Box 3.1

SECTORAL INDICATORS FOR APPLYING THE BANCO DE ESPAÑA'S NEW MACROPRUDENTIAL TOOLS

Banco de España Circular 5/2021 implements two new sectoral macroprudential tools: a sectoral component of the countercyclical capital buffer (CCyB) and limits on sectoral concentration.[1] These tools make it possible to address situations where systemic risks are confined to, or are relatively higher in, specific sectors, as happened with the real estate sector in Spain during the financial crisis. In such cases, applying sectoral macroprudential measures early or more forcefully may be more effective in controlling the build-up of risks than activating aggregate macroprudential tools on credit exposures as a whole.[2]

The Circular also describes a series of sectoral indicators that must be regularly analysed by the Banco de España when assessing sectoral systemic vulnerabilities and, where appropriate, when considering the activation of sectoral macroprudential measures. This box sets out some of these indicators, which have already been incorporated into the Banco de España's framework for monitoring financial stability risks. 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; and iv) other loans to households (primarily consumer loans).

In this respect, the methodology for analysing sectoral credit cycles is similar to that used for the total credit cycle of the Spanish economy in CCyB decisions.[3] It is basically used to calculate each sector's credit gaps, which measure the difference between several sectoral debt indicators and their equilibrium values, estimated as long-term trends by means of statistical procedures.[4] The rationale behind these indicators is based on the fact that deviations from their long-term behaviour tend to be reversed and that, the greater and more persistent the deviation, the more likely and sharper such correction will be. Consequently, credit booms that push the credit gap above its long-term trend are a sign of imbalance.

While the basic debt indicator for the total economy is the credit-to-GDP ratio, in the case of specific sectors, in addition to GDP, a series of measures more closely connected to the sector's activity, or to households' ability to pay, are considered as denominators. In the case of firms, for example, 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 is used as the denominator. When assessing macroprudential policy, these indicators are complemented by others relating to credit standards and also by real estate asset price developments, which are particularly relevant in the case of loans for house purchase.[5]

As with the general CCyB, in addition to the estimated credit gaps, other indicators are also calculated. Included here is sectoral credit intensity, which is determined as the ratio of the annual change in each sector's credit (as the numerator) to the annual cumulative GVA, disposable income or GFCF (as the denominator). This indicator seeks 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.[6]

As in the case of the credit gap used to set the general CCyB, sectoral credit gaps have widened significantly since the outbreak of the COVID-19 health crisis, except for the consumer loan gap (see Chart 1). This widening is mainly due to the decline in the ratios' denominators (GVA and disposable income) and, to a lesser extent, to the support measures for the economy (State guarantees for loans, moratoria, etc.) which have underpinned lending, particularly to NFCs. Thus, these developments in the gaps should not be construed as an early warning, as no

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1 Circular 5/2021 also provides for the possibility of imposing limits and conditions on loan origination. The full text of the Circular is available here (available in Spanish only).

2 Aggregate macroprudential tools would be less efficient if applied to all sectors equally and could even shift lending towards sectors with more systemic risk, with potentially counter-productive effects. For more details on the rationale behind the new sectoral tools, see C. Trucharte (2021), "Nuevas herramientas macroprudenciales para las entidades de crédito", and C. Castro and A. Estrada (2021), "Function and application of the new macroprudential tools available to the Banco de España", *Financial Stability Review* No 40, Banco de España.

3 See BCBS (2010), *Guidance for national authorities operating the countercyclical capital buffer,* and BCBS (2019), *Guiding principles for the operationalisation of a sectoral countercyclical capital buffer.*

4 See J. E. Galán (2019), "Measuring credit-to-GDP gaps. The Hodrick-Prescott filter revisited", *Occasional Paper* No 1906, Banco de España.

5 These credit standards indicators and house and other real estate asset prices are not covered in this box. For information on their current situation, see Chapter 1 of this FSR; for a more in-depth analysis of their relationship with credit quality, see J. E. Galán and M. Lamas (2019), "Beyond the LTV ratio: new macroprudential lessons from Spain", *Working Paper* No 1931, Banco de España.

6 Several papers relate credit growth to subsequent financial crises. See, for example, M. Schularick and A. Taylor (2012), "Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870-2008".

