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Macroprudential policies aim to prevent an excessive build-up of risks and to make the financial sector more resilient.

This paper proposes a methodology for measuring macroprudential policy stance based on a risk management approach to controlling and assessing macroprudential policy.

The semi-structural approach strikes a middle ground between standard empirical and structural models and offers a high degree of flexibility in incorporating relevant information in its forecasts.

Several alternative macroprudential policy stance measures of the distance-to-tail type are considered in this paper.

As for the results of applying our methodology, a policy exercise tracking the evolution of macroprudential policy stance from 2017 to 2021 reveals a mild tightening of the stance before the end of 2019, reflecting at least partially a coordinated effort of macroprudential and supervisory authorities following the 2008 crisis.

The policy exercise also covers the evolution of macroprudential policy stance in selected euro area countries.

A policy stance captures, in relation to a specific point in time and situation, the balance between policy instruments and policy objectives.

The first challenge in measuring macroprudential policy stance is that macroprudential policy involves multiple instruments.

Another challenge relates to the measurement of the objective of macroprudential policies, i.e. financial stability.

In this paper, we assess the macroprudential policy stance by employing the Growth-at-Risk (GaR) perspective and a semi-structural model.

The GaR-based measure of the stance assessment rests on the macro-micro Banking Euro Area Sector Stress Test (BEAST) model.

Banks in the model are subject to system-wide and bank-specific capital requirements and buffers.

Banks are also affected by market interest rates, allowing us to track the interplay between prudential and monetary policies.

The model's semi-structural design allows us to absorb various sources of information available at the point of building macro-financial forecasts.

The model can be used to build interval forecasts of macroeconomic and banking sector conditions.

The availability of the full distributions of economy-wide outcomes allows us to describe the corresponding Growth-at-Risk (GaR) or even expected shortfall (ES) metrics.

A so-called distance-to-tail metric calculated as a difference between GaR or ES and mean or median of the distribution is then used to build a measure of the macroprudential policy stance.

This paper contributes to the rapidly growing body of research that advocates the risk management framework as the most appropriate to developing and assessing macroprudential policy.

The proposed semi-structural model approach fortifies the assessment of the macroprudential policy stance with broad data use and narrative building.

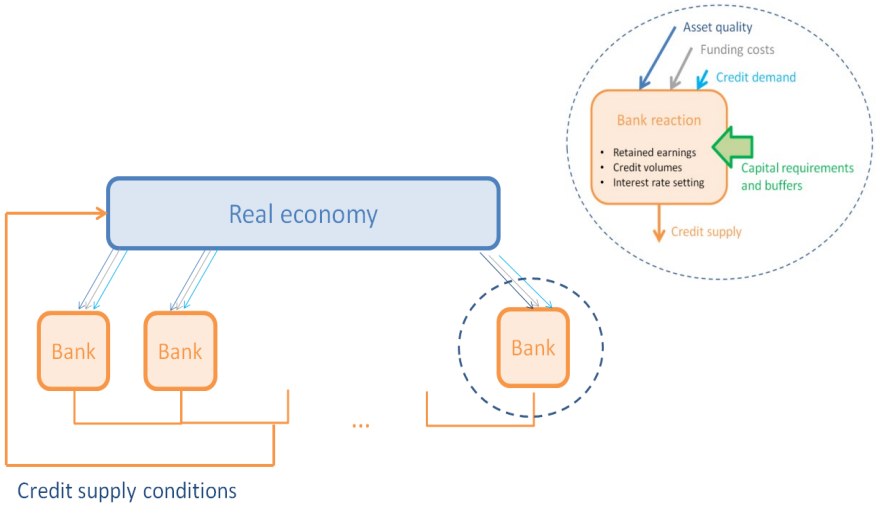
The rest of our report is structured as follows.

The BEAST is a semi-structural model linking macro and bank-level data and is regularly used by the ECB for macroprudential stress testing and policy assessment.

A share of model equations maps the pass-through of scenarios into bank balance sheet parameters.

A further set of bank-level equations stipulates banks' behavioural responses.

