

## IMPACT OF THE MACROECONOMIC CYCLICAL POSITION AND CREDIT STANDARDS ON MORTGAGE DEFAULTS

Not only is mortgage credit for house purchase the main component of Spanish household debt (according to the Spanish Survey of Household Finances, 56.3% of households had bank debts in 2020, of which mortgage debt accounted for 62.8%), it also represents a significant segment of financial institutions' credit portfolios (42.8% of lending to the resident private sector in business in Spain at end-2022). These two factors make it essential to analyse the quality of such credit from a financial stability standpoint.

With this in mind, it is well worth identifying the factors driving trends in mortgage defaults so as to be able to anticipate such events and set in place prudential measures to reduce their impact.<sup>1</sup> To this end, it is important to work with time series with sufficient historical depth (including expansionary and recessionary cycles) and data that are sufficiently granular (enabling the key features of loans to be distinguished) and properly representative.

The aim of this box is to analyse the main determinants of the probability of default in the flow of new mortgages granted in Spain since 2001, focusing on macroeconomic factors, certain characteristics included in the credit standards for such lending, such as the loan-to-income (LTI) and loan-to-value (LTV) ratios, and household income levels and trends (which would capture any shocks relating to employment developments, for example),<sup>2</sup> by drawing on data from the Banco de España's Central Credit Register (CCR).

Thanks to its broad time frame and the fact that it serves as a census of all mortgage loans granted in Spain, this

database is the natural candidate for this purpose, although it does pose several challenges. In particular, the CCR's historical time series offers scant information on the circumstances of individual debtors or on the collateral put up (both when a mortgage is granted and during the life of the loan).<sup>3</sup> In particular, it does not include any measure of the LTI ratio, since household income is not recorded in the period of analysis, while the LTV ratio has only been available at transaction level since 2016, when the value of the collateral securing outstanding mortgages began to be reported to the CCR.

To overcome these difficulties by making use of all the information available, the postcode of the oldest person among the borrowers under a single mortgage loan (identified as the household reference person) is used. This postcode is then used to proxy the household's income level, as well as any changes in such income over time. Meanwhile, for analyses of the effects of the LTV ratio, the sample is restricted to outstanding mortgages at end-2016, thus partially limiting the representativeness of such findings for the entire set of mortgage credit granted since 2001.

The database used in the analysis includes a representative sample of the new mortgages granted every month between 2001 and 2015.<sup>4</sup> This time frame means that information is available on trends in mortgage credit quality during the global financial crisis, the boom that preceded it and the recovery that followed. Each new loan is monitored over four years to ascertain whether it became non-performing at any point in that period (defining non-performing as failure to pay during a period of more than 90 days).<sup>5</sup> This event (classification as non-performing) is precisely what this study seeks to explain. This database

1 Previous studies on the situation in Spain include the articles by J. M. Casado and E. Villanueva. (2018). "Spanish household debt defaults: results of the Spanish Survey of Household Finances (2002-2014)". *Financial Stability Review*, Banco de España, No 35, November 2018, pp. 149-171; and by J. E. Galán and M. Lamas. (2019). "Beyond the LTV ratio: new macroprudential lessons from Spain". Working Papers, Banco de España, No 1931.

2 Box 3.1 of the Autumn 2022 Financial Stability Report looked at the impact of credit standards on the supply of mortgage loans and their quality, based, in the case of the second metric, on data on securitised mortgage loans from 1999 to 2007. In addition to using a more comprehensive database to confirm the importance of credit standards for mortgage defaults, the current study (based on the CCR) also enables an analysis of how macroeconomic factors impact such defaults and how they interact with credit standards.

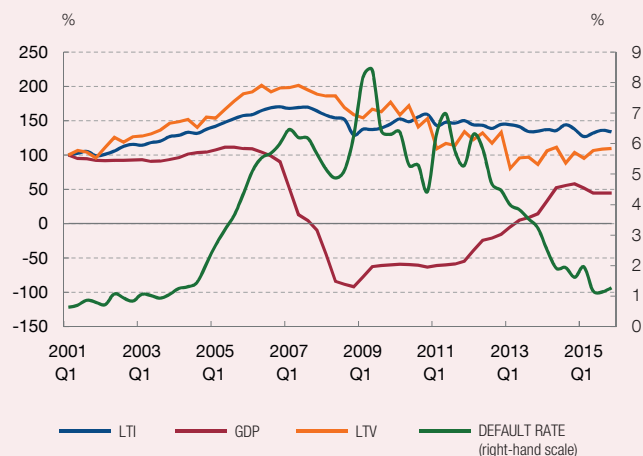
3 Moreover, the CCR's historical data do not include any loan identifiers, making it hard to distinguish and, subsequently, monitor new loans. To this end, an analysis at borrower level is needed. In turn, the existence of a 100% mortgage is used as a criterion for identifying the relevant data, since information on the purpose of loans is not available for the entire historical time series.