Chart 1
CREDIT-TO-GVA GAP (FIRMS) AND CREDIT-TO-DISPOSABLE INCOME GAP (HOUSEHOLDS) (a)

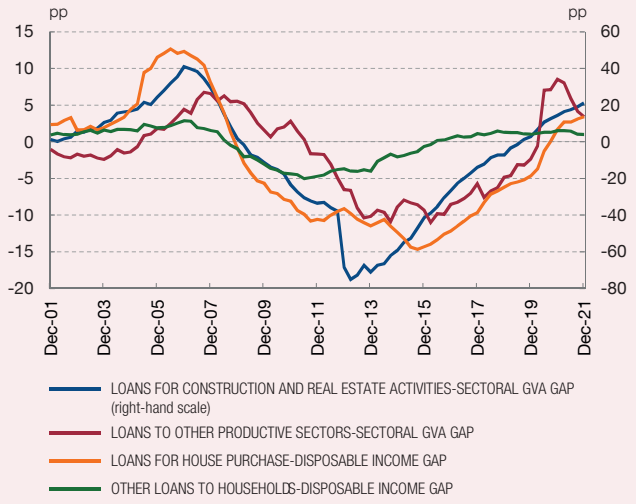


Chart 2
CREDIT INTENSITY OF FIRMS AND HOUSEHOLDS WITH RESPECT TO GVA AND DISPOSABLE INCOME, RESPECTIVELY (a)

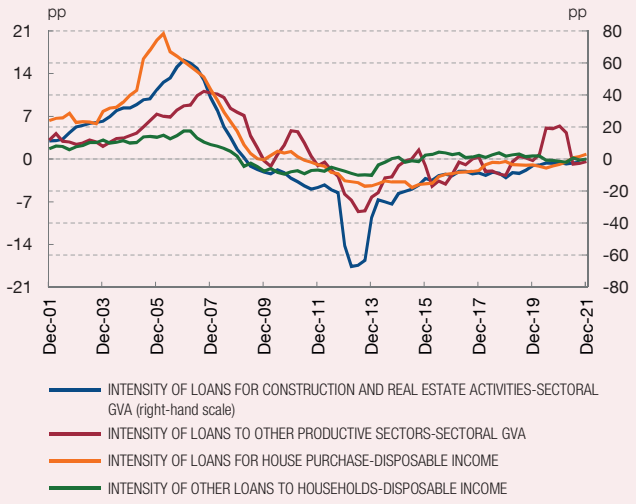


Chart 3
PREDICTIVE POWER OF THE TOTAL CREDIT GAP AND SECTORAL CREDIT GAPS (b)

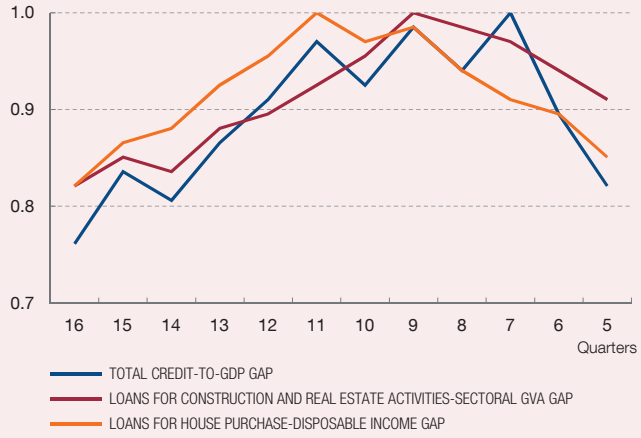
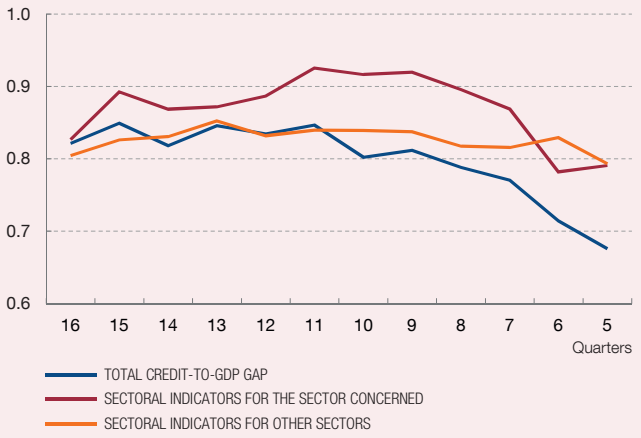


