EUROPEAN CENTRAL BANK

EUROSYSTEM

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Model-based risk analysis at the ECB: Some illustrations

30 September 2019

The views expressed are my own and not necessarily those of the ECB

Model-based approaches to risk analysis: incorporating expert judgment

- **Statistical risk metrics: combining predictive densities with judgment**

  Combine a range of models (including non-linear ones) to derive a tilted predictive distribution (with the (B)MPE baseline as a median/mode)

  Survey participants on second and/or third moment of the distribution: qualitative or quantitative input (e.g. QRA)

  Derive new tilted predictive distribution, imposing the surveyed moments

- **Event-based risk analysis: assessing macroeconomic contingencies**

  Fully-fledged scenario analysis of selected risk events (potentially using a range of models)

  Survey participants on the probability of each risk event

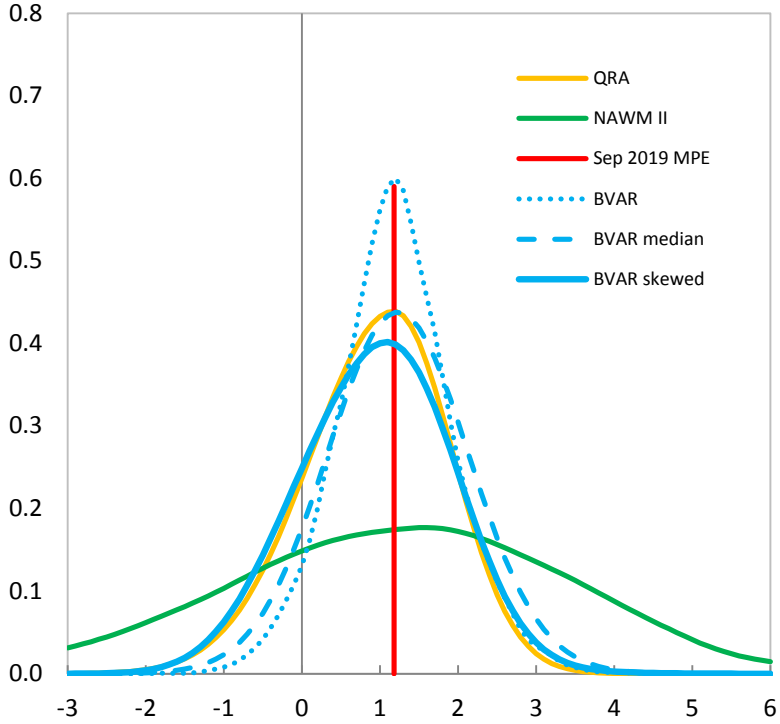
  Derive new tilted predictive distribution, imposing the mean effect of the risk events

- **Potential combination of the two approaches for the final risk balance indicators**

Predictive densities around the growth and inflation projections (Sep 2019 MPE)

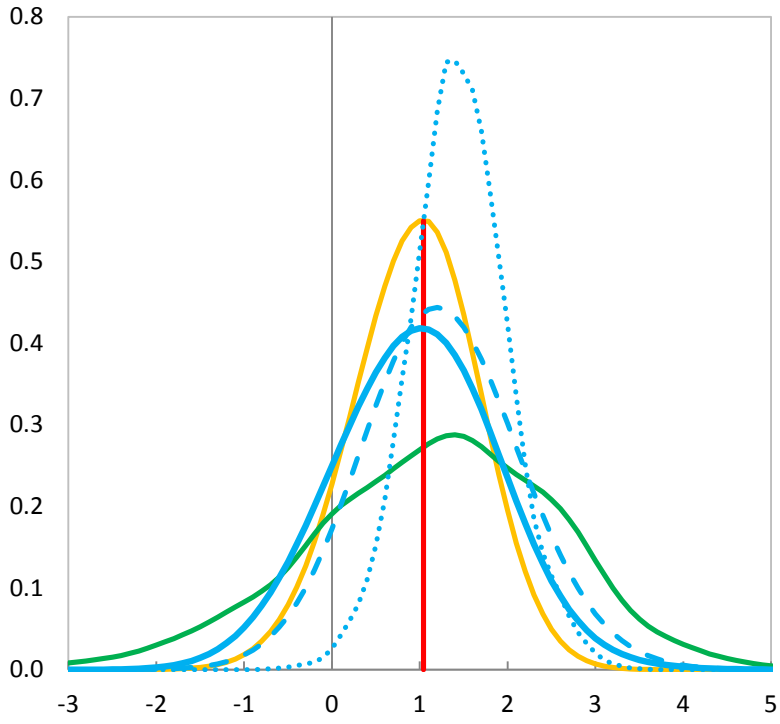
2020 Real GDP – Euro area

(annual growth rate, in %)



