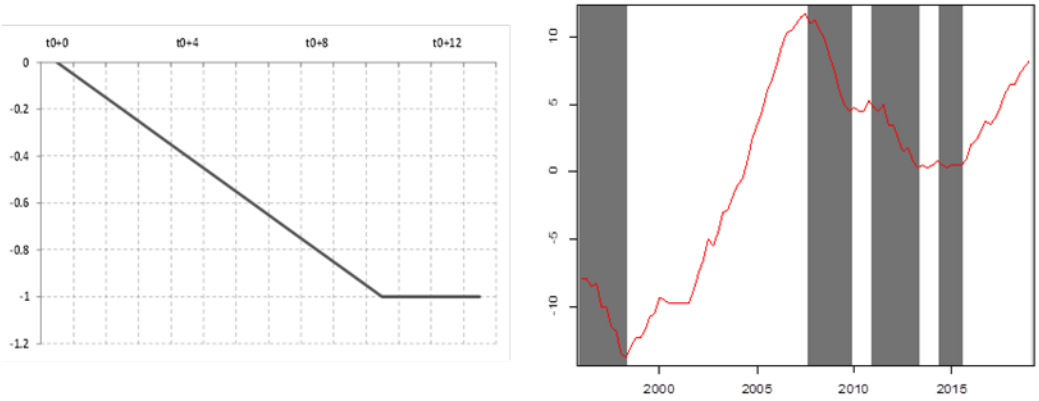


In a second step, a risk tolerance value (RTV), i.e. a tail adverse level of the variable of interest (here house prices), was selected. An operational assumption was to set the minimum RTV value equal to the seventh percentile of the historical distribution of the valuation measure. Given that the over/undervaluation of residential real estate prices was not available over the simulation horizon, i.e. 2020-22, the house price valuation was based on house price projections assuming an incomplete pass-through from house price changes to house price valuations, with the pass-through assumed to be constant and identical for all countries (see Chart 15 for illustration).

In addition, a time-varying RTV path was chosen. The implemented profile of the RTV, as illustrated in Chart 16 (left-hand panel), was based on the euro area house price valuation drops experienced during the global financial crisis. The global financial crisis appears to be a suitable benchmark with respect to the 2020 narrative given that it is one of the main crises in the short history of the euro area that shows some similarities with the considered narrative.

Chart 16

Path of the residential real estate price shocks (left-hand panel); euro area house price valuation during the last crises (right-hand panel)



3.8 Commercial real estate prices shocks

The calibration of commercial property price shocks followed a two-step approach:

(i) a regression based on the other scenario variables was estimated and commercial property prices were projected over the scenario horizon on the basis of this regression;

(ii) an adjustment of the projection in (i) based on the commercial real estate market risk assessment.

The calibration of commercial real estate prices suffers limitations owing to the scarcity of commercial real estate prices data. A simple regression could be estimated for very few countries, while for the other countries the calibration of commercial real estate prices was based on a regression estimated on aggregate EU data. The regression includes commercial real estate prices as the main dependent variable and real GDP, residential property prices, interest rates and equity prices as the main regressors.

In a second step, information on commercial real estate price overvaluations was also incorporated, and the model-based projection of commercial property prices performed. The model generally predicted that commercial property prices are highly correlated with residential property prices. However, the residential property price shocks follow the residential property price over/undervaluation measure. From the analysis of the residential and commercial real estate market which is carried out in the framework of the countries' macroprudential assessment it could emerge that for some countries, over/undervaluation of commercial property prices differs from that observed for residential property prices. The data underlying this assessment is not sufficiently rich to calibrate commercial real estate price shocks. However, on the basis of this information, the regression model projections were adjusted downwards/upwards to reflect the differences in the valuations of the commercial and residential property markets. The magnitude of the adjustment followed the average difference in the overvaluation measure of the residential real estate prices

(owing to the limited information on commercial prices). For example, if the average difference between highly overvalued residential real estate markets and moderately overvalued residential real estate markets was 5 percentage points, then a 5-percentage point downward adjustment was applied to commercial property prices resulting from the model's projection if the macroprudential policy assessment found that residential markets are highly overvalued and commercial property prices have a moderate overvaluation.