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In 2014 all ECB publications feature a motif taken from the €20 banknote.

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ABSTRACT

This paper analyses the cross-country heterogeneity in retail bank lending rates in the euro area and presents newly developed pass-through models that account for the riskiness of borrowers, the balance sheet constraints of lenders and sovereign debt tensions affecting interest rate-setting behaviour. Country evidence for the four largest euro area countries shows that downward adjustments in policy rates and market reference rates have translated into a concomitant reduction in bank lending rates. In the case of Spain and Italy, however, sovereign bond market tensions and a deteriorating macroeconomic environment have put upward pressure on composite lending rates to non-financial corporations and households. At the same time, model simulations suggest that higher lending rates have propagated to the broader economy by depressing economic activity and inflation. As a response to increasing financial fragmentation, the ECB has introduced several standard and non-standard monetary policy measures. These measures have gone a long way towards alleviating financial market tensions in the euro area. However, in order to ensure the adequate transmission of monetary policy to financing conditions, it is essential that the fragmentation of euro area credit markets is reduced further and the resilience of banks strengthened where needed. Simulation analysis confirms that receding financial fragmentation could help to boost economic activity in the euro area in the medium term.

JEL code: E43, E44, E52, C22, C52, C53.

Keywords: Bank lending rates, pass-through models, DSGE models, financial fragmentation, monetary policy.

NON-TECHNICAL SUMMARY

A well-functioning banking sector is fundamental in order to guarantee the effectiveness of the monetary policy transmission mechanism, especially in the euro area, where banks play a predominant role in providing external finance for the non-financial private sector. The outbreak of the financial and sovereign debt crisis affected all segments of the financial system and, in particular, the banking sector, thereby hampering the transmission of the monetary policy measures implemented by the European Central Bank (ECB) to Monetary Financial Institutions' (MFI) interest rates and bank lending conditions. Moreover, in a general environment of sluggish economic activity, high sovereign debt and economic uncertainty, bank lending conditions have remained heterogeneous across euro area countries and very low policy interest rates have not been fully passed through to bank lending rates. Such developments reflect, in part, asynchronous business cycles and differing perceptions of credit risk across countries over the last few years.

In order to assess the effectiveness of the monetary policy pass-through across the euro area countries and enhance cross-country comparability, it is necessary to use harmonised measures of the borrowing costs for firms and households in those countries. As an accurate measure of the cost of borrowing of non-financial corporations should consider the overall financing structure of firms, this paper introduces a new indicator which accounts also for overdrafts, which are a major source of financing for firms in some large euro area countries (e.g. Italy). The indicator is then used to describe developments in interest rates on loans to non-financial corporations in the four largest euro area economies.

On the basis of these harmonised measures of borrowing costs, the paper analyses different factors determining heterogeneity in bank lending rates for firms and households. Among those are financial structures and institutional factors, which may differ substantially across countries. In particular, increasing credit risk and bank risk aversion, in an environment of weak economic growth, eventually weigh on the profitability and financial buffers of non-financial corporations, increasing their probability of bankruptcy and impairing their debt-servicing capacity. As a result of the higher risk they bear, banks will tend to charge higher lending rates and tighten credit conditions for borrowers, particularly in those countries where economic conditions are weaker.

Some of these factors are not taken into account in the traditional pass-through models, which consider policy and market interest rates to be direct determinants of retail bank lending rates under the assumption of a low and stable level of risk, well-capitalised financial institutions and no fragmentation in bank funding conditions. The financial crisis and the euro area sovereign debt crisis have brought to the fore the importance of credit risk and risk perceptions, banks' undercapitalisation or poor asset quality of their assets and fragmentation in bank funding conditions for bank lending rates and bank lending policies.

Another factor explaining the divergence in MFI lending rates and bank lending policies is fragmentation in banks' funding conditions arising from sovereign debt tensions. In setting the remuneration on their deposits and the return on bonds issued in the market, banks "compete" at the retail level with high yields on bonds and Treasury bills issued by the government. In countries where such yields have increased or have not declined at the same pace and to the same extent as policy rates, this association contributes to increase banks' funding costs, which may be passed through to bank lending rates. Bank funding costs increased substantially during the financial and the sovereign debt crisis, reaching peaks in countries with a distressed sovereign.