4 For computational cost reasons, the decision was made to use a random sample of 10% of the total CCR mortgages based on the selection of a particular number in the fourth position on the national identify card or foreigner ID number of the borrower chosen as the household reference person, within the group of borrowers under a single mortgage loan. Meanwhile, the amounts of the mortgages chosen range between €20,000 and €1,000,000. The final database contains more than one and a half million mortgages.

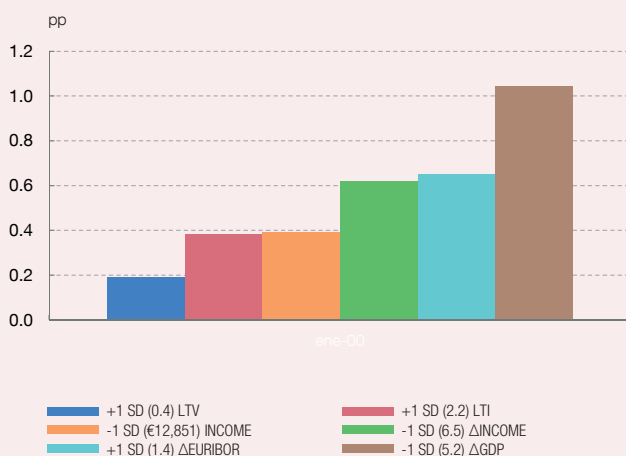
5 A four-year period was chosen so as to avoid considering the COVID-19 crisis for the more recent mortgages in the sample, given the particular characteristics of this period. The results are similar where a five or six-year time horizon is used.

**IMPACT OF THE MACROECONOMIC CYCLICAL POSITION AND CREDIT STANDARDS ON MORTGAGE DEFAULTS (cont'd)**

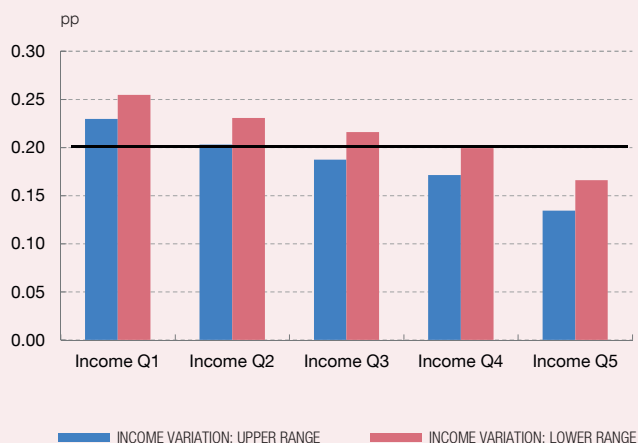
**Chart 1**  
DEFAULT RATE, LTI, LTV AND CUMULATIVE RATE OF CHANGE IN GDP BY ORIGINATION DATE (a)



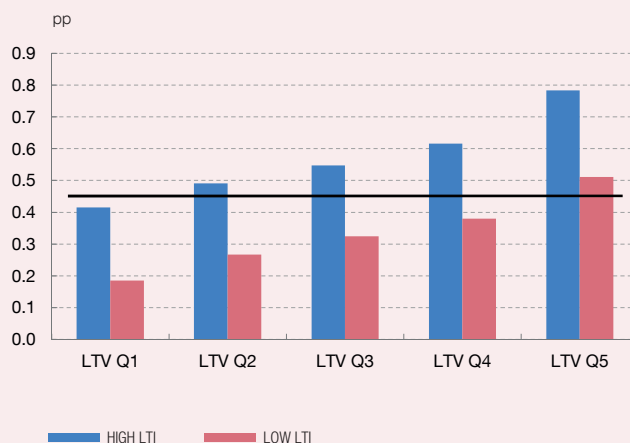
**Chart 2**  
IMPACT OF DIFFERENT ADVERSE SHOCKS ON THE PROBABILITY OF MORTGAGE DEFAULT (b)



**Chart 3**  
IMPACT ON THE PROBABILITY OF DEFAULT OF A -1 PP CHANGE IN GDP BY INCOME QUINTILE AND FOR DIFFERENT LEVELS OF INCOME VARIATION (b) (c)



**Chart 4**  
IMPACT ON THE PROBABILITY OF DEFAULT OF A +1 PP INCREASE IN THE EURIBOR BY LTV QUINTILES AND FOR DIFFERENT LEVELS OF LTI (b) (d)



