Recent developments in loans to euro-area non-financial corporations

The financial and sovereign debt crisis triggered a slump in bank lending to non-financial corporations in the euro area to which the Eurosystem responded with an array of non-standard monetary policy measures. Loan developments began to stabilise in mid-2013 and have improved distinctly since the autumn of 2014. But the aggregate data conceal what remain considerable country-specific differences in loan developments. This article outlines the recovery process across the euro area and analyses the causes of the persistent differences in loan growth in the four largest euro-area countries.

What the four countries have in common is they are all experiencing an economic recovery to a greater or lesser degree that is now stimulating credit growth. Yet deeper analyses suggest that lending in Spain and possibly in Italy, too, has been weaker by historical standards, while loan developments in Germany and France have been consistent with past patterns. Two main reasons why such differences exist are the need for the non-financial private sector to reduce debt overhangs built up before the crisis, and the problems the crisis caused for the banking systems.

While both factors tended to dampen loan dynamics in periphery countries in recent years, their influence is likely to be much less noticeable of late. Thus, Spanish businesses have appreciably cut their debt overhang since 2012, a process which has recently been given additional traction by the country's robust economic upswing. What is more, the available indicators suggest overall that negative bank-specific factors are now impacting much less materially on lending in Italy and Spain.

However, persistently high levels of non-performing loans are continuing to drag on earnings and capital levels across both countries' banking systems. The need to reduce these vulnerabilities is a task facing both the banks themselves as well as banking supervisors and fiscal policymakers.

Current situation

Bank lending plays special role in euro area

Bank lending has exceptional macroeconomic importance in the euro area, for two reasons. First, households borrow almost exclusively from domestic banks. Second, bank loans are a key source of debt financing for non-financial corporations – much more so than in the English-speaking world.[1] So a bank lending squeeze can potentially amplify an existing cyclical weakness or obstruct a nascent recovery in the real economy, with the corresponding adverse effects for price stability. Furthermore, price stability may also be jeopardised by the interactions between bank lending and asset prices.

Recovery in bank lending since 2014

It follows that analyses of bank lending to the private sector and of its determinants play a key role in the Eurosystem's monetary policy strategy, geared as it is to safeguarding price stability. Lending to the euro area's non-financial private sector was notably highlighted by its steep and abrupt decline in 2008-09, which was exacerbated by the sovereign debt crisis, particularly in the periphery countries. The situation has since eased to the extent that the fall in lending – consistent with developments in the real economy – has bottomed out. Thus, bank lending in the euro area stabilised from mid-2013 and began to recover in autumn 2014. Yet loan growth remains muted at an annualised rate of no more than +1.4% in July 2015.[2]

This article outlines the recovery process that has been underway over the past two years and also seeks to explain why there are persistent differences in loan growth at country level. Since patterns observed in the four largest euro-area countries can explain much of the euro area's aggregate development in terms of both loan volumes and loan dynamics, this article focuses on comparing and contrasting the recovery process in these four countries.

Broad recovery process

Developments driven by loans to non-financial corporations

The breakdown of loans to the non-financial private sector (see the chart on page 17) shows that the upswing in lending to households and to non-financial corporations commenced at roughly the same time. As far as lending to households is concerned, the upturn was fuelled almost entirely by loans for house purchase; since 2014 consumer credit, too, has been buoyed by the pick-up in private consumption in the euro area. But growth in loans to households remains modest on balance at an annual growth rate of 1.9%. Given that household borrowing has registered consistent growth in recent years, it may be concluded that the slump in loans to the non-financial private sector, as well as the pace of the subsequent upturn, were driven primarily by lending to non-financial corporations. That is why this article focuses on corporate borrowing.

Recovery in corporate borrowing broadly spread across maturities, …

The recovery in lending to non-financial corporations affected almost all maturities, sectors and countries but to differing degrees. As far as maturities were concerned, the recovery followed the usual cyclical pattern in that short and medium-term loans up to five years initially contributed perceptibly to the rise in corporate loans from 2013 onwards (see the chart on page 17). But long-term loans, too, have meanwhile stopped making a negative contribution to credit growth.

1 A more nuanced analysis can be found in Deutsche Bundesbank, An international comparison of the importance of bank credit as a debt financing instrument for non-financial corporations, Monthly Report, November 2014, pp 42-43.
2 This article uses the hitherto customary definition of loans adjusted for sales and securitisation. On 21 September 2015 the European Central Bank published new data series using an enhanced method for adjusting loans for sales and securitisation; this method will be applied both to euro-area aggregates and to national data series. The broad recovery in loans to the non-financial private sector will remain evident after taking account of the data revisions.

… sectors …

As for economic sectors, industry reclaimed its role as the main driver of lending growth in the euro area in the fourth quarter of 2014.[3] This probably reflects the renewed, albeit hesitant, upturn in industrial output that has been observed since the end of 2012. Lending to the real estate and other services sectors, which had dragged down the aggregate figure during the global financial crisis, at least stopped holding back overall lending developments from the end of 2013.

… and countries

The country breakdown likewise indicates that the recovery in lending is becoming increasingly broad-based (see the chart on page 18). Thus, almost half of all the euro-area member states are now once again showing positive annual growth rates in lending to non-financial corporations. In each of the four largest euro-area countries (Germany, France, Italy and Spain) the contribution of loans to firms to the annual growth rate in the euro area has increased distinctly since the beginning of 2014. Moreover, country-specific differences in lending patterns have also diminished during the recovery process. The dispersion of national growth contributions to the overall loan dynamics has contracted appreciably since the trough in lending developments in 2013.

But clear country-specific differences in lending growth remain

Country-specific differences nonetheless continue to feature strongly in lending patterns. While Spain and Italy were still running negative (albeit improving) annual growth rates of -2.4% and -0.9% respectively in July this year, that same metric climbed to +5.5% in France. In Germany, by contrast, loans to non-financial corporations supported overall credit growth in the euro area with only a modest year-on-year growth rate of +0.6%.

Lending developments in a cyclical context

Developments in real economic activity are a key determinant of credit growth. Cyclical upturns usually generate a rise in both credit demand and credit supply because, for example, improving corporate profitability and collateral valuations make lending a less risky undertaking for banks.

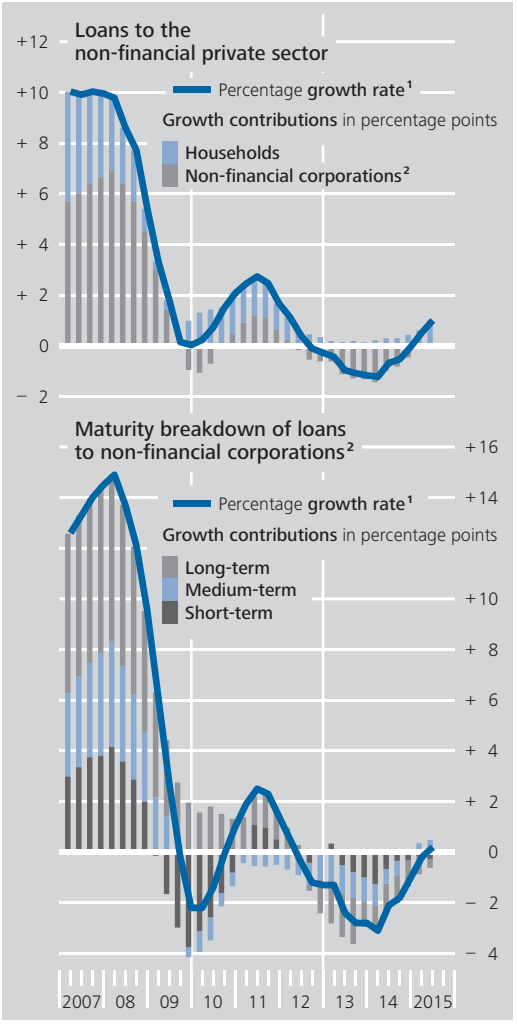
Lending traditionally shaped by developments in real sector

The hypothesis that there is a close and stable relationship between lending and developments in the real sector is supported by the wavelet analysis for all four major euro-area countries shown in the box on pages 20 to 22. The results of the wavelet analysis of the rela-

Analysis confirms that credit growth lags GDP growth

Loans in the euro area*

Seasonally adjusted, end-of-quarter data



Source: ECB and Bundesbank calculations. * Adjusted for loan sales and securitisations. **1** Year-on-year change. **2** Non-financial corporations and quasi-corporations.
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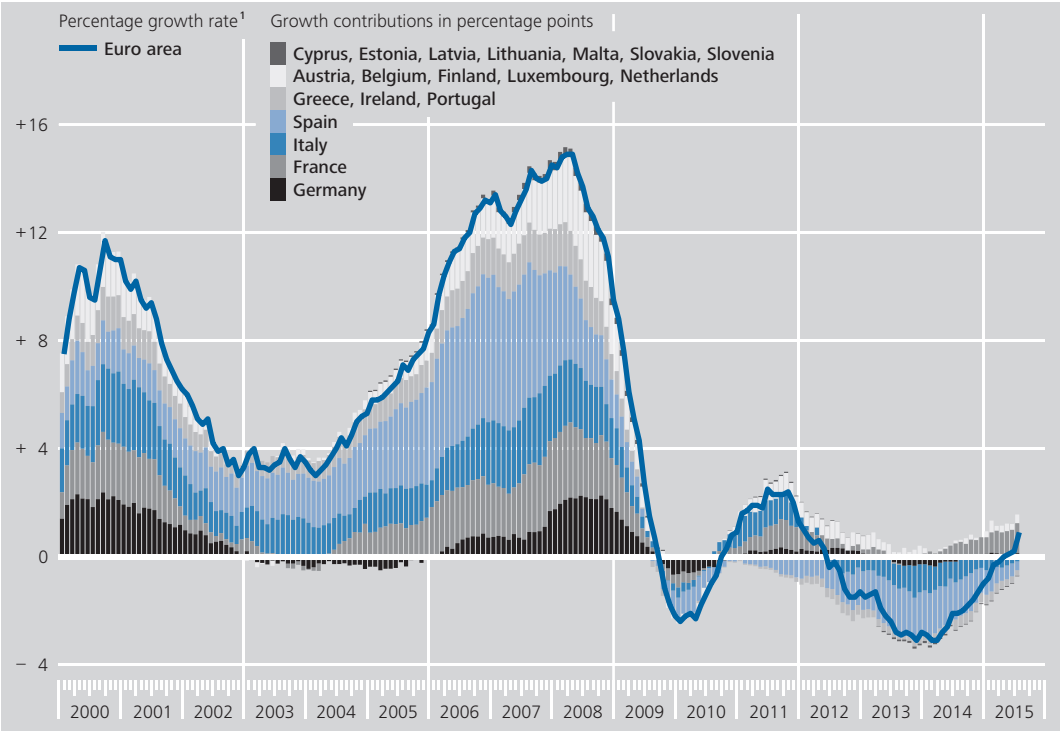
3 The European Central Bank regularly publishes estimates of developments in lending to euro-area non-financial corporations by economic activity. The latest dataset reports figures up to December 2014.