2020 HICP– Euro area

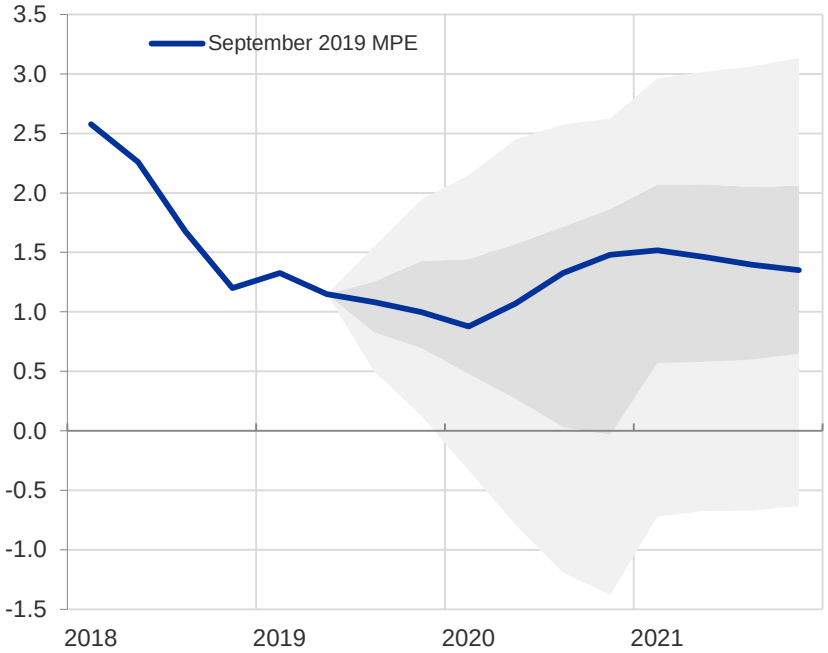
(annual growth rate, in %)



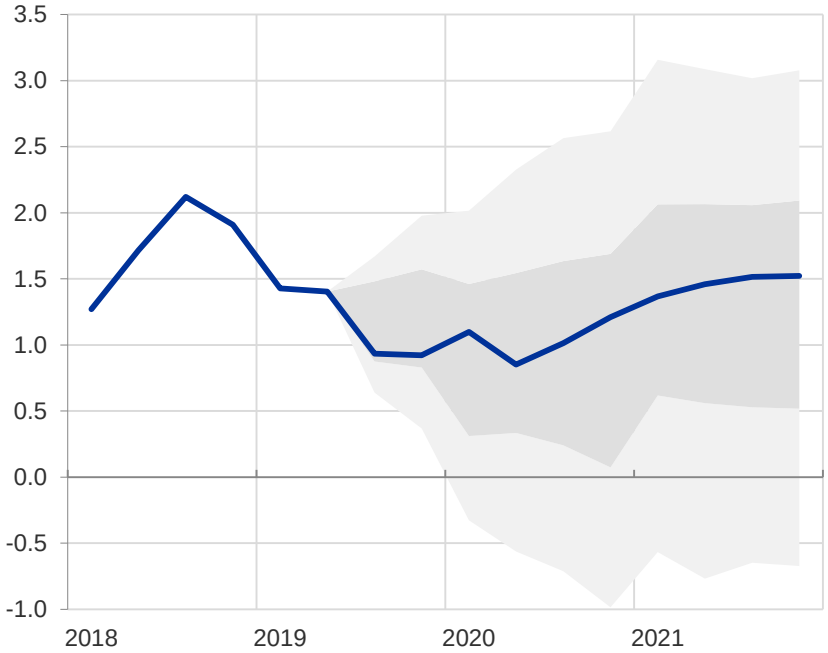
Source: ECB projections database and ECB staff calculations based on: NAWM II, BVAR (density forecast from a combination of seven 3-variables BVAR models, with weights obtained by optimizing the combined predictive likelihoods), BVAR median (same as BVAR, with median tilted to match the baseline), BVAR skewed (same as BVAR median, tilted to match also the skewness of QRA), QRA (quantitative risk assessment of the September 2019 MPE baseline). For NAWM II, PCD is used instead of HICP.