**SOURCES:** Banco de España, INE and Agencia Tributaria.

- a Chart 1 shows, by origination date of the new mortgages analysed, grouped quarterly, the average value of the LTI and LTV ratios and the 4-year cumulative change in GDP (100 = January 2001), as well as the default rate in the first 4 years.
- b Charts 2, 3 and 4 show the effect (in pp) of shocks to certain variables on the probability of default of new mortgage credit between January 2001 and December 2015, using a linear probability model that controls for loan, household and lending bank characteristics, as well as for macroeconomic factors and other non-observable factors. Specifically, Chart 2 shows the direct impact of shocks to income, LTI and LTV ratios, changes in income ( $\Delta$ INCOME), the EURIBOR ( $\Delta$ EURIBOR) and GDP ( $\Delta$ GDP). In each case, the size of the shock is of 1 standard deviation within the sample, triggering an increase in the probability of default. Thus, the model envisages increases for LTI, LTV and  $\Delta$ EURIBOR, and decreases for the other variables.
- c Chart 3 depicts income quintiles and the upper range/lower range income variation groups are based on the median of the distribution. The horizontal line shows the median effect of a 1 pp decline in GDP.
- d Chart 4 depicts LTV quintiles and the high/low LIT groups are based on the median of the distribution. The horizontal line shows the median effect of a 1 pp increase in interest rates.

is combined with financial information from banks (from their periodic reporting to the Banco de España), as well as with data on average gross household income by postcode (from the State tax revenue service) and macroeconomic variables such as GDP or the EURIBOR rate.

The model includes loan-related explanatory variables such as the LTI or LTV ratios (the latter only in certain specifications), the number of borrowers, whether any of the borrowers is a foreigner, a sole proprietor or a woman, and the month in which the loan was granted. It also factors in household-specific characteristics, such as estimated gross income, the changes in such income over the first four years of the mortgage, the age of the oldest borrower and whether borrowers had another mortgage at the mortgage origination date or had defaulted on other mortgages at any point between 1999 and the date on which the mortgage is originated.

In terms of the lending banks' profile, the model includes their assets and leverage, liquidity and profitability ratios, as well as their NPL ratios, all of these prior to the mortgage origination date. Given the importance of the macroeconomic components, the estimate includes changes in GDP and interest rates during the four years following the granting of the loan. Lastly, other non-observable bank (and, in certain specifications, postcode) factors are controlled for.<sup>6</sup>

By way of illustration, Chart 1 shows that both mortgage default frequency and credit standards, particularly the LTI and LTV ratios, are subject to a high degree of cyclical variation. For example, the average probability of default during the first four years following the granting of the mortgage loan for the sample as a whole is 3.6%, but the variable ranges from minimum of around 1% to a maximum of 8.5%.

The results of the estimation show that the variables with a greater individual impact on the probability of

mortgage default are the existence of past mortgage defaults (with the average probability rising by 26 pp) and the fact that one of the borrowers is a foreigner (with the probability increasing by 10 pp). That said, the former account for less than 1% of new mortgages, while the latter account for 5%. Thus, despite their impact, these are not the most salient factors from a systemic standpoint. The probability of experiencing payment difficulties rises by 0.9 pp where the core household members include a sole proprietor,<sup>7</sup> by 0.5 pp where the oldest borrower is under the age of 55, and by 2.2 pp where the household has more than one mortgage.<sup>8</sup> Moreover, the probability of default falls slightly (by 0.1 pp) where the borrowers include a woman.

As regards the amount of the mortgage as a share of income at the origination date, a one standard deviation (1 SD) rise in the LTI ratio (equivalent to 2.2 units) increases the probability of default by 0.4 pp, while lower household income at the origination date (a 1 SD reduction, i.e. €12,851) is associated with a 0.4 pp increase in the probability of default (see Chart 2). In particular, the effect of income is non-linear. Thus, the probability of default falls by 1 pp for the top 20% of wealthiest households, a decline that increases to 1.3 pp for the top 10%. Lastly, if, rather than household income levels, changes in such income over time are examined, a 1 SD decrease (6.5 pp) over the first four years of the life of the mortgage loan would trigger a 0.6 pp increase in the probability of default.<sup>9</sup> For most households, changes in household income are very closely linked to the employment status of their members, which is used as a proxy for such income for the purposes of this study.

The exercise with the mortgages for which LTV data are available (67% in terms of the number of loans) reveals that the results obtained for the different variables detailed in the preceding paragraphs are qualitatively similar. The LTV ratio has a highly non-linear effect on

<sup>6</sup> Standard errors are corrected for the possibility of correlations at the level of loan origination date, bank and postcode.