National contributions to growth in loans to non-financial corporations* in the euro area

End-of-month data



Source: ECB and Bundesbank calculations. **1** Year-on-year change. **2** Non-financial corporations and quasi-corporations; adjusted for loan sales and securitisations.

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tionship between annual growth rates of real MFI lending to non-financial corporations and annual real GDP growth rates in Germany,[4] France, Italy and Spain show that the two variables display strong coherence for oscillations over business cycle periods. Loan growth tends to lag real GDP growth by between two and six quarters, depending on the country in question and the point in time.

The time-lag of real loan growth vis-à-vis real GDP growth found in the analysis is generally reflected for the individual member states in the current upturn (see the chart on page 19). However, a number of differences are apparent between the individual countries. For one thing, the (real) rate of lending growth in France has meanwhile overtaken GDP growth again, in line with past upswings. In Germany, by contrast, the solid economic upturn has so far been accompanied by only a very muted increase in loans to non-financial corporations, which means that the real growth rate of lending is still in negative territory. Similarly, in Spain, which is currently experiencing a robust pick-up in economic activity, and Italy, where the annual GDP growth rate edged back above zero at the beginning of 2015, loan growth *per se* has been comparatively frail relative to the growth rates posted over the last decades.

Real economic developments explain current lending dynamics …

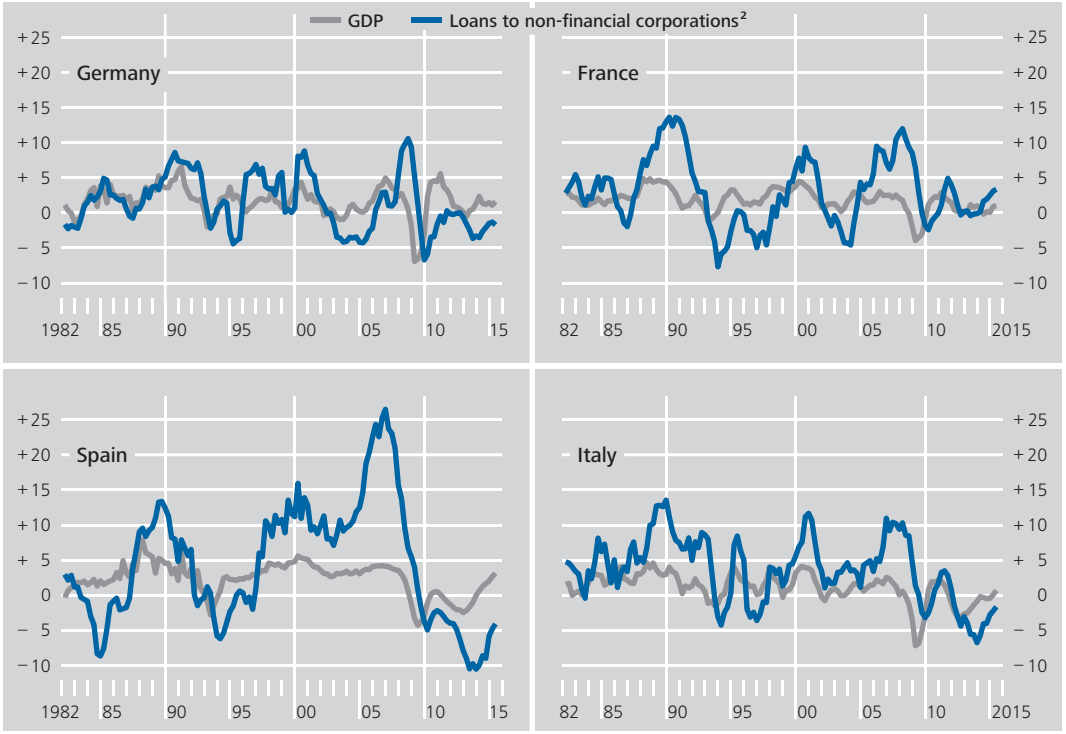
This observation is explored in greater detail in the box on pages 23 to 27, which includes a comparison, for Germany, France, Italy and Spain, of actual growth rates in lending to the non-financial corporate sector[5] with a hypothetical loan growth rate that would have been expected given the observed business cycle developments and the past correlations between lending and the business cycle. In this box, the

4 For a detailed analysis of loan growth over the business cycle for Germany, see also Deutsche Bundesbank, German banks' lending to the domestic private sector since summer 2009, Monthly Report, September 2011, pp 59-78.

5 For reasons of data availability the study uses data on the four countries' national contributions to the euro-area loan aggregate rather than lending to domestic firms only.

Growth in GDP and loans in selected euro-area countries

Real percentage growth rates,[1] end-of-quarter data



Sources: ECB, Eurostat and Bundesbank calculations. **1** Year-on-year change. **2** Non-financial corporations and quasi-corporations; adjusted for loan sales and securitisations.

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hypothetical credit development is simulated using an empirical model which maps the dynamic interaction between lending and other macroeconomic variables (output, price level, monetary policy rate, money supply, loans and government bond interest rates).[6] To investigate loan developments in the course of the financial and sovereign debt crisis, the starting point for the simulations is set in the third quarter of 2008, a period in which the global financial crisis flared up with the collapse of US investment bank Lehman Brothers. To control for the actual business cycle development when deriving the hypothetical loan growth path, the simulations are conditioned on the realised data for real GDP and the Harmonised Index of Consumer Prices (HICP).

… well in Germany and France …

All in all, the results of the analysis support the view that from mid-2008 onwards, loans made by German and French banks to the corporate sector largely followed the cyclical patterns that had been observed in the past. Taking due account of estimation and forecast uncertainty, the loan growth rates for these two countries during the observation period do not deviate substantially from the path that would have been expected solely on the basis of the historical correlations with output and the price level. The much stronger loan growth in France than in Germany coupled with flatter GDP growth can be attributed to structural differences in the availability of alternative sources of funding in both countries.[7]

6 The model is essentially similar to those commonly used for analysing the monetary transmission process and the effects of macroeconomic shocks (eg the effects of credit shocks).

7 As the Monthly Report for November 2014 explains, the ample internal funding sources of German non-financial corporations have long outstripped their still-muted capital formation; mirroring this, their demand for bank loans and other external financing instruments is fairly limited. Non-financial corporations in France, on the other hand, have for years now been much more reliant on external funding to finance their investment. See Deutsche Bundesbank, Differences in dynamics of loans to non-financial corporations in Germany and France, Monthly Report, November 2014, pp 36-37.

Results of a wavelet analysis examining the relationship between lending to non-financial corporations and real economic activity in Germany, France, Italy and Spain

The relationship between cycles of bank lending and real economic activity can be examined by applying procedures used in spectral analysis. These show, among other things, which frequencies are significant in contributing to the variance of a given time series, the strength of the relationship between cycles of equal length in the case of two variables and whether the two cycles display a phase shift, ie one leads or lags the other.

This text presents the results of a wavelet analysis. Unlike standard spectral analysis which presumes stable relationships over time, a wavelet analysis allows the researcher to investigate changes in the empirical relationships between the two variables, both with respect to the frequencies being observed (ie for fluctuations with periods of different length) and over time.[1] The time series are approximated using flexible functions (known as wavelets), which are stretched or compressed depending on the frequency under examination. Time variability is captured by estimating the wavelets via windows of observation, with the length of the window adapted to the frequency under examination.

This approach was applied to investigate the relationship between the annual growth rate of real loans to non-financial corporations and annual real GDP growth in Germany, France, Italy and Spain.[2] The estimation period starts in the first quarter of 1982 and ends in the fourth quarter of 2014. The chart on page 21 shows the estimated wavelet coherence between the two time series over time for the individual country and for two selected frequency ranges in each case. The degree of coherence is a measure of the local correlation between two time series, or in other words, of the strength of their relationship.[3] The analysis in question is purely descriptive and says nothing about causalities.

The relationship between the two variables on business cycle frequencies is captured by focussing on periodicities between two and ten years.[4] For the purpose of measuring shifts over time within the frequency range under observation, once again a distinction was made between fluctuations with a

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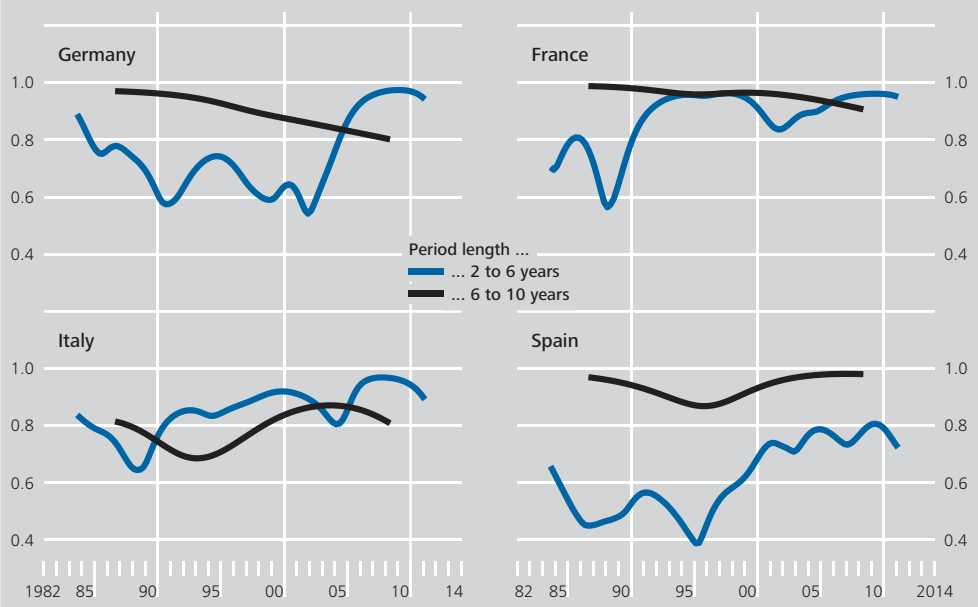
1 Wavelet analyses represent an alternative to standard Fourier analysis which presumes unchanged relationships over time or to rolling Fourier analysis which depicts time variability using a rolling window of fixed length that does not depend on the frequency under examination. In contrast to rolling Fourier analysis, a wavelet analysis provides superior time resolution for high frequency fluctuations and improved frequency resolution for low frequencies. For an introduction to wavelet analysis, see A Rua (2012), Wavelets in economics, Economic Bulletin, Summer, Banco de Portugal, pp 71-79; L Aguiar-Conraria and M J Soares (2015), The continuous wavelet transform: moving beyond uni- and bivariate analyses, Journal of Economic Surveys, 28, pp 344-375. Regarding a standard spectral analysis of the relationship between lending to non-financial corporations and GDP/investment in Germany, see Deutsche Bundesbank, German banks' lending to the domestic private sector since summer 2009, Monthly Report, September 2011, pp 59-78.
2 The data representing loans are the national contributions to the euro-area aggregate. To this end, an index series is constructed. Up to 1996 this was derived from stocks but from 1997/2009 onward it has been based on transaction-related changes or changes additionally adjusted for loan sales and securitisations. The series was deflated using the implicit GDP deflator.
3 For all the countries concerned, the wavelet power spectrum shows important cycles on the frequencies under consideration for both lending and GDP growth rates.
4 For information on an upper limit of ten to twelve years as the length of business cycle fluctuations in the euro area, see A Musso (2004), Basic characteristics of the euro area business cycle, Statistical Working Paper KS-AN-03-066, Eurostat. A lower limit of two years was selected because still significant coherences are also obtained up to as far as this frequency range.

