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## The sectoral systemic risk buffer: general issues and application to residential real estate-related risks

No 352

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# Abstract

The 2019 revision to the Capital Requirements Directive allowed the systemic risk buffer to be applied on a sectoral basis in the European Union. Since then an increasing number of countries have implemented the new tool, primarily to address vulnerabilities in the residential real estate sector. To inform and foster a consistent understanding and application of the buffer, this paper proposes two specific methodologies. First, an indicator-based approach which provides an aggregate measure of cyclical vulnerabilities in the residential real estate sector and can signal a potential need to activate a sectoral buffer to address them. Second, a model-based approach following a stress test rationale simulating mortgage loan losses under adverse conditions, which can be used as a starting point for calibrating a sectoral buffer. Besides these methodological contributions, the paper conceptually discusses the interaction between the sectoral buffer and other prudential requirements and instruments, ex ante and ex post policy impact assessment, and factors guiding the possible release of the buffer. Finally, the paper considers possible future applications of sectoral buffer requirements for other types of sectoral vulnerabilities, for example in relation to commercial real estate, exposures to non-financial corporations or climate-related risks.

**Keywords:** financial stability, banks, macroprudential policy, capital buffers

**JEL codes:** G21, G28

# Non-technical summary

**This paper seeks to deepen common understanding of the application of the sectoral systemic risk buffer (sSyRB), with a focus on vulnerabilities related to residential real estate (RRE); it discusses conditions for activating and releasing the buffer, approaches to calibration and the interplay with other capital requirements.** Sectoral application of the systemic risk buffer (SyRB) became possible in 2019, when the Capital Requirements Directive V (CRD V) was adopted. Since then several countries have applied an sSyRB, primarily to enhance resilience against RRE-related vulnerabilities. European Banking Authority guidelines already provide a common framework for designating appropriate subsets of exposures to which an sSyRB can be applied. Experience with the new tool to date has demonstrated many commonalities across countries, but also technical and conceptual differences. This paper provides a comprehensive conceptual discussion and proposes two specific methodologies to inform and foster consistent application of the buffer. The primary focus is on applying the tool to address RRE-related vulnerabilities, but the paper also includes initial reflections on possible applications in other risk areas.

**The paper proposes two methodologies to support future policy decisions on activating and calibrating the sSyRB: an indicator-based approach and a model-based approach.** Both complement the ECB's existing RRE risk and policy analysis framework and emphasise the policy dimension. Assessments are generally performed sequentially, first considering the need for additional policies from a risk-based perspective and then discussing how measures might be calibrated where a need is identified. The indicator-based approach supports the first step, while the model-based approach can be a starting point for the second.

**The indicator-based approach provides an aggregate measure of cyclical vulnerabilities in the RRE sector and aims to highlight the potential need to activate an sSyRB.** It relies on an early warning methodology to develop an RRE composite indicator (CI) similar to existing measures for broader cyclical systemic risk. The RRE-related CI is constructed as the optimally weighted average of selected early warning indicators covering four different dimensions: i) household credit and debt service burdens, ii) prices and valuations, iii) construction activity and investment, and iv) interest rates. It reliably provides early warnings of RRE-related financial crises and can signal a potential need to activate an sSyRB when pre-defined early warning thresholds are crossed. Given the partial overlap with a broader systemic risk indicator informing activation of the countercyclical capital buffer (CCyB), both indicators need to be assessed together when deciding whether one or both of them should be activated. The indicator needs to be complemented with further information on structural risk factors that may also warrant activating an sSyRB or imply greater urgency in addressing a build-up of cyclical risk in RRE markets, for example if the country-level RRE CI simultaneously increases to levels close to or above the signalling threshold.

**The model-based approach using the Integrated Dynamic Household Balance Sheet (IDHBS+) framework relies on an RRE stress test rationale and simulates loan losses under adverse scenarios, which can then be used as starting points for calibrating an sSyRB.** The integrated framework combines macro-financial and household data to determine credit risk parameter sensitivities to macroeconomic developments and attaches the resulting changes in credit risk parameters to bank mortgage portfolios to calculate loan losses under adverse conditions. Simulated loan losses vary across countries, depending on the initial risk parameters and estimated sensitivities. The paper applies three simple stress scenarios of varying severity to compute simulated losses, which can then be used as indicative starting points for calibrating an sSyRB. The rationale behind this approach is that buffer rates should be high enough to cover potential losses on mortgage portfolios under adverse conditions.

**From a conceptual perspective, the final calibration of the sSyRB needs to take the existing policy mix into account so as to avoid potential overlap in risk coverage between different prudential measures.** The potential for overlap in risk coverage is greatest for the CCyB (in cases where the sSyRB is primarily targeting risk of a cyclical nature) and the broad SyRB (in cases where the sSyRB is primarily targeting risk of a structural nature); the sSyRB calibration may have to be adjusted on a case-by-case basis to avoid this. Authorities also need to consider the role of the capital conservation buffer (CCoB) when translating simulated losses from an adverse stress scenario into sSyRB rates. For severely adverse scenarios in particular, there may be conceptual merit in assuming that banks will use part of the CCoB to absorb the corresponding losses, since covering all hypothetical losses with a dedicated sectoral buffer could prove inefficient. By contrast, Pillar 1 and Pillar 2 requirements, G-SII/O-SII buffers and Pillar 2 guidance are unlikely to imply a need to adjust the calibration of the sSyRB, since they constitute permanent requirements to be met at all times, serve different purposes and/or represent legally non-binding microprudential guidance tackling idiosyncratic bank risk. Finally, a stress test/model-based calibration approach can automatically account for the effects of existing borrower-based measures (BBMs), since any gradual improvement in borrower risk profiles induced by these should translate into lower initial credit risk parameters and thus lower simulated losses to feed into the sSyRB calibration. Provided this effect is appropriately captured (as it should be for the model inputs in the IDHBS+ framework), there is no need to adjust calibrated buffer rates any further to account for existing BBMs.

**While the calibration of sectoral buffers should be guided by financial stability considerations, a proper impact assessment is needed to gauge effectiveness and avoid unintended side effects.** This paper discusses several types of analysis authorities can conduct to assess the impact of sectoral policy measures on the resilience of the banking sector and lending to the real economy. These include ex ante assessments of bank capital headroom and profitability (since the effects of measures are likely to depend on these variables), impact analysis looking at descriptive statistics and econometric models, and model-based simulations. The choice of assessment method depends on the modelling approaches applied, the data available, the precise design and objectives of the measures to be deployed

and, potentially, country-specific aspects. The paper recognises the need for flexibility in this respect.

**Releasing the sSyRB when risks materialise serves to support banks' ability to absorb losses while maintaining the provision of key financial services.** Given the sectoral nature of the buffer, the primary focus before releasing should be on the extent to which risks have materialised in the specific segment of the economy, in this case the RRE sector. When deciding the timing and the magnitude of any release authorities need to weigh a range of different factors, primarily relating to expectations of widespread losses and excessive tightening in the supply of credit due to bank capital constraints. Both forward and backward-looking indicators can be useful. Authorities may also wish to issue guidance on the use of the capital released, particularly if this occurs at an early stage of a crisis or risk materialisation episode. They further need to consider how any decision to release may interact with other buffers, such as the CCyB, and if sequencing of releases is appropriate.

**The sSyRB enlarges the toolkit for addressing RRE-related vulnerabilities and provides authorities with additional flexibility.** Although it offers several benefits, there are still situations with elevated RRE risks where authorities would prefer to apply other tools. For example, if RRE risk is embedded in broader cyclical systemic risk, the CCyB or a combination of the SyRB and the CCyB may be the preferred choice. As the sSyRB can only amplify specific risk-weighted requirements (since it builds on existing risk weights), it may be necessary in some cases to substitute or complement the tool with add-ons or floors to risk weights to avoid excessive heterogeneity. Finally, capital-based measures such as the sSyRB are generally complementary to BBMs; the former ensure sufficient resilience against vulnerabilities in the entire stock of mortgages, while the latter work primarily on mortgage flow to limit further build-up of vulnerabilities.

**The sSyRB has the potential to play an important role in mitigating and addressing sectoral risk beyond just RRE.** Article 133 CRD lays down a broad list of exposures to which it may apply. This paper considers the possibility of applying the sSyRB to address risks in relation to commercial real estate, risks stemming from exposures to non-financial corporations and climate-related risks. Future work may further deepen our understanding of how to apply the tool in these and other areas.

# 1 Introduction

## 1.1 Motivation and objectives of the paper

**In 2019 the Capital Requirements Directive V (CRD V)[1] introduced a set of targeted legal changes that inter alia made it possible to apply the systemic risk buffer at the sectoral level (the sectoral systemic risk buffer or sSyRB).** The aim was to design a targeted tool for addressing systemic risk in specific sectors or subsets of sectors. The legal changes also broadened the potential scope of the buffer by expanding the range of risks that can be covered and mitigated by using this instrument. The reference to "long-term non-cyclical […] risks" in Article 133 CRD was replaced by a more generic reference to macroprudential or systemic risks not covered by the countercyclical capital buffer (CCyB), the buffers for global or other systemically important institutions (G-SIIs and O-SIIs) or by instruments enshrined in the Capital Requirements Regulation (CRR).[2] At the same time, to avoid any overlaps in risk coverage, an SyRB or sSyRB may only be introduced for risks that are not already addressed by other measures in the CRR (in particular, those taken under Articles 124, 164 or 458) or by Articles 130 (CCyB) and 131 (G-SII/O-SII buffers) CRD.

**Following these legislative changes, several countries in the banking union have applied an sSyRB, primarily to enhance resilience against vulnerabilities related to residential real estate (RRE).** Authorities in Belgium, Germany, Lithuania, Malta, Portugal and Slovenia have used the tool to address RRE-related vulnerabilities (see **Annex 1**), while authorities in France recently activated the buffer to address risks in the non-financial corporate (NFC) sector (see **Box 2**). To calibrate the buffer for RRE-related vulnerabilities, authorities have mostly relied on stress test-based approaches, mapping estimated bank losses under adverse real estate scenarios to buffer rates that would enable banks to absorb these losses while maintaining provision of key financial services. While the rationale for calibration is generally similar across countries, technical implementation differs. Authorities have used a broad range of tools to evaluate the sectoral buffers implemented.

**As the use of the sSyRB becomes more widespread, this paper seeks to deepen the common understanding on the conditions for activating and releasing it, approaches to calibrating it, and how it interacts with other capital buffer requirements.** Given the broad scope of potential application, a better common understanding of the buffer and a high degree of consistency in its application across the EU will be beneficial both for communicating with banks that may be affected by measures introduced by different national authorities and with

1 Directive (EU) 2019/878 of the European Parliament and of the Council of 20 May 2019 amending Directive 2013/36/EU as regards exempted entities, financial holding companies, mixed financial holding companies, remuneration, supervisory measures and powers and capital conservation measures (OJ L 150, 7.6.2019, p. 253).

2 Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (OJ L 176, 27.6.2013, p. 1), as amended by Regulation (EU) 2019/876 of the European Parliament and of the Council of 20 May 2019 (OJ L 150, 7.6.2019, p. 1) (CRR II).

respect to reciprocation of measures. It will also facilitate discussions between authorities, since the buffer falls under the scope of the SSM Regulation (SSMR)[3] and the ECB is therefore required to assess any measures that relevant national authorities intend to implement, and apply higher requirements if needed. This paper provides a conceptual discussion and proposes two specific methodologies to inform and foster consistent application of the buffer, complementing existing methodologies at national level.[4] Given experience to date, the primary focus is on applying the sSyRB for RRE-related vulnerabilities. Nevertheless, the report concludes with an outlook on the prospects for its use in other risk areas, since such applications are likely to increase in the future.

The remainder of the paper is organised as follows: the next subsection briefly recalls the legal background to the sSyRB. **Section 2** proposes two specific methodologies to inform activation, calibration and release of the instrument, and also discusses interaction with existing instruments. **Section 3** examines how the sSyRB fits into the existing toolkit. **Section 4** provides an outlook on the prospects for applying the sSyRB to other risk areas and **Section 5** concludes.

## 1.2 Legal background

**The legal changes introduced with CRD V broadened the scope of Article 133 CRD and gave relevant authorities several options for applying the SyRB.[5]** Flexibility was enhanced by allowing the SyRB to address both structural and cyclical systemic risks, and by enabling it to be applied to specific sectors. In terms of institutions targeted, the buffer requirement can be applied either to the entire banking sector or to one or more subsets within the sector. A general SyRB and different sSyRBs may be introduced for different subsets of institutions and exposures, which can result in different buffers with different designs being in place at the same time. The buffer can be applied to all domestic exposures, all exposures located in other Member States, domestic sectoral exposures, subsets of domestic sectoral exposures, sectoral exposures located in other Member States (but only to enable recognition of an SyRB set by another Member State) and exposures located in third countries.[6] In all cases, the buffer rate must be set in steps of 0.5 percentage points or multiples thereof. For RRE the relevant exposure category is referenced in Article 133.5(b)(i) CRD: all domestic retail exposures to natural persons secured by residential property.

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3 Council Regulation (EU) No 1024/2013 of 15 October 2013 conferring specific tasks on the European Central Bank concerning policies relating to the prudential supervision of credit institutions (OJ L 287, 29.10.2013, p. 63). For completeness, interaction with borrower-based measures is discussed in Section 4.3, although the latter remain exclusively under national competence.

4 Given the scope of the SSM Regulation, the focus of this paper is on banking union countries, although a common conceptual and methodological underpinning may be useful for other EU Member States too.

5 See Annex 2 for a more detailed description of the relevant legal framework.

6 As noted in Annex 2, the wording of Article 133(5)(e) CRD can be read as covering the possibility of applying a sectoral SyRB to exposures located in third countries. However, it could also be argued that the sectoral SyRB may be applied only in cases where this is explicitly provided for.

**Following the legal changes the EBA adopted guidelines on the appropriate subsets of sectoral exposures to which a relevant authority may apply an sSyRB.**[7] The guidelines aim to set a common framework within which authorities can define subsets of exposures as needed, facilitating a shared approach throughout the EU and supporting reciprocation of sSyRBs among Member States. According to the guidelines, subsets may be defined by employing three dimensions: type of debtor or counterparty sector, type of exposure and type of collateral. If deemed appropriate, duly justified and proportionate when targeting systemic risk, these dimensions may be supplemented with three sub-dimensions: economic activity, risk profile and geographical area. The guidelines include detailed definitions of the elements used in each dimension and sub-dimension, along with examples of how they may be combined when applying the SyRB. The use of pre-defined dimensions aims to ensure that the increased flexibility in the use of the buffer does not result in excessive complexity and make reciprocation difficult. When defining subsets, the systemic relevance of the risks stemming from the subset of sectoral exposures must be examined in a qualitative and quantitative assessment conducted by the relevant authority considering three criteria: size, riskiness and interconnectedness. Relevant authorities are asked to disclose the approach used when defining a subset of exposures, as transparency can help banks manage their risks and support decisions on reciprocity between Member States. The guidelines also advocate appropriate coordination and cooperation between the competent authority and the designated authority in order to avoid the risk of overlaps, double counting and inefficient risk targeting.

**When it comes to activating an SyRB the CRD requires different coordination procedures at EU level, depending on the design and calibration of the instrument.** These depend on the level at which the buffer rate is set and the legal status of the institutions targeted. For countries subject to European banking supervision, the SSMR states that they must first complete the notification procedure with the ECB before proceeding with the coordination process envisaged in the CRD. The CRD requires the European Systemic Risk Board (ESRB) to be notified one month before the measure is published, regardless of the level of the buffer (for which there is no cap). Where the buffer rate exceeds certain thresholds or the buffer targets a subsidiary with a parent located in another Member State the European Commission must be involved, and possibly also the EBA and other national authorities.[8] Finally, relevant authorities must review SyRBs and sSyRBs at least every second year, and must ensure that activating them does not entail disproportionate adverse effects on parts or the whole of the financial system of

7 EBA/GL/2020/13, Final guidelines on the appropriate subsets of sectoral exposures to which competent or designated authorities may apply a systemic risk buffer in accordance with Article 133(5)(f) of Directive 2013/36/EU, 30 September 2020.

8 See Annex 2 for further details. As discussed in European Central Bank (2022), the current CRD provisions related to thresholds triggering EU governance procedures for sectoral SyRB rates raise concerns about the proportionality and consistency of the EU capital framework as regards setting such rates. These can lead to situations where a sectoral SyRB rate applied to a relatively small portfolio could activate a stricter EU governance procedure, while a lower but broad SyRB would not, despite the latter having a much larger impact on capital requirements. As a result, thresholds are more restrictive for the sectoral SyRB than for the broad SyRB. The current provisions can therefore generate inconsistencies in the capital framework and could influence the selection of macroprudential instruments by discouraging use of the sectoral SyRB.

other Member States or the Union as a whole in such a way as to create an obstacle to the proper functioning of the internal market.

# 2 Proposed methodologies to inform activating and calibrating the sSyRB

**This section introduces a set of tools to inform how the sSyRB might be activated and calibrated to address RRE-related vulnerabilities in countries in the banking union.** They build on the ECB's existing framework for assessing RRE-related risks and policies and are meant to complement the toolkit already in use with a view to informing future policy considerations.[9] First, an indicator-based approach relying on an early warning methodology develops an RRE composite indicator. This provides an aggregate measure of cyclical vulnerabilities in the RRE sector and aims to link the comprehensive macro-financial assessment in the ECB's RRE risk framework with the need to potentially activate an sSyRB. The indicator is supported by further information on structural risk factors. Second, the integrated micro-macro simulation-based approach (IDHBS+) is used to inform how an sSyRB might be calibrated. In line with methodologies used by national authorities to date, it computes possible loan losses related to stress in RRE markets as a starting point.

