

Sectoral indicators for applying the Banco de España's new macroprudential tools

Carmen Broto, Esther Cáceres and Mariya Melnychuk

BANCO DE ESPAÑA

The authors belong to the Banco de España's Financial Stability and Macroprudential Policy Department. They are grateful to Ángel Estrada, Carlos Pérez Montes, Javier Mencía, Matías Lamas and a referee for their comments. Email for comments: [mariya\(dot\)melnichuk\(at\)bde\(dot\)es](mailto:mariya(dot)melnichuk(at)bde(dot)es).

This article is the sole responsibility of the authors and does not necessarily reflect the opinion of the Banco de España or of the Eurosystem.

Abstract

Since December 2021 the Banco de España has three new macroprudential tools (Circular 5/2021): the sectoral component of the countercyclical capital buffer, limits on sectoral concentration, and limits and conditions on loan origination. The new sectoral instruments will allow it to address the risks that are concentrated in specific sectors, for which the aggregate macroprudential tools would be less effective, as they are applied equally across all sectors. In order to apply these tools, any potential vulnerabilities building up in the different sectors must be previously identified by means of adequate indicators. This article analyses the battery of sectoral indicators proposed in the circular, which may be useful for activating these new macroprudential tools. Their calculation methodology is similar to that used for the general countercyclical capital buffer indicators. In addition, a study of their predictive power is conducted, which shows their efficiency in identifying risks early. According to these indicators, on data up to 2021 Q3, no warning signals have been observed suggesting that these new tools should be activated.

Keywords: macroprudential policy, systemic risk, early warning indicators, sectoral component of the countercyclical capital buffer, limits on sectoral concentration.

1 Introduction

One of the responsibilities of central banks and the supervisory authorities is to promote the stability of the financial system as a whole. To this end, it is necessary to ensure not only the solvency of each financial institution individually through microprudential supervision, but also that the financial system as a whole is stable. The latter task is the main objective of macroprudential policy. This is a paradigm shift with respect to the microprudential supervision approach, which is one of the most significant advances introduced in the wake of the international financial crisis.¹ Macroprudential policy supplements the traditional microprudential approach to increase the financial system's resilience and prevent the build-up of the cyclical and cross-sectional dimensions of systemic risks. In particular, systemic risk builds up as financial imbalances increase and materialises when financial instability becomes so widespread that it hampers the proper functioning of the system to the extent that economic growth and the welfare of the population are adversely affected.²

1 In Spain, since 2014 the Banco de España is the national designated authority responsible for implementing the macroprudential policy instruments provided for in the legislation on the supervision of credit institutions (Law 10/2014 on the regulation, supervision and solvency of credit institutions). Also, the Spanish macroprudential authority (AMCESFI) is mandated to regularly analyse systemic risks.

2 This definition of systemic risk is based on that of the European Central Bank (ECB) (see ECB (2009)). Although there is no consensus as to what constitutes systemic risk, this is one of the most commonly accepted definitions.

For each economic policy target there must be at least one policy tool (see Tinbergen (1952)).³ Therefore, instruments different from those used by monetary and fiscal policy will be necessary for macroprudential policy to prevent the build-up of systemic risks. However, the objective of macroprudential policy, i.e. financial stability, is broader than that of other policies, owing to the multi-dimensional nature of systemic risk. Accordingly, the authorities will need to have a wide range of tools to enable them to address this risk on all fronts.

These considerations justify why the competent authorities continue to work on developing and perfecting the tools available to them. In this spirit, the macroprudential toolkit available to the Banco de España has expanded recently. Specifically, Circular 5/2021 amending Circular 2/2016⁴ implements three new macroprudential instruments in Spanish legislation: (1) a sectoral component of the countercyclical capital buffer (SCCyB); (2) sectoral concentration limits (SCLs); and (3) limits and conditions on loan origination and other transactions, known as borrower-based instruments (BBIs).

Until the approval of this circular, the Banco de España only had at its disposal the macroprudential tools implemented in European legislation. These basically consisted in capital tools, including most notably the countercyclical capital buffer (CCyB), the buffers for global and domestic systemically important institutions, and the systemic risk buffer (SyRB). The latter is the only one that can be applied to specific sectoral portfolios and to cyclical and structural risks, provided these risks are not being simultaneously addressed through the CCyB or the buffers for systemically important institutions. However, European legislation does not currently propose indicators for monitoring sectoral vulnerabilities. In this connection, the new sectoral tools developed in Circular 5/2021 supplement the macroprudential tools set out in European legislation through a more transparent framework for monitoring risks in sectoral credit portfolios and for activating such tools, in the event systemic imbalances are detected. Additionally, the circular introduces the possibility of introducing limits on institutions' terms and conditions on loans, a tool that was not available under European legislation.

Any increase in the number of macroprudential tools, such as that deriving from the new circular, must always be accompanied by an adequate and transparent risk identification and monitoring framework. Thus, having a set of indicators of proven efficiency will facilitate the early detection of potential threats to financial stability, which will help to address them by means of the most adequate macroprudential policy tools. Also, good communication on risk identification enhances transparency, while contributing to reducing uncertainty (see Oosterloo and De Haan (2004)). Although the correct identification of risks is a prerequisite for the adequate

3 As explained by Santos (2022), the Tinbergen rule requires as many instruments as targets, regardless of whether or not these instruments are used independently.

4 The full text of Circular 5/2021 is available on the Banco de España website.

application of macroprudential policy instruments, a comprehensive framework of indicators of sufficiently proven efficiency is still lacking (see Mencía and Saurina (2016)). This is because macroprudential policy is still in its early stages. Therefore, analysing the capacity of the indicators associated with the different instruments to identify risks early provides important insight in this area.

This article focuses on analysing the sectoral indicators that may be useful for informing the need for activating the new tools implemented in Circular 5/2021. After describing the new macroprudential toolkit available to the Banco de España, various sectoral indicators that may be used to identify risks are listed. Lastly, an exercise for analysing these indicators' predictive power is proposed, which confirms their efficiency in identifying sectoral systemic risks.

2 The new macroprudential tools available to the Banco de España

Macroprudential policy is a relatively recent field where there is still limited information about the functioning and effectiveness of the macroprudential tools available. As this knowledge increases, more and improved macroprudential tools become available to the competent authorities. This is the case of those developed under Circular 5/2021, which refer to specific sectors (SCCyBs and SCLs) and to the limits and conditions on loan origination (BBIs).