Wavelet coherence between the annual growth rate of real loans to non-financial corporations and of real GDP*

Quarterly data



* Average wavelet coherence between the annual growth rate of real loans to non-financial corporations (national contributions) and of real GDP for different frequency ranges, ie for fluctuations with different lengths. Since more neighbouring observations are used for the estimation at each point in time, the period for which coherences can be estimated shortens as the period of the fluctuations becomes longer.

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length of between two and six years and those of between six and ten years. These periodicities were selected on the basis of a detailed analysis of different parts of the frequency range in question.

Overall, the results shown in the chart above point to a pronounced cyclical relationship between the annual growth rates of real loans to non-financial corporations and the corresponding growth rates of real GDP at business cycle frequencies. However, there are country-specific differences over time and differences in the relative importance of individual frequency ranges. Notwithstanding this, at almost every point in time there is a maximum coherence for one of the observed frequency ranges of 0.8 or above.

It is apparent that in Germany, France and Spain the relationship exhibited by fluctuations with a six-to-ten-year period is more pronounced for most of the sample analysed here than in the case of fluctuations with a two-to-six-year period, while for Italy the opposite holds true.[5] Moreover, in the case of the first three countries listed, the coherence in the longer frequency range exhibits a greater degree of stability.

The lead-lag relationship of real loan growth and real GDP growth at the selected frequencies is estimated using the phase or time difference.[6] As regards fluctuations with periodicities of between six and ten years, the time difference indicates a lag of lending growth compared with GDP growth of four to five quarters, six to eight quarters and two to three quarters for France, Italy

5 In France, the coherences for both frequency ranges stand at roughly the same level in the second half of the 1990s.

6 The wavelet analysis allows for time variability in phase and time differences. The time difference corresponds to the phase difference divided by the frequency.

and Spain respectively. Turning to Germany, the lag of lending widened from about two quarters at the end of the 1980s to about six quarters by the middle of the first decade of the 2000s. In the case of Italy, fluctuations with two-to-six-year periodicities, which demonstrate a greater coherence with real GDP growth than fluctuations with six-to-ten year periodicities, exhibit a lag of about one to three quarters.[7]

If, instead of real GDP, real gross fixed capital formation or real investment in machinery and equipment is used as a gauge of real economic activity, this delivers similar results with respect to the measured coherences and time differences. Overall, the results presented here thus point to a close and relatively stable relationship over time between loan growth and business cycle developments.[8]

7 For details of possible causes of such a lag, see Deutsche Bundesbank (2011), loc cit, p 69. For example, during an economic upturn enterprises can initially meet their funding requirements using internally available resources, meaning that they will not increase their demand for loans until a later date.
8 Compared with the results of the spectral analysis of loans to non-financial corporations in Germany (see Deutsche Bundesbank (2011), loc cit), the wavelet analysis produces somewhat greater coherences. In other words, it shows a stronger correlation between loan growth and GDP or investment growth. The time differences estimated using the wavelet analysis are consistent with the previously presented results which did not assume any time variability. However, they do point to an increase in the lag over time.

… but lending growth in Spain and Italy too weak relative to real economic developments

Unlike Germany and France, the simulated results for Spain and, with qualifications and depending on the estimation period, for Italy, too, indicate that actual business lending has been lower than would have been expected from the historical correlations. In Spain's case, however, the view based on aggregate data masks a macroeconomic restructuring process that has shifted resources from credit-intensive economic activities like construction to less credit-centric sectors.[8] This process has been accompanied by a reallocation of lending volumes within the corporate sector. A decomposition of lending by economic activity reveals that loans to the real estate industry, which was booming in the pre-crisis era, have shrunk more than in other sectors since 2009 and are still contracting appreciably today. By contrast, annual growth rates for loans to industry and the non-real-estate-related services sector are now back close to zero (see the chart on page 28). In light of the research presented in the box on pages 23 to 27, this can mean that model projections based on a country's past economic structure may overstate the projected lending growth rate for a given economic growth rate. Although in this case of macroeconomic restructuring the lending pattern merely follows the normal cyclical correlations, the charts on pages 24 and 25 would point to a gap between the actual and hypothetical rates of credit growth and thus imply that the pace of credit growth is too low.

The selected empirical approach does not allow a detailed analysis of what causes the deviations observed in Italy and Spain between actual and hypothetical loan growth.[9] The section below therefore considers several aspects which have featured prominently in the debate

8 See Banco de España, Growth and reallocation of resources in the Spanish economy, Annual Report 2014, pp 33-62.
9 This would necessitate identifying the structural shocks, but that comes up against the difficulty of deriving suitable identifying restrictions, given the size of the model.

Developments in loans to non-financial corporations from the perspective of a multi-country BVAR model

While economic activity in the euro area has recorded moderate growth since spring 2013, the pace of loan growth has remained weak. The close correlation between lending and real economic developments on the one hand, and the lag in lending on the other – as shown in the wavelet analysis in the box on pages 20 to 22 – could, however, indicate that an acceleration of loan growth might be on the cards. This raises the question as to whether, given the cyclical environment, the observed lending growth follows the normal cyclical pattern. To establish whether or not this is the case, the following analysis compares actual loan developments with hypothetical loan developments. The latter are derived from correlations observed in the past between loans and economic conditions using a quantitative economic model. If the model is able to provide a sufficiently precise picture of the correlations between lending and its relevant determinants, it is then possible to examine to what extent the lending developments observed in reality deviate from the counterfactual simulation, ie from the developments that would have been expected based on the relationships between lending and its determinants contained in the model. This deviation can then be interpreted as an indication that current lending developments might exhibit peculiarities, which can, in turn, be analysed in greater detail, particularly with regard to the underlying causes and their macroeconomic implications.

A vector autoregressive model is selected for the analysis, which takes into account potential interactions between all the variables included in the model.[1] In order to reflect the heterogeneity of lending developments in the major euro-area member states, a multi-country model is used, with the aim of empirically mapping the developments of MFI loans along with the developments of other relevant macroeconomic variables in Germany, France, Italy and Spain. The selection of the vector autoregressive model means that interactions between the countries are possible.

The model contains a total of 25 variables, including the following variables for each country: real gross domestic product (GDP), the Harmonised Index of Consumer Prices (HICP), the national contribution to the monetary aggregate M3 in the euro area, the national contribution to MFI loans to non-financial corporations in the euro area, an average interest rate for these loans and the yield on ten-year government bonds. In addition, EONIA is taken into account as a monetary policy indicator.[2] The estimation is carried out using Bayesian methods (Bayesian

1 In principle, a variety of different models can be used to construct these fictitious loan developments which act as a benchmark. They vary, inter alia, with regard to the strength of the assumptions they make concerning structural economic relationships, which is of relevance when interpreting the extent to which actual loan developments deviate from the fictitious ones. In the absence of sufficiently strong structural assumptions, it is not possible to interpret the deviations as the outcome of certain economically interpretable shocks. For example, dynamic stochastic general equilibrium (DSGE) models make very strong assumptions about economic structural relationships. By contrast, the model applied here does not include any assumptions regarding the structural interpretation of the shocks owing to the number of variables it contains.

2 For the period before 1999, EONIA is replaced by a German interbank interest rate for overnight credit. The variables are selected broadly in line with C Altavilla, D Giannone and M Lenza (2014), The financial and macroeconomic effects of OMT announcements, European Central Bank, Working Paper Series No 1707. There are differences, inter alia, with regard to the selection of the credit aggregate and the inclusion of lending rates rather than yields on short-term government bonds.

Conditional forecasts of the annual growth rate of loans to non-financial corporations (estimation up to 2008)*

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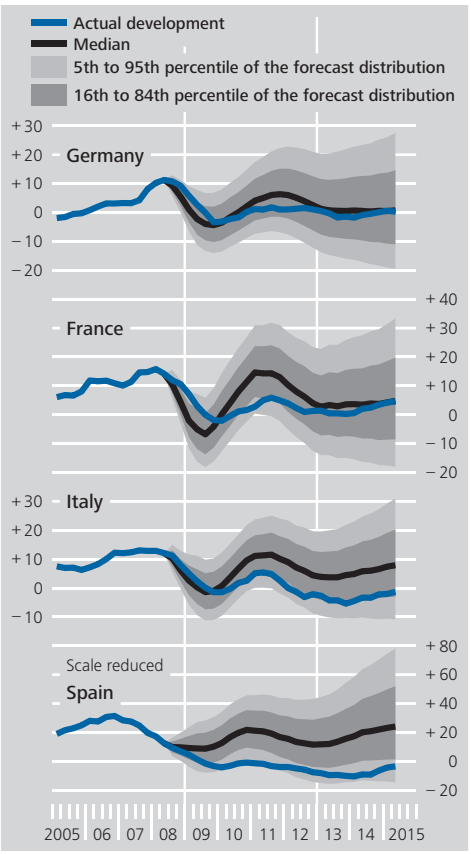

* Simulated posterior forecast distribution based on the four-country BVAR model. Estimation period 1996 Q2 to 2008 Q2. Forecast period 2008 Q3 to 2015 Q2. Forecasts based on actual developments in real GDP and HICP from 2008 Q3 onward; level forecasts converted into annual growth rates.

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vector autoregression, or BVAR).[3] All the variables enter the model in levels.[4] The lag order is five. The estimation period for the model runs from the second quarter of 1996 to the second quarter of 2008.[5] The estimation thus reflects the correlations between the model variables prior to the financial market crisis.