## 2.1 The indicator-based approach

**This sub-section develops a composite indicator for RRE-related systemic risks (RRE CI) which is akin to similar measures for broader cyclical systemic risk.[10]** This aims to capture the build-up of systemic cyclical vulnerabilities in the RRE sector and should be used in combination with other approaches. The RRE CI is based on a set of variables across different categories which have shown good early-warning properties in signalling previous RRE crises. Once the relevant variables have been identified, they are aggregated into a composite index to derive a combined risk signal. The RRE CI is intended to be used alongside other cyclical risk indicators such as the one developed by Lang et al. (2019), with the objective of having a more specific risk measure targeting the RRE sector.

**The index is based on a sample of fifteen RRE crises used to analyse the signalling properties of several early-warning indicators.** The reference set of RRE crises identified in Ferrari et al. (2015) is updated with additional information from Lo Duca et al. (2017), which is the most up-to-date crisis database for EEA countries and the UK. For the early warning exercise, the crisis variable is converted into a vulnerability indicator that takes a value of one between 12 and 5 quarters before the start of a crisis, and zero otherwise. The vulnerability indicator is set to missing between the end of the specified pre-crisis period and the end of the actual crisis. The objective of the exercise is to identify indicators that issue warning signals sufficiently far ahead of crises to inform potential macroprudential policy actions.

9 For an overview on macroprudential policy considerations and the ECB's existing analytical toolkit for the assessment of RRE-related vulnerabilities see Lang et al. (2022) and Jarmulska et al. (2022).

10 See the Systemic Risk Indicator (SRI) developed by Lang et al. (2019).

**The early warning indicators considered for the index cover four different dimensions: household credit and debt service burdens, RRE prices and valuations, construction and residential real estate activity/investment, and interest rates.** The analysis considers several indicators that are found to have good predictive power in the early-warning literature, with a focus on those considered most relevant for the RRE sector. In line with Lang et al. (2019), several transformations of each variable are tested. The early warning properties of these variables are evaluated using univariate logit regressions with the vulnerability indicator as a dependent variable. They are then ranked from highest to lowest based on the in-sample AUROC, and the top performing variable in each category is selected. The variables comprise the three-year change in households' debt service ratios,[11] the two-year change in the deviation from house price-to-income ratio, the three-year growth rate of RRE investment and the one-year change in short term interest rates (**Table 2.1**, panel a). The variables are subsequently used to construct the RRE CI via a multivariate logit regression, following Ferrari et al. (2015).

**The RRE CI is constructed as the optimal weighted average of four early warning indicators, after normalising the individual indicators:**

$$RRE\ CI_{i,t} = \sum_{j=1}^{K} \omega^j * \tilde{x}_{i,t}^j$$

where $\omega^j$ is the weight of indicator j, and $\tilde{x}_{i,t}^j$ is a normalised sub-indicator j in time t and country i. Following the same methodology used by Lang et al. (2019), we normalise the variables by subtracting the median and dividing by the standard deviation of the pooled dataset for each of the variables. The weights for aggregating sub-indicators are chosen to optimise the early warning properties of the composite systemic risk indicator. The optimal sub-indicator weights $\omega^j$ are obtained by running a linear regression of the vulnerability indicator (defined above) on the normalised sub-indicators. Specifically, the coefficient estimates are used as weights, after constraining them to sum to 1 with a minimum weight of 5% for each variable.[12] This provides the optimal linear combination of the underlying sub-indicators to identify vulnerable periods, which is defined by the relative weights

[11] For the subsequent multivariate analysis, the three-year change in households' debt service ratio is replaced with the two-year change of the same variable. The reason for this is that the performance of the RRE CI can be tested on a slightly larger set of crises if the latter variable is used. Although there are 15 crisis episodes in the sample, the number of crises used to test the early warning performance of each of the indicators considered in the univariate logit approach might vary depending on the length of the time series for each variable and country. In contrast, only nine crisis episodes are considered for testing the early warning performance of the resulting index using a multivariate setting as only those crises for which there is data for all sub-indicators can be included. Notably, the in-sample AUROCs of the two variables are very similar, so this change should not have a negative impact on the early warning properties of the RRE CI (the in-sample AUROC of the three-year change in households' debt service ratio is 0.90, whereas the same metric for the two-year change is 0.89).

[12] As noted in Lang et al. (2019), optimal country-specific weights are difficult to estimate due to the scarcity of crises at the country level. Pooled indicator normalisation and constant weights across countries and time implicitly assume there are common indicator patterns across the crises experienced by individual countries at different points in time which can help identify the build-up of systemic risk. This pooled approach hedges against overfitting for specific individual crises. However, to the extent that countries deviate from common patterns, this assumption might bias country-specific weights upwards/downwards, signalling higher/lower cyclical risks than if they were calibrated using only historical data for each individual country.

derived for each sub-indicator (**Table 2.1**, panel b). The index can be interpreted as the weighted average deviation from the median value of the individual indicators, expressed in multiples of the respective standard deviations. The in-sample AUROC estimated for the resulting index equals 0.89, which confirms it performs well as an early-warning indicator.[13]

Table 2.1: In-sample univariate results and optimal weights for the RRE CI

| a) Top performing variables in univariate analysis | | b) Optimal weights for the RRE CI sub-indicators | |
|---|---|---|---|
| **Variables** | **AUROC** | **Variables** | **Weights** |
| 3-year change in HH debt service ratio | 0.9 | 2-year change in HH debt service ratio | 50% |
| 2-year change in house price-to-income | 0.82 | 2-year change in house price-to-income | 22% |
| 1-year change in 3-month interest rate | 0.77 | 1-year change in 3-month interest rate | 16% |
| 3-year growth of RRE investment | 0.77 | 3-year growth of RRE investment | 12% |

Sources: ECB and ECB calculations
Notes: Table a) shows the top-performing variables across the different categories considered, ranked by in-sample AUROC. For the univariate logit regressions we consider all crises available for each variable, as the number covered by each one differs depending on the length of the time series available. Table b) shows the RRE CI sub-indicators and the relative weights of each which provide the optimal linear combination for identifying vulnerable periods.

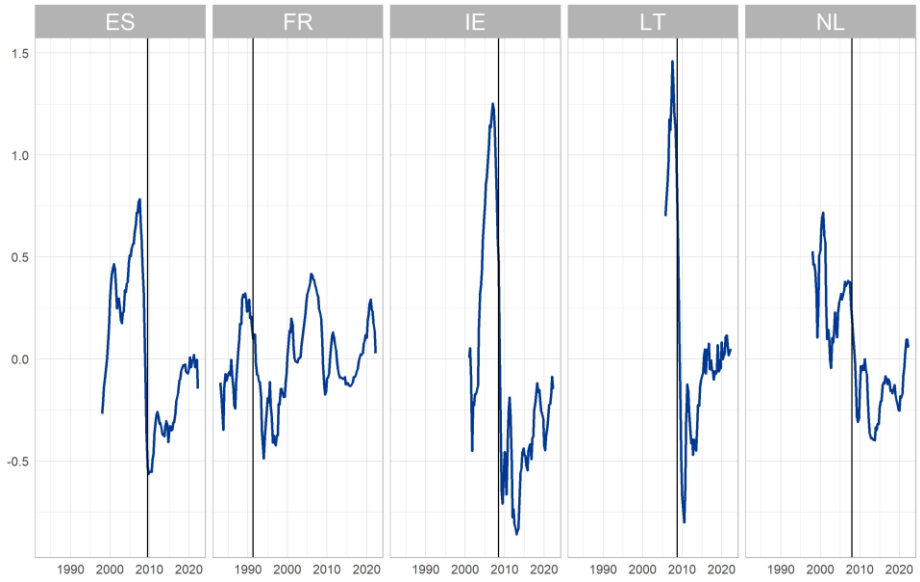
**A cross-validation exercise confirms the RRE CI has good early-warning properties.** The number of crisis episodes in the sample is small and mostly concentrated in the global financial crisis (GFC), which limits the possibilities for an out-of-sample exercise. Although the sample includes five episodes which came ahead of the GFC, complete data for all the best-performing early-warning indicators exist for only one of these (France). A cross-validation exercise was therefore conducted by leaving out one crisis episode at a time and re-estimating the RRE CI as described above based on the remaining episodes. The resulting RRE CI performs well in signalling the crisis excluded from the sample and typically peaks ahead of the crisis event (**Chart 2.1**). For instance, when the episode in France is excluded (i.e. the RRE CI is estimated based only on events around the GFC), the resulting RRE CI peaks eight quarters ahead of the French crisis.

[13] The in-sample AUROC of the RRE CI is similar to that of the three-year change in the HH debt service ratio in a univariate setting. However, we see added value in proposing an index encompassing a comprehensive set of relevant variables, including RRE prices and valuations, construction and residential real estate investment/activity and interest rates, as this provides a more thorough picture of the market. In addition, the small sample size used for the exercise and the fact that most crises episodes are related to the GFC suggests including a more diverse set of variables to capture the build-up of RRE vulnerabilities.

Chart 2.1: Out-of-sample exercise confirms good early-warning properties of RRE CI

a) Cross validation exercise excluding one crisis and re-estimating the RRE CI

(index)




Sources: ECB and ECB calculations.
Notes: The dark blue lines show the RRE CI computed for ES, FR, IE, LT and NL, respectively, but based on the weights obtained from regression models that re-estimate the RRE CI on a dataset excluding the respective country (see the text for more details). The vertical black line represents the start of the systemic crisis in the country excluded from the estimation of the RRE CI.

**Country-level RRE CIs increased substantially ahead of the start of the GFC for most euro area countries, and decreased sharply afterwards.** They generally move in line with expectations and intuition, confirming the relevance of the pre-selection of indicators based on their univariate early warning properties. Following the long period after 2010 during which the indices remained at subdued levels, increases can be observed since around 2020 (**Chart 2.2**, left-hand panel). However, they do not seem to be pronounced in most countries. Similar to the CI used in CCyB assessments, RRE CIs tend to increase and reach peak levels around six to eight quarters ahead of systemic crises, and decline afterwards (**Chart 2.2**, right-hand panel). This feature of the index is very important; an early-warning indicator is useful only if it issues a signal sufficiently early to allow an sSyRB to be implemented before the crisis starts, ensuring sufficient resilience is in place when necessary and avoiding procyclicality.

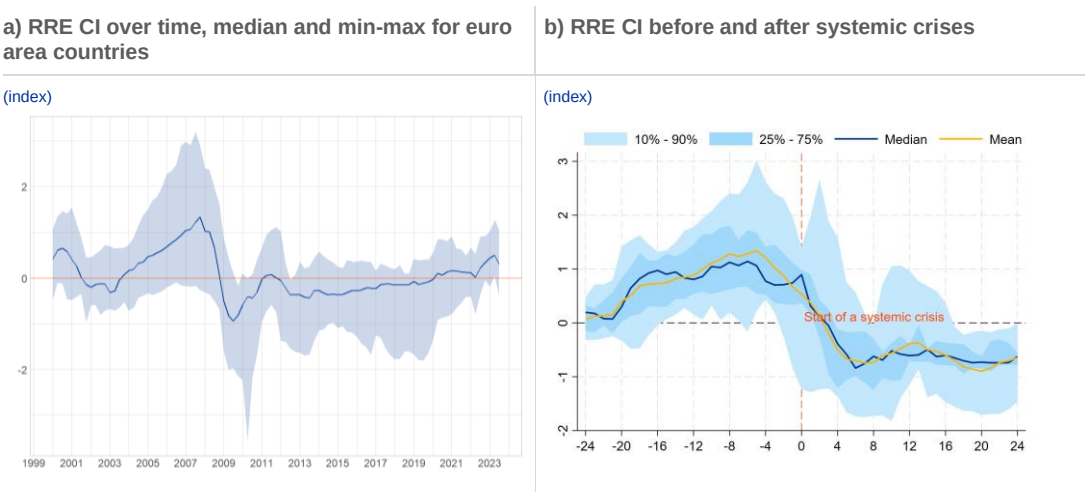
**A signalling approach where the indicator issues a warning whenever it exceeds a certain threshold can support interpretation of the index.**[14] The signalling threshold distinguishes periods with elevated RRE cyclical vulnerabilities. The threshold is chosen to maximise the weighted sum of the proportion of periods where a build-up of elevated RRE vulnerabilities is correctly classified (true positives) and the proportion of those without elevated RRE vulnerabilities that are correctly classified (true negatives).[15] To be useful for policy makers, a conservative threshold should be chosen that signals a build-up of RRE cyclical risk at an early stage. This

[14] The signalling approach was originally developed by Kaminsky et al. (1998).

[15] Conversely, the threshold should minimise the weighted sum of false positives and negatives.

can be achieved by choosing the threshold via a weighting function where the cost of a false negative is twice the cost of a false positive. The logic is that for a risk-averse policy maker, false negatives are more costly than false positives. The threshold maximising the weighted sum of true positives and true negatives for the RRE CI stands at 0, and the in-sample fraction of observations above the threshold is 47%.[16] Using this threshold, the levels of the index in many countries exceeded the proposed signalling threshold by large margins in the period ahead of the GFC. The boom of recent years and the increase in interest rates have pushed the indices beyond this threshold in many countries.[17] However, the threshold should be interpreted as an auxiliary feature of the index, not an automatic trigger for activation.

Chart 2.2: Country-level RRE CIs increased substantially ahead of the start of the GFC and decreased afterwards




Sources: ECB and ECB calculations.
Notes: In the left-hand chart the red horizontal line denotes the signalling threshold above which the RRE CI issues a warning signal; In the right-hand side chart the horizontal axis indicates the number of quarters before and after the start of the systemic crises; last observation is third quarter 2023.

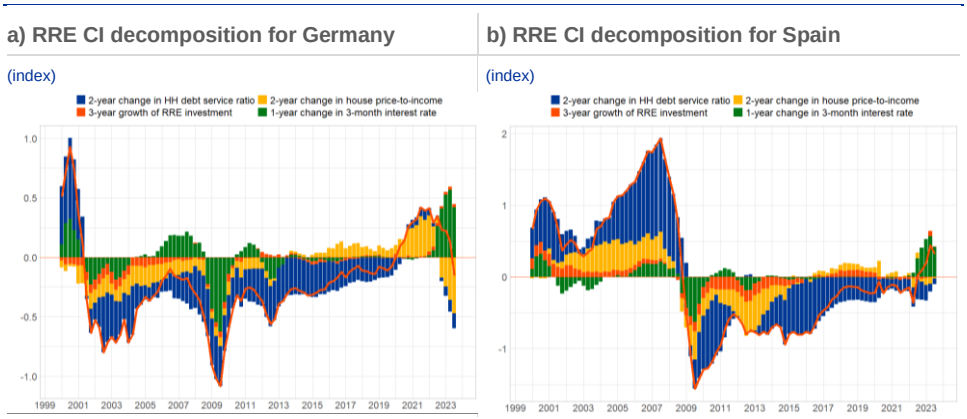
**The construction of the RRE CI index means it can be decomposed into contributions from different factors.** This makes it possible to monitor the main drivers of build-up of systemic risk in RRE markets in each country. For example, the substantial increase in the RRE CI in Spain over the period 2005-2008 was driven by all the variables, but the largest contributions came from increases in the debt service burdens of households and increasing house price overvaluation (**Chart 2.3**, right-hand panel). In contrast, in Germany at the same time only the changes in short-term interest rates were pushing the index up; changes in the debt service burdens of households, house price overvaluation and the residential real estate investment brought the index down to negative levels. However, more recently the index increased in Germany to levels exceeding the signalling threshold before

16 The exact level of the threshold would be 0.05, but we rounded it to 0 for simplicity.

17 A less conservative alternative signalling threshold could be obtained by maximising the equally weighted sum of true positives and true negatives. This would stand at an index value of 0.45, implying that only 20% of historical observations in the in-sample estimation exceed this level, and would be signalling potential RRE stress.

falling again, with both the increase and the decrease to a large extent driven by the ratio of house price-to incomes (**Chart 2.3**, left-hand panel).

Chart 2.3: Decompositions of RRE CIs allow relevance of components to be monitored over time




Sources: ECB and ECB calculations
Notes: The red horizontal line denotes the signalling threshold above which the RRE CI issues a warning signal; last observation third quarter 2023

**Beyond the cyclical component captured by the RRE CI, structural features of country housing markets have the potential to amplify losses in a downturn and may also warrant activating an sSyRB.** Variables such as levels of house price overvaluation, household indebtedness and household debt service ratios are fairly structural in nature in the short term. They should be monitored jointly with the cyclical RRE CIs to arrive at a comprehensive country-level assessment. In practice, indicators of structural vulnerabilities exceeding medium or even pronounced scoreboard thresholds may in themselves merit activating an sSyRB, and imply increased urgency in addressing a cyclical build-up of risk in RRE markets if the country-level RRE CI increases at the same time to levels close to or above the signalling threshold. Structural market features may also require consideration. First, it is crucial to be aware of the size of RRE exposure in a given country's banking sector to gauge its systemic importance. Second, the share of fixed and floating-rate mortgage lending is also worth monitoring, as this determines who bears the risk of increasing interest rates.

**Given the potential overlap between different measures, the proposed RRE CI should be monitored jointly with broader measures of cyclical systemic risk.** For example, the measure developed by Lang et al. (2019) is a very broad index mainly covering the RRE and NFC sectors. In addition, it includes other types of lending such as consumer and car loans, which typically make up a much smaller fraction of bank credit. Given the relevance of the RRE sector for this broad systemic risk index, it is unsurprising that its correlation with the RRE CI is high for some countries. As broader measures are often used to inform the calibration of the CCyB, a simple decision tree approach can be used to decide whether or not to take one or more actions. Specifically, (i) if the RRE CI is above an activation threshold but the broad measure is not, the methodologies are suggesting a policy action targeted at the RRE sector; (ii) conversely, if the RRE CI is below the activation threshold while the broad measure is above, activating a broad-based buffer may be more

appropriate; (iii) if both are above the activation threshold, the authorities could consider a policy mix consisting of the CCyB and the sSyRB, or activate only one of them. In the latter case, the choice between the buffers should depend on the degree to which overall cyclical risks are broad-based (which would favour activating the CCyB) or driven by RRE markets (which would favour activating the sSyRB).