Figure 1

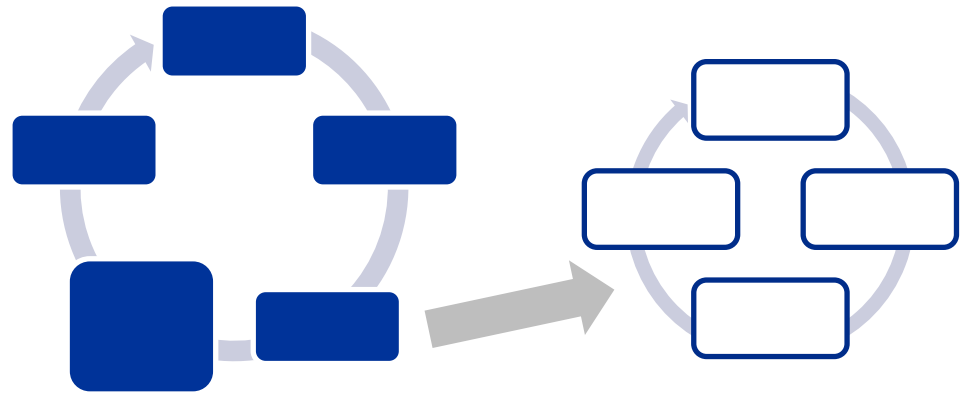


The macroeconomic module captures the dynamics of each euro area economy including intercountry trade spillovers.

Solving all equations jointly enables a comprehensive modelling of amplification mechanisms, therein the feedback loop between the banking sector and the real economy.

A further amplification mechanism represents the interaction between solvency and funding costs.

Figure 2



The SVAR model represents each euro area economy and includes a dozen macro-financial variables that can significantly affect banks' balance sheets.

Each euro area economy is also exposed to a dozen structural or reduced-form shocks.

Additionally, the uncertainty of future outcomes is related to parameter uncertainty in the macro block of the model.

A reduced-form panel VAR for 19 euro area economies has the following form:

$$Y_{i,t} = c_i + \sum_{j=1}^{p} A_{i,j} Y_{i,t-j} + B_i X_{i,t} + D_i \varepsilon_{i,t}$$

$Y_{i,t}$ i c_i
$X_{i,t}$ $A_{i,j}$
j p
B_i D_i
$\epsilon_{i,t} \sim N(0, \Sigma)$
$\varepsilon_{i,t} \sim N(0,1)$ $\epsilon_{i,t} = D_i \varepsilon_{i,t}$

The estimation procedure follows the Bayesian approach proposed by Jarocinski (2010). $A_{i,j}$ B_i

c_i
$p = 2$

The structural representation D_i of the panel VAR model is derived by combining a set of zero and sign restrictions.

Alternative macro-financial scenarios are generated by creating series of draws from the joint posterior distribution of structural shocks $\varepsilon_{i,t} \sim N(0,1)$.

c_i $A_{i,j}$ B_i D_i
$\varepsilon_{i,t} \sim N(0,1)$

Bootstrapping eliminates any ex ante parametrical assumptions about the reduced-form residuals ϵ_t in the VARs.

$\hat{\epsilon}_t$ $\{\epsilon_t,\ t \in 1, \ldots, n\}$ n
ϵ_t

The bootstrapping method applied in this paper is the geometric block bootstrap, which recognises the time-series nature of the model.

i t_i $\{1, \ldots, n\}$
t_1

The designation geometric is derived from the length of each block being drawn according to a geometric distribution. l

$$P(l = k) = p(1-p)^{k-1},$$

p p

$$l_{avg} = 1/p$$

l_1

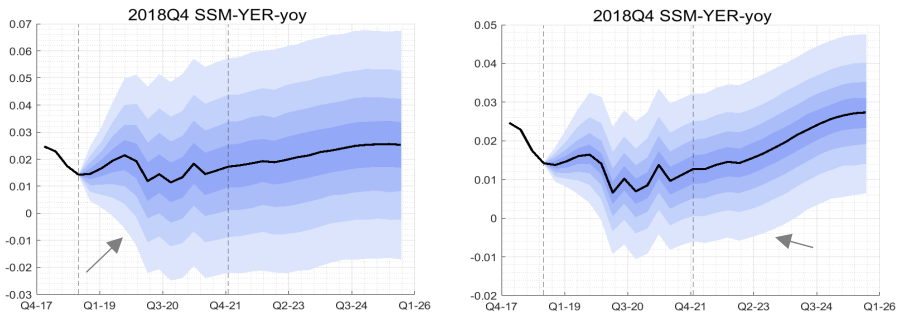
$$\{\hat{\epsilon}_1, \hat{\epsilon}_2, \ldots, \hat{\epsilon}_{l_1}\} = \{\epsilon_{t_1}, \epsilon_{t_1+1}, \ldots, \epsilon_{t_1+l_1-1}\}.$$

Chart 1 shows the forecast GDP growth distribution for the benchmark specification and the bootstrapping approach defined above.