On the basis of this estimated relationship, developments in MFI loans to non-financial corporations are then simulated in the four countries beginning with the third quarter of 2008. The simulations are conditional on actual developments in real GDP and HICP, enabling the impact of actual economic developments on lending to be recorded.[6] The lending simulations measured in terms of levels of loans are then converted into

3 The estimation methodology follows D Giannone, M Lenza and G Primiceri (2015), Prior selection for vector autoregressions, Review of Economics and Statistics, 97, pp 436-451. A hierarchical prior distribution is assumed which combines prior distributions of the hyperparameters with standard prior distributions (normal-inverse-Wishart) for the VAR parameters conditional on the priors for the hyperparameters. The large number of parameters included in the VAR model and the relatively short estimation period mean that the choice of the prior distribution has an impact on the results. In the present analysis, the conditional prior distribution of the VAR model parameters was specified in accordance with the Minnesota prior and combined with a "sums of coefficients prior" and an "initial dummy observations prior". See R Litterman (1980), A Bayesian procedure for forecasting with vector autoregressions, Working Paper, Massachusetts Institute of Technology; T Doan, R Litterman and C Sims (1984), Forecasting and conditional projection using realistic prior distributions, Econometric Reviews, 3, pp 1-100; C Sims (1993), A nine-variable probabilistic macroeconomic forecasting model, in J Stock and M Watson (eds), Business cycles, indicators and forecasting, University of Chicago Press, pp 179-204; C Sims and T Zha (1998), Bayesian methods for dynamic multivariate models, International Economic Review, 39, pp 949-968.

4 Some of the variables used are normally considered to be non-stationary. In principle, the prior distributions permit common stochastic trends for the variables, ie they do not automatically exclude potential cointegration relationships.

5 The estimation period ends before the collapse of Lehman Brothers (September 2008), which marked the first dramatic episode of the international financial crisis. The start of the estimation period was determined by the availability of harmonised data.

6 This means that money supply, loans, lending rates, government bond yields and EONIA are forecast dynamically using the estimated model relationships, but that their changes are at the same time influenced by exogenously given output and price patterns and therefore differ from an unconditional dynamic forecast. The conditional forecast is computed by means of the state-space representation using the Kalman filter and the Carter-Kohn algorithm. See M Bańbura, D Giannone and M Lenza (2015), Conditional forecasts and scenario analysis with vector autoregressions for large cross sections, International Journal of Forecasting, 31, pp 739-756. The deviations are not necessarily only caused by shocks affecting those variables that were not conditioned on for the forecast. The fact that the forecast is conditional on output and prices does not preclude shocks affecting these variables contemporaneously influencing other variables, too, and thus having a direct or indirect impact on the credit aggregates without being controlled for. This is because the forecasts take the VAR model in its estimated reduced form as a basis. Consequently, a structural identification of the model is not required but, at the same time, deviations from the forecasts cannot be decomposed into the contributions of economically interpretable shocks.

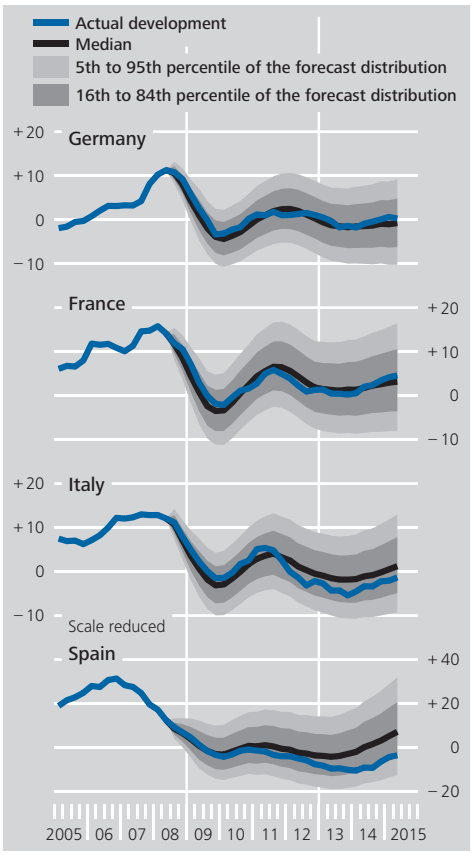
annual growth rates to aid visualisation. The chart on page 24 shows the distribution of the conditional forecasts of MFI loans to non-financial corporations as well as the actual annual growth rates broken down by country. The forecast distribution is represented by the median and selected percentiles.[7] By comparing actual loan growth with the forecast distribution, it can be ascertained whether loan growth, measured in terms of the forecast distribution, has been particularly strong or weak.

According to these results, loan growth in Germany and France (during the forecast period) was largely in line with past regularities. By contrast, the lending developments observed in Italy, and most notably in Spain, are unusually weak – measured in terms of the historical correlations between loan developments on the one hand and actual developments in real GDP and HICP on the other (since mid-2010 and the end of 2009, respectively).

However, it cannot be ruled out that the selected estimation period and/or the starting point for the simulation have biased the results. Setting the third quarter of 2008 as the starting point means that the deviation between the actual and hypothetical loan developments for the second quarter is implicitly set at zero. If, however – measured in terms of the long-term relationship between the lending volume and the other variables – the loan volume was already excessive at this point in time, the weak lending developments relative to the simulation could potentially entirely or partially reflect the reduction of this loan overhang, ie a deleveraging process.

Furthermore, the comparison of the actual lending developments with the distribution of the conditional forecasts is based on the assumption that the estimated model maps

Conditional forecasts of the annual growth rate of loans to non-financial corporations (estimation up to 2014)*



* Simulated posterior forecast distribution based on the four-country BVAR model. Estimation period 1996 Q2 to 2014 Q4. Forecast period 2008 Q3 to 2015 Q2. Forecasts based on actual developments in real GDP and HICP from 2008 Q3 onward; level forecasts converted into annual growth rates.

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the "normal" correlations between the model variables. This assumption may not be met if there have been persistent deviations from the "normal" common development of the variables during the estimation period. For instance, the estimation period used here covers the credit boom phase in the years running up to the crisis, which means that the model parameters partially reflect

7 The distribution shown is the simulated posterior distribution of the conditional forecasts. The forecast bands comprise the uncertainty regarding the model parameters on the one hand and the uncertainty concerning the disturbances (stochastic uncertainty) on the other.

the adjustment to this strong credit expansion. The simulated loan developments could therefore have an upward bias.[8]

To get an idea of whether this potential bias of the simulations owing to the credit boom in the mid-2000s is a relevant factor, the model was additionally estimated for the period from the third quarter of 1992 to the fourth quarter of 2004 and simulated from the first quarter of 2005, with the forecasts once again being conditional on actual developments in real GDP and HICP.[9] As the crisis period is not included in the estimation, there is also no danger of the model estimation being biased downwards by a crisis-induced structural break. In Italy, actual lending growth rates are initially in line with the median of the simulations, but drop noticeably short of it during the sovereign debt crisis. In Spain, actual loan growth initially strongly outpaces the forecasts based on output and price developments from 2005 onward, causing a loan overhang to build up. However, beginning in 2008, loan growth falls below the median and slides towards the lower tail of the forecast distribution.[10] This is consistent with the hypothesis that the weak loan developments in recent years could fully or partially reflect a correction of the loan overhangs that had accumulated in the past. However, a comparison of the levels of the actual and forecast loan aggregates reveals that the decline in the lending volume in Spain might have gone beyond correcting the already existing loan overhang.

Yet the fact that the estimation period lies further back in time increases the risk of structural changes in the economies having occurred in the meantime and thus of the model parameters no longer accurately describing the currently relevant correlation between the variables. To address this risk, the model was additionally estimated for the period from the first quarter of 1996 to the fourth quarter of 2014. The chart on page 25 shows actual loan developments and the distribution of the forecasts conditional on output and price developments, as obtained from the model estimation for the period from the second quarter of 1996 to the fourth quarter of 2014, ie from the estimation including the crisis period. This is based on the assumption that the crisis does not produce a structural break in the model and that the "normal" correlations between the variables can be accurately recorded on average by taking into account the boom and bust phases.

The results show that the loan growth observed in Germany and France is close to the median of the conditional forecasts throughout the entire forecast period.[11] For Italy, too, the deviations grow smaller in size and the loan growth rates observed are in the central area of the forecast distribution, although the loan growth rate since the end of 2011 has been somewhat below the median of the forecast distribution. The deviation of

8 For example, a credit boom can result in an upward bias of the estimated elasticity of the lending volume with respect to output. In such a case, a simulation that is conditional on the output path would ceteris paribus result in an overstated contraction in the loan volume in the period when output slumped during the crisis and an overstated expansion in the loan volume in the ensuing period of recovery.

9 The time series used for the Italian lending rate is not available in full for this period and had to be replaced by another time series which merely records the interest rates on short-term corporate loans.

10 Comparable results in qualitative terms were obtained in a simulation experiment using a similar BVAR model in: European Central Bank, Extensions to the models for assessing money and credit, Monthly Bulletin, February 2014, pp 77-96. In this experiment, however, the forecasts are conditional on the realised values of all other model variables and not – as is the case in the analysis presented here – only on developments in real GDP and HICP in each country.

11 As the estimation period covers the vast majority of the simulation period, the simulations now predominantly comprise conditional in-sample forecasts. The difference compared with the fitted values in the model is that in the simulations only real GDP and HICP are given, whereas the fitted values would be computed based on the lagged actual values of all variables.

actual lending developments from the distribution of the conditional forecast is also smaller than in the chart on page 24 in the case of Spain. However, from 2011 onward, the observed loan growth rate has increasingly diverged from the median of the forecast distribution, and since the start of 2014 it has been close to the 16th percentile. Although the deviation is thus less extreme than in the previous simulation, the results nevertheless indicate that lending dynamics observed in Spain are weaker than would be expected based on the estimated correlations and output and price level developments.

Overall, the results indicate that the dynamics of German and French banks' loans to the corporate sector observed in recent years are in line with the historical correlations between economic dynamics and lending. By contrast, it can be seen that loan developments in Spain and, depending on the estimation period, possibly in Italy, too, are weaker than would have been expected based on the historical correlations between lending and output and price developments.[12] An explicit analysis of the causes of these deviations is not possible within the framework of the empirical approach applied here.[13]

12 The model can be extended to include additional, potential determinants to enable an even better explanation of loan developments. For example, model variants were estimated that include the difference between corporate bond yields/bank bonds and yields on German Bunds calculated by Mojon and Gilchrist. See B Mojon and S Gilchrist (2014), Credit risk in the euro area, NBER Working Paper Series No 20041, National Bureau of Economic Research. However, these data are only available from 1999 onward. Simulations using this model for the period from the third quarter of 2008 onward produce narrower deviations compared with the chart on p 24, particularly for Italy, but also for Spain.
13 This would require the identification of the structural shocks, but, given the size of the model, that presents the problem of deriving suitable identifying restrictions.

on the lacklustre growth of bank lending in these two countries. Discussions over what caused the slump in business loans in 2012 and 2013 were dominated at that time by two main topics – the role played by supply-side constraints, and the deleveraging process in the Spanish business sector.[10] Hence, the following analysis investigates how far these two topics have continued to affect lending patterns in the countries under observation up to the present time.

