Box 3.1

DECOMPOSITION INTO SUPPLY AND DEMAND FACTORS OF THE RECENT DEVELOPMENTS IN BANK LENDING TO HOUSEHOLDS AND FIRMS IN SPAIN

Developments in bank lending to households and firms may stem from changes in demand on the part of these agents or from changes in banks' readiness to provide credit, or most likely from a combination of both with a varying degree of intensity. However, to provide economic policy guidance it is essential to be able to identify both factors. These considerations are especially important for monetary and macroprudential policy.

The monetary policy stance particularly affects the different demand components, but it also influences the supply of bank credit. Accordingly, the measure of these two factors is key to assess the effectiveness of past monetary policy decisions and substantiate future ones.

Macroprudential policy focuses more on the supply of bank credit, to ensure that it is resilient to adverse scenarios and to limit its fluctuations over the economic and financial cycle. But it may also affect demand for bank credit. Sustained expansionary credit supply conditions may lead to an excessive build-up of macro-financial risks and imbalances. In such circumstances, it might be appropriate to activate macroprudential measures. By contrast, contractionary credit supply conditions would tilt the macroprudential stance towards deactivation or non-activation of measures.

The fact that credit supply and demand factors are not directly observable hampers this decomposition. Indeed, various methodologies have been developed to endeavour to separate the two factors, notably those based on soft indicators and on theory-based econometrics applied to historical data.

In this box these methodologies are combined to achieve a more robust assessment of the relative influence of supply and demand factors on developments in bank lending to households and firms in the most recent period, which is when significant decreases in the stock of bank credit have begun to be observed in Spain. Using more than one methodology also provides a measure of the level of uncertainty as to the relative contribution of these factors: the more similar the estimates obtained, the lower the uncertainty.

The bank lending survey

The bank lending survey (BLS) presents a qualitative assessment by a sample of European banks of credit supply and demand developments. The survey indicates that, since early 2022, Spanish banks' credit standards have tightened continuously in all segments (see Chart 1).

Surveys conducted among borrowers also indicate that they have had greater difficulties accessing bank loans in this period. The Survey on the Access to Finance of Enterprises (SAFE) in the euro area shows a deterioration, since early 2022, in the perceived availability of bank credit among Spanish small and medium-sized enterprises (SMEs). Similarly, the ECB's Consumer Expectations Survey reflects, also since the start of last year, an increase in households' perceived difficulties in accessing credit.[1]

On the demand side, the BLS shows that both firms' and households' demand fell in 2022 and in the first three quarters of 2023. Similarly, the SAFE shows that loan applications by SMEs and large firms have fallen since late 2021.

Econometric methods

The informational content of this kind of survey data is well tried and tested,[2] but there are also potential limitations. For instance, owing to possible errors of perception among respondents, or the limited incentives to reveal all the information available.[3]

Methods can be employed to exclude – or at least mitigate – these possible survey data biases and extract more

1 For more details, see *Report on the financial situation of households and firms*, First half of 2023, Banco de España, *Nota de Prensa Estadística* (available only in Spanish), Banco de España, of 24 October 2023, and *ECB press release* of 24 October 2023.

2 For instance, for the euro area BLS, see: Carlo Altavilla, Matthieu D. Pariès and Giulio Nicoletti. (2019). "Loan supply, credit markets and the euro area financial crisis". *Journal of Banking & Finance,* Vol. 109, 105658; and Gabe de Bondt, Angela Maddaloni, José-Luis Peydró and Silvia Scopel. (2010). "The Euro Area Bank Lending Survey Matters: Empirical Evidence for Credit and Output Growth". ECB Working Paper No 1160. And for the United States, for example, Cara Lown and Donald P. Morgan. (2006). "The Credit Cycle and the Business Cycle: New Findings using the Loan Officer Opinion Survey". *Journal of Money, Credit and Banking,* Vol. 38(6), pp. 1575-1597.

3 Banks' responses to bank lending surveys may, for example, be biased towards tighter credit conditions. See Petra Köhler-Ulbrich, Hannah. S. Hempell and Silvia Scopel. (2016). "The euro area bank lending survey", ECB Occasional Paper No 179, or for the United States, William Bassett and Marcelo Rezende. (2015). "Relation between Levels and Changes in Lending Standards Reported by Banks in the Senior Loan Officer Opinion Survey on Bank Lending Practices", *FEDS Notes.* Board of Governors of the Federal Reserve System. The evidence on the informational content of the BLS for specific European countries is generally positive, albeit with some mixed conclusions. See Koen J. M. van der Veer and Marco M. Hoeberichts. (2016). "The level effect of bank lending standards on business lending". Journal of Banking & Finance, Vol. 66, pp. 79-88; or Andrea Nobili and Andrea Orame. (2015). "Estimating the effects of a credit supply restriction: is there a bias in the Bank Lending Survey?". Banca d'Italia Occasional Paper No 266.