The model captures asymmetry in the distribution of output growth forecasts based on the non-linearities of bank behaviour.

Chart 1

Mean and individual deciles of the future GDP growth distribution



This chapter introduces individual elements of the macroprudential policy stance assessment.

The macroprudential policy stance establishes a relationship between macroprudential actions by policymakers and the objective of financial stability (ESRB, 2019).

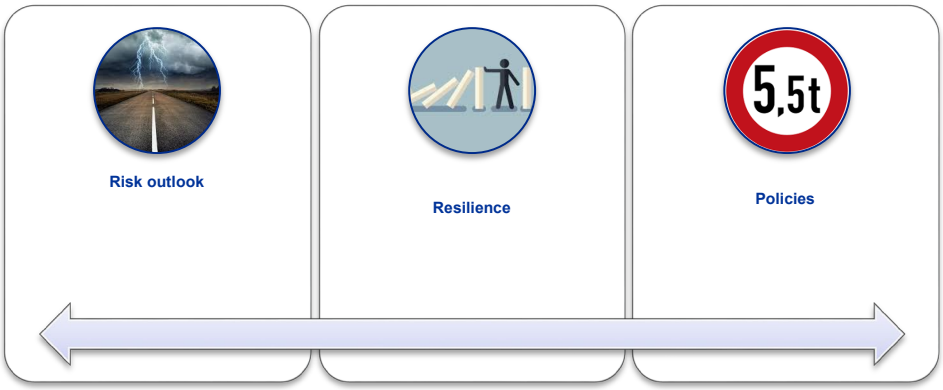
Growth-at-Risk (GaR) is widely regarded as a promising approach for assessing the macroprudential policy stance.

ESRB (2021) recommends the distance-to-tail as a stance metric that focuses on the relative importance of risks embedded in the lower tail of the growth distribution, relative to its central tendency

The Growth-at-Risk approach to the macroprudential policy stance assessment can be pursued with different models.

The BEAST model can provide a comprehensive risk outlook, while accounting for system resilience along with active or planned policies at a point in time.

Figure 3



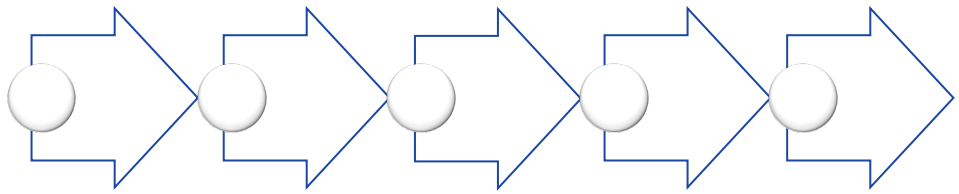
The central tendency of the forecasted distribution of variables can be anchored on projections derived from models best tuned to this purpose.

The information on banking system resilience rests on the most recent data on individual banks' balance sheets sourced from FINREP and COREP frameworks.

Last, the model can encapsulate a complete picture of macroprudential, supervisory and regulatory policies.

The interactions between macroprudential and regulatory policies appear relevant as several regulatory reforms have been phased-in in recent years or are being planned for the years ahead.