The first two tools of the new circular enable the Banco de España to apply measures on specific sectors. The SCCyB allows for the introduction of a surcharge on the capital requirements applicable to credit exposures to a specific sector. This tool seeks, first, to strengthen the banking system in the face of systemic shocks arising in that sector and, second, to discourage the growth of credit in the sector by increasing the relative cost, in terms of regulatory capital, of lending to the sector involving a greater systemic risk. SCLs are more coercive and seek to directly limit the sectoral concentration of banks' credit exposures. The limits will be triggered when the ratio of sectoral exposure to common equity tier 1 (CET1) exceeds a specific threshold. These limits do not represent a quantitative restriction in absolute terms to exposures; instead, they will only be triggered when the ratio exceeds said threshold. Therefore, the main difference between the SCCyB and the SCLs is that the activation of the latter would have an immediate effect on the sectoral credit concentration (via the "quantity" effect). However, raising the capital requirements in a specific sector using the SCCyB would increase the cost of the exposure to that sector compared with the rest, by changing the relative yields of the different credit portfolios to the disadvantage of the sector generating the systemic risk. In other words, the SCCyB would indirectly discourage the concentration of credit in this sector (via the "price" effect).⁵

⁵ See Trucharte (2021) and Estada and Castro (2021) for a more detailed description of the two sectoral tools (SCCyB and SCLs) and for a quantitative analysis of the impact of their potential activation.

The use of sectoral tools is justified by the fact that, when systemic risks are concentrated in specific sectors (as occurred in the Spanish real estate sector during at least the initial phase of economic growth between 2000 and 2008), the activation of general macroprudential tools might be less effective. Thus, in the face of a systemic crisis of sectoral origin, increasing the capital requirements through the general CCyB would keep the relative cost of the exposures to the sectors where the risks are concentrating constant. This may even encourage institutions to increase their exposure to the riskiest sector, for which they obtain a higher expected yield. However, if the CCyB only increases for exposures to the sector in which the risks originate, institutions will have to assume a greater relative cost for such exposures compared with the other sectors, which could contribute to inhibiting their growth. In other words, the application of sectoral tools may be more efficient to tackle sectoral risks; in any event, their use should be complemented by a comprehensive analysis of the possible effects on other sectors.

Finally, the third new macroprudential tool developed in Circular 5/2021 is the limits and conditions on loan origination (BBIs). This instrument would only affect the flow of new lending, while the two sectoral tools would affect both the existing transactions and the new ones. The expected effect of this third instrument would be a reduced implicit risk for each new transaction. This tool is based on the empirical evidence that the non-performance levels of loans extended under stricter standards in terms of capital or maturity, among others, are lower than those extended under laxer standards (see Galán and Lamas (2019)). Therefore, when it is detected that banks do not internalise correctly that their lending standards might be too lax and that they may be contributing to a future systemic crisis, the Banco de España may react by tightening such lending standards. This would make future defaults less likely, while preserving the banking system's solvency and mitigating systemic risk. Specifically, the circular allows limits to be set on the loan-to-value ratio, the debt service-to-income ratio, the debt-to-income ratio and the maturity of the loan, among others.

3 Sectoral indicators for identifying risks

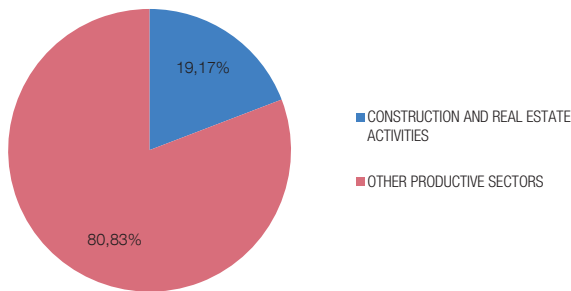
In order to determine whether the sectoral macroprudential tools should be applied, the Banco de España will regularly monitor the composition of the different categories of exposures by sector, as well as a series of indicators capable of issuing warnings about the build-up of systemic risks. According to the circular, credit exposures to the following four sectors will be monitored periodically to identify potential vulnerabilities:

- 1 Loans to non-financial corporations (NFCs) and sole proprietors engaged in construction and real estate activities.
- 2 Loans to NFCs and sole proprietors not engaged in construction and real estate activities.

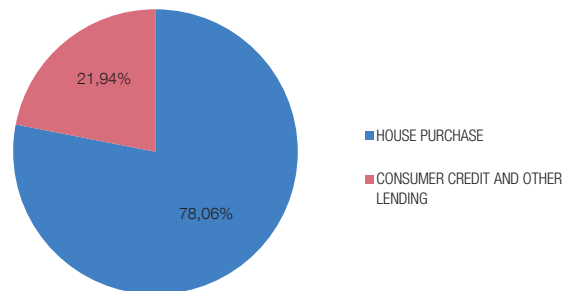
Chart 1

BREAKDOWN OF LENDING TO FIRMS AND HOUSEHOLDS

1 LOANS EXTENDED TO FINANCE FIRMS' PRODUCTIVE ACTIVITIES (a)



2 LOANS TO HOUSEHOLDS, BY TYPE OF SPENDING (b)



SOURCE: Banco de España.

- a Lending to other productive sectors comprises lending for agriculture and fishing, industry (excluding construction and real estate activities) and the services sector, which includes trade and repairs, hospitality, transport and storage, financial intermediation (except in credit institutions) and other services (excluding real estate activities). The data have been obtained from Chapter 4.18 of the Statistical Bulletin and are updated as at September 2021.
- b Credit to households for house purchase comprises loans for both house purchase and renovation. Consumer credit includes consumer durables. Other lending includes loans for the purchase of land and rural property, securities and current goods and services not considered consumer durables (e.g. loans for financing travel expenses) and loans for sundry purposes not included in the above. The data have been obtained from Chapter 4.13 of the Statistical Bulletin and are updated as at September 2021.

3 Loans for house purchase and renovation.

4 Other loans to households (primarily consumer loans).

Chart 1 shows the breakdown of loans to NFCs and households, on data as at September 2021. Most of the loans extended to finance productive activities are granted to firms not engaging in the real estate sector (around 81%), especially the services sector (58%). More than 78% of loans to households are for house purchase, which gives an idea of the importance of the real estate sector in the Spanish economy.

Also, the circular itself includes a list of the possible indicators that the Banco de España should analyse periodically to assess sectoral systemic vulnerabilities and thus steer sectoral tool decisions. These tools could be activated when the indicators forming part of the risk identification framework point to sector-specific imbalances which the Banco de España considers might threaten the stability of the financial system as a whole. The list includes four groups of metrics, although it is open to the inclusion of any additional quantitative or qualitative information deemed significant:

- (i) Loans to the sectors mentioned above in absolute value, in both nominal and real terms, and in relative terms as a percentage of GDP, disposable income and gross value added (GVA) in each sector.

- (ii) Growth of the indicators mentioned in point (i) above and deviation from their long-term trends.
- (iii) Indicators on the degree of financial imbalance in the sectors analysed, including variables such as the debt-to-disposable income or debt-to-GVA ratios, among others.
- (iv) Level of, changes in, and deviation from, the long-term trend of asset prices relevant for monitoring cyclical imbalances in each sector, such as purchase and rental prices in the real estate market.