## Box 1. Sectoral indicators for monitoring risks at Banco de España[18]

**In December 2021 Banco de España developed a new macroprudential toolkit that comprises two new sectoral macroprudential tools: a sectoral component of the countercyclical capital buffer (sCCyB) and limits on sectoral concentration.**[19] These tools can address situations where systemic risks are confined to, or relatively higher in, specific sectors. In such cases, applying sectoral measures early or more forcefully may be more effective in controlling the build-up of risks than activating aggregate macroprudential tools to all exposures.[20]

**To monitor risks in sectoral credit portfolios, the Banco de España has developed a dedicated framework with a series of key sectoral indicators.** These are analysed regularly when monitoring financial stability risks, assessing sectoral systemic vulnerabilities, and, where appropriate, considering the activation of sectoral macroprudential measures. The indicators refer to four main sectors: i) loans to non-financial corporations (NFCs) engaged in construction and real estate activities; ii) loans to other NFCs; iii) loans for house purchase and renovation; iv) other loans to households (primarily consumer loans).

**The methodology for analysing sectoral credit cycles is similar to the one used for the total credit cycle of the Spanish economy in CCyB decisions.**[21] Mirroring the setup for the general CCyB, the benchmark indicators are sectoral credit gaps which measure the difference between various sectoral debt indicators and their equilibrium values, estimated as long-term trends by means of statistical procedures.[22] In addition to GDP, the gaps use a range of measures more closely connected to the sector's activity as denominators. In the case of firms, the ratios of sectoral credit to the sector's gross value added (GVA) or gross fixed capital formation (GFCF) are considered. For households, disposable income or GDP are used as the denominator. As with the general CCyB, complementary indicators are also considered for informing potential policy decisions. Examples include credit standards, real estate price trends (particularly relevant for mortgage loans) and measures of sectoral credit intensity.[23]

**Although sectoral credit gaps widened significantly at the onset of the coronavirus (COVID-19) pandemic (Chart 2.4, top left), the sectoral risk framework does not currently signal any need to apply sectoral macroprudential measures.** Gaps have narrowed since the GFC but

18 For further details on the analysis presented in this box, see Broto et al. (2022).

19 The instruments were developed in Circular 5/2021 and introduced into the Spanish legislation on credit institutions by Royal Decree-Law 22/2018 and Royal Decree 102/2019. Circular 5/2021 also provides for the possibility of imposing limits and conditions on loan origination.

20 For more details, see Trucharte (2021) and Castro and Estrada (2021).

21 See Basel Committee on Banking Supervision (2010) and Basel Committee on Banking Supervision (2019).

22 For further details, see Galán (2019).

23 The latter are determined as the ratio of the annual change in each sector's credit (the numerator) to annual cumulative GVA, disposable income or GFCF (the denominator). These indicators seek to proxy the flow of credit granted in a specific period of time with the sectoral activity generated in that period, as a sign of the gradual build-up of imbalances.

widened notably at the beginning of the pandemic. This was mainly due to the decline in denominators (GVA and disposable income) and, to a lesser extent, support measures for the economy (state guarantees for loans, moratoria, etc.), which supported lending, particularly to NFCs in sectors vulnerable to the pandemic. The temporary nature of the rise in these indicators is reflected in their gradual correction in recent quarters, driven by the recovery in economic activity since mid-2021, which has continued to date. The moves in the gaps should not be construed as an early warning signal, as no excessively large credit build-ups had been observed in any of the sectors. The absence of warnings is clearer when observing the changes in sectoral credit intensity. These indicators remained close to zero, and generally in negative territory (**Chart 2.4**, top right).[24]

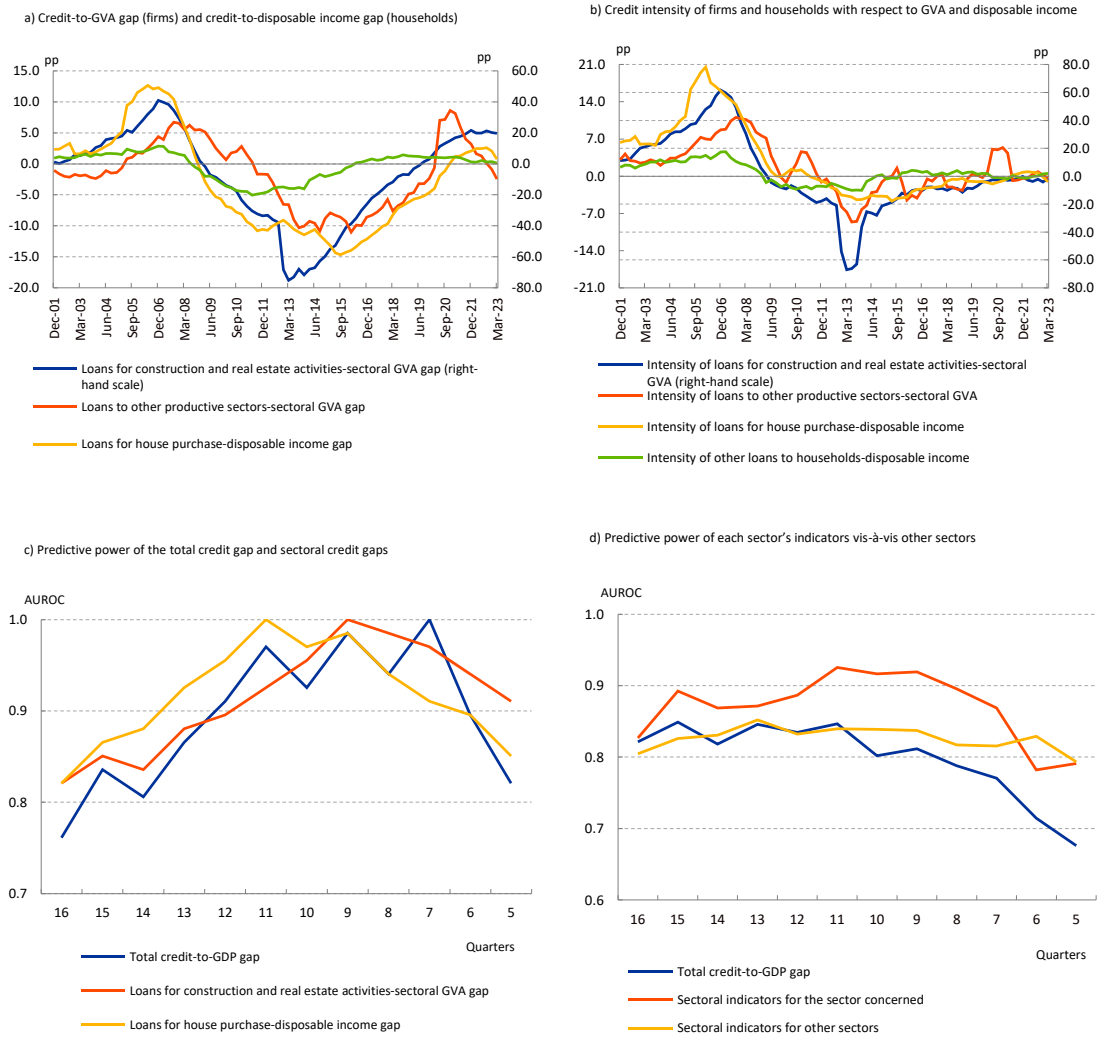
**The sectoral credit-to-GDP gaps have good early warning properties and perform better at anticipating the GFC than the general gap.** The explanatory power of sectoral gaps was analysed using AUROC methodology and the 2009 GFC as the sole systemic event.[25] The results show that for this specific episode, the credit-to-GDP gap offers a lower predictive power for the crisis than sectoral gaps over much of the projection horizon (**Chart 2.4**, bottom left). Therefore monitoring the new sectoral indicators might help identify new systemic imbalances earlier than monitoring only the overall credit cycle of the economy. Nevertheless, this exercise is only based on one crisis event and the results require confirmation as more experience is gained and more data are analysed.

**Sectoral gaps also have a greater predictive power for future materialisation of defaults in their own sector than gaps in other sectors or the general credit-to GDP gap.** Focusing on each indicator's capacity to predict an increase in the sectoral NPL ratios relative to their historical average, the results confirm that sectoral gaps do indeed show a greater power to predict the future materialisation of defaults in the sector concerned than in other sectors (**Chart 2.4**, bottom right). These sectoral gaps are also more appropriate for anticipating an increase in the specific sector's NPL rate than aggregate measures such as the credit-to-GDP gap.

[24] The only relevant exception is the temporary rise in the credit intensity series for loans to other NFCs (those not engaged in construction or real estate activities). This temporary surge reflected the higher impact of the pandemic on some of these activities, and also the credit support measures for these segments, specifically the state guarantees for loans.

[25] Specifically, to assess the predictive power of the sectoral indicators using AUROCs, univariate logit models have been estimated with a binary dependent variable equal to 1 in the case of a systemic crisis 16 to 5 quarters ahead (and 0 otherwise), and the different (sectoral) gaps as dependent variables. The sample period comprised the time from December 2001 to September 2017.

## Chart 2.4: Indicators used in the monitoring exercise




Notes: Data available up to March 2023. Predictive power is measured by AUROC; this represents the relationship between the false positive rate and the true positive rate for all possible binary classification thresholds of a logit model. An AUROC equal to 1 would indicate perfect predictions from the indicator. The horizontal axis represents the number of quarters before the crisis occurs. The range of between 16 and 5 quarters is considered appropriate for the purposes of setting macroprudential policy, to ensure measures can be activated sufficiently in advance. A distinction is made between the capacity of sectoral gaps to predict an increase in the default rate with respect to its historical average in the same sector (red line) and the capacity to anticipate an increase in the default rate in other sectors (orange line). These measures are obtained from the average AUROC values of sectoral gaps, which assess the predictive power of the default rates in the related sectors. The capacity of the credit-to-GDP gap to anticipate the sectoral default rate (blue line) is also considered. This is calculated as the average AUROC values that measure the power of this aggregate gap to predict an increase in each sector's default rate.

## 2.2 The model-based approach using the IDHBS+ framework

**This section employs the semi-structural Integrated Dynamic Household Balance Sheet (IDHBS+) framework[26] to compute loan losses associated with risk materialisation in residential real estate markets, which can serve as starting points for calibrating the sSyRB.** The framework combines macro-financial and household data to determine credit risk parameter sensitivities to macroeconomic developments and applies these sensitivities to bank mortgage portfolios for the purposes of computing loan losses. Five macro-financial variables

[26] See Gross et al. (2022).

(the unemployment rate, the short-term interest rate, house price growth, employee compensation growth and stock price growth) are varied, one at a time, over pre-specified grids to obtain the sensitivity of household-level simulated probabilities of default (PDs) and losses given default (LGDs) to the individual variables. These sensitivities are combined into multivariate PD and LGD equations at the household sector × country level.[27] They can be used to compute baseline and adverse PDs and LGDs using exogenous macroeconomic scenarios (e.g., from the Eurosystem/ECB Broad Macroeconomic Projection Exercise (BMPE) or the EBA stress test). Alternatively, exogenous adverse assumptions can be applied directly to the PDs and LGDs consistent with a particular baseline macroeconomic scenario (as in this exercise).

**In this application, the framework is used to estimate additional loan losses on the mortgage portfolio, calculated as the difference in the CET1 ratio resulting from adverse and baseline macroeconomic scenarios.**[28] The impact on the CET1 ratio is obtained by estimating how the PD and LGD change under the two scenarios. The PDs and LGDs derived are then applied to the stock of mortgage loans to calculate cumulative provision flows (losses) over a three-year horizon. The provision flows are included in the numerator of the CET1 ratios, with losses expressed as the difference between the CET1 ratio under the baseline and adverse scenarios as a percentage of total risk-weighted assets. These additional losses from RRE-related stress can then be used as a starting point to inform how an sSyRB might be calibrated.

**The data used comes from a number of sources (see Annex 3, Table A3.1 for details)**. Baseline forecasts for the macroeconomic variables used in the model are sourced from the BMPE of March 2023, with December 2022 being the latest actual data point.[29] Anchor values for the household PDs and LGDs come from the December 2022 EBA Key Risk Indicators (KRIs).[30] Bank balance sheet data are from COREP/FINREP as at the fourth quarter of 2022 (non-mortgage assets are static). Banking system figures are obtained by aggregating the bank-level reports using harmonised and comparable cross-country criteria, both in terms of COREP and FINREP coordinates, and also sample selection and consolidation. In particular, country aggregates include all entities that do not have a domestic parent in the jurisdiction where they are domiciled, to rule out double-counting of mortgage exposures. Other parameters such as write-off and cure rates are fixed at pre-specified values identical across countries.

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27 Default events underlying the simulated PDs are based on a financial margin concept (see Gross et al, 2022). Household level simulated PDs are aggregated at the country level using mortgage exposure weights. The multivariate PD and LGD equations are obtained by combining the coefficients of the univariate models and implying the intercept of the multivariate equation from external anchor values (e.g. EBA KRI PDs and LGDs on retail loans secured by real estate).

28 The methodology is that of Gross et al. (2022) which studies the drivers of household default rates in the EU and the US using an enhanced version of the IDHBS model in Gross and Población (2017). See also additional technical details on the banking module from Giannoulakis et al. (2023).

29 See European Central Bank (2023).

30 See European Banking Authority (2022). When available, point in time PDs and LGDs are used, as they are conceptually the most appropriate. Where these are not available, through-the-cycle (PD) and downturn (LGD) values are used instead.

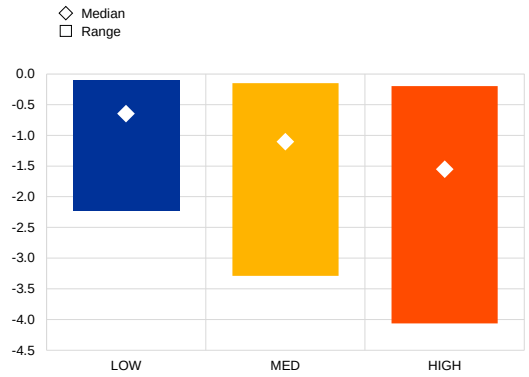
**Stressed PDs and LGDs are calculated under three adverse scenarios (labelled low, medium, and high).** In each case the PDs under the adverse path are set to a multiple of those under the baseline scenario (double in the low adverse scenario, triple in the medium adverse scenario and quadruple in the high adverse scenario). In all three adverse scenarios the adverse LGD is obtained by adding 10 percentage points to the baseline LGD.

**Under the three adverse scenarios, additional median loan losses across countries amount to 0.65%, 1.1% and 1.5% of total RWA respectively (Chart 2.5).** These reference figures should be taken as an indicative starting point for calibrating an sSyRB for countries where relevant risks are identified, not as fully developed calibrations. The impact of existing measures and other country-specific factors should be considered in a further step before determining the latter. Importantly, the results are calculated with a focus on cross-country consistency and naturally trade off certain country specificities. A sensitivity analysis highlights that the results using cross-country consistent data are commensurate overall, but nevertheless illustrates the important role played by the key initial parameters, country specificities and the data input (see Annex 3 for details).

Chart 2.5: Loan losses under three adverse scenarios

**Changes in CET1 ratios after three years due to worsening credit risk under three scenarios**

(As a percentage of total RWA)




Sources: EBA and ECB, ECB calculations.
Notes: Median and min-max intervals across countries for each specific scenario. The country sample comprises: Belgium, Germany, Estonia, Ireland, Greece, France, Italy, Cyprus, Latvia, Lithuania, Hungary, Netherlands, Austria, Poland, Slovenia, Slovakia, Finland.

**In the calculations above the risk-weighted assets used to scale mortgage loan losses do not change from their starting points**. This is equivalent to assuming no pass-through from the point-in-time credit risk parameters used to calculate the loan loss provisions to their regulatory concepts (through-the-cycle PDs and the downturn LGDs used to calculate risk-based capital ratios under the internal ratings-based approach, IRB). It would be possible to make a case for establishing a link between point-in-time risk parameters and regulatory risk parameters, on the rationale that if a rise in point-in-time parameters under an adverse scenario were to persist for a reasonably long period, an upward adjustment to regulatory parameters would be warranted for consistency and conservatism. However, the need to

establish a link depends on the nature of the scenario employed (cyclical vs. structural), and implies additional model uncertainty.[31]

**The calculation of loan loss provisions represents a possible first step in calibrating a sectoral buffer**. To reach a final calibration, the role of other macroprudential measures (as well as that of qualifying information) needs to be taken into account. The sections below discuss these issues.

## 2.3 Implications of existing policies for calibrating an sSyRB

### 2.3.1 Capital-based measures

**While the indicator and model-based approaches capture the risk conditions prevalent in the RRE sector, final calibration of the sSyRB also needs to account for the existing policy mix.** Capital-based measures (CBMs) differ in their precise design and objectives, but they all aim to increase the banking sector's resilience and capacity to absorb losses, often including in relation to the real estate portfolio (see more detailed discussion in **Section 3**). Given the close interplay between the objectives of different tools, it is important for policy makers to have a comprehensive overview of risks and policies so as to avoid potential overlaps or gaps in risk coverage. When calibrating sectoral capital buffers to address vulnerabilities in the real estate portfolio, policy makers need to assess the extent to which existing policies are already addressing the risks identified.[32]

**Risk and resilience aspects can be relevant when considering how existing macroprudential capital buffers should be taken into account when determining additional capital needs for potential losses in the RRE portfolio.** First, as mentioned above, the issue of risk coverage is of primary importance. Clearly, measures that address the same or a very similar type of risk as the one targeted by any new sectoral buffer should be considered when determining the magnitude of the latter, to avoid addressing the same risk twice. This includes both buffer requirements and risk weight measures. Second, from a pure resilience perspective one can argue that all capital buffers available to absorb losses on the stressed real estate portfolio should be considered when determining the additional capital needs that would have to be captured by the new sectoral buffer. In other words, the new sectoral buffer would have to be calibrated so it covers only stressed losses not already covered by any other relevant usable or releasable buffer. Clearly, the second approach would lead authorities to consider a broader set of buffers when determining residual stressed losses to be covered with a sectoral buffer, implying that the resulting sectoral buffer rate would be lower than under the first approach for any given amount of stressed losses.