Box 3.1

DECOMPOSITION INTO SUPPLY AND DEMAND FACTORS OF THE RECENT DEVELOPMENTS IN BANK LENDING TO HOUSEHOLDS AND FIRMS IN SPAIN (cont'd)

Chart 1
Bank lending, supply and demand (a)

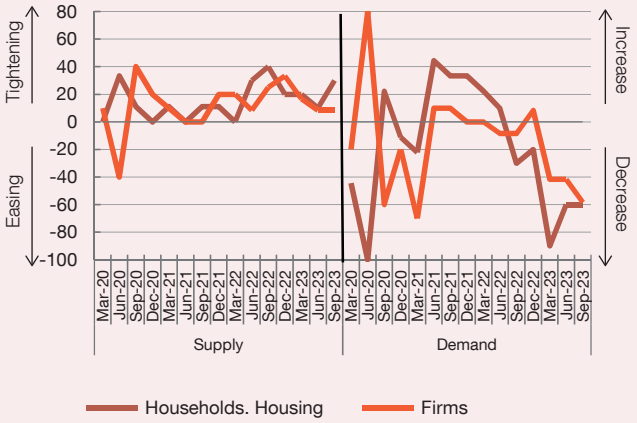
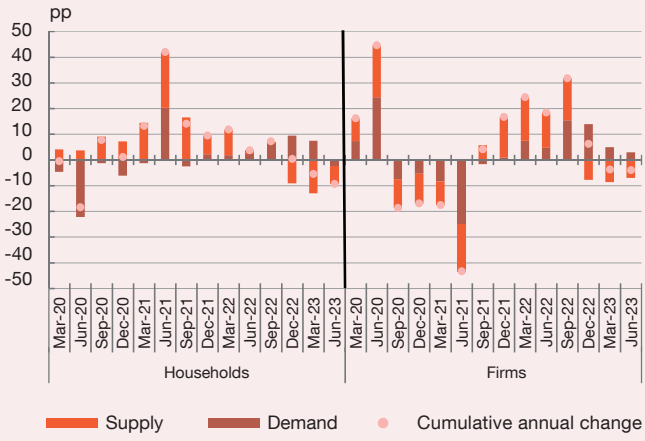


Chart 2
Macroeconomic decomposition by supply and demand factors of new lending to households and firms (b)



SOURCES: ECB and Banco de España.

a For supply, the chart shows the percentage of banks that have tightened their credit standards or conditions, minus the percentage that have eased their credit standards or conditions. For demand it shows the percentage of banks reporting an increase in demand, minus the percentage reporting a decrease. For more details, see *Nota de Prensa Estadística* (available only in Spanish), Banco de España, of 24 October 2023, and *ECB press release* of 24 October 2023.

b Cumulative annual change. Supply and demand effects estimated using a S-VAR model applied to data on new lending taken from the euro area statistical returns. The model is estimated by means of Bayesian inference, using a Gibbs sampling algorithm and Minnesota priors, drawing on 5,000 MCMC (Monte Carlo Markov Chain) samples out of a total of 50,000 iterations.

information. But it is useful to complement this approach with econometric models[4] that combine a theoretical framework with the use of observed data on credit volumes and interest rates, as well as bank and borrower characteristics, to ascertain if a specific change observed is due to supply or demand factors. These econometric methods also have limitations.[5] For this reason, different data sources and methodologies must be combined to obtain more robust conclusions.

Two of these econometric methodologies are used here: a macroeconometric approach that uses aggregated data, and a microeconometric approach that uses loan-level data for the portfolio of loans to non-financial corporations (NFCs).

Macroeconometric analysis of lending to households and firms

Drawing on aggregated data on credit volume and interest rates, a structural vector autoregressive (S-VAR) model[6] is used to analyse supply and demand shocks in lending to households and NFCs. Using this model, the correlation between the change in lending and the lending-deposit spread can be estimated simultaneously, making it possible to identify whether certain behaviour is more responsive to shifts in the credit demand or the credit supply curve.[7] Intuitively, an increase (decrease) in demand should simultaneously raise (reduce) the credit volume and widen (narrow) the spread, whereas an increase (decrease) in credit

4 Econometrics is the set of statistical and computational techniques used to describe and test hypotheses on the economic and financial system.