This article focuses on the first three indicator categories. The fourth group of metrics, which relates to the assessment of possible real estate market risks, has already been dealt with extensively by the Banco de España (see, for instance, Banco de España (2020)).

4 Methodology for calculating sectoral indicators

The methodology for analysing sectoral credit cycles is similar to that used for the Spanish economy's overall credit cycle in the general CCyB decisions.⁶ The activation of the CCyB is related to the identification of periods of excessive credit growth. Therefore, the credit growth rates themselves are insufficient to determine whether or not such growth is excessive. The benchmark indicator for steering decisions on the general CCyB is the credit-to-GDP gap. The rationale behind this indicator is based on the fact that deviations from its long-term behaviour tend to be corrected 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.⁷

The credit-to-GDP gap, known as the “Basel gap”, is calculated in accordance with the guidelines of the Basel Committee on Banking Supervision (BCBS) (see BCBS (2010)) and is the deviation of the credit-to-GDP ratio from its long-term trend, using an adjusted one-sided Hodrick-Prescott filter with a smoothing parameter equal to 400,000. However, this standard gap is not appropriate for countries such as Spain, with a shorter historical duration of the credit cycle. To better reflect this empirical evidence, the Banco de España also regularly calculates an adjusted gap with a smoothing parameter equal to 25,000 (see Galán (2019)).

To calculate sectoral gaps, which measure the difference between sectoral credit ratios and their long-term trend, a methodology similar to that used for the credit-

6 As specified in Article 61 of Royal Decree 84/2015, although the Banco de España calculates the percentage in accordance with criteria deemed appropriate by it for identifying risks arising from excessive credit growth, it should use as a basis the deviation of the credit-to-GDP ratio from its long-term trend.

7 Several papers relate credit growth to subsequent financial crises. See, for example, Schularick and Taylor (2012).

to-GDP gap is employed (see BCBS (2019)). Specifically, each sector's credit gaps measure the difference between several sectoral debt indicators and their equilibrium values, estimated as long-term trends by means of statistical filters. As in the case of the adjusted credit-to-GDP gap, a smoothing parameter equal to 25,000 is used to calculate the sectoral gaps. As regards indebtedness metrics, the most significant sectoral credit ratios are used to assess sectoral imbalances. Thus, while the credit-to-GDP ratio is the main benchmark for analysing the level of indebtedness of the economy as a whole, for specific sectors, a series of more accurate measures regarding the contribution of the sector's activity to the economy are used as denominators, together with GDP. For example, the ratios of sectoral credit to the sector's GVA or gross fixed capital formation (GFCF) are considered in the case of firms. For loans to households, disposable income is used.

As in the case of the general CCyB, the information provided by the sectoral gaps is complemented by additional indicators.⁸ For example, as proposed in Circular 5/2021, simple indicators, such as each sector's volume of credit in absolute value and credit ratios, are analysed. These ratios are calculated based on the denominators used to calculate the sectoral credit-to-GDP gap accumulated in the last four quarters.

In addition, indicators such as credit intensity, the debt service ratio and price imbalances in the real estate sector, among others, are used. Specifically, the total credit intensity indicator is defined as the ratio of the annual change in aggregate credit to cumulative GDP for the same period. Unlike credit gaps, which are defined based on the ratios of the balance of credit to a flow variable, intensity is conceptually more consistent, as it evaluates the ratio between two flow variables. Similarly, in the case of the sectoral toolkit, credit intensity is calculated 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).

Table 1 summarises the main indicators proposed to steer the possible activation of sectoral tools. The scant evidence available in connection with these sectoral indicators makes it difficult to assess their relative importance. Since a methodology similar to that used for the overall credit cycle has been used for analysing sectoral credit cycles, in principle credit gaps are considered the main indicator. The other indicators (mainly credit ratios and intensities) are complementary. As with the general CCyB metrics, these complementary indicators may gain importance during periods of sharp falls in the ratios' denominators, when the gaps may increase without this being construed as a warning sign.

⁸ In the case of the general CCyB, the use of additional indicators follows Recommendation of the European Systemic Risk Board (ESRB) ESRB/2014/1 of 18 July 2014 providing guidance for setting countercyclical buffer rates.

Table 1

INDICATORS PROPOSED TO PROVIDE REGULAR GUIDANCE FOR THE POSSIBLE ACTIVATION OF SECTORAL TOOLS

	Households	Non-financial corporations and sole proprietors
Credit in absolute value	Loans to households	Loans to NFCs
Credit ratio	Ratio of household lending to GDP	Ratio of NFC lending to sectoral GVA
	Ratio of household lending to disposable income	Ratio of NFC lending to GFCF
Gaps	Deviation of the ratio of household lending to GDP from its long-term trend	Deviation of the ratio of NFC lending to sectoral GVA from its long-term trend
	Deviation of the ratio of household lending to disposable income from its long-term trend	Deviation of the ratio of NFC lending to GFCF from its long-term trend
Credit intensity	Annual change in household lending relative to GDP	Annual change in NFC lending relative to sectoral GVA
	Annual change in household lending relative to disposable income	Annual change in NFC lending relative to GFCF

SOURCES: Circular 5/2021 and devised by authors.

Additionally, the lack of empirical evidence on sectoral indicators makes it more difficult to interpret them. For example, in the case of gaps it is analysed whether there is a significant deviation from their long-term trend. However, while a 2% threshold was set for the overall credit-to-GDP gap above which activation of the buffer is recommended,⁹ no such threshold has yet been set for sectoral gaps. As for the other indicators, credit intensities well above zero could be interpreted as a sign of risk, as could continued increases in the ratios. Nevertheless, as in the case of sectoral gaps, no alert thresholds have been set.

Lastly, although the main indicators informing decision-making about the sectoral tool are those mentioned above, the Banco de España has discretion to use other additional variables that may help to identify imbalances. These include most notably the debt service ratio (DSR), which is the proportion of interest and principal payments relative to aggregate disposable income. It is constructed using a standard formula for calculating the present value of a term loan (based on the aggregate stock of credit, and average interest rate and term) and dividing it by the disposable income.¹⁰ Lastly, as in the case of the general CCyB, indicators for price imbalances in the real estate sector can also be used to steer sectoral tool decisions.¹¹

9 This 2% benchmark level for the activation of the general CCyB follows the guidelines of the Basel Committee on Banking Supervision (see BCBS (2010)) and of Recommendation of the European Systemic Risk Board ESRB/2014/1.

10 The DSR used by the Banco de España to identify risks was first proposed by Drehmann and Juselius (2012) as an early warning indicator for financial crises and is currently considered one of the main benchmark indicators for the general CCyB, together with the credit-to-GDP gap.