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31 See Gross et al. (2020).

32 See Annex 1 for a legal perspective on this issue.

**Both risk and resilience perspectives have their relative merits; the choice between them is likely to depend on the nature and severity of the stress scenario used in the model-based calibration exercise.** A relatively broad risk scenario would result in potential overlap with other requirements anchored in stress test results; narrower (e.g. real estate-specific) scenarios such as the ones used in this paper minimise this risk. As regards severity, a relatively mild and targeted calibration of the adverse scenario would suggest considering a fairly small set of other buffers when determining the magnitude of the sectoral buffer (i.e. only those where there is a direct overlap in risk coverage). The case for considering a broader set of buffers becomes more appealing in a severe stress scenario. The reason for this is that it may become increasingly costly to cover all potential losses with a dedicated buffer under such scenarios, making it preferable to assume that banks would have to draw on less targeted (but still usable) macroprudential buffers to absorb potential losses instead. This line of argument becomes less convincing, however, when there are stronger obstacles to buffer usability, which may in turn speak in favour of covering all potential losses with releasable buffers.[33] Moreover, problems may arise if risks tackled by other buffers materialise at the same time as RRE risks, in which case the overall amount of buffers available to absorb losses may prove to be insufficient without a dedicated RRE buffer.

**Besides the design of the stress scenario, other conceptual factors may have to be considered when accounting for the existing policy mix.** For example, the nature of existing measures may play a role. First, microprudential tools differ from macroprudential ones in the sense that they are not supposed to be used under stress (Pillar 1 and Pillar 2 requirements), or that they are legally non-binding (Pillar 2 guidance). There may therefore be less scope to consider them when calibrating sectoral buffers. Second, among macroprudential buffers, there may be stronger overlap in objectives between sectoral buffers and other releasable buffers (the CCyB and/or the SyRB), given concerns about the usability of non-releasable buffers. Moreover, a distinction may be warranted between buffers serving specific purposes (such as G-SII/O-SII buffers) and more generic ones like the CCoB. Finally, the structural or cyclical nature of the various tools, in conjunction with the nature of the new sectoral buffer, also appears relevant in determining possible overlaps. It thus seems desirable to avoid overly complex or formalistic approaches when determining potential buffer overlaps. Pragmatism and cross-country flexibility may be warranted, not least considering the differences in the design and nature of national approaches to calibration.[34]

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33 Evidence from the pandemic suggests that banks may be unwilling to dip into their unreleased capital buffers when losses materialise, possibly undermining the buffers' intended role as shock absorbers (see Berrospide et al., 2021, Couaillier et al., 2022a). Releasable buffers effectively reduce concerns about buffer usability, since they enable banks to operate with lower capital ratios without breaching buffer requirements, thus addressing possible impediments to buffer usability arising from market stigma or automatic distribution restrictions (see Couaillier et al., 2022b; Behn et al., 2023).

34 Besides buffer requirements, also risk weight measures under Articles 124, 164 or 458 CRR have an impact on required capital, since they modify risk-weighted assets and hence the absolute amount of capital required for any type of requirement. To the extent that such measures address the same or a similar type of risk as the prospective sectoral buffer, their impact on overall capital requirements should be considered when calibrating the latter, to avoid the same risk being addressed twice. Of course, this does not apply in cases where risk weight measures serve a complementary or different purpose, an example being risk weight floors addressing undesired heterogeneity in capital requirements for similar types of exposures across banks (see further discussion in Section 3.1).

Table 2.2: Arguments for and against deducting existing buffers from stressed losses

| Requirement | Arguments in favour of deduction | Arguments against deduction |
|---|---|---|
| Pillar 1 requirement, Pillar 2 requirement | Capital available to absorb losses | Microprudential requirements; to be met permanently (not available for use); cover idiosyncratic bank risk; not sector-specific; not releasable |
| Capital conservation buffer (CCoB) | Generic buffer available for use in adverse conditions | Does not target specific risks or sectoral exposures; pre-defined/fixed buffer requirement; not releasable; only for extraordinary loss absorption |
| G-SII / O-SII buffers | Available for use; risk indicators may correlate | Serve a different purpose: cover externalities stemming from SIBs; not releasable |
| Systemic risk buffer (SyRB) | Available for use; releasable; may target the same or a similar type of (structural) systemic risk as the new sSyRB | May target a different type of (structural) systemic risk than the new sSyRB |
| Countercyclical capital buffer (CCyB) | Available for use; releasable;may target the same or a similar type of (cyclical) systemic risk as the new sSyRB | May target a different type of (cyclical) systemic risk than the new sSyRB |
| Pillar 2 guidance | Available for use | Covers idiosyncratic bank risk; microprudential tool; not legally binding; rate differs across banks, making it hard to deduct a single value |

Note: This table provides an overview of the main arguments for or against deducting a specific buffer requirement from simulated losses when using a model or stress test-based approach to calibrating the sSyRB requirement.

**Reflecting the considerations above, Table 2.2 assembles the arguments for and against deducting specific buffers or requirements from simulated losses in the RRE stress scenario.** There are substantial grounds against deducting Pillar 1 and Pillar 2 requirements, including the fact that they constitute permanent microprudential requirements to be met at all times and are therefore not usable under stress.[35] Equally, several arguments militate against deduction of Pillar 2 guidance: it represents a legally non-binding microprudential requirement tackling idiosyncratic bank risk, and this idiosyncratic nature would increase the complexity of deducting a uniform aggregate value to arrive at a single rate for the sectoral buffer.[36] On the macroprudential side, the need to deduct existing SyRBs or CCyBs appears to primarily depend on the nature of the risks to be tackled by the new sectoral buffer. If they are primarily of a cyclical nature and already captured by the CCyB, then the latter should be deducted. Similarly, if the risks are primarily of a structural nature and already captured by the broad SyRB, then this buffer should be deducted when calibrating the sSyRB.[37] For G-SII/O-SII buffers, a strong reason against deduction from simulated losses is that they serve a different purpose and are supposed to address risks stemming from the existence of systemically

35 In principle also this capital is available to absorb unexpected losses on sectoral exposures in a severely adverse scenario, although the bank would no longer remain a going concern in this case. Overall, arguments against deduction seem to weigh more strongly than those in favour.

36 Theoretically, there could be an overlap between sectoral buffers and Pillar 2 guidance if the stress scenario informing calibration of the former was designed too broadly, since the level of the Pillar 2 guidance for each bank is based on how it performs in the regular EU-wide stress tests. However, targeted and real estate-specific scenarios such as the ones used in this paper minimise this risk.

37 In this case, it is particularly important to look at the precise motivation of the previous SyRB. Even though the buffer may be designed to tackle systemic risks of a structural nature, these need not necessarily be the same as the ones addressed by the new sectoral buffer, so the SyRB should not necessarily be deducted from simulated losses, even if both buffers are tackling structural risks.

important banks. Finally, a variety of arguments can be made for the CCoB. On the one hand, the buffer is supposed to be usable in stress situations, including stress in the real estate sector. This argues in favour of deducting it from simulated losses, particularly if the latter are based on severely adverse scenarios and therefore large, making it inefficient to cover them all with a dedicated buffer.[38] On the other hand, the CCoB does not cover specific risks, so by definition there can be no overlap in risk coverage with other buffers. Moreover, the buffer is not releasable and supposed to absorb losses only in extraordinary cases, all of which argue against deducting it from simulated losses in a real estate-specific stress scenario.

**The above discussion illustrates that in some cases there may not be a one-size-fits all approach to deducting other buffers and requirements from simulated losses informing the calibration of sectoral buffers.** The need to do so is likely to depend on the precise design and purpose of the buffers and requirements concerned, as well as the design and severity of the adverse scenario used for calibration purposes. The following general principles can be established:

- Pillar 1 and Pillar 2 requirements, G-SII/O-SII buffers, and Pillar 2 guidance should generally not be deducted from simulated losses;
- Existing domestic CCyB rates should generally be deducted if the motivation for the new sectoral buffer is primarily of a cyclical nature and overlaps with the motivation for the CCyB already in place;
- Existing SyRB rates on the relevant exposures should generally be deducted if the motivation for the new sectoral buffer is primarily of a structural nature and overlaps with the motivation for the SyRB already in place;
- Different options should be assessed with respect to the CCoB; deducting the buffer has potential conceptual merit only in the case of severely adverse scenarios with large losses, where it may be inefficient to cover all losses with a dedicated sectoral buffer.

**While in principle the same methodology should be used consistently for first-time activations and future recalibrations of the sSyRB, mechanical adjustments to the buffer rate due to changes in other buffer requirements need to be avoided.** Clearly it would be suboptimal if, for example, a release of the CCyB would be mechanically offset by a corresponding increase in the sSyRB rate on RRE exposures. Equally, an increase in the CCyB should not automatically imply a decrease in the applicable sSyRB rate, although there may be cases where authorities want to act in this manner to ensure consistency across calibrations. Generally, to avoid mechanical links between different buffers, there needs to be some flexibility with respect to the calibration methodology, and authorities need to be able to adjust all tools independently from each other as necessary. The

[38] In principle, this argument can be extended to other macroprudential buffers and serve as justification for deducting all buffers and requirements that are supposed to be usable. However, the case may be stronger for the CCoB, given the generic nature of the buffer.

periodical sSyRB reviews prescribed by regulation will be good opportunities for authorities to reassess calibration against the applicable risk and policy environment.

### 2.3.2 Borrower-based measures

**Besides CBMs, borrower-based measures (BBMs) are also often used to address RRE-related risks and may thus have to be considered when deciding on sectoral buffer calibration.** CBMs and BBMs are generally complementary in nature. They both contribute to enhancing banking sector resilience and reducing macro volatility, but via different transmission channels and with different time lags.[39] BBMs work on the flow of new mortgages by constraining the riskiest part of the distribution, and thus help to gradually improve borrower risk profiles in the mortgage stock. In contrast, CBMs work directly on the entire mortgage stock and can complement BBMs by enhancing resilience against vulnerabilities that have already accumulated. By using both types of measures in conjunction, macroprudential authorities can achieve a more comprehensive and effective response to systemic risks in RRE markets.

**Although BBMs and CBMs work through different transmission channels, they share a degree of substitutability over the medium term, as both improve the resilience of banks to financial shocks.** CBMs directly increase resilience by requiring banks to use a greater portion of equity financing for their loan portfolios, while BBMs enhance resilience only gradually by improving the quality of banks' mortgage portfolios and thus reducing the magnitude of future shocks. Thus, implementing BBMs in the early stages of the financial cycle can lead to safer mortgage portfolios, potentially reducing the need to activate capital-based measures as the cycle matures.[40] Conversely, CBMs may act as imperfect substitutes for BBMs in cases where the latter are not readily available in national legislation or cannot be implemented or tightened for political or institutional reasons. CBMs may also be used as a backstop against potentially excessive loosening of credit standards resulting from increased competition between banks following a relaxation of BBMs.

**A stress test/model-based approach to calibration can automatically account for the effects of existing BBMs so there is no need for further ex post adjustment of buffer rates.** By improving borrower risk profiles and the quality of banks' mortgage loans, BBMs help reduce starting point credit risk parameters and hence the level of simulated losses, thereby automatically contributing to a lower calibration of the sSyRB. This effect can be expected to be stronger, the more stringent the calibration of existing BBMs and the longer they have been in place.

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39 See Tereanu et al. (2022) for a more extensive discussion.

40 This can also be illustrated in a risk-resilience framework used to define the macroprudential policy stance. In such a framework, the need for macroprudential policy action is assessed by comparing the level of residual systemic risk, i.e. the level of systemic risk after taking into account the resilience of the banks and borrowers and the effect of macroprudential measures already implemented, with the macroprudential authorities' risk tolerance. Applying the framework, the calibration of the sSyRB is expected to be lower when BBMs are already in place, as the level of residual systemic risk is lower. The level of the limits set out in BBMs also affect calibration of the systemic risk buffer: tighter BBMs should lead to a lower calibration of the systemic risk buffer, and vice versa.

This rationale applies to both collateral-based instruments (e.g. loan-to-value, LTV, limits) and income-based instruments (e.g. loan-to-income, LTI, debt-to-income, DTI, or debt service-to-income, DSTI, limits), which help to reduce the LGD and PD properties of mortgage loans, respectively. In addition, the regulatory framework itself already captures the partial substitutability between BBMs and CBMs over the medium term, at least to some degree. This is because improved mortgage risk characteristics due to binding BBMs should partially pass through into regulatory PDs and LGDs and thus decrease RWAs under the IRB approach. As a result, the nominal amount of capital required with BBMs in place will decrease for any given buffer rate, reflecting the improved quality of the loan portfolio. Further discounting of sSyRB calibration based on stressed losses on account of existing BBMs therefore does not seem warranted.

## 2.4 The role of qualifying information in final buffer calibration

**While the calibration of sectoral buffers should be guided by financial stability considerations as outlined above, a proper impact assessment is needed to gauge effectiveness and avoid unintended side-effects.** Sectoral macroprudential capital buffers can affect banks and the real economy in various ways.[41] First and foremost, the measures aim to increase or at least preserve banks' resilience against possible shocks, and authorities may want to check whether this intended objective is being achieved. Second, the measures may affect lending to the real economy. For example, to the extent that higher capital requirements cause an overall increase in banks' cost of capital, lending rates for firms and households may increase if the latter are passed on by banks. Moreover, by increasing the amount of capital required for specific asset classes, the measures may differentially affect banks' cost of capital and thus induce portfolio reshuffling. It is essential for policy makers to understand these effects, as they impact both the effectiveness of measures and possible costs or side effects.

**The potential dampening effects of sectoral capital buffer requirements on bank lending may have both intended and unintended components.** On the one hand, changes in bank behaviour can help curb an accumulation of vulnerabilities that endangers financial stability. First, an sSyRB on RRE exposure can help to dampen mortgage lending growth in an environment where prices are already high, slowing down the accumulation of vulnerabilities.[42] Second, the sectoral nature of the buffer may also induce a shift in portfolio composition towards sectors not affected by the measure,[43] thus increasing the diversity of a bank's portfolio and decreasing its vulnerability to sector-specific shocks. Third, behavioural adjustments in response to the measure may be stronger for banks with less capital headroom or that have more concentrated loan portfolios.[44] Hence, the measures may lead to market share in lending being reallocated to banks that are more resilient to shocks,

41 For recent generic discussions on the transmission and effectiveness of capital-based macroprudential policies see Behn et al. (2022) and Tereanu et al. (2022).

42 See Basten & Koch (2015).

43 See Auer et al. (2021).

44 See Basten (2019).

thus increasing the resilience of the overall system. On the other hand, excessively tight calibration of sectoral buffers may induce overly constraining effects on mortgage lending, harming banks and borrowers. Drawing the line between intended dampening of credit growth and unintended and excessive tightening is inherently difficult. Authorities need to analyse the effects on lending, but should not overemphasise the role of "cost estimates" in guiding how buffers are calibrated.

**The effects or "costs" of sectoral macroprudential measures are likely to be dependent on macro-financial conditions.** As for any capital-based measure, the current state of the banking system is likely to have a key impact on transmission. When banks are well capitalised (have high capital headroom) and sufficiently profitable to generate capital internally, the effects of any increase in capital requirements are likely to be low, as banks already have or can easily obtain the capital needed to meet the higher requirement. Conversely, effects are likely to be stronger when significant parts of the banking system are capital-constrained and/or unable to generate capital internally.[45] In turn, the effects of measures should also depend on the stage of the financial cycle and the macroeconomic environment. Introducing a buffer in an earlier phase of the financial cycle, when the economy is growing fast and banks are still doing well as risks build up, may be less costly, as the dampening effect on credit growth may be minor or non-existent. Introducing one in a later phase, when risks are starting to materialise, can help to preserve resilience for loss absorption but may also entail a risk of procyclical effects on lending, depending on the state of the banking system. Authorities should monitor banking sector and macro-financial conditions closely and factor them into their policy decisions on activating and calibrating sectoral buffers.[46]

**Authorities use a wide range of tools to assess the effects of the measures they take (see Annex 1) and a degree of flexibility is warranted.** Analyses include, for example, ex ante assessments of bank capital headroom and profitability or impact assessments (descriptive statistics, econometric models) of measures on balance sheet variables. They also comprise assessments of possible adjustment processes derived from historical data using panel-data techniques,[47] and analyses of long-term adjustment processes in macroeconomic variables such as house prices, GDP growth, default rates, etc. via model-based simulations or projections based on time-series models. The choice of assessment method depends on the state-of-the-art with respect to economic or econometric modelling approaches, the availability of data, the precise design and objectives of the measures, and other country-specific aspects. Impact assessments and cost-benefit analyses will be an essential part of future policy discussions, but it appears undesirable to prescribe one specific tool to be used in all future assessments. Still, developing a harmonised set of approaches or a repository of models to be used in future assessments could

45 For further discussion see Behn et al. (2019) and Lang & Menno (2023).

46 The implementation of macroprudential measures may also have unintended effects for specific groups of borrowers and conflict with other policy objectives. For example, the introduction of an sSyRB on RRE might make it more difficult for low-income households to buy a house, to the extent that it makes mortgage lending more expensive. Such side effects should not preclude the implementation of macroprudential measures for financial stability purposes and may be addressed by other policies (e.g. fiscal policy) if politically desired.

47 See Geiger (2022) for an example of such an analysis.

be a useful exercise, to allow for comparison and introduce some degree of consistency between countries and over time.