Progress in non-financial corporations' deleveraging

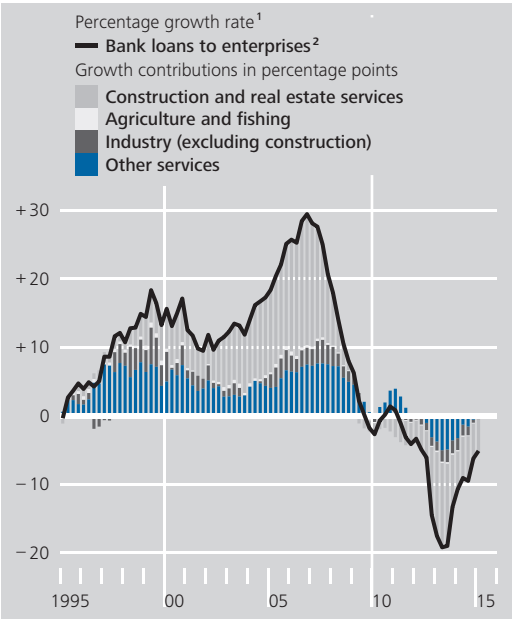
Spanish firms much less leveraged since 2012

As discussed in earlier *Monthly Report* articles, one of the key constraints holding back credit demand in the Spanish non-financial private sector in recent years was the need to correct the debt overhang that had accumulated in the past.[11] Thus, non-financial corporations' unconsolidated debt ratio – a metric comprising a wide range of liabilities and showing the sum of loans, debt securities and pension reserves as a percentage of GDP – has contracted sharply since mid-2010, after being greatly inflated by a sustained pre-crisis credit boom and the consequent property price bubble (see the chart on page 28).[12] As a result of this, the deleveraging process focused on cutting bank borrowing.[13] In 2012 and 2013, despite the unfavourable economic setting, Spanish firms managed to partly replace their bank loans,

10 See in particular Deutsche Bundesbank, Differences in money and credit growth in the euro area and in individual euro-area countries, Monthly Report, July 2013, pp 47-64.
11 See Deutsche Bundesbank, Private debt – status quo, need for adjustment and policy implications, Monthly Report, January 2014, p 65.
12 The following analysis is based on data extracted from the financial accounts and compiled according to the European System of Accounts (ESA) 2010.
13 An additional factor, alongside transaction-driven deleveraging, was the substantial write-downs when bank loans were transferred to Spain's SAREB resolution agency. This topic is discussed in greater detail in Banco de España, An analysis of the situation of lending in Spain, Economic Bulletin, October 2013, pp 19-35.

Breakdown of loans in Spain by selected economic sectors

End-of-quarter data



Source: Banco de España and Bundesbank calculations. **1** Year-on-year change. **2** Non-financial and financial corporations. Data series not adjusted for loan sales and securitisations. The large-scale transfer of loans to the state-owned SAREB resolution agency between the end of 2012 and the beginning of 2013 affected the annualised rate between 2012 Q4 and 2014 Q1.

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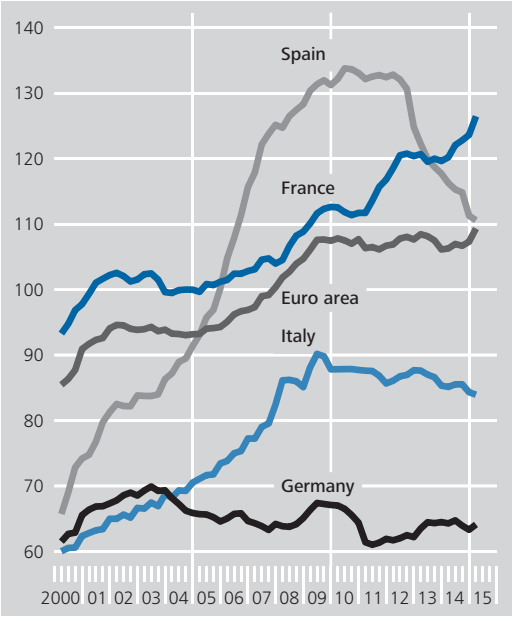
Unconsolidated debt* of non-financial corporations**

As a percentage of GDP, end-of-quarter data



Source: ECB and Bundesbank calculations. * Sum of loans, debt securities and pension fund reserves as a percentage of GDP, as defined in ESA 2010; figures for Italy for the period from 2000 Q1 until 2012 Q1 are estimations based on data compiled according to ESA 1995. ** Non-financial corporations and quasi-corporations.

Deutsche Bundesbank

which are factored into the debt ratio, with other financing instruments. They did this in two ways. First, they stepped up their equity issuance, a move which also helped to significantly redress the pre-crisis drop in the equity ratio. Second, they increased their internal financing, notwithstanding the cyclical decline in gross value added, primarily because employee compensation fell sharply on the back of employment adjustments.

Debt overhangs …

To gauge whether the adjustments involved in the deleveraging process are still having a dampening effect on loan demand, it is necessary to quantify the debt overhang. This is frequently done by comparing the actual debt ratio with a hypothetical equilibrium level, the difference being interpreted as the debt overhang or underhang. However, estimating the equilibrium level is fraught with major difficulties,[14] which is why it makes sense to measure the debt overhangs using various reference values; in this case, the results calculated using different methods should only be viewed in their totality and interpreted as rough approximations.

The table on page 29 presents the debt overhangs for the four largest euro-area countries, as quantified using three different reference values. The first of these reference values is the euro-area debt ratio, which is used to approximate a cross-country metric.[15] Such a cross-country benchmark analysis is relatively straightforward and transparent, given that it focuses on a given point in time. But in light of the excesses experienced in Spain and other member states, this metric is prone to understating actual national debt overhang levels be-

14 For the conceptual problems involved in quantifying a debt overhang or underhang as the deviation of actual debt from an empirically estimated hypothetical equilibrium level, see Deutsche Bundesbank, Private debt – status quo, need for adjustment and policy implications, Monthly Report, January 2014, pp 57-58.

15 For a similar approach to assessing indebtedness in the form of bank borrowing, see Deutsche Bundesbank, Change in outstanding loans relative to gross domestic product in selected euro-area countries, Monthly Report, July 2013, pp 60-61.

Debt overhang* (positive figures) of non-financial corporations from selected countries as defined in ESA 2010**

As a percentage of GDP, cut-off date: 31 March 2015 (in brackets: 31 March 2010)

Reference value	Germany		France		Italy		Spain	
Euro area	– 45.2	(– 40.7)	17.4	(4.9)	– 25.1	(– 18.7)	1.6	(24.6)
Historical national average	– 1.0	(1.4)	19.5	(10.7)	7.1	(16.5)	5.5	(35.8)
Debt ratio of 90%	– 26.2	(– 23.1)	36.4	(22.6)	– 6.1	(– 1.1)	20.6	(42.2)

Source: ECB and Bundesbank calculations. * "Debt overhang" corresponds to the difference between the debt ratio on the cut-off date and the respective reference value. "Euro area" denotes the euro area's debt ratio on the cut-off date. "Historical national average" refers to the mean debt ratio between 1999 Q1 and the cut-off date. The "debt ratio of 90%" is derived from Cecchetti et al (2011). ** Non-financial corporations and quasi-corporations.
Deutsche Bundesbank

cause, over time, national developments of that kind also feed into the benchmark. If the excesses have not been sufficiently reduced at the time of the comparison, the benchmark will have an upward bias.

A somewhat stricter reference value for gauging a possible debt overhang is the historical average of a given country's debt ratio. However, the results thus calculated are heavily dependent on the sample period chosen. Owing to data availability constraints, the period from the first quarter of 1999 until the first quarter of 2015 was selected for the above table.[16] The sample period thus covers a protracted phase of excessive credit expansion, notably for Spain, but not the complete correction of these excesses. That is why, rather like the first reference value, this approach risks understating a possible debt overhang.

The analysis is augmented by a reference value derived from a paper authored by Cecchetti *et al* (2011).[17] Based on a panel of 18 OECD countries between 1980 and 2010, the authors conclude that a debt ratio of 90% or more for non-financial corporations impacts negatively on economic growth. Being a fixed reference ratio that is largely unaffected by country-specific factors, it significantly reduces the risk of understating the debt overhang in individual countries.

… already far reduced in Spain …

It may be cautiously inferred that, while all three indicators in the above table continue to point to the existence of a debt overhang in Spain, it is considerably smaller than it was at the beginning of 2010, and it is now relatively low in absolute terms, too. The upturn in GDP over the last few quarters has further supported the deleveraging process. Bearing this in mind, the need for adjustment in the non-financial corporate sector resulting from the debt overhang should now be exerting much less pressure overall on bank lending in Spain.

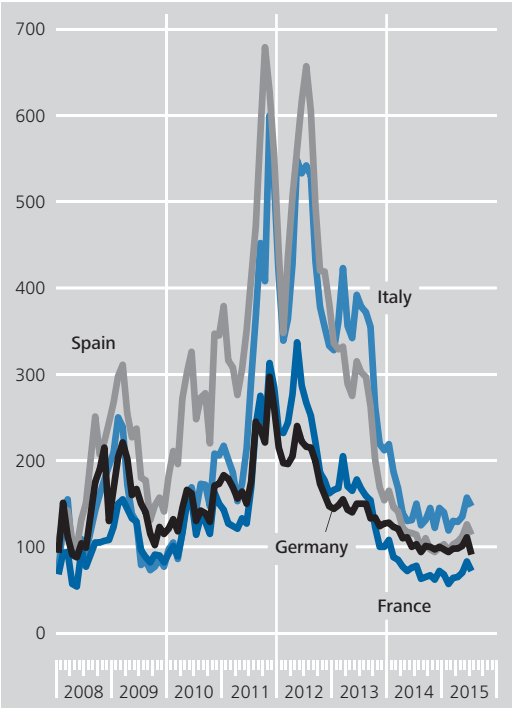
… and not a major concern in Italy

On the whole, indebtedness is a less critical topic for non-financial corporations in Italy. The debt-to-GDP ratio was below the euro-area average both before and after the onset of the financial crisis, and the reference value defined by Cecchetti *et al* was not exceeded. However, the debt ratio increased steadily until 2009 and has contracted only marginally since then, indi-

16 Since ESA 2010 data for Italy are only available at the current end, the missing data points are calculated as the difference between the value measured according to ESA 1995 and the average difference between the ESA 1995 and ESA 2010 values for which data are available.
17 See S Cecchetti, M Mohanty and F Zampolli (2011), The real effects of debt, BIS Working Paper, No 352, November 2011.

CDS spreads on bank bonds*

Bps



Sources: Thomson Reuters, Datastream and Bundesbank calculations. * Country aggregates derived from the unweighted means of single-name CDS spreads on senior bank bonds.

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cating that indebtedness is slightly above the historical average at the current juncture. But by and large, debt levels in Italy *per se* should not have significantly dampened firms' demand for loans.