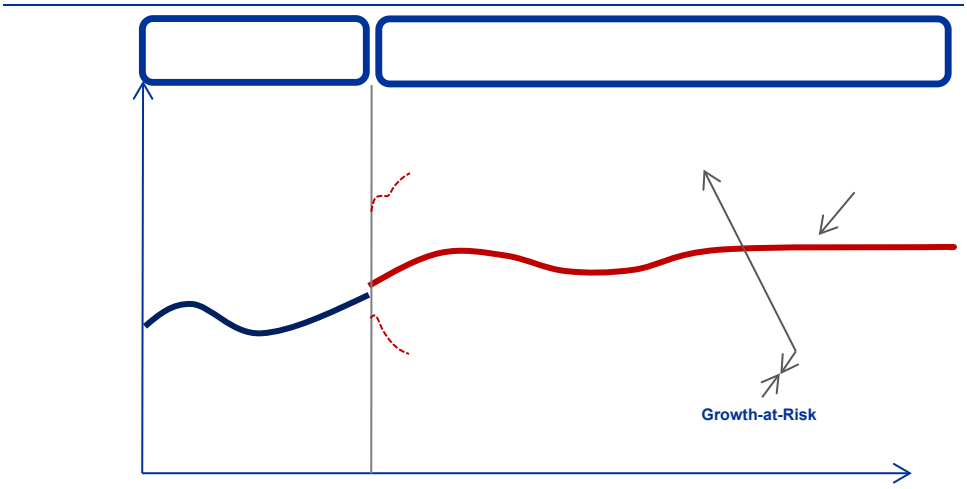
Figure 4



The final key policy element incorporated in the model are Covid-19 mitigation policies not directly targeting but having a very pronounced effect on the banking sector.

Figure 5 summarises the essence of the stance assessment.

Figure 5



In order to illustrate the methodology, the model was used to assess the macroprudential policy stance evolution in the euro area from 4Q 2017 to 3Q 2021.

Figure 6 illustrates the concept of the exercise. For each quarter, we derive a forecast of the real GDP (or alternatively private sector lending) distribution at a pre-selected horizon.

Figure 6

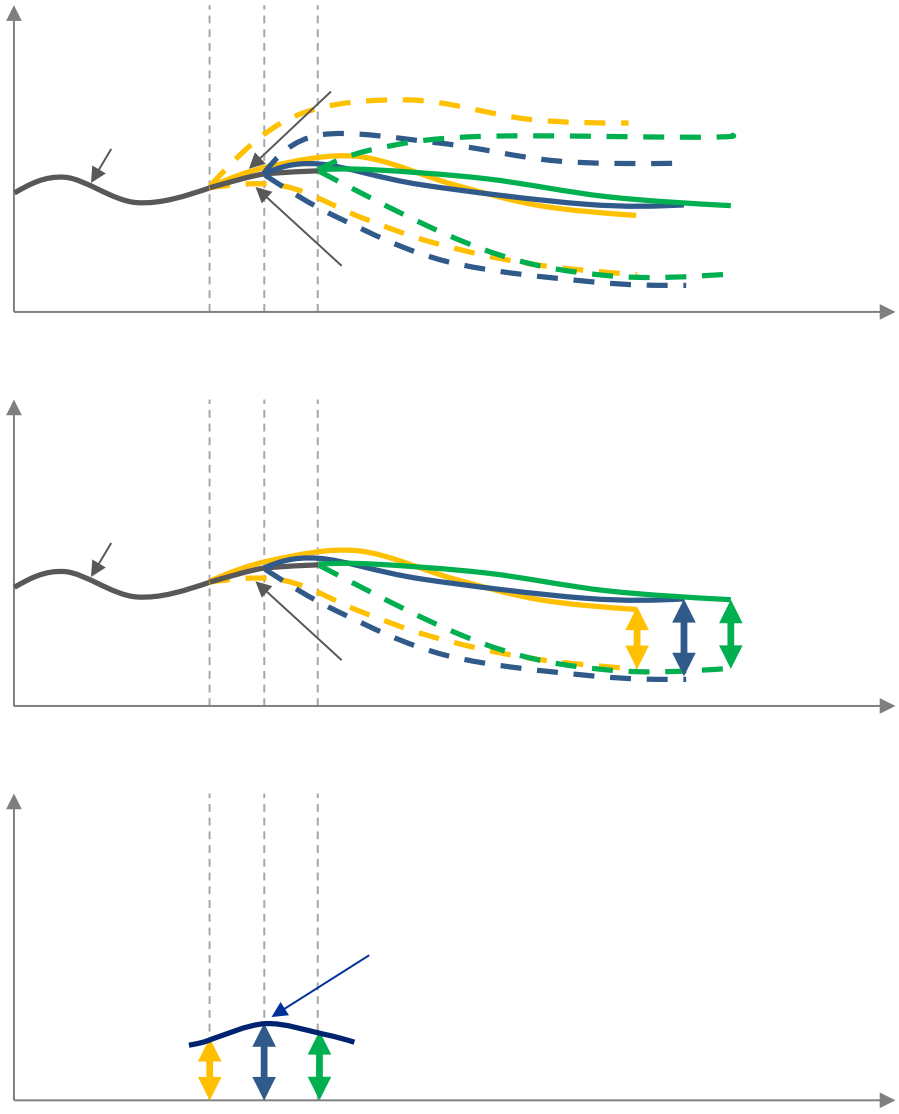
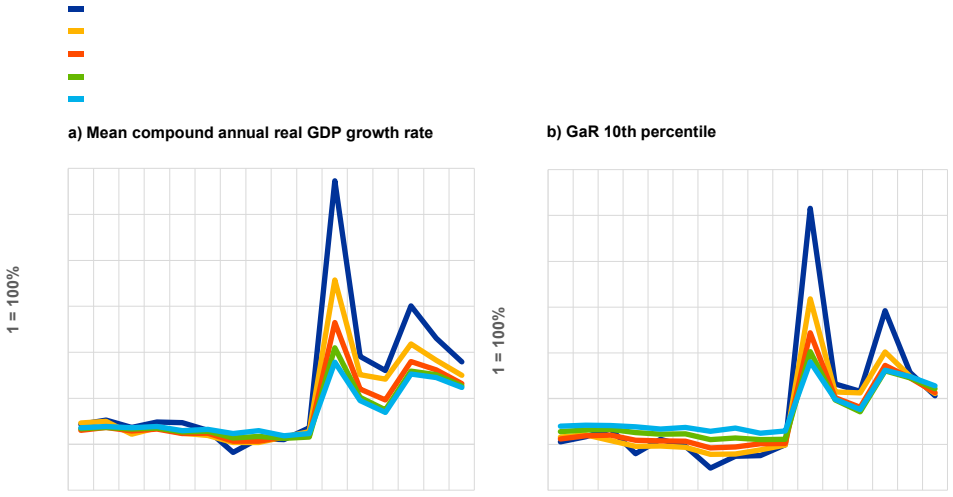