Chart 4
PREDICTIVE POWER OF EACH SECTOR'S SECTORAL INDICATORS VIS-À-VIS OTHER SECTORS (b) (c)



SOURCES: Banco de España and INE.

a Data available up to December 2021.
b Predictive power is measured by means of the AUROC. This measure 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, in order to thus assess whether measures could be activated sufficiently in advance.
c A distinction is made between the sectoral gaps' capacity 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 – in the specific sector and in other sectors, respectively –. The credit-to-GDP gap's capacity 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.

excessively large credit build-ups can be seen in any of the sectors.

The absence of warnings is clearer when observing the changes in sectoral credit intensity, where the four series remain close to zero, and generally in negative values (see Chart 2). The only relevant exception is the temporary rise in the credit intensity series for loans to other NFCs (those not engaged in construction and real estate activities). This temporary surge reflects 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. Accordingly, despite the widening gaps, the developments in credit intensity suggest the absence of warning signals, and it is therefore not considered that any of the new sectoral macroprudential tools requires activating at present.

Lastly, these indicators' capacity to anticipate systemic crises is assessed. In particular, the explanatory power of sectoral gaps is analysed using the so-called "AUROC" methodology.[7] This method, which has been widely used in the literature to assess early warning indicators,[8] makes it possible to analyse the sectoral gaps' capacity to anticipate the outbreak of the global financial crisis in 2009. Specifically, the capacity of the credit-to-GDP gap and that of the sectoral gaps to warn of a systemic crisis 16 to 5 quarters in advance were compared. A historical sample was used, spanning from December 2001 to September 2017,[9] which includes, as the sole systemic event, the 2009 global financial crisis.[10] The results show that, for this specific episode, the credit-to-GDP gap is less able to anticipate crises than sectoral gaps over much of the projection horizon (see Chart 3). Therefore, monitoring the new sectoral indicators might help identify new systemic imbalances earlier than when monitoring the overall credit cycle of the economy. Nevertheless, it should be noted that this exercise is only based on one crisis event and, accordingly, these results require confirmation as more experience is gained or more data are analysed.

Additionally, it is important to study whether the sectoral indicators are also useful for identifying imbalances in the specific sector and whether they provide leading information on losses materialising in the future. For this purpose, instead of analysing the power to predict systemic events (such as the beginning of the global financial crisis), the assessment focuses on each indicator's capacity to predict an increase in the sectoral default rate with respect to its historical average. The results indicate that the sectoral gaps show a greater power to predict the future materialisation of defaults in the sector concerned than in other sectors (see Chart 4), confirming the importance and usefulness of closely monitoring the different sectoral credit cycles. Furthermore, these sectoral gaps are also more appropriate for anticipating an increase in the specific sector's default rate than aggregate measures such as the credit-to-GDP gap.

7 The Area Under the Receiver Operating Characteristics Curve (AUROC) assesses the relationship between the false positive rate and the true positive rate for each probability threshold of a logit model. As such, it provides a measure of the probability that the model predictions are correct. The AUROC takes values of between zero and one. A value of 1 would indicate perfect predictions, while a value of 0.5 would suggest that the indicator has no capacity to inform on the probability of a crisis occurring.

8 See, for example, C. Castro, A. Estrada and J. Martínez (2016), "The countercyclical capital buffer in Spain: an analysis of the key guiding indicators", *Working Paper* No 1601, Banco de España.

9 In view of the forward-looking nature of the AUROC, the last 16 quarters (from 2017 Q4 to 2021 Q3) are excluded from the analysis.

10 In Spain, the global financial crisis entailed a systemic banking crisis between 2009 Q1 and 2013 Q4. Although the COVID-19 pandemic can also be deemed to have triggered a systemic crisis, the methodology used in this exercise cannot predict this type of exogenous event that originates outside the financial system.