Model-based risk sensitivity: predictive densities imposing QRA risk balance

Real GDP – Euro area
(y-o-y growth rates, in %)



HICP– Euro area
(y-o-y growth rates, in %)



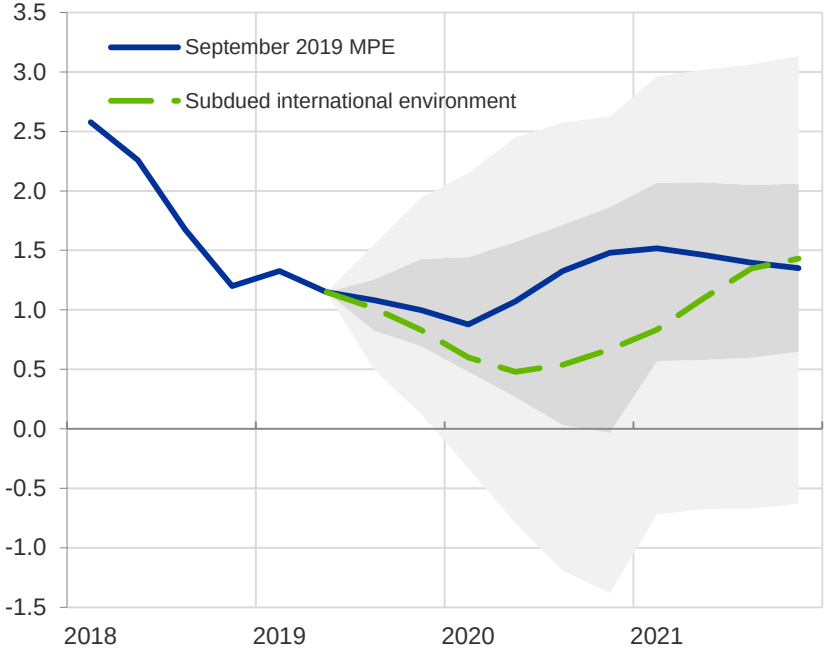
Source: ECB projections database and ECB staff calculations. The shaded areas represent the 50% (dark grey) and the 90% (light grey) of a forecast density obtained from a combination of seven 3-variables BVAR models with optimal weights, tilted so that the mean and the skewness match those of the Quantitative Risk Assessment (QRA).