11 In the case of the general CCyB, four indicators are assessed which seek to capture deviations of real estate sector prices from their long-term level, thus providing information on the build-up of systemic risks stemming from excessive credit growth. Specifically, these four indicators are: (i) the house price gap; (ii) the gap of the ratio of house prices to disposable income; (iii) the house price imbalance owing to long-term trends in disposable income and mortgage rates; and (iv) the long-term house price imbalance owing to past prices, disposable income, new mortgage rates and fiscal variables. The first three indicators are calculated from gaps with respect to long-term trends using the same statistical filter as for the credit-to-GDP gap. The last indicator is obtained using econometric models.

5 Recent developments in sectoral indicators

The recent developments in the proposed sectoral indicators are analysed below, on data as at September 2021. For illustration purposes, the main indicators informing decisions regarding sectoral tools have been selected. This set of metrics comprises simple indicators based on the volume of credit and credit ratios for each sector, together with credit intensities for both households and firms.

5.1 Lending to non-financial corporations

Lending for construction and real estate activities has declined since the global financial crisis, in both absolute and relative terms, although it stabilised after the onset of the COVID-19 crisis (see Chart 2.1). In the rest of the productive sectors, credit was more stable before the outbreak of the pandemic, but it subsequently rebounded slightly owing to the economic support measures that were put in place. This trend was also reflected in the credit ratios (see Chart 2.2), which declined for construction and real estate activities, although they stabilised after the outbreak of the pandemic owing to the fall in GVA and GFCF. In the sectors not related to the real estate sector, the ratios increased at the beginning of the pandemic because of the support measures and the sharp fall in their corresponding GVA.

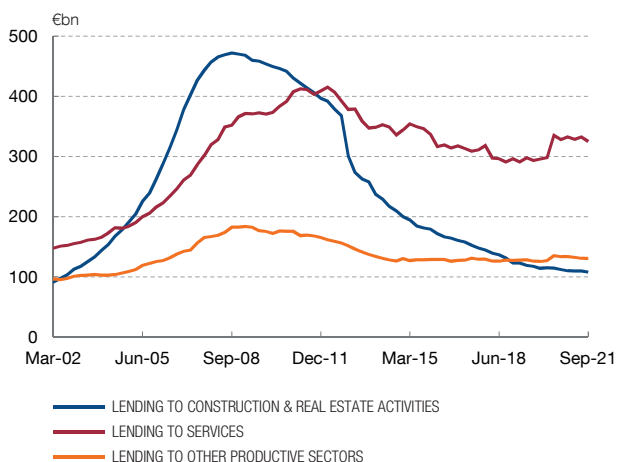
Credit gaps and intensities show similar trends. As with the credit gap used to set the general CCyB, sectoral credit gaps increased across the board after the outbreak of the health crisis, particularly in sectors other than construction and real estate activities (see Chart 2.3). This increase owes mainly to the sharp fall in the GVA included in the denominator of the ratios, which has also influenced credit intensity (see Chart 2.4). These gap developments should therefore not be construed as an early warning, insofar as no excessively large credit build-up can be seen in any NFC sector. In this regard, the rebound in the gaps for sectors other than real estate has partially corrected as GVA recovered over the past year. The temporary widening of the gaps in these sectors reflects the higher impact of the pandemic on some of these activities and the support measures for credit to these segments (particularly State-guaranteed loans).

As for the construction and real estate sector credit gap, it was already on an upward trend before the pandemic and its growth has not yet reversed. However, this development is due to a decline in the trend of this credit category calculated using a statistical filter, while the ratios for credit to construction and real estate relative to GVA or GFCF have remained stable. Chart 3.1 shows this breakdown into ratio and trend for the case of the gap with respect to sectoral GVA. The contributions of the gap's components to its variation show that their recent increase is due only to changes in the trend (see Chart 3.2). In other words, once again, the changes in the gaps are not due to imbalances.

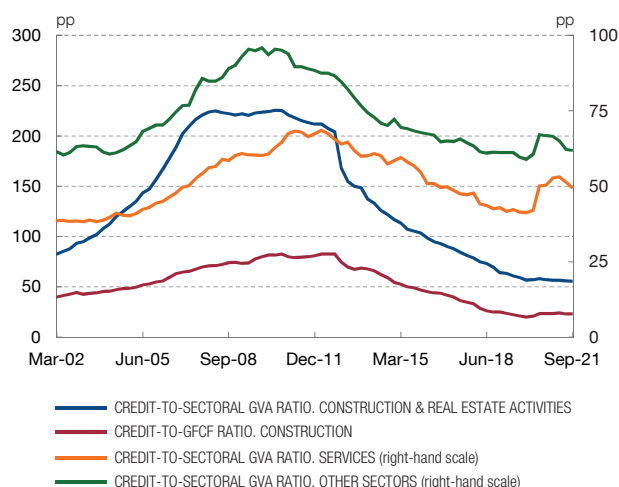
Chart 2

INDICATORS FOR ANALYSING NON-FINANCIAL CORPORATIONS' CREDIT CYCLE (a)

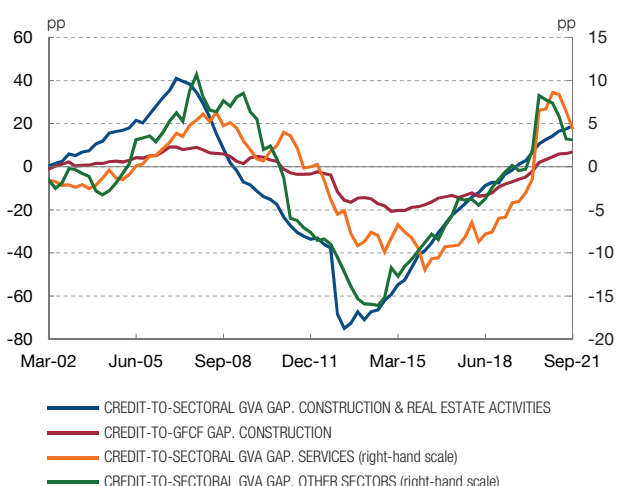
1 VOLUME OF LENDING TO FINANCE FIRMS' PRODUCTIVE ACTIVITIES



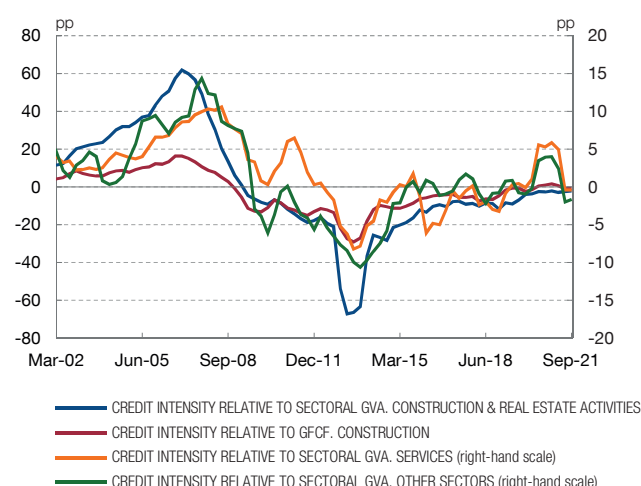
2 CREDIT RATIO OF FIRMS' PRODUCTIVE ACTIVITIES



3 CREDIT GAP OF FIRMS' PRODUCTIVE ACTIVITIES



4 CREDIT INTENSITY OF FIRMS' PRODUCTIVE ACTIVITIES



SOURCES: Banco de España, INE and own calculations.