## 2.5 Considerations when releasing the buffer

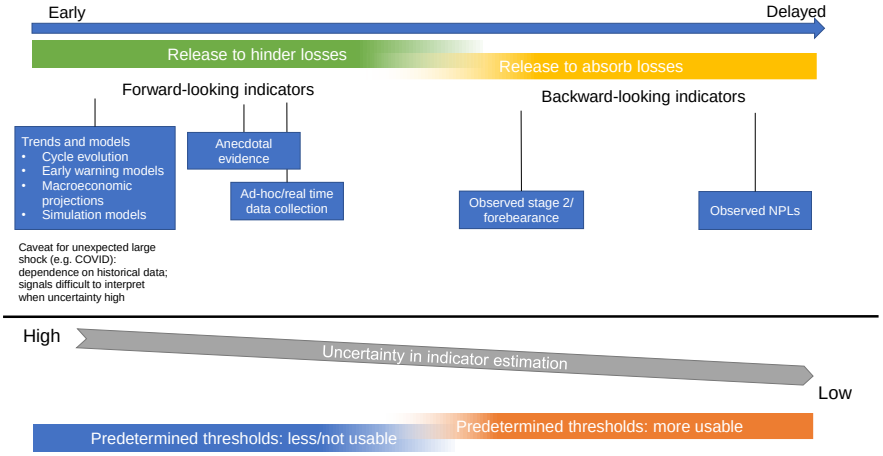
**The sSyRB can be released when risks materialise, to support banks' ability to absorb losses while maintaining the provision of key financial services.** Given the sectoral nature of the buffer, the primary focus when releasing should be on the materialisation of risk in specific segments of the economy, for the purposes of this paper the RRE sector.[48] Releasing an RRE-related sSyRB can enhance the capacity of the banking system to absorb losses due to defaults on loans to the sector. It can also encourage banks to make use of forbearance measures for borrowers in temporary difficulties as a way of preventing a larger number of defaults, and hence hinder losses at a later stage. In both cases, releasing the sSyRB can support continued provision of financial services to the real economy, by avoiding a tightening of credit supply due to capital constraints (bank deleveraging). However, the approach chosen is likely to have implications on (1) the timing and size of the release, (2) the need for guidance on the use of the capital released, and (3) the type of information used to guide the decision to release.

**The impact of a capital release is likely to depend on its timing and magnitude.** On the one hand, an early release may help to limit the magnitude of eventual losses, as it can help reduce the number of effective defaults (e.g. by encouraging forbearance measures) and allow some non-performing loans to perform again. It can also help to prevent the situation where banks are already capital-constrained at the time of release, rendering it less effective as they continue to deleverage in the face of ongoing losses materialising. On the other hand, maintaining a buffer for longer can help preserve banking sector resilience. If the buffer is released too early (or too much of it released at an early stage), the risk of payouts or buybacks inappropriate for the risk environment increases. Such outflows can deprive the banking system of the capital needed when risks eventually materialise. In addition, a release might have to be followed by a costly rebuilding of capital buffers at a later stage (when it may be more expensive as profitability is declining). With respect to magnitude, full release can send a powerful signal but may be suboptimal, especially when the extent of a shock is unclear. Conversely, a partial release can be more efficient (i.e. minimise costs), but only if guided by accurate measurement of risk materialisation. However, partial release might be perceived by banks as a signal to not use that part of the buffer not released, which can be problematic in cases where it turns out that too little was released. The optimal strategy for release has to balance these factors against each other and is likely to depend on the specific risk materialisation scenario.

[48] Of course, the sSyRB rate may also be recalibrated or set back to zero in cases where the underlying systemic risk that motivated the initial buffer activation changes in intensity or vanishes completely. In such instances the authorities should consider both the change and the level of vulnerability, since there may be situations where cyclical risk indicators (such as the index developed in Section 2.2.1) no longer signal the need for a buffer to address the build-up of vulnerabilities, but the level of vulnerability nevertheless remains high and suggests keeping the buffer in place.

**Authorities may accompany release with guidance on the use of the capital set free, with a degree of strictness that should vary depending on the timing and objective of the release.** On the one hand, unconditional release is unambiguously linked to the objective of loss absorption and particularly suitable when risks are clearly materialising. In such cases, authorities may nevertheless communicate their expectation that the capital released is to be used for loss absorption rather than increased distributions. On the other hand, a more explicit conditional release may be useful in an early release approach that aims to prevent losses occurring. In particular, conditioning on expectations for banks' use of capital released (e.g. for refinancing, or for forbearance to sound borrowers facing temporary liquidity shocks) can help reduce the risks of excessive payouts from capital made available at an early stage, and provide targeted debt relief and prevent the build-up of NPLs. However, a conditional release comes with practical challenges, as it usually lacks any explicit legal anchor and needs effective monitoring and an ad hoc enforcement mechanism.

Chart 2.6: The role of quantitative information in guiding release




Note: Conceptual illustration of possible indicators to inform decisions on releasing a buffer.

**While the release decision will ultimately need to factor in expert judgement, quantitative information can be used as a starting point (Chart 2.6).** Indicators can be forward-looking, with the benefit of real-time information but at the cost of uncertainty. Backward-looking indicators, on the other hand, are more reliable but less timely. The first category includes information from quantitative analysis looking at financial cycles, early warning indicators, macro-financial projections and simulation models, as well as anecdotal evidence and real time ad hoc data collections. The second category focuses primarily on indicators of losses materialising on bank balance sheets such as observed stage 2 ratios, forbearance ratios and observed NPLs. Setting ex ante thresholds to trigger a buffer release can help guide the timing of release. However, in case of forward-looking indicators, identifying ex ante thresholds is less appropriate, as this would result in ineffective pre-commitment, particularly if published, at times of high uncertainty, and limit the room for expert judgement. For the backward-looking indicators, thresholds are potentially more useful and can help to steer expectations. However, thresholds

always come at the cost of reducing flexibility and room for expert judgment, both of which are essential to weigh the different sets of information guiding release. Forward-looking indicators are necessary by definition in the case of an early release aiming to hinder losses, while the loss absorption approach can rely on a larger set of indicators including more backward-looking indicators.

**If broader releasable capital buffers are already calibrated at positive levels, the sequencing of releasing the sectoral SyRB and other buffers depends on the type of shock to be addressed and the likelihood of cross-sectoral spillovers.** If the shock originates from the real estate sector and is likely to be contained to that sector and remain of limited magnitude, the targeted sectoral SyRB should be released first, with the broad buffer kept in reserve (noting also that part of the broader buffer serves to maintain resilience against any further deepening of the sectoral shock). In contrast, if the shock is broad-based and severe, the broader buffer (e.g. the CCyB) should be released immediately. Depending on the specific nature of the shock, release may or may not be accompanied by a contemporaneous release of the sectoral buffer. On the one hand, a cautious wait-and-see approach to the sectoral buffer would make it possible to assess the speed and persistence of the shock, to arrive at a more informed judgment on whether an additional release of the targeted buffer is needed. On the other hand, immediate release of all available buffers would help maximise the impact and effectiveness of intervention, noting the trade-offs previously discussed with respect to the timing and magnitude of release.

# 3 Interaction of the sSyRB with other tools

## 3.1 Capital-based instruments

**Up until the implementation of CRD V, the CCyB and risk-weight add-ons and floors were the primary tools for addressing RRE-related risks; neither proved optimal.** Although many of the countries that have increased the CCyB in recent years mentioned real estate vulnerabilities as one of the main reasons for doing so, the buffer is broad-based and affects the other parts of a bank's loan portfolio too. Moreover, bearing in mind that risk weights on mortgage exposures are relatively low, the primary impact of the CCyB in terms of increasing resilience is on NFC exposures, rather than the mortgage portfolio.[49] Nevertheless, making use of the CCyB has three important benefits: (i) the activation procedure is simple and straightforward, (ii) the buffer can be released in case of need, and (iii) there are automatic reciprocity rules. Besides the CCyB, risk weight add-ons and floors have also been used to address RRE vulnerabilities, primarily under Article 458 CRR. While such measures have proven to be efficient in targeting specific buckets of risk, their practical use is constrained by cumbersome activation procedures, and current regulation prescribes that they should be used only if authorities deem other tools less suitable and effective in dealing with the risks identified (see **Section 1.2**). Moreover, reciprocity rules are less straightforward, and the effective releasability of the measures has not been tested and may be more challenging to communicate.

**The sectoral systemic risk buffer is a new tool and has considerable potential to combine the advantages of the CCyB and risk weight measures in addressing RRE risk (Table 3.1).** First, the buffer can be activated flexibly to address identified risks and does not hinge on any pre-defined indicators or buffer guides, although also the CCyB has increasingly been used in a more flexible manner of late. Second, it can be used in a highly targeted manner on sub-portfolios (e.g. mortgage loans rather than total retail exposure, or high-LTV mortgages rather than total mortgage exposure) or sub-groups of banks (e.g. only IRB institutions), which makes the tool very flexible in terms of application. Finally, the buffer is broad in scope, as it can be applied to address both cyclical and structural systemic risks, and is fully releasable in case of need. Authorities can provide predictability for banks by communicating clearly throughout the various phases of activation, release and replenishment.

[49] Differences in risk weights between NFC and mortgage exposures may also induce portfolio rebalancing towards the latter following a CCyB increase, given the stronger capital impact on the former.

Table 3.1: Overview of different instruments for addressing RRE vulnerabilities

| Instrument | Activation process | Scope | Transmission channel | Character | Level playing field impact | Releasability |
|---|---|---|---|---|---|---|
| sSyRB | Well established | Selected credit risk exposures | Targeted resilience of portfolio | Very targeted | Depending on risk weight heterogeneity | Yes |
| SyRB | Well established | All risk exposures | General resilience | Not targeted | Negligible | Yes |
| CCyB | Well established | Domestic credit risk exposures | General resilience | Not targeted | Negligible | Yes (integral part of the instrument) |
| 458 CRR | Rather cumbersome | Selected credit risk exposures | Targeted resilience of portfolio | Very targeted | Can ensure level playing field | Yes (when risks materialise or cease to exist) |
| BBM | Rather cumbersome; not available in all countries | Flow of new loans | Lower PD and LGD on new lending | Very targeted | None | Structural but limits can be adjusted |

Note: Main features of the different instruments that can be used to address RRE-related vulnerabilities.

**Despite its benefits, there may still be cases where the sSyRB needs to be complemented with risk weight measures to be fully effective.** As indicated above, the sSyRB comes first in the legal pecking order, implying that other tools should be used only if they are more suitable or effective in addressing the risk identified. For example, its suitability or effectiveness may be compromised by the fact that it can only amplify specific risk-weighted requirements, since it builds on existing risk weights. Hence, substituting or complementing the tool with risk weight add-ons or floors may be necessary in some cases (see **Table 3.2** for an illustration). For example, if there is an undesired heterogeneity in risk weights that is not justified by differences in portfolio riskiness (e.g. between IRB and SA institutions, or among IRB banks), applying the sSyRB has the potential to further deepen the differences in capital requirements. This can amplify level playing field issues, so that application of risk weight measures (or a combination of a risk weight floor and an sSyRB) may be preferable.[50] By contrast, in a situation where risk weights are very low across the board and do not allocate enough capital to cover stressed losses, sSyRB rates can simply be increased to address this insufficiency.

[50] Calibration challenges may also arise in situations where some banks change their IRB models or switch between SA and IRB approaches. In such situations, the allocation of capital to specific exposure changes. In calibration approaches based on simulated losses, this would normally imply an adjustment to the sSyRB rate, to keep the balance between the capital allocation and portfolio riskiness. However, a regular and direct reaction in the calibration of the sSyRB to every change in IRB models seem to be beyond the scope of macroprudential policy.

Table 3.2: The distinction between SA and IRB exposures

| Heterogeneity layer | Heterogeneity description | Impact on the market | Preferred policy option |
|---|---|---|---|
| SA vs IRB banks | RW differences between IRB and SA banks are **negligible** or **adequate** | sSyRB **would not interfere** with the level playing field | sSyRB **for all banks** |
| | RW differences between IRB and SA banks are **substantial** and **concerning** | sSyRB **would amplify** undesirable differences in capital requirements | sSyRB for **IRB banks only** |
| Among IRB banks | Differences in RW **reasonably reflect** differences in portfolios riskiness | sSyRB **would not interfere** with the level playing field | sSyRB for **IRB banks only** |
| | Differences in RW **cannot be explained** by differences in portfolios riskiness | sSyRB **would amplify** undesirable differences in capital requirements among IRB banks | sSyRB for **IRB banks only** after RW heterogeneity is addressed **via RW floor** |
| | Few individual cases of **outlier banks with low RWs** | sSyRB **would amplify** undesirable differences in capital requirements among IRB banks | sSyRB for **IRB banks only** after RW heterogeneity is addressed **by micro supervisors** |

Note: Conceptual illustration of the implications of risk weight differences when applying a sectoral buffer.

## 3.2 Minimum requirements for own funds and eligible liabilities

**Another aspect that needs to be considered is that introducing or adjusting capital-based measures has an impact on the minimum requirement for own funds and eligible liabilities (MREL), whether explicitly or implicitly.** The magnitude and the timing of this impact depends on the type of buffer or requirement, whether the bank is subjected to a positive recapitalisation amount, and whether it fulfils MREL largely by using excess own funds or other eligible liabilities. It is important to assess how any change in capital-based measures would impact the calculation of MREL and banks' subsequent compliance with it. Three cases can be distinguished.

**First, the most direct and immediate impact can be expected with measures that directly modify the risk-weighted Pillar 1 requirement, i.e. risk weight floors and add-ons under Article 458 CRR.** Such measures affect the basis for the calculation of risk-weighted capital requirements and risk-weighted MREL, increasing both requirements with an immediate impact, all else equal.[51] Under risk-weighted MREL this affects the loss absorption amount and the recapitalisation amount including any applicable market confidence charge (MCC).[52]

**Second, an impact can also be expected via measures that are part of the MCC of risk-weighted MREL, including the sectoral systemic risk buffer.** These measures also affect both risk-weighted capital requirements and risk-weighted MREL, but with a possible time delay on the latter if the cycles for recalibration of the two requirements are not synchronised. The first impact on capital requirements, via

51 Whether such an increase also increases the overall requirement for banks depends on whether the constraining requirement is the risk-weighted one or the one based on the leverage ratio exposure measure. Furthermore, under Basel III (implementation of which in the EU is not yet finalised), Pillar 2 requirements could be adjusted in cases where they capture the same risks as addressed by the output floor, and macroprudential authorities may assess whether the buffer calibration is still adequate.

52 Only for resolution entities/groups with external MREL.

an increase in the combined buffer requirement (CBR), may imply a need to reallocate free capital to cover the increase, and would occur at the time the measure becomes effective; the second impact, via a possible increase in the MCC, would affect the bank from the time the MREL is recalibrated.[53]

**Third, the impact is more muted for an increase in the CCyB, since the latter forms part of the CBR but does not feature in the default formula for calculating the MCC.**[54] An increase in the CCyB can still interact with MREL by reducing the amount of free capital available to meet MREL, once the CCyB is effective. However, it does not have any direct impact on MREL, since it is not considered when calibrating the recapitalisation amount or the MCC.

## 3.3 Borrower-based instruments

**As discussed in Section 2.3.2, capital-based measures (CBMs) and borrower-based measures (BBMs) are generally complementary and help improve banking sector resilience via different transmission channels.** BBMs improve resilience and the soundness of mortgage loan portfolios by reducing PD and LGD for mortgage exposures. Specifically, borrowers' resilience to income and house price shocks increases as they can take on less debt relative to their income or collateral value.[55] Income-based measures such as DSTI limits in particular reduce the risk that borrowers will default on their loans, which improves the overall quality of banks' mortgage loan portfolios. LTV limits also reduce the LGD of mortgage exposures by ensuring that banks can recover a significant share of the outstanding loan, possibly even after a correction in house prices.

**BBMs work on the flow of new mortgages and are particularly well suited to early stages of the financial cycle, as they can help limit the build-up of vulnerabilities.** Such measures directly affect the terms of mortgage loans by constraining the maximum amount of credit that can be borrowed.[56] They restrict access to credit and therefore affect credit flows. Households affected by the limits can adjust by borrowing less or exiting the credit market. Tightening borrower-based instruments can therefore dampen the real estate cycle by reducing the flow of credit. In aggregate, this will slow down new lending, resulting in lower demand for

53 The second impact is not automatic, since the MCC remains at the discretion of the resolution authority. They can adjust it up or down from the amount resulting from the default formula.

54 The default formula for calibrating the MCC is CBR – CCyB. As noted above, resolution authorities have the power to discretionally adjust the MCC. For further details, see Single Resolution Board (2022).

55 For example, LTV limits require borrowers to make a downpayment on the property they are buying. This reduces their share of debt, making them less vulnerable to unexpected financial shocks. DSTI and D/LTI limits restrict the amount of debt that borrowers can take on relative to their income. This increases the ability of borrowers to continue to repay their loans, even if their income declines or interest rates increase. Maturity and amortisation limits can also help to protect borrowers and lenders. Limiting the maturity of a loan reduces the probability of experiencing a negative event, such as a job loss or medical emergency, before the term of the loan, thus making borrowers less likely to default. Amortisation requirements require borrowers to make a minimum monthly payment on their loan. This helps to ensure that borrowers make progress on repaying their debt, making them less vulnerable to future financial shocks. Additionally, maturity limits and/or amortisation requirements improve the LGD since they require a loan to be amortised at a faster pace.

56 They limit the amount of debt relative to the value of the underlying collateral (LTV limits), the borrower's income (DTI limits), or the borrower's debt service payments (DSTI limits).

real estate. Pre-emptively activating BBMs in the early stage of the real estate cycle can therefore help to limit the build-up of vulnerabilities early on, possibly avoiding the need to impose additional measures later in the cycle. By helping to dampen house prices during the upturn, BBMs can also reduce the negative effects on private consumption and aggregate demand that result from a reversal in house prices.