Chart 2 includes the empirical counterpart of measures that can be read out from the upper panel of Figure 6.

There is a strong co-movement between the mean and the tail of the forecast GDP growth over time, signifying the empirical relevance of shifts in the overall forecast distribution.

Chart 2

Substantial co-movement of stance measures at different time horizons



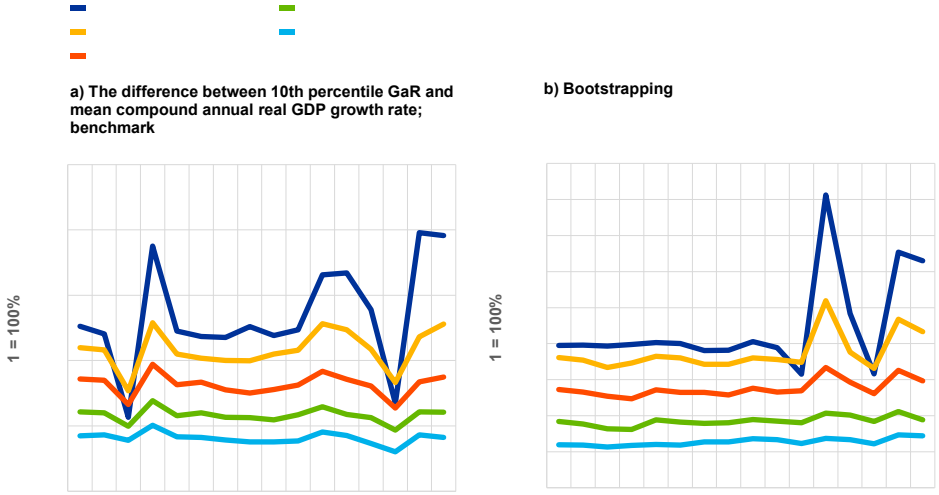
This chapter explores alternative measures of the macroprudential policy stance and presents an evolution of the stance between 2017 and 2021, including country-level results.

Several stance measures can be defined building on the principles described in the last section.

The choice of the horizon should, among other factors, reflect transmission lags of macroprudential policies and persistence of macro-financial risks.

Chart 3

Substantial co-movement of stance measures at different time horizons



The level and time-variation of the stance indicator generally decreases with the length of the horizon.