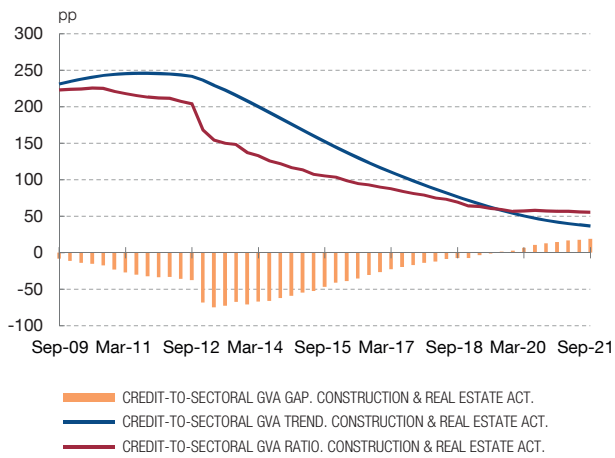
a Data available up to September 2021.

This absence of warnings relating to lending to NFCs is most clearly seen in the changes in sectoral credit intensities (see Chart 2.4), where all series remain close to zero and generally at negative values. The only relevant exception is the temporary increase in the credit intensity series for NFCs other than construction and real estate. As in the gaps, this temporary increase reflects the higher impact of COVID-19 on these types of activities (which include the sectors most vulnerable to the pandemic) and the credit support measures introduced in this segment to mitigate it.

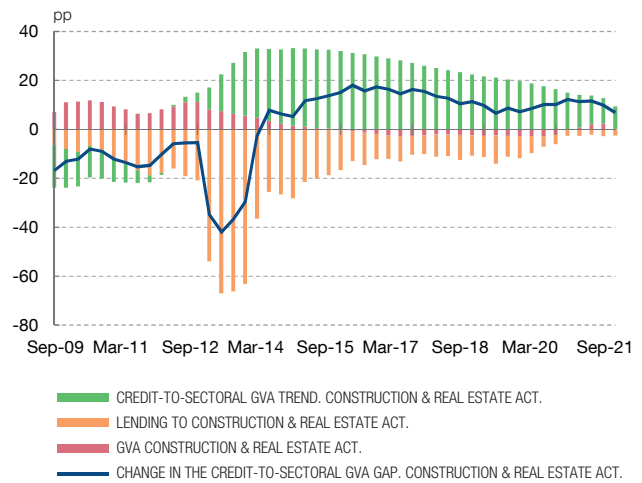
Chart 3

CREDIT-TO-GVA AND CREDIT-TO-GFCF GAPS AND ESTIMATED TREND FOR THE CONSTRUCTION AND REAL ESTATE ACTIVITIES SECTOR (a)

1 CREDIT RATIO, GAP AND TREND FOR CONSTRUCTION AND REAL ESTATE ACTIVITIES



2 CHANGE IN THE CREDIT GAP FOR CONSTRUCTION AND REAL ESTATE ACTIVITIES, BY COMPONENT



SOURCES: Banco de España, INE and own calculations.

a Data available up to September 2021. The credit trend is calculated using a Hodrick-Prescott filter with a smoothing parameter of 25,000.

5.2 Loans to households

Lending to households remains stable after declining during the financial crisis, less intensely in consumer credit than in loans for house purchase (see Chart 4.1). Chart 4.2 shows that, at the onset of the pandemic, credit ratios picked up somewhat in the case of loans for house purchase, again owing to the sharp fall in GDP and disposable income. However, this increase started to reverse in the wake of the economic recovery that began at end-2020. Meanwhile, consumer credit was not as affected by the pandemic and its ratios remained stable.¹² However, the decline in consumer credit resulted in a slight reduction in the figure for 2021 Q3.

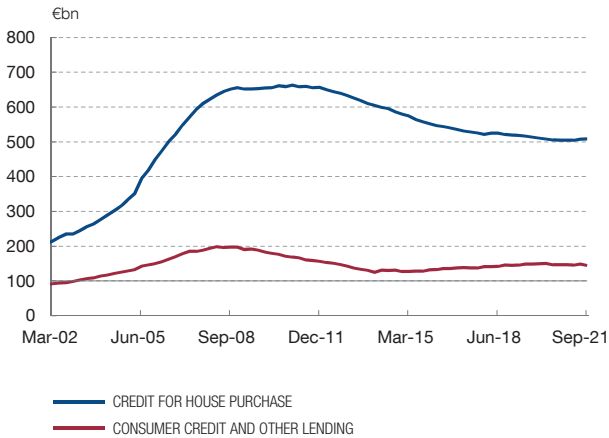
In the case of households, the credit gaps most affected by the pandemic were those related to loans for house purchase (see Chart 4.3). As in the productive sectors, credit gaps picked up sharply owing to the fall in GDP and disposable income, which has already started to correct. Consumer credit gaps are more stable, although they narrowed in 2021 Q3, given the decline in consumer credit, which is included in the numerator of the ratios. Finally, households' credit intensities (see Chart 4.4) increased slightly at the onset of the health crisis for both types of spending, after the downward trend and subsequent stabilisation

¹² The consumer credit series has a significant seasonal component, so a preliminary seasonal adjustment has been made.

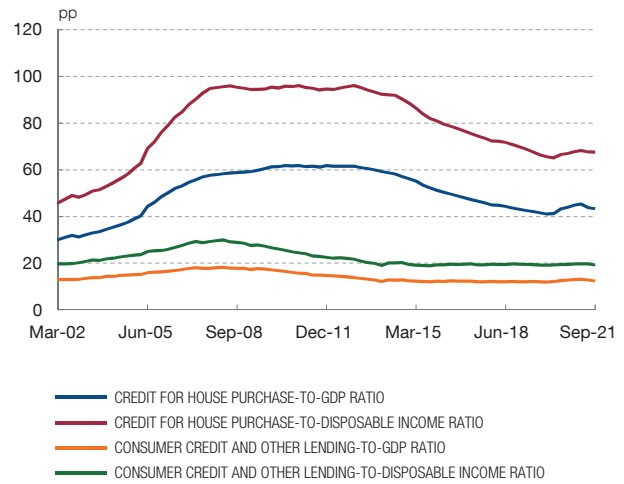
Chart 4

INDICATORS FOR ANALYSING THE HOUSEHOLD CREDIT CYCLE (a)