5 In general, for estimates to be obtained these models must be fed with specific technical assumptions. If these assumptions are not appropriate to the observed data, the results will be biased or uninformative.

6 These models have been developed extensively in the literature for decomposing supply and demand factors and are based on the proposal of Olivier Blanchard and Danny Quah. (1989). The Dynamic Effects of Aggregate Demand and Supply Disturbances, *The American Economic Review,* Vol. 79(4), pp. 655-673.

7 To identify structural credit supply and demand shocks, sign restrictions are imposed, in accordance with economic theory, in the associated coefficients. For more details, see Pana Alves, Fabián Arrizabalaga, Javier Delgado, Jorge E. Galán, Eduardo Pérez Asenjo, Carlos Pérez Montes and Carlos Trucharte. (2021). "Box 1. Developments in lending to households and firms in Spain: Analysis of the supply and demand-side factors involved". In "Recent developments in financing and bank lending to the non-financial private sector", *Economic Bulletin - Banco de España,* 1/2021, Analytical Articles.

supply should raise (reduce) the credit volume but narrow (widen) the spread, in keeping with a parallel shift in the demand or credit supply curve, respectively. The analysis is conducted by separately modelling lending to households and lending to NFCs.[8]

Chart 2 depicts the decomposition of the supply and demand factors, in cumulative annual terms, of the growth in new lending to households and NFCs from 2020 Q1 to 2023 Q2. Credit flows contract in both segments from 2023 Q1, in contrast to the high growth observed in previous quarters.[9] This change in trend is mainly on account of supply factors, which have made a negative contribution in both credit segments since 2022 Q4.

Under this methodology, demand for credit has also slowed since 2023 Q1, albeit less sharply, particularly in the household segment, which contributed negatively to growth in new lending in 2023 Q2.

These results are qualitatively consistent with those reported by banks in the BLS for recent quarters. However, the econometric results identify the contractions in supply and demand with a greater lag than the BLS results, which better anticipate these declines and, in the case of demand, identify a steadier trend.

Microeconometric analysis of lending to non-financial corporations

Supply and demand effects can also be identified and measured drawing on data at borrower-bank level. This section is based on the methodology developed by Amiti and Weinstein (2018),[10] which enables individual borrower and bank factors to be isolated from aggregate macro-financial developments. This methodology is based on weighted regressions where the explanatory variable is the change in the volume of lending from a bank to a borrower between two given periods, and the determinants are a set of borrower and bank fixed effects.[11]

Specifically, with this methodology, the change in lending can be decomposed into the sum of three elements: a common component, which may respond to aggregate supply and demand factors (defined as the median effect of all banks and borrowers at any given time); a demand component, which incorporates the particular decisions of each NFC vis-à-vis the median NFC (calculated as the borrower fixed effect relative to the median of all NFCs at any given time); and, lastly, a supply factor, which incorporates the particular decisions of each bank relative to the median bank (defined as the idiosyncratic supply effect of each bank measured with respect to its median value).

Chart 3 shows the results of this decomposition applied to the series of annual rates of change in the stock of lending to NFCs (not including sole proprietors) obtained from the Banco de España's Central Credit Register (CCR) from 2020 to mid-2023.[12] A recurrently negative common component can be observed. The supply factor (differential relative to the median) was predominantly positive during the health crisis that began in 2020, possibly linked to the raft of measures the authorities implemented to mitigate the impact of the pandemic and, in particular, to the public guarantee programme. However, from mid-2021, this component has gradually shrunk, to reach negative levels in the last six

8 Using data on new lending to households (which include sole proprietors) and NFCs, and on the spread between weighted average interest rates on new lending to each sector and average aggregate deposit rates for households and NFCs. The new lending data do not include renegotiations, overdrafts or credit card balances. Drawing on quarterly data from the euro area statistical returns from 2003 Q1 to 2023 Q2.

9 These changes may differ from those described in Chapter 2, mainly because this exercise considers the cumulative change over the last four quarters, rather than the year-on-year change in the 12-month cumulative amount.

10 The methodology used is described in detail in M. Amiti and D. E. Weinstein. (2018). "How Much Do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data". *Journal of Political Economy,* Vol. 126, pp. 525-587.

11 Where data exist on a variable in several time periods for a group of economic agents, each agent's fixed effects capture the portion of that variable (e.g. the difference between that agent's loans and the median volume of loans of all the agents) that does not vary over time for each of them. In other words, the time-invariant characteristics of each agent that influence the changes in that variable. An agent-time fixed effect captures the value of the variable for that agent at a given time.