<sup>7</sup> Sole proprietors are associated with more volatile household income. This outcome is similar to the one found across the euro area by J. Gaudêncio, A. Mazany and C. Schwarz. (2019). "The impact of lending standards on default rates of residential real estate loans". Occasional Paper Series, ECB.

<sup>8</sup> By using an estimation of income at postcode level in this study, the socio-economic variables whose impacts are described in this paragraph can shed additional light on the unobserved individual component of income, although they are also likely to contain specific differential information, e.g. on the level of rootedness. The effects of this factor on mortgage credit have been studied in, for example, J. E. Galán, M. Lamas and R. Vegas. (2022). "Roots and recourse mortgages: Handing back the keys". Working Papers, Banco de España, No 2203.

<sup>9</sup> In the event of a 1 pp fall in household income over that four-year period, the probability of default would rise by 0.1 pp.

the probability of default, which rises sharply above the 94% LTV threshold. Any increase in the LTV ratio above this threshold would therefore entail a 0.4 pp increase in the probability of default.

Turning to the macroeconomic factors, a 1 SD increase (1.4 pp) in the EURIBOR benchmark interest rates at any point during the first four years of the loan would be associated with a 0.6 pp rise in the probability of default, while a 1 SD decrease (5.2 pp) in GDP would cause a 1 pp rise. Expressed in other terms, a 1 pp rise in the EURIBOR interest rates would entail a 0.45 pp increase in the probability of default,<sup>10</sup> while a 1 pp fall in GDP would cause it to rise by 0.2 pp.<sup>11</sup>

Notably, the effects of individual household income levels and any changes therein are influenced by the position in the business cycle (see Chart 3). Thus, during a downturn in activity, the impact on defaults is exacerbated for households with a decline in their income (e.g. for employment reasons) or lower income levels (structurally more vulnerable households). Consequently, a 1 SD decrease in GDP (5.2 pp), combined with a fall in individual household income (by 1 SD, or 6.5 pp) would increase the probability of default by 1.1 pp. Moreover, the probability of default would rise by 1.2 pp for lower income households (decrease of 1 SD, or €12,851). All of these effects would be in addition to those already associated with lower levels of individual income or any adverse changes in such income.

Meanwhile, changes in benchmark interest rates have a greater impact among households that had higher LTI or LTV ratios at origination (see Chart 4) or that have experienced a negative income shock. Thus, the impact of a rise in interest rates (1 SD, 1.4 pp) would double for mortgages with a higher LTI ratio (a 1 SD increase in this

ratio, 2.2 pp), to 1.3 pp, while the probability of default would rise by 0.9 pp for households with reduced income (a 1 SD decrease, 6.5 pp). Moreover, benchmark interest rate hikes have a bigger impact among mortgages with a high LTV ratio (above the 94% threshold), rising by 0.8 pp. Again, these aggregate adverse effects of a shock to a macroeconomic variable (in this case, interest rates) are in addition to the individual income effects.

The above findings reveal that macroeconomic developments, household income levels and credit standards alike are factors with a significant impact on mortgage credit quality.

Prudent lending criteria in terms of LTI and LTV ratios make mortgage defaults less likely, thanks both to their direct impact – in terms of lower indebtedness and greater servicing capacity – and to the composition of the mortgage portfolio in terms of borrowers' overall risk profile. In this regard, the stability of these ratios in recent years (at moderate levels by historical standards) points to the resilience of the quality of these types of loans.

Nonetheless, the interest rate hikes seen since 2022 are proving to be very steep, exerting pressure on households' ability to pay, and there are both expectations of and upside risks linked to further rate hikes. All of these risk factors would affect more vulnerable, lower income households to a greater degree. With all of this in mind, it is important that banks continue to keep a close eye on any deteriorations in the quality of this portfolio. Similarly, an appropriate use of potential restructuring arrangements, analysed in a special chapter of this Financial Stability Report, could be beneficial for both banks and the households affected. It is therefore essential that such arrangements be implemented appropriately.

10 For the dates analysed, the CCR has no information on whether mortgages have fixed or variable interest rates. Nonetheless, according to the National Statistics Institute (INE), more than 96% of the home mortgages granted between 2003 and 2015 had variable rates. In an exercise similar to the one carried out for collateral value (i.e. collecting these data for outstanding mortgages in 2018), it can be seen that, as is only to be expected, fixed-rate mortgages are not affected by changes in the EURIBOR rate.

11 Note that, according to the INE, 52.5% of the new mortgages granted on residential property over the last five years were fixed-rate loans, making this segment more resilient in the face of interest rate hikes.