French firms' growing indebtedness

While comparisons of this kind indicate that debt levels at German non-financial corporations have been rather unremarkable and relatively stable over time, for French enterprises they reveal that debt levels have climbed persistently over many years, even though GDP has followed a positive growth path overall since 2010. This trend was driven primarily by an increase in debt securities, whereas the ratio of loans to GDP has remained static since 2009. Yet two factors have a stabilising effect on debt levels in the French non-financial corporate sector – first, firms still have an ample equity level relative to other euro-area countries; second, a large proportion of the debt of French non-financial corporations is in the form of intra-sectoral loans. Factoring them out of the debt ratio reduces the debt overhang figures calculated above quite substantially.[18]

Importance of supply-side factors

Higher funding costs for Italian and Spanish banks during sovereign debt crisis

Besides the demand-side determinants discussed so far, the sluggish loan growth in Italy and Spain is also partly a consequence of the strains which the financial and sovereign debt crisis caused in those countries' banking systems. The tightening sovereign-bank nexus in both Italy and Spain since the onset of the financial crisis considerably raised banks' funding costs at the peak of the sovereign debt crisis to an even higher level than that seen during the financial crisis in 2008 and 2009 (see the adjacent chart).[19] By comparison, German institutions faced barely any strains and French institutions only moderate pressure.

Non-standard monetary policy measures

The Eurosystem implemented a series of non-standard measures in the midst of the sovereign debt crisis to support bank lending and counter the severe tensions in the financial markets. Its measures notably included implementing two three-year tenders in late 2011/early 2012 and announcing that under certain conditions, it stood ready to activate a purchase programme for sovereign debt securities (outright monetary transactions: OMT). Since the end of 2012, these measures have contributed to a steady improvement in general bank funding conditions in the periphery countries; however, CDS spreads for banks domiciled there remained at elevated levels into early 2014.

18 See G Cette und J-P Villetelle, The financial position and funding of French non-financial corporations, Banque de France, Quarterly Selection of Articles, No 37, Spring 2015, pp 17-33.

19 See A v Rixtel and G Gasperini, Financial crises and bank funding: recent experience in the euro area, BIS Working Paper, No 406, March 2013; and European Central Bank, Measuring the cost of bank equity in the euro area, Financial Stability Review, May 2015, pp 61-63.

Volume of non-performing loans still high

Compounding the situation, the cyclical slump markedly deteriorated[20] credit quality in Italy and Spain, particularly among small and medium-sized firms, driving up the banks' exposures to non-performing loans.[21] Since impairments of loans and advances affect earnings, the rise in non-performing loans fed straight through to banks' P&L and hindered their efforts to build up capital internally. Profitability in Spain's banking sector has been improving appreciably since legacy loan portfolios were transferred to a resolution agency at the turn of 2012-13 and the pronounced pick-up in the country's economy; the level of impaired loans remains high, however, though it has been easing somewhat of late. Italy is planning to establish an asset management company specialising in the purchase of non-performing loans.[22]

Development of credit standards

BLS indicates easing of credit standards, …

This raises the question of to what extent the strains on the banking systems, particularly those that emerged at the peak of the sovereign debt crisis, are continuing to affect corporate lending developments and whether any supply-side factors are still curtailing the supply of bank loans today. Banks can respond to the funding and capital problems they face both by tightening their credit standards – which can potentially constrain lending volumes – or by imperfectly passing through the reductions in Eurosystem policy rates.

An important source of information on supply-side constraints to bank lending is the Bank Lending Survey (BLS), a quarterly survey in which the Eurosystem asks selected banks to report on changes in their credit standards when granting new corporate loans. Primarily Italian banks, but also Spanish and French institutions, reported that the sovereign debt crisis had prompted them to tighten their credit standards in 2011-12, in some cases considerably, whereas in Germany credit standards remained basically unchanged. Since the fourth quarter of 2013, however, credit standards have not been noticeably tightened in any of the three countries. In fact, Italian and French banks have loosened their credit standards again somewhat over the past three quarters. However, there are substantial differences in the level[23] of credit standards: Italian banks reported that the current level of their credit standards is still considerably tighter than the reference level prevailing after the second quarter of 2010,[24] while Spanish banks said that their level is still moderately tighter. In France, the respondent banks stated that their credit standards were currently considerably looser than the relevant reference level.

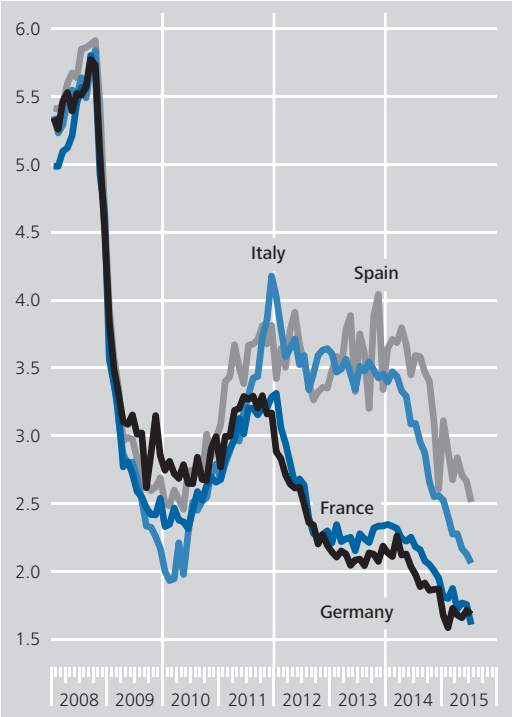
… supply-side factors now no longer dampening standards

Besides the banks' responses about their credit standards, the factors they report as having prompted them to adjust their lending policy provide additional useful information. These responses indicate that supply-side constraints were one of the reasons why they tightened their credit standards during the sovereign debt crisis. Those constraints included funding conditions in the money and bond market plus, in Italy and France, banks' liquidity position and the cost of capital. However, from mid-2012, and in Spain from the spring of 2013, banks

20 See European Banking Authority, 2014 EU-wide stress test results. It should be noted that the sample used for stress testing is heavily skewed to larger banks. For further information, see https://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014/results.
21 See International Monetary Fund, Italy, Staff report for the Article IV consultation, 16 June 2015; and International Monetary Fund, Spain, Staff report for the Article IV consultation, 10 July 2015.
22 See Banca d'Italia, Economic Bulletin, July 2015, pp 35-36.
23 The reference level is the midpoint of the range of credit standards between the maximum and the minimum level of credit standards during this time period. The wording of the question, which asks each bank to compare the current level of its credit standards with its individual past reference level, prevents any cross-country comparison of the current level of credit standards. See Deutsche Bundesbank, The level of credit standards in the Bank Lending Survey, Monthly Report, August 2014, pp 44-47.
24 This assessment is broadly consistent with the cumulated changes in credit standards since 2010 in Italy, where they continued to be tightened considerably after the onset of the sovereign debt crisis in the second quarter of 2010, whereas this was barely the case in the other countries.

Average interest rates on corporate loans in euro-area countries*

%, new business



* Based on the harmonised MFI interest rate statistics.
Deutsche Bundesbank

mainly cited cyclical and demand-side factors as the reason for tightening their credit standards. The loosening of credit standards for loans to enterprises in Italy that has been observed for the past three quarters is primarily being fuelled by improved conditions for bank funding. Banks particularly pointed to their robust liquidity position – which has probably been substantially bolstered by the accommodative monetary policy measures adopted since mid-2014 – and the reduced cost of capital as the reasons why they eased their credit standards.

Lending rates and pass-through

Changed pass-through behaviour of Italian and Spanish banks

Econometric analyses, moreover, suggest that Italian and Spanish banks changed the manner in which they passed through interest rates during the financial and sovereign debt crisis (see the box on pages 33 to 35). Although funding costs for euro-area banks were pushed down in 2012 by contracting government bond yields as well as the policy rate cuts and non-standard monetary policy measures implemented by the Eurosystem, lending rates for new corporate loans in Italy and Spain initially persisted at a relatively high level, while the corresponding rates in Germany and France began to decline significantly from the end of 2011 (see the adjacent chart). Lending rates for business loans in Italy and Spain did not begin to clearly diminish until the spring of 2014.

Crisis-related mark-ups on base interest rate …

The results of interest rate pass-through estimations (see the box on pages 33 to 35) indicate that bank lending rates in Italy and Spain persisted at a relatively high level in 2012 and 2013 because the monetary policy stimulus, which *per se* tended to facilitate lower interest rates, was increasingly cancelled out by growing bank mark-ups on the base rate of interest for business loans. This was how banks responded to their earnings problems and prevented their interest margins (net interest income as a percentage of total assets) from plummeting. Indeed, interest margins in the overall interest-bearing business of Italian and Spanish banks contracted only slightly between 2010 and 2014.[25]

… back on the decline since early 2014

Interest rate pass-through behaviour has been returning to normal since the beginning of 2014. The mark-ups which banks added to their base rate of interest in response to the crisis are decreasing, and lending rates in periphery countries are converging towards core country rates again. A decomposition of lending rates reveals that the lingering differences in lending rate levels in Germany and France on the one hand and in Italy and Spain on the

25 The low-interest-rate environment has barely affected the interest expenditure of banks in Italy and Spain, which has remained largely static since 2006. If interest rates on business loans in these two countries had shrunk to the same extent as they did in Germany and France, say, their banking systems would have run into very real earnings problems. Those problems did not arise in Germany because although German banks' net interest income was relatively low, the low level of credit risk kept loan-loss provisioning costs down, thus bolstering their net earnings.

The interest rate pass-through in the crisis

One possible cause of the weak development of loans to non-financial corporations in the EU periphery countries lies in the relatively high lending rates there compared to the core countries. As the chart on page 32 shows, the spread between interest rates for new loans to enterprises in Italy and Spain and the corresponding German interest rates increased sharply from 2011 and has only narrowed again since 2014. The following analysis therefore examines whether the pass-through from market rates to bank lending rates has changed during the financial and sovereign debt crisis in the euro area, with a special focus on Italy and Spain.

When carrying out analyses of this kind, error correction models such as the one below are typically used, whereby the short-term[1] interest rate for new bank loans to enterprises br_t depends on a reference interest rate[2] mr_t and a measure of risk $spread_t$[3].