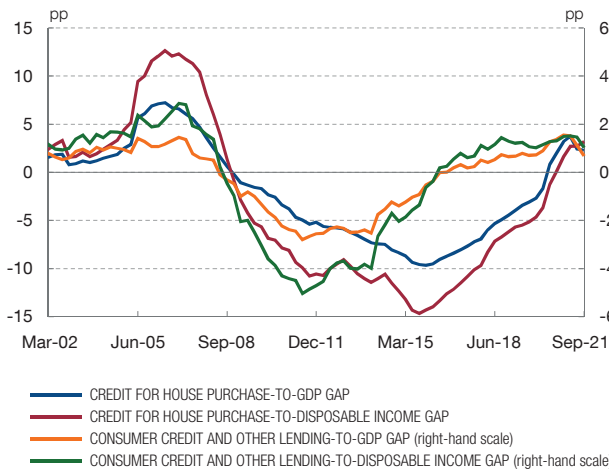
1 VOLUME OF LENDING TO HOUSEHOLDS BY TYPE OF SPENDING



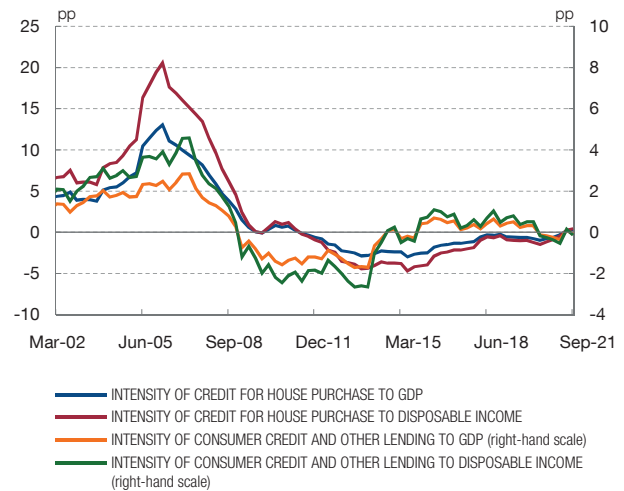
2 HOUSEHOLD CREDIT RATIO BY TYPE OF SPENDING



3 HOUSEHOLD CREDIT GAP BY TYPE OF SPENDING



4 HOUSEHOLD CREDIT INTENSITY BY TYPE OF SPENDING



SOURCES: Banco de España, INE and own calculations.

a Credit for house purchase includes both house purchase and renovation. Data available up to September 2021.

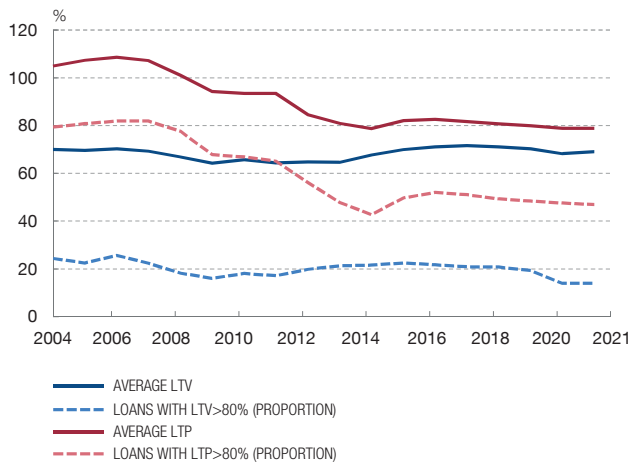
following the financial crisis. As with NFCs, these credit intensities are close to zero and largely in negative territory. This indicator therefore points to an absence of systemic risks.

In sum, the analysis of the four types of sectoral indicators, for both NFCs and households, suggests that there are no warning signs of a build-up of systemic risks. Thus, there is no need to activate any of the new macroprudential tools for the time being.

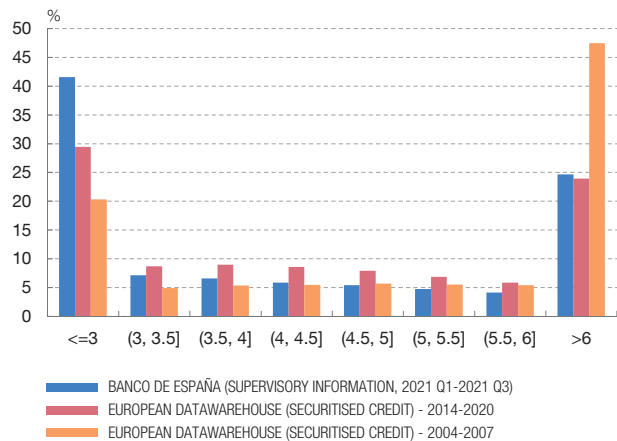
Chart 5

CHANGES IN CREDIT STANDARDS FOR NEW HOME MORTGAGES

1 LOAN-TO-VALUE (LTV) AND LOAN-TO-PRICE (LTP) RATIOS (a)



2 LOAN-TO-INCOME (LTI) RATIO, DISTRIBUTION (b)



SOURCES: Registrars Association of Spain, Banco de España and European DataWarehouse.

- a In the LTV ratio, the denominator is the appraisal value of the house, while in the LTP ratio the denominator is the price of the house recorded in the real estate registry. The LTP ratio is calculated for a representative sample of loans. Indicators obtained from the Registrars Association. Data available up to September 2021.
- b When supervisory information is used, the denominator of the LTI ratio is the borrowers' annual disposable income, while in the case of securitised credit the denominator is the main mortgagor's gross annual income. Data up to 2020 obtained from European DataWarehouse. Data for 2021 obtained from the Banco de España's supervisory information.

6 Additional indicators

The sectoral indicators presented above contain useful information to determine the appropriateness of setting limits and conditions on new loans, but they are not the most important to decide whether to activate these tools. In particular, other additional indicators need to be analysed to activate these tools, such as, for example, institutions' credit standards. In fact, recent literature has shown that these metrics are a good leading indicator (see, for example, Campbell and Cocco (2015) or Haughwout et al. (2008)). There is a wide range of credit standards, referring to both the value of the property and the borrower's income.¹³ By way of illustration, Chart 5.1 shows the ratios of the loan amount to the appraisal value of the home (loan-to-value or LTV ratio) and to the recorded purchase price (loan-to-price or LTP ratio). Before the financial crisis, mortgages were granted with very high initial indebtedness (around 100% on average), particularly as measured by the LTP ratio. Chart 5.2 shows the distribution of the ratio of the loan amount to mortgagors'

13 Circular 5/2021 mentions: (1) the loan-to-value (LTV) ratio, i.e. the ratio of the loan amount to the appraisal value; (2) the loan-to-price (LTP) ratio, i.e. the ratio of the loan amount to the value of the real estate transaction; (3) the loan-to-income (LTI) ratio, i.e. the ratio of the loan amount to income; (4) the loan service-to-income (LSTI) ratio; (5) the debt-to-income (DTI) ratio; (6) the debt service-to-income (DSTI) ratio; (7) the interest coverage ratio (ICR); (8) the loan-to-rental income (LTR) ratio; (9) the loan-to-total assets (LTA) ratio for NFCs; and (10) the debt-to-total assets (DTA) ratio for NFCs.

income (loan-to-income or LTI ratio), evidencing that credit standards were loose before the financial crisis and have tightened in recent years.