12 The factors depicted in Chart 3 for each month analysed are defined as the average for that month and the previous two months, for smoothing purposes. The Amiti-Weinstein procedure could likewise be applied to households, but very few households have more than one bank relationship, compared with NFCs (two-thirds of which have relationships with more than one bank, accounting for close to 77% of existing credit, as opposed to a quarter of households). The supply shock can only be estimated for borrowers with more than two bank relationships, since a borrower fixed effect can only be introduced if the borrower has relationships with at least two banks at some time during the period analysed. This part of the box therefore focuses on NFCs.

Box 3.1

DECOMPOSITION INTO SUPPLY AND DEMAND FACTORS OF THE RECENT DEVELOPMENTS IN BANK LENDING TO HOUSEHOLDS AND FIRMS IN SPAIN (cont'd)

Chart 3
Supply and demand developments in bank lending to NFCs (a)

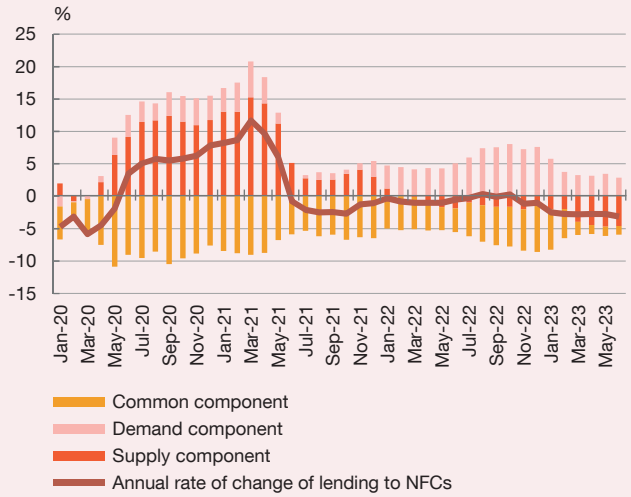


Chart 4
Distributions of bank loan supply to NFCs by year (b)

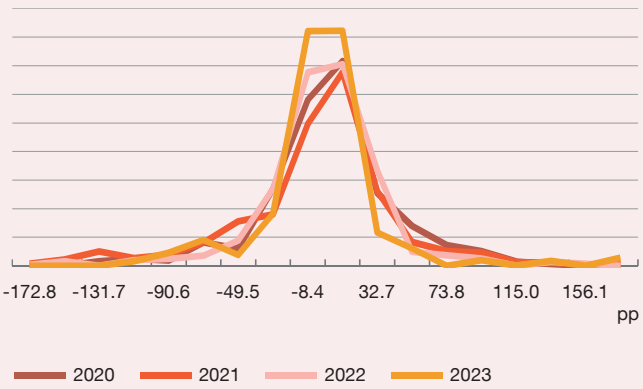


Chart 5
Distributions of bank loan supply to NFCs by capital ratio (c)

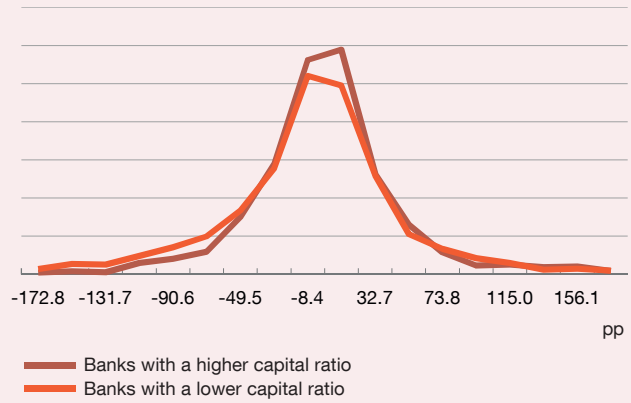
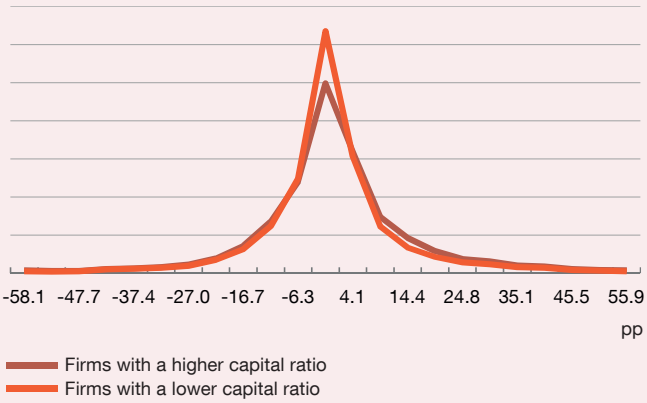