Model-based risk sensitivity (NAWM II): Macroeconomic contingencies

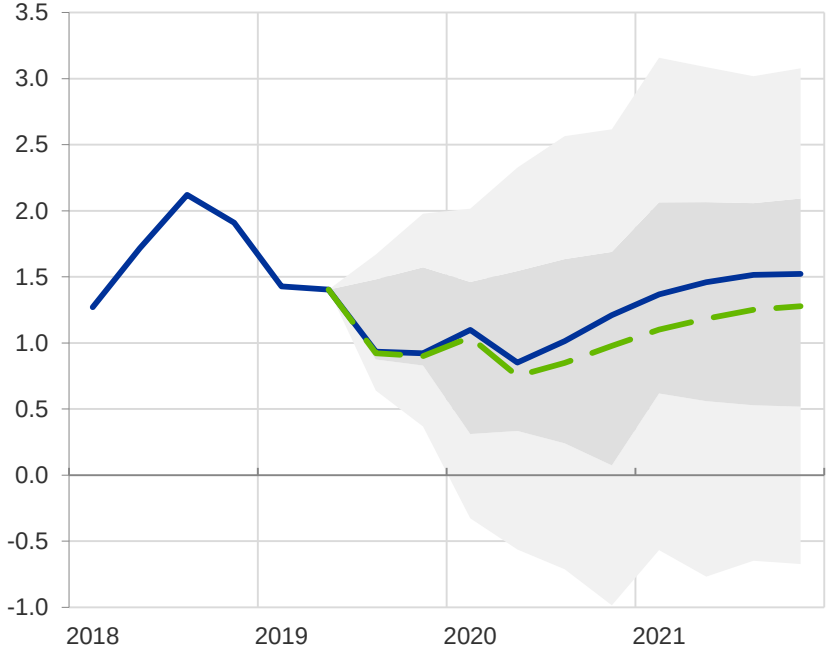
Scenario	Description
Subdued international environment	lower world demand and weaker external competitiveness consistent with the Brexit scenario included in the Special Feature 1 of the September 19 MPE Forecast Report and an escalation of the trade dispute which drops exports and raises import tariffs similar to Special Feature "The resurgence of protectionism: potential implications for global financial stability" in Financial Stability Review November 2018.
Brexit	lower world demand and weaker external competitiveness consistent with the Brexit scenario included in the Special Feature 1 of the September 19 MPE Forecast Report
Trade dispute	an escalation of the trade dispute which drops exports and raises import tariffs similar to Special Feature "The resurgence of protectionism: potential implications for global financial stability" in Financial Stability Review November 2018.
Financial set-back	reflects the counterfactual paths for the short- and the long-term interest rates which are designed to bring the financial conditions index (FCI) back to its historically tightest level since the APP announcement in February 2016. See Annex 3 of September 19 MPE Forecast Report
Weaker bank lending pass-through	reflects a scenario with a widening of credit spreads amounting to 15bp
Financial set-back and de-anchoring	reflects the counterfactual paths for the short- and the long-term interest rates which are designed to bring the financial conditions index (FCI) back to its historically tightest level since the APP announcement in February 2016. See Annex 3 of September 19 MPE Forecast Report and a reduction in long-term inflation expectations by 0.5 p.p.
Stronger financial easing	reflects a scenario with a further 40bp drop in the long-term rates mimicking conditions by which all the revisions in the yield curve since the June 19 BMPE would be explained by favourable interest rate shocks in the NAWM
Supportive fiscal policy	Gradual increase in government expenditures according to fiscal package calibration (2pp increase up to 2021)

Model-based risk sensitivity (NAWM II) : Subdued international environment

Real GDP – Euro area
(y-o-y growth rates, in %)



HICP– Euro area
(y-o-y growth rates, in %)



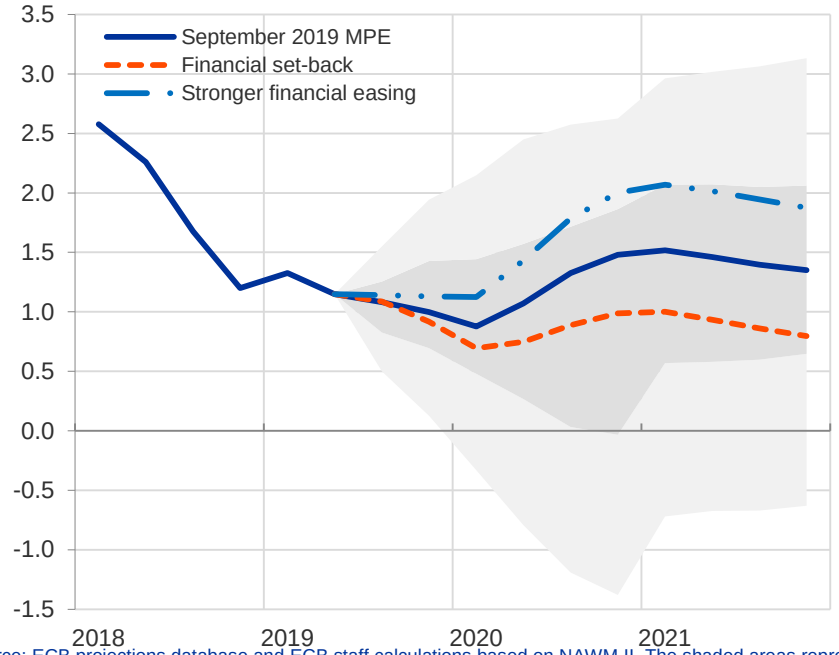
Source: ECB projections database and ECB staff calculations based on NAWM II. The shaded areas represent the 50% (dark grey) and the 90% (light grey) of a forecast density obtained from a combination of seven 3-variables BVAR models with optimal weights, tilted so that the mean and the skewness match those of the QRA.