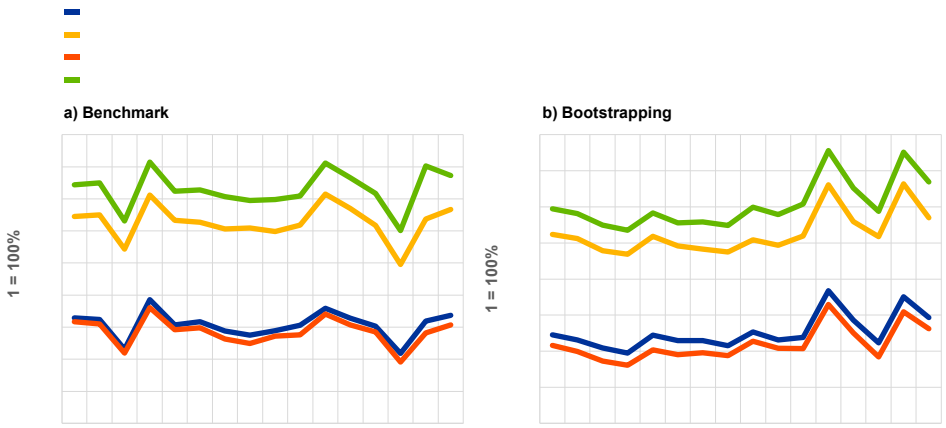
A correlation analysis of co-movements between the stance measures based on different horizons reveals that they move together closely, though the relationship between them weakens with an increasing gap between reference time horizons. $t \pm 1$

$t \pm 2$ $t \pm 3$ $t \pm 4$

Another dimension of comparison concerns the usage of different risk measures, based on GaR at 10th percentile versus GaR at 5th percentile, GaR versus expected shortfall (ES), and mean versus the median of the forecast distributions.

Chart 4

Alternative measures of macroprudential policy stance based on different measures of tails and central tendency



To complement the analysis, we also explored approaches based on non-GDP measures, especially private sector lending, as shown in Chart 5.

Chart 5

Private sector lending-based assessment of macroprudential policy stance for different time horizons

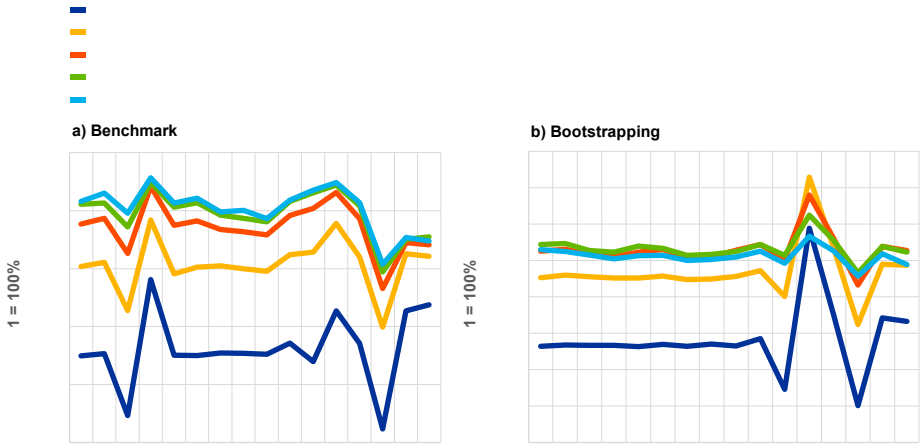
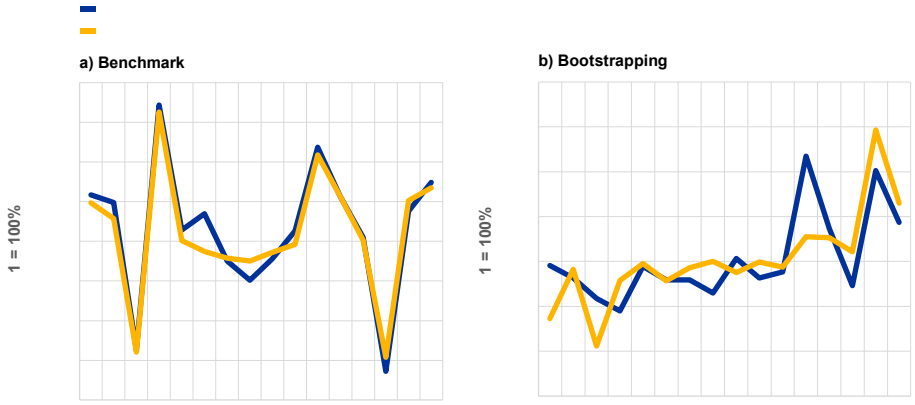


Chart 5 depicts the evolution of the semi-structural GaR-based macroprudential stance measure for the three-year ahead compound annual real GDP growth rate forecast for the euro area.