7 Predictive power of sectoral indicators

The predictive power of these sectoral indicators is analysed below. This analysis is key to assessing the effectiveness of the proposed indicators in providing early warning signs of economy-wide crises, and in alerting to sectoral vulnerabilities. Specifically, this analysis focuses on comparing the predictive power of the different sectoral credit gaps presented above to the general credit-to-GDP gap, as this is the benchmark indicator that determines the activation of the CCyB (see BCBS (2010)). While the effectiveness of the general credit-to-GDP gap as a leading indicator of systemic crises has been widely demonstrated in the literature (see Drehmann et al. (2010), Detken et al. (2014) and Drehmann and Tsatsaronis (2014)), that of sectoral indicators has barely been studied.¹⁴ Although this analysis is based on gap developments, it can be made extensive to the other sectoral indicators discussed in this article.

The predictive power of indicators is assessed using a metric known as AUROC (Area Under the Receiver Operating Characteristics Curve), which is a useful method for analysing the performance of early warning indicators. The AUROC, which takes values between 0 and 1, measures the accuracy of each indicator for each probability threshold of a logit model. This statistical procedure makes it possible to measure the performance of each indicator in terms of the proportion between correct signals (correctly predicting crises and absence of signals in non-crisis periods) and incorrect signals (i.e. false alarms or unidentified crises). It therefore roughly quantifies the probability that the model's forecasts are correct. This metric is the standard methodology used to assess the appropriateness of the indicators commonly used to steer the activation of the CCyB, particularly the credit-to-GDP gap (see Galán (2019) and Castro et al. (2016)).¹⁵

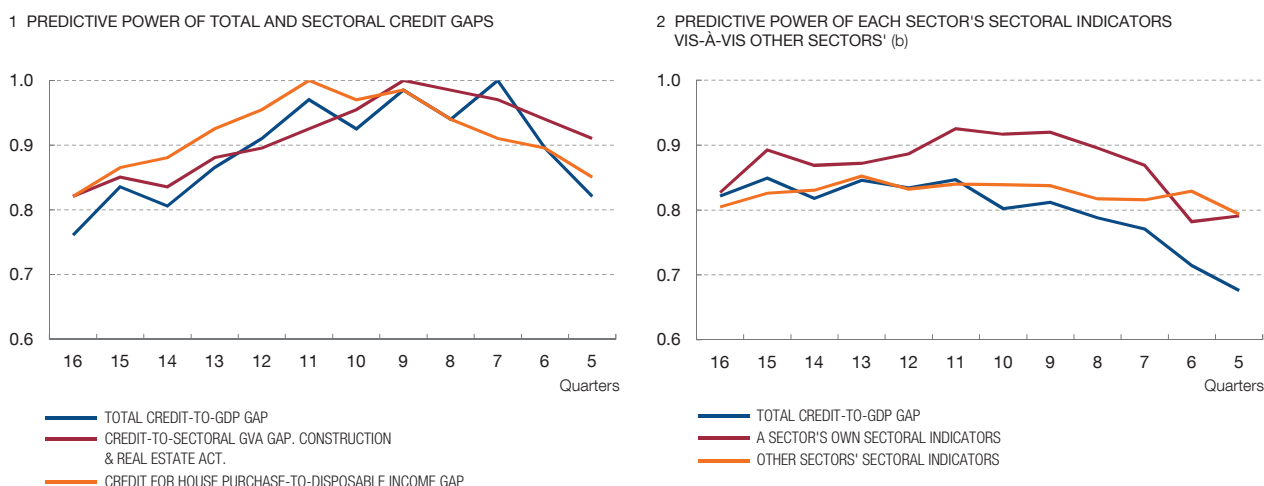
Specifically, to assess the predictive power of the sectoral indicators using AUROCs, univariate logit regressions have been estimated where the dependent variable is binary. This variable is 1 in the case of a systemic event and 0 otherwise, and the explanatory variables are the different sectoral gaps. This model has been used to analyse the ability of sectoral gaps to warn of a systemic crisis 16 to 5 quarters before it materialises, based on a historical sample from December 2001 to

14 Among these few empirical contributions, see, for example, Ferrari and Rovira Kaltwasser (2019) and Fiori and Pacella (2018) for an analysis of the relationship between sectoral credit cycles and systemic risk in the United States and Italy, respectively.

15 An AUROC value of 1 suggests that the indicator provides perfect forecasts, while a value of 0.5 indicates that the indicator has no predictive power, as it would predict crises randomly.

Chart 6

PREDICTIVE POWER OF SECTORAL INDICATORS (a)



SOURCES: INE and Banco de España.

- a Predictive power is measured using AUROCs. This measure represents the ratio of the false positive rate to the true positive rate for all possible binary classification thresholds of a logit model. An AUROC of 1 would indicate that the indicator makes perfect forecasts. The horizontal axis represents the number of quarters prior to the occurrence of the crisis. The range between 16 and 5 quarters is considered appropriate for policy purposes, allowing sufficient time to assess whether macroprudential measures could be activated. Data available up to September 2021.
- b The credit gap of the sector itself is the average AUROC of the sectoral gaps in predicting the NPL ratio of the corresponding sector. The credit gap of other sectors is the average AUROC of the sectoral gaps in predicting the NPL ratios of the other sectors.

September 2017,¹⁶ where the only systemic event is the global financial crisis that began in 2009 Q1 (see Lang et al. (2019)).¹⁷

Chart 6.1 shows the predictive power of sectoral credit gaps versus the credit-to-GDP gap in different quarters before the materialisation of the systemic crisis. The results show that, for this particular episode, the general gap is less able to predict crises than the sectoral gaps over much of the projection horizon. Therefore, monitoring the new sectoral indicators could be useful to identify fresh systemic imbalances earlier than if the economy’s overall credit cycle is monitored. It should be noted, however, that this exercise is based on a single crisis event. These results will therefore have to be confirmed as more experience becomes available and more information is analysed.¹⁸

16 Given the forward-looking nature of AUROCs, the last 16 quarters (between 2017 Q4 and 2021 Q3) are excluded from the analysis.

17 In the case of Spain, the global financial crisis led to a systemic banking crisis between 2009 Q1 and 2013 Q4. Although the crisis triggered by the COVID-19 pandemic can also be considered systemic, the methodology used in this exercise cannot predict this type of event, as it originated outside the financial system.