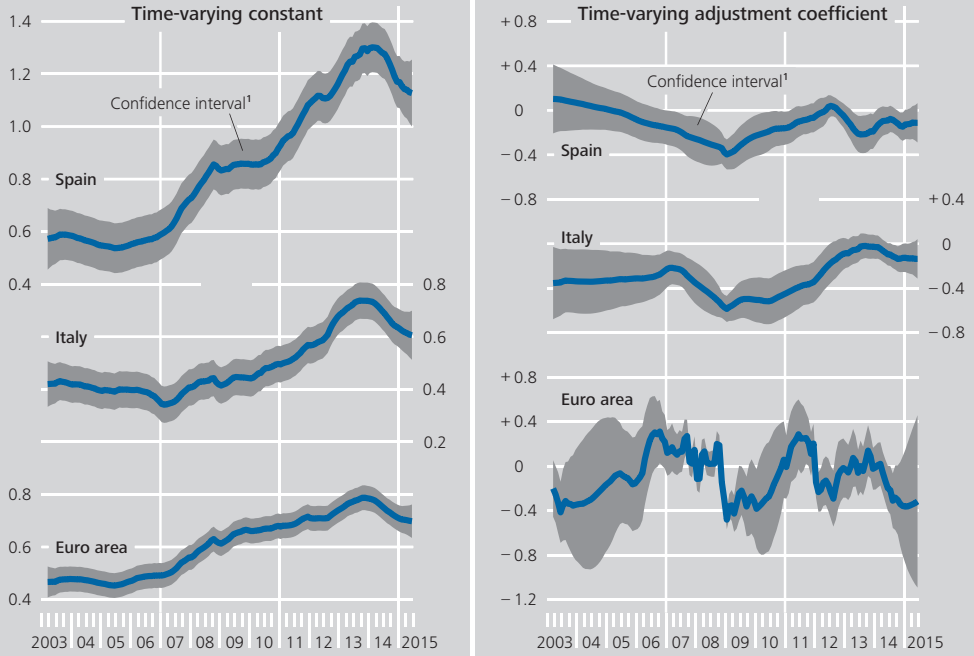
$$\begin{aligned}\Delta(br_t) = {} & \beta_1\Delta(mr_t) + \beta_2\Delta(mr_{t-1}) \\ & + \beta_3\Delta(spread_t) + \beta_4\Delta(spread_{t-1}) \\ & + \beta_5\Delta(br_{t-1}) + \gamma(-\alpha - br_{t-1} \\ & - \beta_6 mr_{t-1} - \beta_7 spread_{t-1}) + \varepsilon_t \\ & \varepsilon_t \sim iid\ N(0, \sigma_\varepsilon^2) \end{aligned} \quad (1)$$

Error correction models such as (1) are composed of two parts. One part captures short-term dynamics, while the other describes the long-term equilibrium relationship which the system generally strives towards. The variables of the equilibrium relationship must be cointegrated over the entire observation period, which for reasons of data availability cannot begin before 2003.[4] This data characteristic can be verified by means of various test procedures.[5] For the countries concerned and for the euro area as a whole, all the procedures used here show that, over the entire period 2003 to 2015, an equilibrium relationship between the reference interest rate and the short-term bank lending rate can only then be assumed if the government bond spread is explicitly taken into account. This is a fundamental difference to the pre-crisis period, when this variable scarcely played any role at all in the interest rate pass-through.[6] This reflects the increased interconnectedness between the government sector and the banking sector. Since 2010, this interconnectedness has been shown in the almost perfect correlation between the credit

1 Encompasses loan agreements with both variable interest rates and initial rate fixations of up to one year. Such interest fixations dominate in the case of new and existing loans in Italy and Spain, but also in the euro area.
2 The reference interest rate is not intended as a proxy for banks' financing costs, but represents the basic rate of interest ("risk-free" interest rate) in the calculation of the lending rate. Banks normally use benchmark money market rates (EONIA, three-month EURIBOR or the 1-month overnight index swap) to calculate interest rates for short-term loans.
3 Risk premium on 10-year government bonds compared to the long-term risk-free interest rate in the euro area (10-year EURIBOR interest rate swap). It is an approximation of the respective country's credit default risk.
4 This is true when, as in this case, the variables are non-stationary. Cointegration generally exists if non-stationary time series have a linear relationship with a stationary error term.
5 Usually, the Johansen test, the Engle-Granger test and the Gregory-Hansen test are used for this purpose. The Gregory-Hansen test takes into account possible structural breaks (level shifts as well as structural breaks) in the long-term relationship. See S Johansen, Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Autoregressive Models, Econometrica, 59, 1991, pp 1551-1580, R F Engle and C W J Granger, Co-Integration and Error Correction: Representation, Estimation, and Testing, Econometrica, Vol 55, No 2, March 1987, pp 251-276, and A W Gregory and B E Hansen, Residual-based tests for cointegration in models with regime shifts, Journal of Econometrics, 70, 1996, pp 99-126.
6 See J von Borstel, S Eickmeier and L Krippner, The interest rate pass-through in the euro area during the sovereign debt crisis, Bundesbank Discussion Paper 10/2015. According to their findings, too, premiums on government bond yields did not impact on bank interest rates prior to the sovereign debt crisis.

Estimation results of the time-varying coefficients in the interest rate pass-through model

Monthly



1 ± two standard deviations.
Deutsche Bundesbank

default risks of both sectors.[7] Accordingly, over the course of the crisis, the risk premium on government bonds has become a relevant determinant for the interest rate pass-through.

Moreover, it is conceivable that parameters of the model (1) may have also changed as a result of the crisis. Of special interest here are the constant α of the equilibrium relationship and the parameter γ. The latter describes the speed of adjustment to the long-term equilibrium and must lie between -1 and 0. A value close to 0 would imply a slow adjustment and thus a sluggish dismantling of imbalances. The constant α in the equilibrium term, which reflects those influences that were not explicitly taken into account in the equilibrium relationship, may likewise have changed as a result of the crisis.[8]

These possibilities are tested by writing the error correction model in a time-variant manner in the form of a state space model.

$$\begin{aligned}\Delta(br_t) = {} & \beta_1\Delta(mr_t) + \beta_2\Delta(mr_{t-1}) \\ & + \beta_3\Delta(spread_t) + \beta_4\Delta(spread_{t-1}) \\ & + \beta_5\Delta(br_{t-1}) + \gamma_{(t)}(-\alpha - br_{t-1} \\ & - \beta_6 mr_{t-1} - \beta_7 spread_{t-1}) + \varepsilon_t \\ & \varepsilon_t \sim iid\ N(0, \sigma_\varepsilon^2)\end{aligned} \tag{2}$$

7 This statement is based on the rolling correlation between risk premiums on government bonds and bank bonds in the countries concerned. For more information on the possible causes, see inter alia V de Bruyckere, M Gerhardt, G Schepens and R V Vennet, Bank/Sovereign risk spillovers in the European debt crisis, Journal of Banking & Finance, 37, 2013, pp 4793-4809, and V V Acharya and S Steffen, The "greatest" carry trade ever? Understanding eurozone bank risks, Journal of Financial Economics, 115, 2015, pp 215-236.

8 By contrast, it is not meaningful for the coefficients β_6 and β_7 to be specified to vary over time, as the cointegration of the relevant variables that has been proven in the case in question implies that these coefficients are constant.

$$\gamma_t = \gamma_{t-1} + \nu_{1t}$$
$$\nu_{1t} \sim iid\ N(0, \sigma^2_{\nu 1}) \quad (3)$$

or

$$\begin{aligned}\Delta(br_t) = {} & \beta_1 \Delta(mr_t) + \beta_2 \Delta(mr_{t-1}) \\ & + \beta_3 \Delta(spread_t) + \beta_4 \Delta(spread_{t-1}) \\ & + \beta_5 \Delta(br_{t-1}) + \gamma(-\alpha_{(t)} - br_{t-1} \\ & - \beta_6 mr_{t-1} - \beta_7 spread_{t-1}) + \varepsilon_t \\ & \varepsilon_t \sim iid\ N(0, \sigma^2_{\varepsilon}) \quad (4)\end{aligned}$$

$$\alpha_t = \alpha_{t-1} + \nu_{2t}$$
$$\nu_{2t} \sim iid\ N(0, \sigma^2_{\nu 2}) \quad (5)$$

Equations (2) and (4) represent the observation equation of the respective state space model. A simultaneous determination of the time-varying coefficients is not possible because the observation equation is required to be linear in the state variables. For this reason, both variants are estimated separately; however, the results of both models must be interpreted together. The hypothesis of time variability in the coefficients γ_t and α_t is modelled in the corresponding state equations (3) and (5), with the respective time variable parameter being specified as a random walk. The models are estimated on the basis of maximum likelihood, and smoothed values are determined for the time-varying coefficients γ_t and α_t using the Kalman filter and smoother.

The chart on page 34 shows the smoothed estimates for the time-varying parameters γ_t (adjustment coefficient) and α_t (constant) in their respective confidence band. The broad confidence bands of the adjustment coefficient and, therefore, the implicitly higher uncertainty in determining this coefficient indicate that the constant is presumably the main driving time-varying factor. The pattern of the constants in Italy, Spain and the euro area is nearly identical, both for the continuous rise starting at the outset of the financial crisis in 2007 and the decline of the constants from the start of 2014.[9]

A core element in interpreting the constant is that it is closely correlated with the interest income from the lending business. It is therefore noteworthy that banks' interest margin declined only slightly between 2011 and 2013, despite high interest expenditure.[10] This suggests that the increased mark-up in lending business served to prevent a slump in the interest margin.

Overall, it can therefore be said that the interest setting behaviour in Spain and Italy, but also in the euro area as a whole, has changed over the course of the financial and sovereign debt crisis compared to the pre-crisis period. For one thing, risk in the form of the government bond spread has gained in importance, leading to a widening of the interest rate gap between lending rates and reference rates. For another, a continuously rising mark-up can be observed in banks' interest setting behaviour from the beginning of the crisis in 2007 that has only latterly declined again slightly.

9 As a robustness analysis, the bank bond spread was also integrated into the analysis, both individually and together with the government bond spread. However, this does not change either the results for the cointegration test or the results of the time-varying constants for Spain, Italy and the euro area. This indicates that the government bond spread since 2010 can be used as a broad measure of risk for the banking sector, too.
10 This is the interest expenditure shown under the banks' profitability and includes all debt financing expenditure.

The influence of credit supply shocks on the development of real GDP and lending to euro-area non-financial corporations

A further option for analysing the causes of weak growth in lending to firms is to decompose the lending growth rate into contributions from selected macroeconomic shocks using a vector autoregressive (VAR) model that describes the dynamic interaction between lending growth and other important macroeconomic variables.