A few important take-aways can be derived from investigating the evolution of the semi-structural GaR macroprudential policy stance between 2017 and 2021.

Chart 6

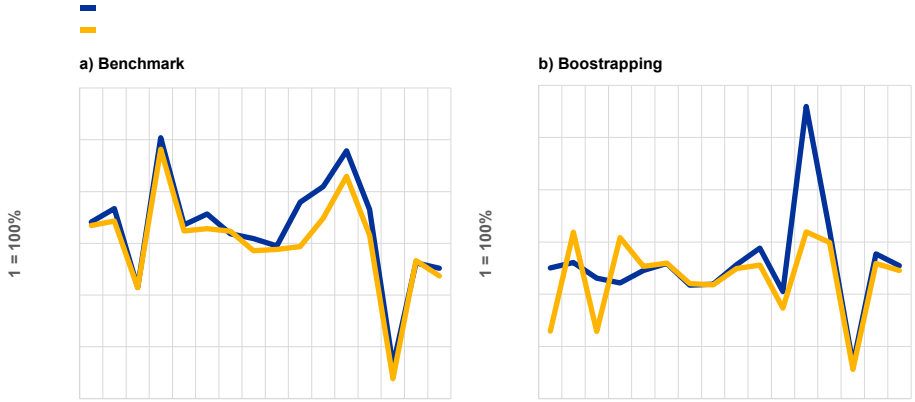
GDP-based assessment of macroprudential policy stance three years ahead for actual and constant policy



The relative impact of macro-financial policies can be best illustrated by the underlying trends in the distance-to-tail of private sector lending growth.

Chart 7

Private sector lending-based assessment of macroprudential policy stance three years ahead for actual and constant policy



The semi-structural GaR stance measure across selected euro area countries is signified by a high degree of co-movement.