18 To address the limitation of this exercise having only one crisis event, the analysis should be extended to include prior systemic crises. However, detailed sectoral credit information is only available from December 1992 onwards, making it impossible to analyse its predictive power for the 1979-1985 and 1993-1994 crises. Another alternative would be to exploit evidence of systemic crises in other countries. Although this possible extension of the analysis is beyond the scope of this paper, it could be a hypothetical area for future work, which would make it possible to increase the number of systemic crises available in the sample.

Additionally, it is important to study whether sectoral indicators are useful to identify imbalances in their own sector and whether they provide leading information on the future materialisation of losses. To this end, instead of analysing the ability to predict systemic events (such as the onset of the global financial crisis), what is studied is each indicator's ability to predict an increase in the sectoral NPL ratio relative to the historical average of that sector.¹⁹ The results indicate that the sectoral gaps have a greater predictive power for the future materialisation of defaults in their own sector than gaps in other sectors (see Chart 6.2), confirming the importance and usefulness of detailed monitoring of different sectoral credit cycles. These sectoral gaps are also better at anticipating a rise in late payments in their sector than aggregate measures such as the credit-to-GDP gap.

8 Conclusions

The article presents a series of useful indicators for assessing the possible build-up of systemic risks that would require activating the new sectoral macroprudential tools set out in Circular 5/2021. The Circular itself lists a series of indicators that the Banco de España should analyse for this purpose, corresponding to four sectors. This paper also shows the methodology for calculating these indicators, which is largely inspired by that currently used to identify the risks that guide the decision on the CCyB.

As in the case of the general CCyB, the behaviour of the indicators during the pandemic has been influenced by the sharp fall in GDP and the support measures introduced by the authorities. These developments should therefore not be construed as a warning sign for the build-up of systemic risks. On the basis of this evidence, it is concluded that no sectoral macroprudential tool needs to be activated for the time being.

Lastly, the predictive power of the new sectoral indicators is analysed. The evidence suggests that they tend to be better at providing early warning signs of systemic crises compared to the indicators relating to the overall economic cycle. Moreover, the results indicate that sectoral gaps have a higher predictive power for the materialisation of future defaults in their own sector than gaps for other sectors. This suggests that it is important to monitor the different sectoral credit cycles in detail. In any event, given that this analysis of predictive power is based on the occurrence of a single systemic crisis (the global financial crisis), going forward it will be necessary to confirm this result using aggregate and sectoral indicators in future systemic crises as more information becomes available.

¹⁹ For the logit models based on sectoral NPL ratios, the different risk thresholds have been determined for each sector using the averages of these ratios. In other words, the binary variable has been defined as 1 in the quarter in which the NPL ratio exceeds its historical average.

REFERENCES

- Banco de España (2020). *"The housing market in Spain: 2014-2019"*, Occasional Paper No 2013.
- BCBS (2010). *Guidance for national authorities operating the countercyclical capital buffer*, December.
- BCBS (2019). *Guiding principles for the operationalisation of a sectoral countercyclical capital buffer*, November.
- Campbell, J. Y., and J. F. Cocco (2015). *"A Model of Mortgage Default"*, *The Journal of Finance* No 70, pp. 1495-1554.
- Castro, C., Á. Estrada and J. Martínez (2016). *"The countercyclical capital buffer in Spain: an analysis of key guiding indicators"*, Working Paper No 1601, Banco de España.
- Detken, C., O. Weeken, L. Alessi, D. Bonfim, M. Bouchina, C. Castro, S. Frontczak, G. Giordana, J. Giese, N. Jahn, J. Kakes, B. Klaus, J. H. Lang, N. Puzanova and P. Welz (2014). *"Operationalising the countercyclical capital buffer: indicator selection, threshold identification and calibration options"*, Occasional Paper Series No 5, ESRB, June.
- Drehmann, M., C. Borio, L. Gambacorta, G. Jiménez and C. Trucharte (2010). *"Countercyclical capital buffers: exploring options"*, BIS Working Paper No 317.
- Drehmann, M. and M. Juselius (2012). *"Do debt service costs affect macroeconomic and financial stability?"*, *BIS Quarterly Review*, September, pp. 21-35.
- Drehmann, M. and K. Tsatsaronis (2014). *"The credit-to-GDP gap and countercyclical capital buffers: questions and answers"*, *BIS Quarterly Review*, March, pp. 55-73.
- ECB (2009). *Financial Stability Review*, December, pp. 134-142.
- ESRB (2014). *Recommendation of the European Systemic Risk Board of 18 June 2014 on guidance for setting countercyclical buffer rates (ESRB/2014/1)*.
- Estrada, Á. and C. Castro (2021). *"Function and application of the new macroprudential tools available to the Banco de España"*, *Financial Stability Review* No 40, Banco de España.
- Ferrari, S. and P. Rovira Kaltwasser (2019). *Sectoral credit cycles and systemic risk in the United States*, mimeo.
- Fiori, R. and C. Pacella (2018). *"Should the CCyB be enhanced with a sectoral dimension? The case of Italy"*, Occasional Paper No 499, Banca d'Italia.
- Galán, J. E. (2019). *"Measuring credit-to-GDP gaps. The Hodrick-Prescott filter revisited"*, Occasional Paper No 1906, Banco de España.
- Galán, J. E. and M. Lamas (2019). *"Beyond the LTV ratio: new macroprudential lessons from Spain"*, Working Paper No 1931, Banco de España.
- Haughwout, A., R. Peach and J. Tracy (2008). *"Juvenile Delinquent Mortgages: Bad Credit or Bad Economy?"*, *Journal of Urban Economics* 64, pp. 246-257.
- Lang, J. H., C. Izzo, S. Fahr and J. Ruzicka (2019). *"Anticipating the bust: a new cyclical systemic risk indicator to assess the likelihood and severity of financial crises"*, Occasional Paper No 219, ECB.
- Mencia, J. and J. Saurina (2016). *"Macroprudential policy: objectives, instruments and indicators"*, Occasional Paper No 1601, Banco de España.
- Oosterloo, S. and J. De Haan (2004). *"Central banks and financial stability: a survey"*, *Journal of Financial Stability* 1(2), pp. 257-273.
- Santos, T. (2022). *"Política monetaria, estabilidad financiera y el regreso de la inflación"*, Informe Económico y Financiero No 30, ESADE.
- Schularick, M. and A. Taylor (2012). *"Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008"*, *American Economic Review* 102(2), pp. 1029-1061.
- Tinbergen, J. (1952). *On the Theory of Economic Policy*, Amsterdam, North Holland.
- Trucharte, C. (2021). *"Nuevas herramientas macroprudenciales para las entidades de crédito"*, *Información Comercial Española, ICE: Revista de Economía*, pp. 45-59.