Chart 6
Distributions of bank loan demand of NFCs by capital ratio (d)



SOURCES: ECB and Banco de España.

a Breakdown of the annual rate of change in bank lending to NFCs, where the supply and demand components are relative to the median and the common component captures the sum of the median supply and demand values. Firm-bank level data are used. The bars represent the average of the components estimated for the last three dates.
b Kernel distributions of the supply component for December in the period 2020-2022 and for June 2023.
c Kernel distributions of the supply component by the bank's capital ratio (own funds as a percentage of assets): banks with a higher capital ratio (those above the third quartile of the capital ratio distribution), and banks with a lower capital ratio (those below the first quartile of the capital ratio distribution).
d Kernel distributions of the demand component by the NFC's capital ratio (own funds as a percentage of assets): firms with a higher ratio (those above the third quartile of the capital ratio distribution), and firms with a lower capital ratio (those below the first quartile of the capital ratio distribution).

months. Lastly, the demand component remained markedly positive in 2022, but has been declining steadily since early 2023.[13]

Using this methodology, each bank's contribution to the supply component at any given time can be obtained. Chart 4 shows the distribution of the supply factor across banks is

13 The common component may also incorporate supply or demand effects provided that they are common to all banks or NFCs, respectively. Moreover, supply and demand components are relative to the median. Thus, if they are positive, supply or demand is above the median (and below the median, if they are negative).

the farthest to the right in 2020 and that it subsequently moves to the left, i.e. towards less positive, or more negative, values.

The bank characteristics that explain the changes observed in the supply component can also be determined with this method. For example, as illustrated by Chart 5, the line showing the distribution of banks with a higher capital ratio (measured as own funds as a percentage of assets), in the top quartile of the distribution, is below that of banks with a lower capital ratio in the negative part of the distribution. This means that banks with higher capital ratios are less likely to present negative values in the cross-bank distribution of credit supply, underscoring the importance of banks having strong capital positions to maintain their supply of credit above the median.

Moreover, demand factors can be linked to firm-level characteristics obtained from the Banco de España's Central Balance Sheet Data Office. Thus, in an exercise similar to that conducted with banks, firms can be classified between those with high or low capital ratios (own funds as a percentage of assets). Comparison of the demand distributions for both groups of firms shows that the line depicting strongly capitalised firms is above that of the less capitalised firms in the positive part of the distribution (see Chart 6). That is to say, the demand for credit of firms with higher capital ratios is more likely to be above the median.

The above exercises show the usefulness of the microeconometric approach in identifying expansionary or contractionary behaviour in credit demand and supply in specific segments, which would potentially favour the adoption of far more targeted measures.

This method has its limitations, such as not allowing demand and supply components to be separated from the aggregate factor, or only being able to include borrowers that have several bank relationships in order to identify different effects. Nonetheless, through these distributional analyses, it serves as a useful complement to macroeconometric and survey approaches.

Conclusion

The BLS and econometric methods presented here both identify a contraction in the supply of credit to both households and firms in recent quarters. According to the BLS, this is attributable to banks' greater risk perception and their higher funding costs. This contraction in supply was also anticipated in the BLS in 2022, whereas econometric methods have only identified it more recently.

In addition, according to both the methods used, households' demand for bank loans appears to have declined in 2023 Q2, as a result of rising interest rates. Again, the BLS signalled this decline at an earlier stage. In the case of demand for credit by firms, the findings of the econometric methods are somewhat less robust than those of the BLS regarding the shift to a contractionary trend. However, both the methods used identify a clear trend towards weakening demand in this sector in recent quarters.

In short, the contractionary behaviour of credit supply identified using different methods, added to other indicators (such as the negative credit-to-GDP gap discussed in the main body of this report), reinforces the diagnosis of weakness drawn from recent developments. The methods used also identify demand weakness, although the signs as to its intensity are uneven, and have tended to converge more only in the most recent period in 2023. If interest rates remain higher for longer, weakening demand signals will foreseeably continue to emerge over the coming quarters under the different methods applied. It should also be borne in mind that this assessment (except under the microeconometric method) refers to new lending, not to the stock of lending. The latter is declining against a backdrop of extraordinary debt repayments, which would associate it more with demand factors than with supply factors.