Subdued international environment: lower world demand and weaker external competitiveness consistent with a Brexit-type risk event and an escalation of the trade dispute which drops exports and raises import tariffs similar to Special Feature "The resurgence of protectionism: potential implications for global financial stability" in Financial Stability Review November 2018.

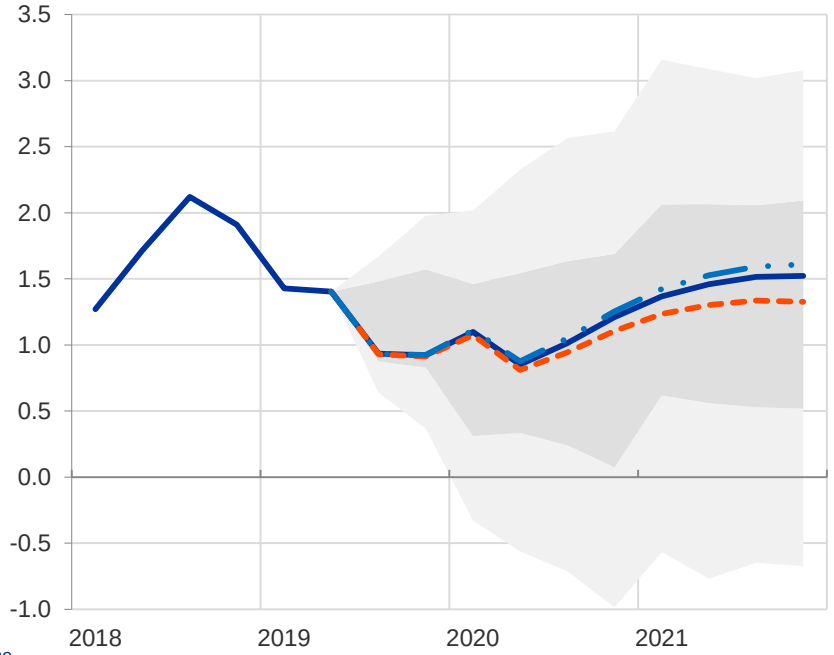
	GDP growth		Inflation	
Difference to baseline (percentage points)	2020	2021	2020	2021
Subdued international environment	-0.6	-0.3	-0.1	-0.3

Model-based risk sensitivity (NAWM II) : Financial risk events

Real GDP – Euro area
(y-o-y growth rates, in %)



HICP– Euro area
(y-o-y growth rates, in %)



Source: ECB projections database and ECB staff calculations based on NAWM II. The shaded areas represent the 50% (dark grey) and the 90% (light grey) of a forecast density obtained from a combination of seven 3-variables BVAR models with optimal weights, tilted so that the mean and the skewness match those of the QRA.

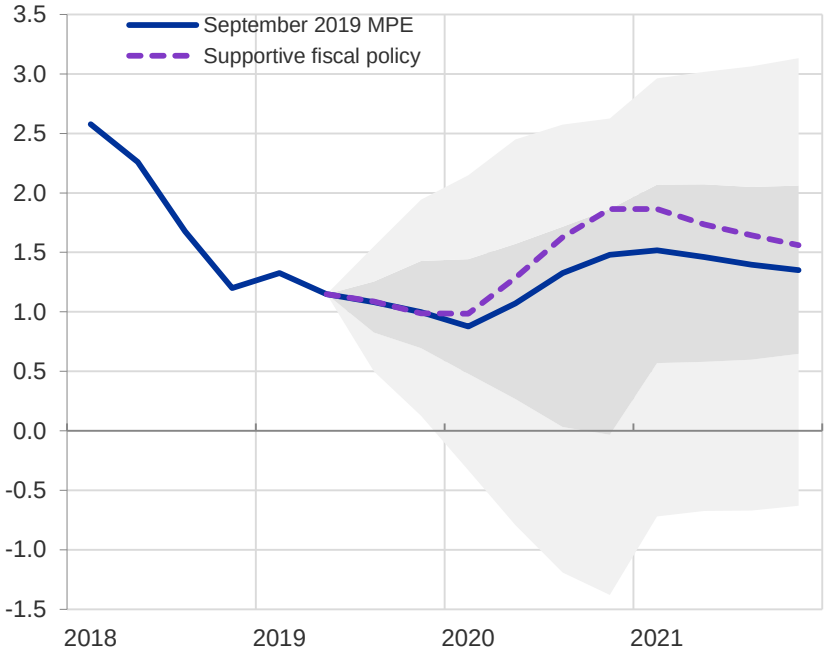
Financial set-back reflects the counterfactual paths for the short- and the long-term interest rates which are designed to bring the financial conditions index (FCI) back to its historically tightest level since the APP announcement in February 2016.