**CBMs primarily help improve resilience and are likely to have more muted effects on the real estate cycle, particularly in upturns.** To the extent that capital-based instruments lead to additional capital accumulation or help preserve existing capital levels, they have a direct impact on resilience by improving banks' ability to absorb losses while maintaining the provision of financial services, including in downward phases of the real estate cycle. By contrast, the impact of CBMs on credit conditions and the financial/business cycle is less direct and likely to depend on the conditions in the banking sector. It is expected to be less pronounced when banks have sufficient capital headroom to meet the new requirement or are highly profitable, so their capacity to generate capital internally is strong. If banks meet the new requirement by raising new equity, their cost of financing may increase, leading to higher mortgage spreads. However, investors may also perceive banks as more resilient and be willing to provide them with additional equity at a lower cost. The net impact on credit conditions will depend on which of these two effects dominates. Banks can also choose to meet the new capital requirement by reducing assets and new loans, which would exert a dampening effect on the business cycle.

**CBMs are particularly important when vulnerabilities have already built up so resilience needs to be strengthened or preserved; activating them early and in a pre-emptive manner can be a sensible policy choice.** CBMs work on both the existing stock of mortgages and newly granted loans and are thus particularly effective in addressing vulnerabilities that have already accumulated. However, implementing them in mature phases of the real estate cycle can be relatively costly, since banking sector conditions may be less favourable by then. Targeted sectoral measures can account for this by focusing on specific pockets of risks, potentially striking a better balance between costs and benefits compared with broader capital measures, and reducing the potential bias to inaction on the part of macroprudential authorities in cases where banks are already capital-constrained. However, the first and best way to address financial stability risks may be to pre-emptively activate measures (either broad-based or sectoral) at an early stage of the cycle when banks are profitable and have sufficient capital headroom while vulnerabilities are still building up.[57]

**Lags in the policy process are also relevant for the timing and choice of macroprudential measures and suggest early activation.** These lags can be caused by several factors; the need to consult with stakeholders, the time needed to pass legislation, the time it takes for a policy to have the desired effects, etc. Lags in the policy process are less of a concern in the early stages of the real estate cycle, when vulnerabilities are still building up. However, as the cycle matures and vulnerabilities become more pronounced, they become more important, because it

[57] See Behn et al. (2022) for a discussion.

can take time for policies to have the desired effects, and if vulnerabilities are not addressed early on they can lead to more severe outcomes. Macroprudential authorities should take the lags in the policy process into account when choosing and timing their interventions.

# 4 Considerations on applying the sSyRB to other risk areas

**Given its flexibility, the sectoral SyRB has the potential to play an important role in mitigating risks beyond the RRE sector.** It can be used to target various subsets of risk exposures, both large and narrow, and can apply to all financial institutions or one or more subsets of the banking sector. Although the current legal framework (CRD V and the EBA guidelines) can, in some cases discussed below, limit the flexibility to target a set of exposures in a very precise manner, the sectoral SyRB can take various forms to fit the source of risk it aims to cover.

**In terms of sectors, Article 133 CRD lays down a broad list of exposures to which the sSyRB may apply.** Aside from RRE, the sSyRB can target exposures secured by mortgages on commercial immovable property, all exposures to legal persons or natural persons or subsets of any of these categories. Even though application to sectors other than RRE is still in its infancy, there is a range of possible exposures where application of the buffer may be useful. The following sections give an overview of the possible benefits and current difficulties associated with using an sSyRB to tackle commercial real estate (**Section 4.1**), risks stemming from NFCs (**Section 4.2** and **Box 2**), and climate-related risk (**Section 4.3**). This may serve as a starting point for future reflections on the calibration of sectoral buffers targeting risks that are not associated with the RRE sector.

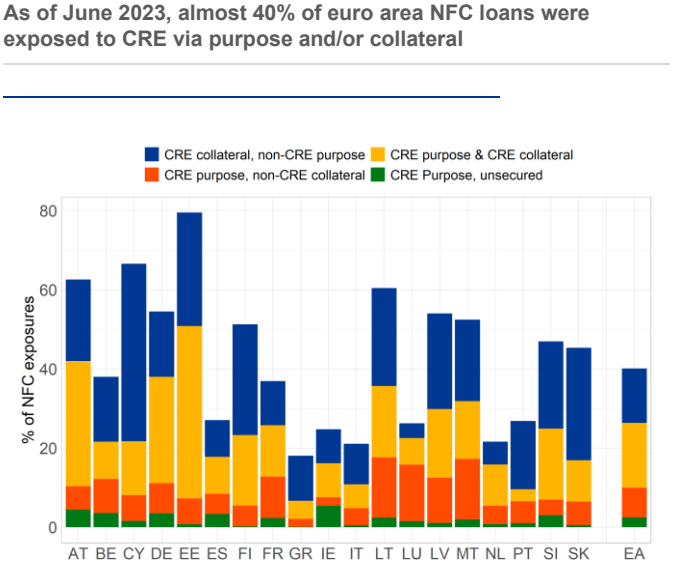
## 4.1 Commercial real estate

**Movements in commercial real estate (CRE) markets can have serious implications for financial stability, particularly via losses on bank exposures.** Euro area banks have smaller exposures to CRE markets than to RRE.[58] Nevertheless, CRE boom-bust cycles can have serious financial stability consequences, not least because of their more volatile nature, as seen in many countries during the GFC. Banks can be exposed to CRE by lending to firms active in these markets, where a deterioration can increase loan PDs, and through the use of CRE as collateral, where market deterioration can increase LGDs. The overlap between these two types of risk is incomplete. CRE collateral is extensively used in wider NFC lending, creating a link with CRE markets via LGD but not PD. CRE-purposed lending is also at times made without collateral or with non-CRE collateral, creating a link with CRE markets via PD but not LGD (**Chart 4.1**).[59]

[58] See Ryan et. al. (2023) for further discussion.

[59] See Ryan et al. (2022) for further discussion.

Chart 4.1: Banks' exposure to CRE via loan purpose and/or collateral




Sources: AnaCredit, ECB calculations.
Notes: CRE purpose includes 1) RRE purchase, 2) construction, 3) CRE purchase. CRE collateral includes 1) CRE for income generation, 2) CRE for own use, 3) RRE. Analysis published in ECB Macroprudential Bulletin article here.

**Euro area authorities have made limited use of macroprudential tools in tackling CRE risks but the sectoral SyRB may be a useful addition to the toolkit.** Under European legislation macroprudential authorities have a number of capital-based tools which could address CRE exposures: broad-based buffers like the systemic risk buffer and CCyB, and risk weight changes under Articles 124, 164 and 458 CRR. CRE risks have been a factor behind CCyB activations in several countries in recent years, but the broad-based nature of the CCyB and SyRB makes them an imperfect tool for targeting CRE risks, particularly when these are not moving in sync with or at the same amplitude as wider credit dynamics. Articles 124 and 164 CRR allow authorities to adjust risk weights on exposures collateralised by CRE, but such measures are currently only in use in Croatia and Latvia. Article 458 CRR can be used in a similar manner, but no country within the euro area is currently tackling its CRE risks via this article. As with RRE, the sectoral buffer has fewer legal barriers than Article 458 CRR and may be more flexible and easier to implement than these risk weight tools, although authorities should account for its potential to amplify the effects of inappropriate risk weights (see **Section 3.1**).[60]

**A sectoral SyRB could be used to target CRE exposures via loan collateral type, borrower sector or risk profile, although challenges exist for each approach.** Articles 11-32 of EBA Guidelines 2020/13 state that the sectoral buffer can be targeted on the basis of a number of elements relevant to CRE.

- **Collateral type:** Targeting exposures collateralised by commercial immovable property would likely be the simplest way to target CRE exposures. However, this approach is subject to two potential limitations. First, it may exclude

[60] Beyond capital tools, the use of borrower-based measures to tackle CRE exposures faces a range of challenges and as a result these too are not in use by authorities.

exposures which have a CRE purpose but are collateralised by other assets, or even uncollateralised - and this latter group may in fact be the riskiest type of CRE exposure. Second, authorities should avoid disincentivising the use of CRE collateral where it may act as a risk mitigant compared to lending which would otherwise be uncollateralised; for example, where the value of collateral far exceeds the value of the outstanding loan and so LGD remains low even in the event of a large market correction.

- **Borrower sector:** Targeting firms with NACE sectors identifying real estate or construction activities could potentially help to address the first limitation mentioned above. It should be kept in mind, however, that this type of differentiation may not always correlate perfectly with those exposures which have a CRE purpose[61] and that the sensitivity of PD to the CRE cycle may vary across types of firms included within these categories.

- **Risk profile:** Adding a risk-sensitive component to the measure could help to align the policy's ultimate calibration with risks and avoid producing adverse incentives, such as disincentivising CRE collateralised lending with very low LTVs. The buffer could target higher risk exposures via the LTV or the firm's debt-to-EBITDA ratio. However, while data is readily available on banks' CRE collateralised exposures across a range of LTV buckets in FINREP, data which breaks down exposures by factors like debt-to-EBITDA is not as easily accessible.

**Authorities could improve the accuracy of the measure by combining these factors, taking into account the nature of their own markets and aiming to strike a balance between accuracy and simplicity.** According to the EBA guidelines, authorities may combine factors provided that risks arising from the subset targeted are systemically relevant. The decision to select from the above factors and combine them should rest on the risks authorities wish to tackle (e.g. LGD, PD and/or risky lending), data availability and a trade-off between policy simplicity and precise targeting of the risks present in their CRE market. For example, authorities wishing to target risky CRE lending could apply a sectoral buffer to one of the following:[62]

- **Example 1:** NFC loans with commercial immovable property as collateral and LTV > 60%

- **Example 2:** Loans to real estate firms (NACE = L and/or F) with debt to EBITDA> 4

The first option may ultimately exclude CRE-exposed loans without CRE collateral and the second could be harder to identify from readily available data. More complex combinations could also be considered, including the application of different buffer rates to different types of CRE exposures. Uncollateralised lending (as a more risky

61 For example construction firms engaged solely in the residential market.

62 Please note that the 50% and 4x values for leverage measures are for illustration only, not suggested calibrations.

form of lending) could also be directly tackled by combining uncollateralised lending with the firm's NACE sector.

**Persistent data gaps in CRE markets may create challenges to buffer calibration.** Analysis of risks arising from CRE markets continues to be hampered by a lack of data. For example, in many euro area countries simple indicators such as price indices are still not available. Where the extent of risk arising from the CRE market cannot be gauged, it will be difficult to motivate and calibrate a CRE-targeted buffer. While new data sets like AnaCredit provide highly granular information on banks' exposures to CRE across the euro area, their time series are limited. As a result, data on the losses experienced during past crises are not available, again posing challenges to calibration where buffers are introduced.

## 4.2 Risks stemming from NFCs

**A sectoral SyRB can also be used to flexibly address systemic risks stemming from exposures to the NFC sector or specific subsets of firms.** Examples of the latter include, for example, highly leveraged firms, firms in specific economic sectors, or even a limited cluster of firms accounting for a sizeable share of bank assets. Compared to a broad CCyB that applies to all domestic exposures, the sectoral SyRB can target identified pockets of vulnerability more precisely. Indeed, the EBA guidelines enable the identification of relevant exposures via the criterion "type of debtor or counterparty sector: NFCs", which can cover all bank exposures to NFCs. The guidelines also allow a broader set of criteria, such as the type of exposure, the economic sector or risk metrics which can narrow the scope of identification. As for other types of exposures, a sectoral SyRB on NFC exposures could enhance banks' resilience against the materialisation of risks associated with NFCs and/or incentivise banks to limit the concentration of their exposures to specific NFCs. On this basis, the French macroprudential authority introduced a sectoral SyRB applied to a subset of NFC exposures in August 2023 (see **Box 2** for details).[63]

**More specific methodologies for identifying risk and calibrating policy would enable macroprudential authorities to adopt a more pro-active approach to risks stemming from NFCs.** For now, there is little experience with macroprudential buffers targeting NFCs specifically. In the French case, the authorities have targeted a specific type of risk stemming from NFCs: the concentration of exposures to a small group of highly indebted large corporates. However, different types of risk associated with exposure to NFCs may require different methodologies to identify the risks and calibrate a buffer. Since the French buffer was only implemented very recently its effectiveness cannot yet be assessed, although it is based on a previous measure under Article 458 CRR that proved useful in containing the risks identified.

**The current EBA guidelines may pose challenges to precisely identifying exposures for a sectoral SyRB on NFCs.** While macroprudential authorities can combine various identification criteria, such as the type of exposure and the

[63] Haut Conseil de Stabilité Financière (2023), Décision D-HCSF-2023-3 du 28 juillet 2023 relative au coussin pour le risque systémique sectoriel.

counterparty risk profile, the set of indicators defining the risk profile in the guidelines is limited to performing status, risk weights, loan-to-value ratio and total debt-to-EBITDA ratio. This exhaustive list could represent a limitation for a macroprudential authority looking to implement a sectoral SyRB on a subset of NFCs that cannot be defined with one of the criteria detailed in the EBA guidelines. A more flexible definition of risk profile would enable macroprudential authorities to fine tune the design of the sectoral buffer to better fit the risk it aims to cover.

**The current regulatory framework also limits application of the sectoral SyRB to exposures located in the Member State setting the buffer (Article 133(5)(b) CRD), which may be less adequate for legal persons given their higher international footprint.** Reciprocation of sectoral buffers plays an important role in limiting leakage. However, if the sectoral SyRB defines a subset of exposures based on a concentration criterion, reciprocity would not prevent the possibility of regulatory arbitrage. Indeed, for transnational non-financial firms, banks subject to the sSyRB could theoretically increase lending to those NFCs' foreign subsidiaries, which could then channel back funds to their parent company through intra-group lending. Under this scheme, banks would reduce their domestic NFC exposures subject to the sectoral SyRB while increasing the riskiness of their overall NFC exposure. Therefore, even with proactive reciprocation, this situation can cause leakage that would affect the effectiveness of the measure (see **Box 2**).

## Box 2. The French sSyRB for risks stemming from highly indebted NFCs

On 1 August 2023, the HCSF (the French macroprudential authority) introduced a 3% sectoral SyRB on exposures to French NFCs that simultaneously satisfy the two criteria of concentration and indebtedness:

(a) the total final exposure to a group of NFCs exceeds 5% of the bank's Tier 1 capital;[64]

(b) the total debt-to-EBITDA ratio of the group of NFCs is either negative or strictly greater than 6.

With two cumulative activation thresholds, this measure targets a very specific subset of exposures: concentrated exposures to highly indebted NFCs. The measure targets concentration risks in bank portfolios but excludes firms that are very unlikely to default. A credit shock simultaneously hitting large and vulnerable corporates to which banks are heavily exposed could lead to significant losses, which warrants a macroprudential preventive action. The sectoral SyRB identifies vulnerable firms with a broad definition of leverage, through the total debt-to-EBITDA ratio,[65] calculated at the highest level of consolidation. The criterion focuses on the level of debt for a given level of current profitability, irrespective of financing costs. The threshold of 6 makes it possible to capture the tail of the leverage distribution across large firms.

[64] The sectoral SyRB is applicable when the total amount of the final exposures of the group of connected clients at the highest level of consolidation, as defined in the CRR large exposures framework, exceeds 5% of its Tier 1 capital.

[65] The definition of total debt-to-EBITDA follows the ECB Banking Supervision Guidance on the leveraged transactions and includes in particular undrawn credit lines.

Compared to a concentration limit, a sectoral SyRB is not a backstop; this means banks can go above the threshold limit, provided they have enough capital headroom to compensate for the additional vulnerability. The measure does not prevent corporates from increasing their debt as soon as their lender base is sufficiently diversified. Such a measure is consistent with the objective of the HCSF, which aims at signalling and preventing excessive credit expansion that could lead to the build-up of systemic risk, while being proportionate by targeting specific sectors where the trend in debt calls for particular attention. By construction the measure is proportional to the level of risk (measured by the RWAs) generated by private actors to the rest of the financial system as a whole. The measure also sends a warning signal and intensifies the vigilance of financial institutions and investors regarding the high leverage of large NFCs and potential risk concentration.

The sectoral SyRB applies only to seven French banks, identified for their systemic importance as either a G-SII or an O-SII, at the highest level of consolidation. The seven largest banks represent 92% of market share in the NFC segment among French banks. Although the measure does not apply to small SIs and LSIs, it provides guidance to these in their assessment of NFC overall indebtedness when financing French NFCs.

The measure has been calibrated to deter banks from lending more to highly leveraged companies to which they are already highly exposed by imposing a cost in the form of a capital surcharge associated with these particular exposures. The total impact of the measure on CET1 capital was not compared to banks' aggregate portfolio but assessed at the level of the loans concerned by the measure. It was calibrated on the basis of different pass-through assumptions, from CET1 capital to borrowing costs. Several sectoral SyRBs were simulated under the hypothesis that the banks use their margin to bear the cost or transfer it to NFCs through higher interest rates. The rate of 3% has been identified as striking the right balance between deterring additional lending to the most leveraged companies to which banks are already highly exposed and enabling profitable corporates to raise debt.

## 4.3 Climate-related risks

**Climate change represents a new source of threats to financial stability that is already well documented.** The Network for Greening the Financial System (NGFS) highlighted in 2018 that climate-related risks – physical and transitional – can translate into financial risks and analysed its potential consequences on financial stability.[66] The Financial Stability Board (FSB) also described, in 2020, how climate risks could affect, or be amplified by, the financial system.[67] The reports by the ECB-ESRB Project Team on climate risk monitoring stress that costs associated with implementing policy measures to limit climate-related risks are lower than long-term inaction costs that imply more severe shocks, and that "a growing body of evidence and analytical tools provides a solid basis for a macroprudential strategy to address the systemic financial impacts of climate change".[68] Macroprudential policy targeting climate-related financial risks can help both contain the build-up of risks and

66 See NGFS (2018) and NGFS (2020).

67 See FSB (2020).

68 See ECB/ESRB (2020), ECB/ESRB (2022), and ECB/ESRB (2023).

enhance the resilience of the financial sector against the materialisation of climate risks.[69]

**The sectoral SyRB is one of the existing macroprudential instruments that were identified by the ECB-ESRB Project Team as relevant to addressing climate-related risks to financial stability, although it has not yet been used for this purpose.** Climate-related financial risks may be included among the macroprudential or systemic risks not covered by existing prudential requirements, the CCyB and the G-SII/O-SII buffers referred to in Article 133 CRD (see **Section 1.2**). This has been explicitly acknowledged by the EU co-legislators in the latest proposed revision of the CRD.[70] Even though climate-related risks are not explicitly mentioned in the list of sectoral exposures to which the sectoral SyRB may apply, the wording of Article 133 CRD V, including the possibility of application to subsets of exposures, appears broad enough to allow for this use. The EBA also refers to the SyRB as the most relevant tool to address environmental risks within the current macroprudential framework.[71]

**The sectoral approach of an SyRB seems particularly appropriate to target climate-related financial risks, which are often characterised by sectoral or geographical concentration.** A sectoral SyRB would enhance resilience in a targeted manner for exposures to those sectors where climate risks are the most concentrated. It could also contribute to limiting concentration, by fostering an appropriate pricing for lending to economic sectors or locational exposures that are particularly exposed to climate risks.