The model used here comprises eight variables for the euro area, namely the annual growth rates of real gross domestic product (GDP), of the GDP deflator, of real MFI loans to non-financial corporations, of the real money supply M3 and of a deflated share price index (DJ Eurostoxx)[1] as well as the average yields on ten-year government bonds, an average interest rate for bank loans to non-financial corporations and a shadow short rate, which serves as an indicator of the monetary policy stance.[2] The model is estimated over the period from the first quarter of 1993 to the second quarter of 2015 using Bayesian methods.[3] Sign restrictions are used to identify economic shocks.[4] The model identifies an aggregate supply shock (inflation shock), an aggregate demand shock, a monetary policy shock and a credit supply shock.[5] They are identified using contemporaneous sign restrictions, in other words by assumptions concerning the direction of the simultaneous reactions of the other variables to the shock in question. In the following, a credit supply shock denotes all shocks that cause lending growth to fall, lending rates to rise, GDP growth to fall and monetary policy to become more expansionary. Defined in this

1 Loans, money supply and share prices are deflated using the GDP deflator.
2 The shadow short rate (SSR) is an indicator that is derived from the yield curve. In "normal" times it corresponds to the monetary policy rate. If this is at the zero lower bound or if non-standard monetary policy measures are implemented, the SSR can deviate from the monetary policy rate and also assume negative values. See L Krippner (2013), Measuring the stance of monetary policy in zero lower bound environments, Economics Letters, 118, pp 135-138. For the SSR used here, see http://www.rbnz.govt.nz/research_and_publications/research_programme/additional_research/comparison-of-international-monetary-policy-measures.html (accessed on 11 September 2015). Inclusion of the SSR enables the model to approximately capture the impact of non-standard monetary policy measures on the monetary policy stance without explicitly modelling them. For the period prior to 1995, the SSR is replaced by a German interbank interest rate for overnight credit.
3 The lag order is five. The estimation methodology follows D Giannone, M Lenza and G Primiceri (2015), Prior selection for vector autoregressions, Review of Economics and Statistics, 97, pp 436-451. The prior distribution for the VAR coefficients and the diagonal elements of the covariance matrix is based on the estimation of an AR(1) model for each variable over the entire estimation period. The model assumes constant relations between the variables and in the covariance matrix of the shock processes over the entire period.
4 See J Arias, J Rubio-Ramírez and D Waggoner (2014), Inference based on SVARs identified with sign and zero restrictions: theory and applications, Dynare Working Paper Series, No 30.
5 For a discussion of the possibility of identifying credit supply shocks using structural VAR models, see H Mumtaz, G Pinter and K Theodoridis (2015), What do VARs tell us about the impact of a credit supply shock?, Working Paper No 739, School of Economics and Finance, Queen Mary University. The sign restrictions used largely correspond to those in M Bijsterbosch and M Falagardia (2014), Credit supply dynamics and economic activity in euro area countries: a time-varying parameter VAR analysis, European Central Bank, Working Paper Series No 1714. The aggregate supply shock pushes up real GDP growth and pushes down the inflation rate and the monetary policy rate; the aggregate demand shock pushes up GDP growth, the inflation rate, the lending rate and the monetary policy rate. A monetary policy shock implies a rise in the monetary policy rate and a fall in GDP growth and the inflation rate. The restrictions apply to the contemporaneous response of the variables to the shock in question and are consistent with the results of various dynamic stochastic general equilibrium models (DSGE models) that contain a banking sector; for instance A Gerali, S Neri, L Sessa and F M Signoretti (2010), Credit and banking in a DSGE model of the euro area, Journal of Money, Credit, and Banking, 42, pp 107-141; M Gertler and P Karadi (2011), A model of unconventional monetary policy, Journal of Monetary Economics, 58, pp 17-34. In a departure from Bijsterbosch and Falagardia (2014), op cit, the restrictions do not comprise a negative response of the inflation rate to a contractionary credit supply shock as this does not generally follow from the theoretical analyses; see, for instance, the short-run positive response of the inflation rate to a bank capital shock in Gerali et al (2010), op cit. Separation of the aggregate supply shock from the credit supply shock is achieved by assuming a negative reaction of the monetary policy rate to the aggregate supply shock. This modification has little impact on the results presented here.

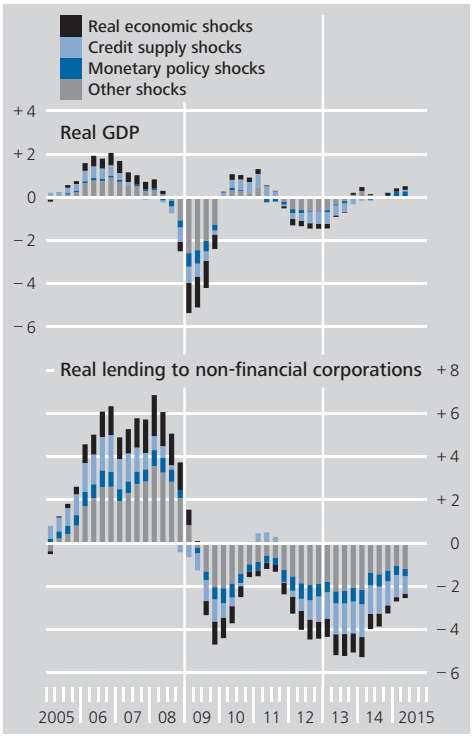
way, the credit supply shock represents a range of underlying disruptions that can all influence the banking sector's loan supply behaviour. This could involve, for instance, exogenous changes in banks' capital or net worth, capital quality, loan-to-value limits or interest-setting behaviour.[6] An historical decomposition for the variables contained in the model is derived from the model estimation and the shock identification. This decomposes the deviations of each variable from its unconditional mean into the contributions of present and past realisations of the identified shocks. The adjacent chart shows this historical decomposition for the annual growth rates of real GDP and real lending to non-financial corporations.

The analysis shows that credit supply shocks had relevant effects on lending growth both in the post-2005 boom and during the sovereign debt crisis. During the latter, negative credit supply shocks made a noticeable contribution to the decline in lending growth, although their negative contribution has been receding for some time now.[7] The stabilisation from mid-2013 and the subsequent recovery of lending growth was additionally bolstered by the negative effects of real economic shocks fading out. Real GDP growth, too, was weakened by negative credit supply shocks between mid-2008 and the end of 2009, and then again in 2012 and 2013. In the recent past, however, these shocks had no negative impact on real economic growth.[8] When taking into account the estimation uncertainty, the monetary policy shock proves by and large to be quantitatively irrelevant for the development of both output and lending.[9]

These results prove to be qualitatively robust to a number of model modifications. In addition, some explorative estimations using similar models have been conducted at the country level. These indicate that credit supply shocks in Italy and, to a lesser extent, in France in the wake of the sovereign debt crisis had a negative influence on

Historical decomposition of the effects of economic shocks on the annual growth rates of real GDP and real lending to euro-area non-financial corporations*

%



* Contributions of present and past realisations of economic shocks to the deviation of the respective variables from their unconditional mean, as derived from a structural VAR model with sign restrictions. The median of the posterior distribution of each shock's contribution is shown. The real economic shock contains the effects of the aggregate supply shock and the aggregate demand shock. The category "Other shocks" captures the contributions of the four non-identified shocks.

Deutsche Bundesbank

6 See Gerali et al (2010), op cit, or Gertler and Karadi (2011), op cit.

7 The contributions of the individual shocks shown in the chart represent the median of the posterior distribution of the shock effects from the Bayesian estimation of the model. The estimation uncertainty shown by this distribution is relatively high, meaning that only the contributions in the chart that are rather pronounced compared to the estimation uncertainty should be interpreted as being relevant.

8 The analysis of the impulse response functions shows that the negative response of lending growth to a credit supply shock is more persistent than in the case of GDP growth. In other words, the impact of past credit supply shocks on lending growth lasts longer than that on GDP growth.

9 Thus the posterior distribution of the contributions of the monetary policy shock shows a noticeable negative effect on GDP growth only for a short time and only at the start of the financial market crisis. For the remaining period and for the lending growth rate, the distribution shows neither a noticeable negative nor a noticeable positive impact.

the development of corporate lending, whereby these influences have recently been declining. For Germany the analysis revealed no discernible role for credit supply shocks during the sovereign debt crisis. With regard to the development of real GDP growth, the analyses indicate that credit supply shocks in Italy during the sovereign debt crisis may have contributed to the weak development of real GDP, whereas this was not the case in Germany and France. According to these estimations, however, credit supply shocks are currently no longer having a negative impact on the development of real GDP in Italy, either.

For Spain, the analysis shows clear negative effects of credit supply shocks on both the development of lending to non-financial corporations and on real GDP growth; in some model specifications, these effects persist up to the current time. But it should be noted that in the case of Spain there is the general problem that, relative to the other countries, the results are subject to very high estimation uncertainty and are sensitive to the estimation period.

However, the finding that credit supply shocks have made a noticeable contribution to explaining the weak lending growth in the euro area during the financial and sovereign debt crisis should not be interpreted as meaning that developments on the loan demand side were irrelevant. The shock decomposition identifies, viewed through the filter of the empirical model, the causes of fluctuations in the variables around their unconditional mean. However it does not identify via which transmission channels the various shocks affected these variables. For instance, aggregate supply shocks, aggregate demand shocks, monetary policy shocks or disruptions contained in the shocks that are not explicitly identified may have resulted in the negative effect shown in the chart on page 37 via the channel of lower loan demand.

other are probably chiefly attributable to borrower credit risk.

Econometric analyses confirm dwindling influence of supply-side factors

All in all, banks' credit standards and their lending rates for non-financial corporations would therefore appear to suggest that supply-side constraints on bank lending indeed played a role in Italy and Spain,[26] but that their influence has dwindled considerably in the meantime. This assessment applies in equal measure to the euro area as a whole (see the box on pages 36 to 38).

Conclusion

Current situation essentially upbeat

Lending to non-financial corporations is now by and large showing clear signs of recovery in all of the four largest euro-area countries. This is due both to the economic recovery and to the waning influence of various demand-side and supply-side factors related to the crisis which had depressed lending levels.

For example, the corporate sector's debt overhang in Spain has been materially lowered since 2012, a process which is now being additionally boosted by the robust economic upswing. Moreover, for Spain and Italy, the available indicators and models used to identify supply-side constraints suggest on balance that the negative supply-side factors hindering bank lending have receded distinctly.

Future risks

While the current situation may generally be considered positive, it is equally important to assess whether there are any lingering risks going forward – not least in the light of the ongoing negative annualised growth rates for loans to non-financial corporations in Italy and Spain. One particular risk factor in these two countries is the high level of non-performing

26 See Deutsche Bundesbank, Monetary policy and banking business, Monthly Report, May 2013, pp 21-32; and Deutsche Bundesbank, Differences in money and credit growth in the euro area and in individual euro-area countries, Monthly Report, July 2013, p 59.

loans, which is continuing to squeeze banks' profitability in periphery countries and thus impinge on their balance sheets. The measures needed to reduce this vulnerability include thoroughly cleansing balance sheets of both existing and anticipated losses as well as implementing regulations aimed at preventing fresh vulnerabilities from emerging in future, including requiring banks to back their sovereign exposures with capital. The task of eliminating these risks is thus a matter which the banks themselves, and banking supervisors and fiscal policymakers, too, will need to address. In Italy, the state-backed asset management company that is currently being set up should be able to play a key role in reducing the volume of non-performing loans in future.[27]

27 See International Monetary Fund, Italy, Staff report for the Article IV consultation, 16 June 2015, pp 17-24.