Stronger financial easing reflects a scenario with a further 40bp drop in the long-term rates mimicking conditions by which all the revisions in the yield curve since the June 19 BMPE would be explained by favourable interest rate shocks in the NAWM II.

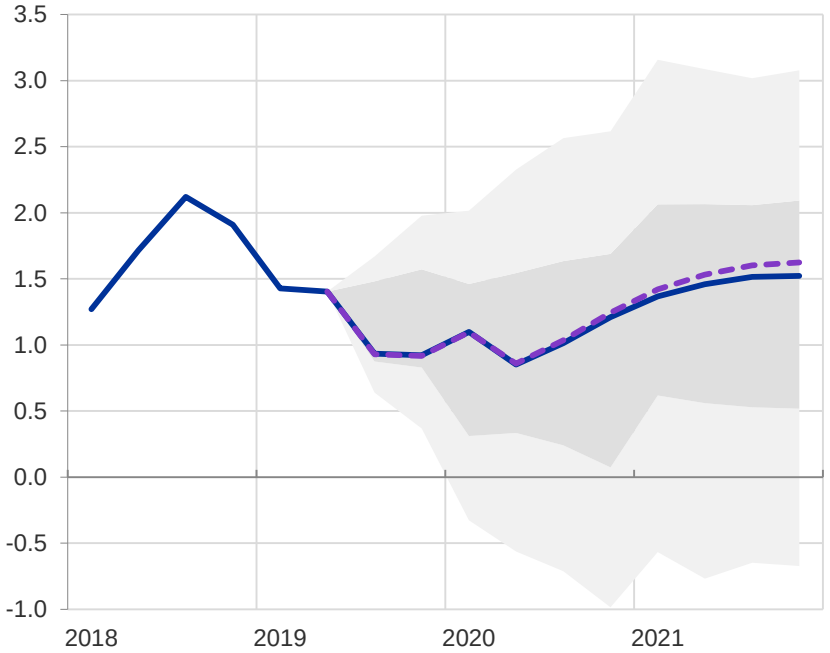
	GDP growth		Inflation	
Difference to baseline (percentage points)	2020	2021	2020	2021
Financial set-back	-0.4	-0.5	-0.1	-0.2
Stronger financial easing	0.4	0.5	0.0	0.1

Model-based risk sensitivity (NAWM II): Supportive fiscal policy

Real GDP – Euro area
(y-o-y growth rates, in %)



HICP– Euro area
(y-o-y growth rates, in %)



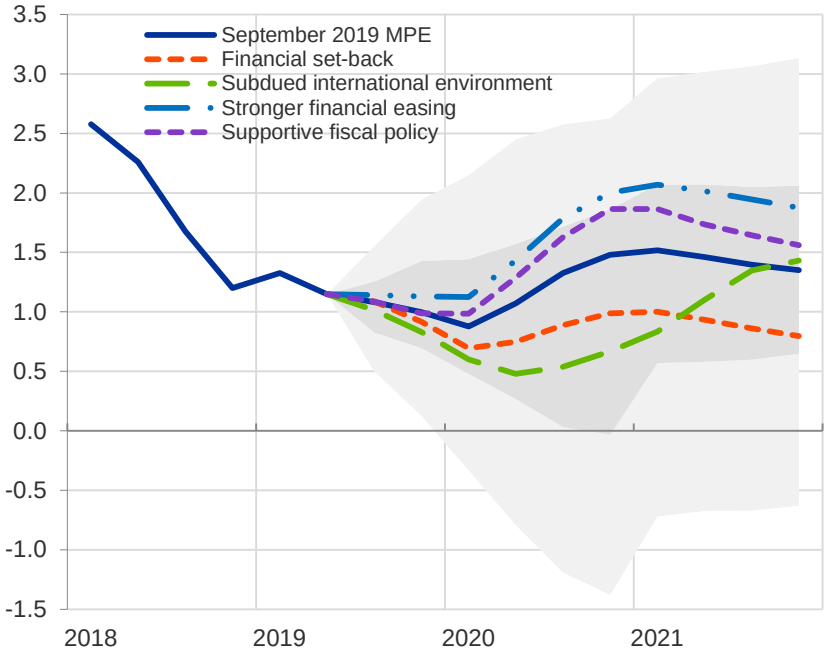
Source: ECB projections database and ECB staff calculations based on NAWM II. The shaded areas represent the 50% (dark grey) and the 90% (light grey) of a forecast density obtained from a combination of seven 3-variables BVAR models with optimal weights, tilted so that the mean and the skewness match those of the QRA.