**Setting up a sectoral SyRB targeting climate-related risks hinges on identifying relevant exposures, which may require more granularity than the EBA guidelines currently enable.** These (see **Section 1.2**) define economic activity only at the first level of NACE and geographical location of the collateral at the NUTS level 3 territorial unit. This level of granularity may not be precise enough to effectively capture climate risk; for example, NUTS level 3 geographical location may be insufficient to accurately target areas highly exposed to physical risk. Similarly, defining exposures to transition risk at the first NACE sector level would equally penalise all exposures within a sector, irrespective of firm-level specificities and transition trajectories, with possible unintended effects on transition financing. Targeted revisions to the EBA guidelines, which the EBA will consider studying in the near future,[72] would allow more granular identification of relevant exposures, provided corresponding data is available.[73]

**The December 2023 report by the ECB-ESRB Project Team proposes a macroprudential framework to address climate-related risks based on existing**

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69 See also FSB (2022).

70 See recital 36 of Proposal for a Directive of the European Parliament and the Council amending Directive 2013/36/EU as regards supervisory powers, sanctions, third-country branches, and environmental, social and governance risks, and amending Directive 2014/59/EU (CRD6).

71 See EBA (2023).

72 ibid.

73 Data availability and quality are key challenges for implementing a sectoral SyRB for climate-related risk. They are critical for risk assessment, buffer calibration and impact assessment. In particular, they are central for identifying banks' exposures to climate-related risk through information on counterparts.

**evidence, and lays out a preliminary operational design based on existing instruments including the SyRB.**[74] The report notably explores indicators and methodologies that could help inform potential future activation and calibration of an SyRB targeting climate-related risks, including in its sectoral form. It finds the stress testing approach to be "the most suitable for calibration purposes", while an indicator-based approach "could be considered but would face significant challenges". Similar to the approach applied in this report for RRE risks, the calibration of an SyRB targeting climate-related risk could rely on a climate stress test as a starting point, to identify the capital needed to cover potential losses in the event a shock materialises.

**Current limitations in the legal framework represent an additional challenge.** For example, according to Article 133(5)(b) CRD V, a sectoral SyRB can only apply to exposures that are located in the Member State that sets that buffer, which is a limitation to potential coverage given the global nature of climate-related risks, but also creates a risk of international arbitrage to bypass the measure. To avoid negative side effects, good coordination among EU countries will be key, especially regarding reciprocation of measures a country implements.

74 See ECB-ESRB (2023).

# 5 Conclusion and way forward

**Focusing on RRE-related risks and building on the experience of national authorities that have activated a sSyRB, this paper aims to deepen the common understanding of how this new tool can be activated, calibrated and released, as well as the way it interacts with other regulatory requirements.** The paper provides a conceptional discussion of key issues and proposes two specific methodologies – an indicator-based approach and a model/stress test-based approach – that can help inform future policy discussions. These methodologies complement the ECB's existing RRE framework as well as existing approaches used at national level. The proposed methodologies seek to promote consistent application of the buffer across countries and may serve as a common reference point, thus facilitating future exchange and interaction between authorities. The same also applies to the conceptual aspects of the paper, which aim to foster a shared understanding of the role of sectoral buffers in the broader macroprudential toolkit.

**While RRE-related risks were a natural starting point for considerations in relation to the sSyRB, broadening the scope to additional risk areas may be a useful exercise for the future.** Authorities in the banking union have recently started or are already considering applying the sSyRB to risk areas other than RRE, and the report already includes an outlook on exposure classes that may become more relevant in the years ahead. Further deepening the common understanding of future applications of the sSyRB may also prove useful for other risk areas, and there is substantial potential for peer learning from authorities that are already more advanced in this respect (e.g. in applying the sSyRB to NFC or CRE-related risks).

**Besides broadening the scope of the sSyRB to other risk areas, a more holistic look at parts of the buffer framework (specifically the CCyB. SyRB and sSyRB) may be a further useful extension.** The paper already includes some discussion on possible interactions and overlaps between the different buffers and calls for them to be jointly calibrated to target risks identified in the most effective manner. Further work on how to conduct such joint calibrations would help identify best practices and ensure consistency in policy implementation across countries. The work could also consider the role of recent innovations in some of the instruments, notably including the increased adoption of positive neutral frameworks for the CCyB.

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# Annex

## Annex 1: Current applications of the sSyRB for RRE-related vulnerabilities

**Until now, six Banking Union countries (Belgium, Germany, Lithuania, Malta, Portugal, Slovenia) have implemented an sSyRB to enhance resilience against vulnerabilities in the RRE sector.** When implementing the tool, they considered both prevalent risk conditions and the existing policy mix. In Belgium, the buffer replaced the previous Article 458 CRR measure which set an add-on and a multiplier to the risk weights on exposures secured by RRE under the IRB approach. While requirements for individual institutions changed, the sSyRB was calibrated in such a way that the overall level of resilience at the system level was maintained. In Slovenia, part of the calibrated sSyRB offsets possible increases in credit risk due to newly allowed exemptions to the DSTI limit on mortgage and consumer loans, with the remainder targeting RRE vulnerabilities. In Germany and Lithuania, the sSyRB aims at enhancing resilience against elevated risks in the RRE sector while avoiding double counting of broader systemic risks (including from RRE) already addressed by the CCyB. In Malta, the tool complements BBMs and a measure under Art. 124 CRR aiming to address risks in relation to high credit growth and increasing household indebtedness. Finally, Portugal was the most recent country to introduce a sectoral buffer on RRE exposures of IRB institutions, aiming to enhance resilience against downside risks.

**Calibrations to date have generally used a stress test or model-based approach, with some differences in technical implementation across countries (see Table A.1.1).** The primary measure guiding authorities' buffer calibrations have been credit loss simulations on mortgage exposures at the bank portfolio level. Loss estimates (i.e. changes in PD and/or LGD) were informed by crisis episodes from other European countries linked to macroeconomic dynamics and/or recovery rates, or based on plausible but conservative ranges. Based on their loss simulations, authorities have implemented buffer rates on mortgage exposures ranging from 1% in Slovenia up to 6% in Belgium. Four countries apply the buffer to all banks, while two have restricted the scope to IRB institutions.

**Besides the calibration exercise, authorities have used a range of tools to perform ex ante and ex post impact assessments of their measures.**[75] Policy evaluation approaches focused on the bank-level impact on capital requirements, or looked at available excess capital, the average cost of capital, bank portfolio composition, changes in mortgage loan spreads and quantities, house prices, GDP and bank defaults resulting from policy implementation. Methods ranged from direct calculation of the policy impact (e.g. on overall capital requirements) to empirical estimates of the impact on the variables of interest, model-based assessments (FAVAR, BEAST) and general equilibrium models.

**Table A.1.1: Overview of current sSyRBs addressing RRE-related risk**

| Country | Buffer rate | Institutions targeted | Calibration method | Impact assessments |
|---|---|---|---|---|
| Belgium | 6% | IRB | Stressed PDs/LGDs (ad hoc assumptions reflecting PD/LGD increases in previous crises) | Focus on bank-level impact analysis (since replacing existing tool) |
| Germany | 2% | All | Stressed PDs/LGDs implied by macro model and adverse scenario featuring real estate price decline and increase in unemployment | Available excess capital; impact on WACC; portfolio composition (incentives/steering); continuous monitoring of impact on loan supply, interest rate and other indicators |
| Lithuania | 2% | All | Credit losses implied by broad-based adverse macro scenario featuring real estate price decline and increase in unemployment | Short and long-term impact on mortgage spreads and flows, house prices and GDP (empirical, DSGE, FAVAR) |
| Malta | 1.5% | All | Stressed LGDs obtained via a shock to house prices | Impact on overall capital requirements and MREL |
| Portugal | 4% | IRB | Unexpected losses under a strongly adverse macro scenario | Impact on capital headroom and MREL, considering projections for banking capitalisation and profitability |
| Slovenia | 1% | All | Ad hoc PD/LGD shock to exposures emanating from relaxation of DSTI cap exemptions | Short and long-term impact on lending spreads and growth, GDP, bank defaults (3D DSGE, BEAST) |

Note: The table provides an overview of the key features of sSyRBs already implemented to address RRE risks in the banking union.

**Experience of calibration in all countries has highlighted important data and technical challenges.** In terms of data, all use supervisory data from COREP as a starting point, but additional sources such as central credit registries and national surveys on mortgage loans or market data on LTV at origination were necessary. The unavailability of granular data (e.g. on credit standards) and exposure type definitions in COREP represented challenges in some cases. For example, within COREP, the data on domestic standard approach (SA) and IRB exposures do not distinguish between RRE and CRE collateral, while SA exposures secured by residential property do not differentiate between retail and non-retail borrowers. Given the relevance of domestic RRE exposures, the absence of these decompositions should be addressed in future updates to the COREP framework (which would also benefit reciprocating Member States). From a technical perspective, it was noted that current PDs may be underestimated given their historically low levels, while LGD models proved rather insensitive to changes in current LTV. Overall, these challenges suggest applying expert judgement and rather conservative calibration, especially in a macro-financial environment of high uncertainty.

**Finally, authorities generally considered the effects of other macroprudential measures when calibrating the sSyRB, in particular the interplay with the CCyB.** Some authorities explicitly calibrated or recalibrated the sSyRB so it complements a CCyB tackling broader cyclical systemic risks including (but not limited to) real estate-related risks. Apart from this, overlaps with other tools were generally sought, but none identified. For the calibration exercise, authorities deducted different types of buffers from the simulated losses under adverse

conditions, depending on the type and severity of the stress scenario. Some authorities analysed the interplay with the LR or MREL with respect to buffer usability and found that their calibrated sSyRB would be fully usable.

## Annex 2: Detailed legal considerations

**The sectoral systemic risk buffer under the CRD**

With the adoption of the CRD V in 2019, the EU legislator entirely revised Article 133 of the CRD IV and introduced amongst other things the ability for national competent authorities (NCAs) or national designated authorities (NDAs) to apply a sectoral systemic risk buffer (sSyRB).[76]

In terms of risks that can be addressed, CRD V erased the previous reference to systemic risks of a "long-term, non-cyclical" nature and clarified that this instrument can be used to prevent and mitigate macroprudential or systemic risks not covered by CRR measures or Articles 130 (CCyB) and 131 (capital buffers for Global and Other Systemically Important Institutions) CRD. In this way, the revision allows for sectoral application of the tool to address both structural and cyclical risks. The reference to Articles 130 and 131 CRD is reiterated in Article 133(7) and Article 133(8)(c) CRD. Recital 70 of CRR II and Recital 26 of the CRD V clarify that "The relevant competent or designated authorities should aim at avoiding any form of duplicative or inconsistent use of the macroprudential powers laid down in Regulation (EU) No 575/2013 and Directive 2013/36/EU. In particular, the relevant competent or designated authorities should duly consider whether the measures that they take under Article 124, 164 or 458 of Regulation (EU) No 575/2013 duplicate or are inconsistent with other existing or upcoming measures under Article 133 of Directive 2013/36/EU."[77]

In terms of targeted institutions, an SyRB (including a sectoral one) can be applied to "all institutions or to one or more subsets of those institutions".[78]

In terms of exposures ("general" vs sectoral SyRB), the tool can be applied to "all exposures, sectoral exposures or to subset of sectoral exposures".

The SyRB can be applied to:

- all exposures located in the Member State that sets that buffer;
- all exposures located in other Member States;

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[76] See Recital 24 of CRD V: "*In addition to a capital conservation buffer and a countercyclical capital buffer, Member States should be able to require certain institutions to hold a systemic risk buffer in order to prevent and mitigate macroprudential or systemic risks not covered by Regulation (EU) No 575/2013 and by Directive 2013/36/EU, namely a risk of disruption to the financial system with the potential for serious negative consequences for the financial system and the real economy in a specific Member State. The systemic risk buffer rate should apply to all exposures or to a subset of exposures and to all institutions, or to one or more subsets of those institutions, where the institutions exhibit similar risk profiles in their business activities.*"

[77] After the CRD V amendments, the former "pecking order" for the SyRB no longer applies, as a) Pillar 2 is once again solely a microprudential instrument, and b) the need to avoid overlaps with other macroprudential measures has been clarified.

[78] While paragraph 1 of Article 133 CRD states that "Each Member State may introduce a systemic risk buffer of Common Equity Tier 1 capital for the financial sector or one or more subsets of that sector […]", paragraph 7 of the same provision clarifies that the SyRB may apply to all exposures, or a subset of exposures, "of all institutions, or one or more subsets of those institutions, for which the authorities of the Member State concerned are competent in accordance with [the CRD]".

- exposures located in third countries.

The sectoral SyRB can be applied to:

- sectoral exposures located in the Member State that sets that buffer and subsets of those sectoral exposures, subject to the EBA Guidelines EBA/GL/2020/13 (see below);[79]
- sectoral exposures located in other Member States, but only to enable the recognition of a sSyRB rate set by another Member State.

**Sectoral use of the SyRB**

According to Article 133(5)(b), NCAs or NDAs can apply an SyRB to the following sectoral exposures located in the Member State that sets that buffer:

(i) all retail exposures to natural persons which are secured by residential property;

(ii) all exposures to legal persons which are secured by mortgages on commercial immovable property;

(iii) all exposures to legal persons excluding those specified in point (ii);

(iv) all exposures to natural persons excluding those specified in point (i).

A sectoral SyRB can also be applied to sectoral exposures as identified in point (b) above located in other Member States, but only to enable recognition of a buffer rate set by another Member State in accordance with Article 134 (Article 133(5)(d) CRD).

Article 133(5)(e) CRD states that relevant authorities can set an SyRB addressing "exposures located in third countries". This wording could be read as covering the possibility of applying a sectoral SyRB to exposures located in third countries. However, it could also be argued that the sectoral SyRB may be applied only in cases where this is explicitly provided for.

Finally, Article 133(5)(f) CRD also provides for application of the SyRB to subsets of any of the above sectoral exposures (see points i, ii, iii and iv). In line with the mandate enshrined in Article 133(6) CRD, in October 2020 the EBA issued guidelines on the appropriate subsets of sectoral exposures to which relevant authorities may apply an SyRB (EBA/GL/2020/13).[80] These recommend a common framework for defining subsets, employing three dimensions: type of debtor or counterparty sector, type of exposure and type of collateral. If deemed appropriate, duly justified and proportionate when targeting the systemic risk identified, these dimensions may be supplemented with three sub-dimensions: economic activity, risk profile and geographical area. The dimensions applied should ensure that flexibility

[79] Article 133 CRD mandates that the sSyRB can be applied only to sectoral exposures (and subsets of those exposures) located in the Member State that sets that buffer. This is clearly stated in Article 133(5)(b) CRD; the interpretation is reinforced by the fact that Article 133(5)(d) CRD specifies that a sSyRB can be applied to sectoral exposures located in other Member States only under a specific scenario, namely to enable the recognition of an sSyRB rate set by another Member State.

[80] See EBA/GL/2020/13.

in using the tool does not yield an excessive degree of complexity and difficulty in reciprocation.

When defining a subset of sectoral exposures in the application of a sectoral SyRB, the systemic relevance of the risks stemming from the subset of sectoral exposures must be subjected to a qualitative and quantitative assessment conducted by the relevant authority. The guidelines recommend three criteria to be used in such instances: size, riskiness and interconnectedness. In addition, the relevant authority should aim to disclose the approach used in its assessments.

**Coordination procedures and related thresholds**

Article 133 CRD mandates different coordination procedures for applying the SyRB, with activation dependent on the rate at which the relevant authority intends to set the buffer and the legal status of the institutions targeted. As is the case for all macroprudential measures enshrined in the CRR/CRD that are implemented by national authorities of Member States participating in the SSM, these coordination procedures should take place only after the SSM notification process mandated by Article 5(1) SSM Regulation has been concluded.[81]

Common to all the different coordination procedures enshrined in Article 133 CRD is the requirement that when the relevant authority intends to set or reset an SyRB or sSyRB it should first notify the ESRB. The latter must forward the notification to the Commission and the EBA (and the competent and designated authorities of other Member States concerned, where applicable) without delay.

The different coordination procedures and related thresholds are provided for in paragraphs 10 to 12 of Article 133 CRD. In particular, it is mandated that "where the setting or resetting of a systemic risk buffer rate or rates on any set or subset of exposures referred to in paragraph 5 subject to one or more systemic risk buffers results in a combined systemic risk buffer rate […] for any of those exposures" that is:

- not higher than 3%, the relevant authority should notify the ESRB one month before publishing the measure. The recognition of a SyRB rate set by another Member State in accordance with Article 134 CRD does not count towards the 3% threshold (see Art. 133(10) CRD);
- between 3% and 5%, the relevant authority should notify the ESRB and request the opinion of the Commission. The latter should provide its opinion within one month. Where the Commission's opinion is negative, the relevant authority must comply with that opinion or provide reasons for not doing so, whereas in case of

[81] As explicitly requested by Recital 24 of the SSMR, which states that "[…] *In order to ensure full coordination, where national competent authorities or national designated authorities impose such measures, the ECB should be duly notified.* […] *The provisions in this Regulation on measures aimed at addressing systemic or macroprudential risk are without prejudice to any coordination procedures provided for in other acts of Union law. National competent authorities or national designated authorities and the ECB shall act in respect of any coordination procedure provided for in such acts after having followed the procedures provided for in this Regulation*."

a positive opinion by the Commission, the relevant authority may proceed with publication of the measure (see Art. 133(11) CRD, 1st and 2nd sub-paragraphs);

- higher than 5%, the relevant authority should notify the ESRB and seek the authorisation of the Commission before implementing the measure. The ESRB should provide its opinion on whether it deems the SyRB appropriate within six weeks of initial notification (the EBA may provide its opinion too[82]).