Chart 8

Country examples for semi-structural GaR stance between 2017 and 2021

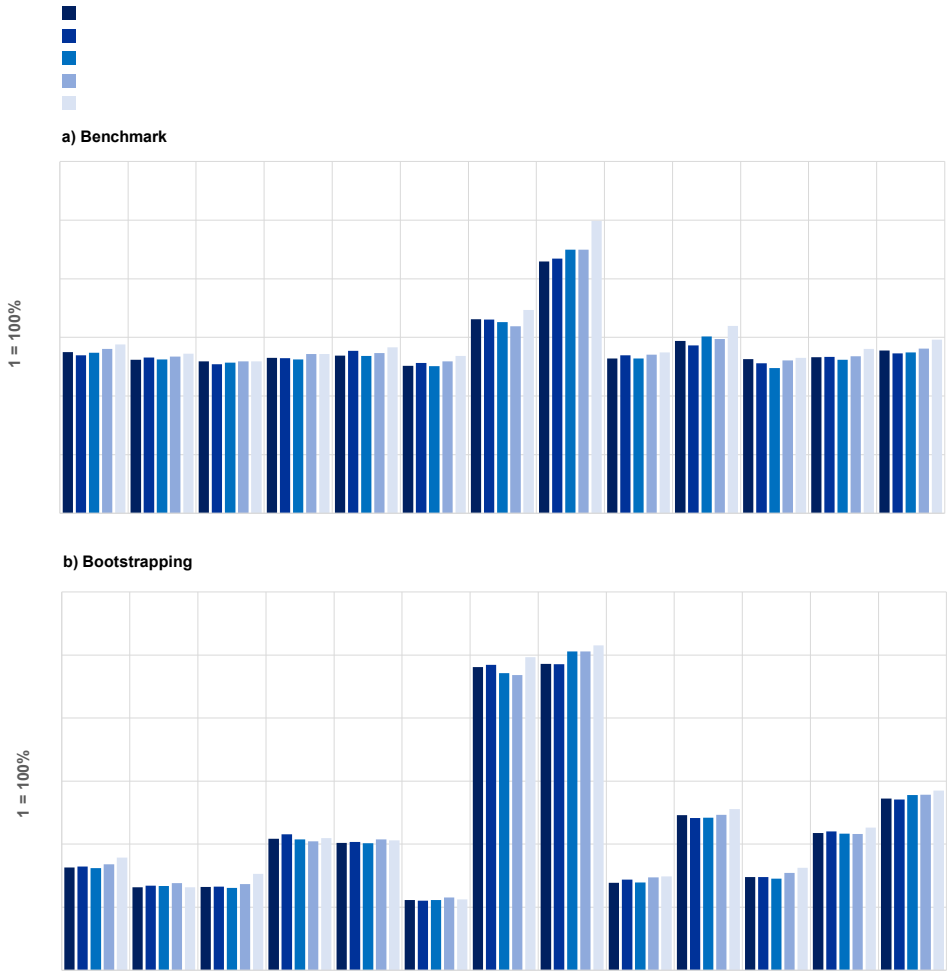
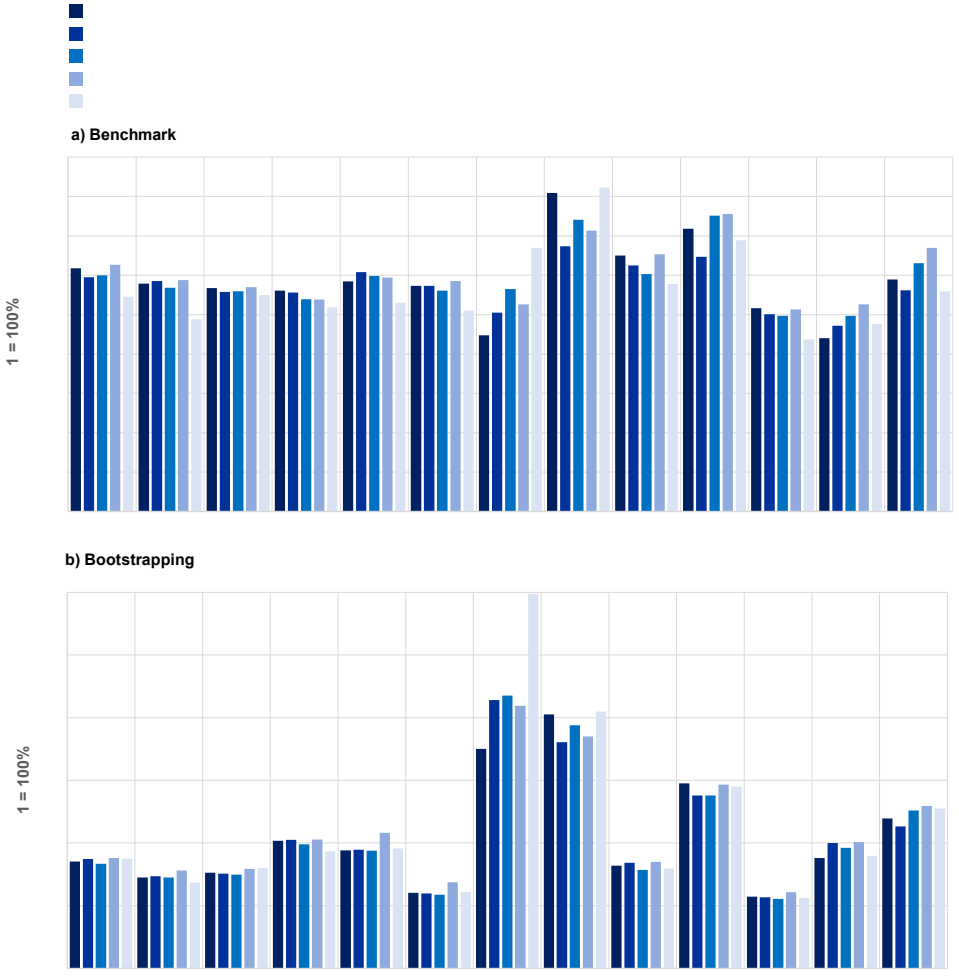


Chart 9

Country examples for semi-structural LaR stance between 2017 and 2021



This paper presents a possible way of measuring macroprudential policy stance by applying a mean-corrected GaR perspective and a large-scale semi-structural model.

The semi-structural approach can accommodate the interplay between macroprudential and monetary and supervisory policies.

Additionally, the merits of the semi-structural approach can be exploited based on other models already available to Member States.

The analysis shows a strong co-movement between the mean and the lower tail of the forecast distribution of the macrofinancial variables considered.

Through the prism of the distance-to-tail metric, we explored multiple alternative stance measures.

The policy exercise we conducted tracks the evolution of macroprudential policy stance from 2017 to 2021 for two different policy options, focusing on both real GDP and private sector lending-based stance measures on a three year horizon.

The policy exercise also focuses on the evolution of country-level macroprudential policy stance measure for selected euro area countries.

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