Supportive fiscal policy reflects a scenario in which government expenditures increase gradually over 2020 and 2021 eventually reaching a 2% higher level compared to the baseline. This implies a fiscal package of around 0.5% of GDP in line with available Fiscal space in DE and NL

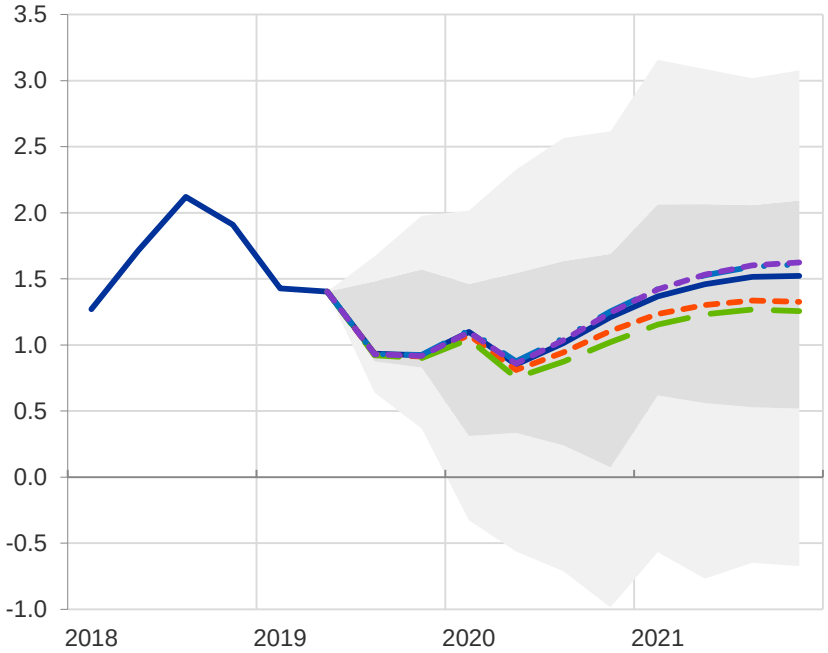
	GDP growth		Inflation	
Difference to baseline (percentage points)	2020	2021	2020	2021
Supportive fiscal policy	0.3	0.3	0.0	0.1

Model-based risk sensitivity (NAWM II): Macroeconomic contingencies

Real GDP – Euro area
(y-o-y growth rates, in %)



HICP– Euro area
(y-o-y growth rates, in %)



Source: ECB projections database and ECB staff calculations based on NAWM IIThe shaded areas represent the 50% (dark grey) and the 90% (light grey) of a forecast density obtained from a combination of seven 3-variables BVAR models with optimal weights, tilted so that the mean and the skewness match those of the QRA.

Financial set-back: higher short- and long-term interest rates.

Subdued international environment: lower world demand and weaker external competitiveness consistent with the Brexit scenario included in the Special Feature 1 of the September 19 MPE Forecast Report and an escalation of the trade dispute which drops exports and raises import tariffs similar to Special Feature "The resurgence of protectionism: potential implications for global financial stability" in Financial Stability Review November 2018.

Stronger financial easing: lower long-term interest rates.

Supportive fiscal policy: increase in government consumption.

Model-based approaches to risk analysis: incorporating expert judgment

- **Statistical risk metrics: combining predictive densities with judgment**

  Combine a range of models (including non-linear ones) to derive a tilted predictive distribution (with the (B)MPE baseline as a median/mode)

  Survey participants on second and/or third moment of the distribution: qualitative or quantitative input (e.g. QRA)

  Derive new tilted predictive distribution, imposing the surveyed moments

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