Taking into account the assessment of the ESRB and EBA, where relevant, and where it is satisfied that the SyRB rate or rates do not entail disproportionate adverse effects on the whole or parts of the financial system of other Member States or of the Union as a whole forming or creating an obstacle to the proper functioning of the internal market, the Commission must within three months of initial notification adopt an act authorising the relevant authority to adopt the proposed measure (see Art. 133(12) CRD).

If the SyRB applies to a subsidiary, the parent of which is established in another Member State, and regardless of the rate, the relevant authority should notify the ESRB, requesting a recommendation from both the Commission and the ESRB, and the authorities of the Member State in which the parent institution is located.[83] These recommendations must be provided by the Commission and the ESRB within six weeks of receipt of the notification. Where the authorities of the subsidiary and the parent disagree on the SyRB rate or rates applicable to that institution and in the event of a negative recommendation from both the Commission and the ESRB, the relevant authority may refer the matter to the EBA and request its assistance.[84] The decision to set the SyRB rate or rates for those exposures must be suspended until the EBA has taken a decision (see 3rd/4th and 5th sub-paragraphs of Article 133(11) CRD).

Where the decision to set the SyRB rate results in a decrease (or no change) from the buffer rate previously set, the relevant authority need only comply with the requirement to notify the ESRB (see Article 133(9) CRD).

**Additivity with capital buffers for G-SIIs and O-SII**

According to Article 131 CRD, which lays down the rules governing G-SII and O-SII capital buffers, SyRB, sSyRB and G-SII/O-SII buffers are cumulative.[85] However, the same provision mandates that where the sum of these buffers' rates is higher than 5%, the relevant authority that intends to set or reset the G-SII or O-SII buffers' rate must notify the ESRB three months before the date on which it intends to publicly

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82 In relation to the option for the EBA to provide the Commission with an opinion, Article 133(12) CRD makes reference to Article 34(1) of Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC (OJ L 15.12.2010, p.331) (the EBA Regulation), now replaced by Article 16a of the EBA Regulation.

83 Note also the ESRB, upon receipt of the notification from the activating authority, must forward the relevant notification to the competent and designated authorities of the Member States concerned without delay (see Article 133(9) CRD).

84 Pursuant to Article 19 of the EBA Regulation, the EBA may assist the authorities in reaching an agreement in accordance with the procedure for the settlement of disagreements between competent authorities in cross-border situations.

85 See Article 131(15) CRD.

announce its decision and seek authorisation from the Commission.[86] The ESRB must forward such notification to the Commission and the EBA (and the competent and designated authorities of other Member States concerned by the G-SII/O-SII buffers, where applicable) without delay. The ESRB should provide its opinion to the Commission on whether it deems the G-SII/O-SII buffer appropriate within six weeks of the initial notification (the EBA may provide its opinion too).

Taking into account the assessment of the ESRB and of the EBA, where relevant, and where it is satisfied that the G-SII/O-SII buffer does not entail disproportionate adverse effects on the whole or parts of the financial system of other Member States or of the Union as a whole forming or creating an obstacle to the proper functioning of the internal market, the Commission must within three months of initial notification adopt an act authorising the relevant authority to adopt the proposed measure.[87]

**Recognition of the SyRB and sSyRB among Member States**

A general mechanism for mandatory reciprocation of macroprudential measures is currently not envisaged in EU law. However, Article 134(1) CRD explicitly envisages that relevant authorities may recognise SyRB rates set by other Member States,[88] applying those rates to domestically authorised institutions for exposures located in the Member State that set the original SyRB. Article 134(5) CRD specifies that when a Member State sets an SyRB, the relevant authority of that Member State may ask the ESRB to issue a recommendation addressed to one or more Member States for the buffer to be recognised. Where Member States recognise an SyRB rate set by another Member State for their domestically authorised institutions, its rate may be cumulative with any SyRBs already applied in their jurisdiction, provided the buffers address different risks. However, in cases where the buffers address the same risks, only the higher buffer applies.[89]

While a general, mandatory reciprocation mechanism is not currently envisaged in EU law, the ESRB put in place a framework of voluntary reciprocity for macroprudential policy measures across EU Member States.[90] The reciprocation process is started by a formal request from the relevant authority of the Member State initially activating the measure. The framework specifies that the request, which can be sent to the ESRB upon activation of the original measure or at a later point in time depending on the circumstances, should specify an institution-level maximum materiality threshold to guide the application of the de minimis exemption.[91] After assessing the request, and if it deems so appropriate, the ESRB recommends reciprocation of the relevant macroprudential policy measure via an ad

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86 Article 131(15) cross-refers to the procedure mandated by Article 131(5a) CRD.

87 See Article 131(7) and (5a) CRD.

88 Pursuant to Article 134(3) CRD, this is done by taking into consideration the information presented, in accordance with Article 133(9) and (13), by the Member State that set the original SyRB.

89 See Article 134(4) CRD.

90 The relevant framework is codified in three documents issued by the ESRB, namely (1) Recommendation ESRB/2015/2; (2) Article 5 of Decision ESRB/2015/4; and (3) Chapter 11 of the ESRB Handbook on operationalising macroprudential policy in the banking sector. For more information on the ESRB's reciprocity framework see the website.

91 To harmonise the application of this exemption, the ESRB amended its voluntary reciprocity framework in Recommendation ESRB/2017/4.

hoc ESRB recommendation updating general Recommendation ESRB/2015/2 so as to include in the latter the macroprudential policy measures for which reciprocation is recommended.

**Interactions and possible overlaps in risk coverage between the SyRB and other macroprudential tools**

In terms of interactions and possible overlaps of the SyRB with other capital requirements or buffers, Article 133(1) CRD, together with recitals 70 CRR and 26 CRD mentioned above, may be read as follows:

- CCyB: as the changes introduced in CRD V allow use of the SyRB to address cyclical risks too, the new wording aims at making clear that the CCyB remains the primary tool to address cyclical risks. However, since the framework does not provide for a sectoral CCyB, the sectoral SyRB is seen as the tool that can be used to address additional cyclical risk in a specific sector. For instance, if credit growth in the RRE sector is higher than the average of all exposures covered by the CCyB, an sSyRB rate should incorporate the additional targeted cyclical component of the RRE-related risk (but no more).

- G-SII/O-SII buffers: before the review of the CRD, some countries used the SyRB to substitute or complement buffers for systemically important institutions. The current framework clarifies that only the latter should be used to address risks related to the operational size of a specific institution, and that G-SII/O-SII buffers and the SyRB are cumulative (Article 131(15) CRD). While it is theoretically possible that risks covered by an sSyRB partially overlap with risk indicators captured in the G-SII/O-SII framework, this is considered less probable or relevant for RRE-related risks.

- Measures taken pursuant to Articles 124, 164 or 458 CRR: as regards Articles 124 and 164 CRR, the possibility of an overlap with a sectoral SyRB addressing exposures secured by immovable property is material and should be carefully assessed. Under the current CRD/CRR framework the options for addressing systemic risks stemming from the real estate sector are the following: ((i) adjusting the risk weights/lending criteria (for institutions using the Standardised Approach) or the minimum LGD values (for institutions using the Internal Rating-Based Approach) pursuant to Articles 124 and 164 CRR (Pillar 1), which has the consequence of also affecting all the other buffers calculated on that basis; (ii) the SyRB, if authorities prefer to increase resilience by means of a capital buffer; or (iii) Article 458 measures, which from an implementation perspective are subject to a more burdensome activation procedure. The best way to avoid double counting of risks seems to be coordination between micro and macro authorities.[92]

[92] The issue of the relationship between the SyRB and macro measures in Articles 124/164 CRR is mentioned five times in the new text of CRD/CRR. Apart from Article 133 CRD and Recitals 26 CRD and 70 CRR, both Article 124(1a) and Article 164(5) CRD stress that "*cooperation shall aim at avoiding any form of duplicative or inconsistent action between the competent authority and the designated authority, as well as ensuring that the interaction with other measures, in particular measures taken under Article 458 of this Regulation and Article 133 of Directive 2013/36/EU, is duly taken into account*."

- Capital requirements not mentioned in Article 133 CRD (or relevant recitals): overlaps with risks covered by institution-specific requirements should in theory not be considered, as the SyRB is by definition a buffer meant to address only macroprudential or systemic risks. The CCoB is a more generic buffer not covering any specific type of risk, so overlap in risk coverage is less probable or relevant. Nevertheless, the buffer is meant to be usable under adverse conditions, which may include real estate-related stress scenarios.

NB. The European Commission's consultation on improving the EU macroprudential framework for the banking sector (30 November 2021 - 18 March 2022), contained specific questions [Q 4.6] on application of the SyRB to sectoral exposures:

- Are the thresholds for opinions and authorisations appropriate for sectoral SyRB rates (and for the sum of G/O-SII and SyRB rates)?
- Should the combined SyRB rate be calculated as a percentage of total risk exposure amounts and not sectoral risk exposure amounts?
- How should sectoral risk exposure amounts be calculated after the introduction of the output floor?

The feedback statement stresses that the use of a common denominator for sectoral and general SyRB rates before applying the additivity rules and activation thresholds was suggested by several respondents.

## Annex 3: technical amendments to Sub-section 2.2.2

*Note: The choice of data in the model-based calibration approach has been guided by the best cross-country coverage available to minimise missing datapoints and ensure consistency across stock concepts (e.g. the NPMLs being a fraction of MLs from the same FINREP template). However, for some jurisdictions this choice may not sufficiently reflect important country specificities.*

**Table A3.1: Overview of metadata for the series used in the computations**

| Variable | Concept description | Source | Table | Rows | Columns |
|---|---|---|---|---|---|
| RWA | Risk-weighted Assets | COREP | C_01.00 | 010 | 010 |
| CET1 | Common Equity Tier 1 capital | COREP | C_02.00 | 020 | 010 |
| ML | Mortgage loan stock - total | FINREP | F_18.00.a | 160+910+930 | 010 |
| NPML | Mortgage loan stock – nonperforming | FINREP | F_18.00.a | 160+910+930 | 060 |
| PD | Point-in-Time (PiT) PD (annual) | EBA KRI Dec 2022 | C_09.02 | 090 | See EBA |
| LGD | PiT LGD | EBA KRI Dec 2022 | C_09.02 | 090 | 090 |
| TTC_PD | Through-the-Cycle (TTC) PD (annual) | EBA KRI Dec 2022 | C_09.02 | 090 | See EBA |
| DT_LGD | Down Turn (DT) LGD | EBA KRI Dec 2022 | C_09.02 | 090 | See EBA |
| URX | Unemployment rate, SA (level, %) | March 2023 BMPE | | | |
| IR | Short term interest rate (3-month money market interest rate) | March 2023 BMPE | | | |
| CPG | Compensation per employee (% change) | March 2023 BMPE | | | |
| HPG | House price growth (% change) | March 2023 BMPE | | | |
| SPG | Stock price growth (% change) | March 2023 BMPE | | | |

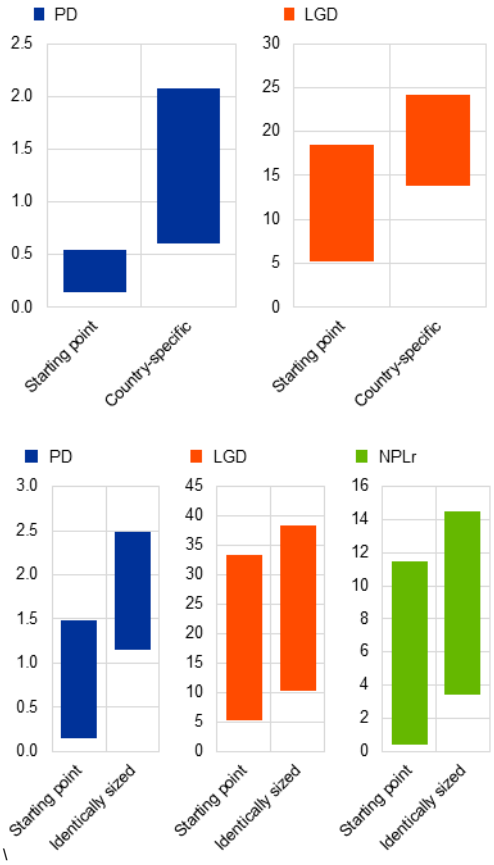
### Sensitivity analysis of loan loss calculations

**The sensitivity of the reference results is tested in two separate exercises, with starting point PD, LGD and NPLs each changed separately.** Each time the exercise is performed, one variable is shocked and the others remain at the initial values used for the reference results described in Section 2.2.2 (e.g. if the PDs are increased by a certain number of percentage points the LGD and the loan stock remain unchanged from their starting points). Both country-specific shocks and cross-country consistent, identically sized shocks are employed, in alternative version of the exercise.

**In the first, country-specific, sensitivity test, the point-in-time starting point PDs and LGDs in each country are increased to their through-the-cycle (PD) and downturn (LGD) levels, respectively (where available; Chart A3.1).** In most countries, this amounts to a notable increase in the value of the credit risk parameters. Taking the medium scenario as a reference, the recalculated loan losses using the increased PDs as a starting point are often close to the reference value under the medium scenario, but with material differences in a few countries (in particular those with the largest difference between the values of point-in-time and through-the-cycle PDs). The difference in loan losses when recalculated using increased LGDs starting points, are much less pronounced, likely due to the higher importance of the PD shocks (**Chart A3.2, left**).

**In a separate sensitivity test, cross-country identically sized shocks are applied to PDs, LGDs and non-performing mortgage loans (Chart A3.1).** PDs are increased by +1 percentage point while, separately, LGDs are increased by +5 percentage points from the starting points used in the reference calculations for all countries. Non-performing mortgage loan stocks are scaled up to correspond to a +3 percentage point increase in the country-specific initial non-performing mortgage loan ratio. Similar to the country-specific exercise, and again taking the medium scenario as a reference, the differences in loan losses resulting from these shocks are mostly driven by differences in the starting point PDs (**Chart A3.2, right**).

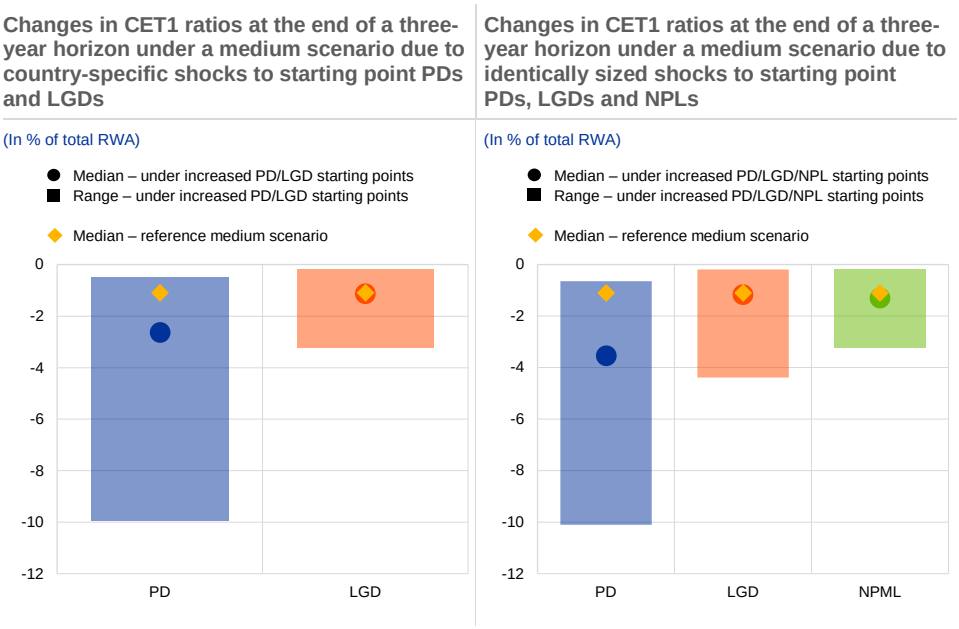
**Chart A3.1: Ranges for starting point and shocked parameters**




Source: EBA and ECB, ECB calculations.
Notes: missing values in the PD and LGD columns are either due to a negative shock (TTC, DT<PiT) or to the fact that PiT data was missing so TTC and DT numbers were used as starting points.

**Chart A3.2**

Stressing PDs to either country-specific values or cross-country consistent add-ons results in median loss differentials of between 1.5% and 3.5% of total RWA compared with the medium adverse scenario




Sources: EBA and ECB, ECB calculations.
Notes: Median and min-max intervals across countries for each specific scenario.

**To capture selected country specificities of the key parameters, loan losses were also re-calculated using the parameters provided by experts from national authorities for their respective jurisdictions, where available.** The experts conducted a data check and provided additional data points and explanations where the values of the credit risk parameters and banking system balance sheet data taken consistently across countries from the indicated data sources were considered less appropriate compared to a national specific value. The resulting loan losses are in most of the cases higher than the calculation with cross-country consistent input data. In relative terms, the recalculated aggregate loan losses for the banking systems are generally higher, by factors varying from 1.6 to almost 6, depending on the country (although in two instances they almost halved). In absolute terms, differences are about 70 basis points on average. This provides a cross-check on the order of magnitude of the reference results calculated with cross-country consistent data, but also highlights the importance of considering country specificities.

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