Model-based evidence tends to confirm that standard pass-through models are ill-equipped to explain increasing levels of heterogeneity in bank lending rates across euro area countries during the crisis. This is because they do not account for risk factors (related to banks and borrowers) and sovereign bond spreads, which are, by contrast, included in the new pass-through models introduced in this paper. Country evidence based on the big four euro area countries shows that downward adjustments in policy rates and market reference rates have translated into a concomitant reduction in bank lending rates. In the case of Spain and Italy, however, sovereign bond market tensions and a deteriorating macroeconomic environment have put upward pressure on composite lending rates to non-financial corporations and households, in spite of policy rates and market reference rates of higher maturities falling to record low levels.

At the same time, simulations from a Dynamic Stochastic General Equilibrium (DSGE) model show that higher lending rates have propagated to the broader economy by depressing economic activity and inflation. Financial shocks have also contributed to amplify business cycles in the euro area through the financial sector. Simulation analysis shows that financial factors have played a key role during the crisis, dampening euro area GDP growth at the peak of the crisis, namely around mid-2009. After receding in the first quarters of 2011, financial factors subsequently weighed on economic activity in 2012, on the back of heightening financial market tensions and the sovereign debt crisis in some parts of the euro area.

The ECB has sought to resist downside risks to price stability in a context of increasing fragmentation by introducing several standard and non-standard monetary policy measures. Those measures have contributed to alleviate bank funding constraints, to contain the risk of a disorderly bank deleveraging process and therefore to ensure an adequate functioning of the monetary policy transmission mechanism.

I INTRODUCTION

Monitoring developments in interest rate statistics across euro-area countries is of pivotal importance for monetary policy decision-making. First, developments in interest rates are key for analysing the mechanism through which monetary policy is transmitted to the real economy, given the predominant role of the banking sector in providing financing to the non-financial private sector.[1] Second, they provide information on the degree of integration in the euro area retail banking market.[2] Third, they help to monitor structural developments in the banking system by providing insights into how banks set their margins and how the latter react to external developments. And fourth, they complement the monetary aggregate statistics by providing information on prices (interest rates).

The analysis of interest rate statistics across euro-area countries has been very insightful, particularly during the financial and sovereign debt crisis. The crisis affected all segments of the euro-area financial system and had a particularly strong impact on the banking sector. A well-functioning banking sector is needed in order to guarantee the effectiveness of the monetary policy transmission mechanism, especially in the euro area, where banks play a predominant role in providing external finance to the non-financial private sector. In particular, bank lending conditions in the euro-area have remained heterogeneous in an environment of high sovereign debt, sluggish economic activity, weak banks and high economic uncertainty in some countries. Consequently, very low ECB interest rates have not been fully passed through to bank lending rates in several countries where the effects of such an accommodative monetary policy stance would be particularly welcome.

The ECB has responded forcefully to the increasing financial fragmentation by introducing several standard and non-standard monetary policy measures.[3] These measures have gone a long way towards alleviating financial market tensions, although the fragmentation of euro area credit markets still remains elevated despite recent improvement.

Against this background, this paper analyses the bank lending rate pass-through in the euro area in a context of high financial fragmentation. The paper is organised as follows. Section 2 presents the construction of cost-of-borrowing indicators to describe developments in interest rates on loans to non-financial corporations and households. The section also analyses developments in interest rates on loans to small and medium-sized enterprises (SMEs). Section 3 focuses on the impact of financial market tensions and fragmentation in bank funding conditions on bank lending rates across countries in the euro area.[4] The main contribution of the section is to provide new empirical evidence on the interest rate pass-through in the four largest euro area economies. Section 4 complements the previous analysis by shedding light on the propagation of bank lending rates to the broader economy using a Dynamic Stochastic General Equilibrium (DSGE) model with financial frictions, and by quantifying the impact of financial factors on euro area business cycles. Section 5 concludes.

1 See, for instance, European Central Bank (2012a).
2 See, for instance, European Central Bank (2012b).
3 Full financial integration in the banking sector implies that all market participants: *i)* face a single set of rules; *ii)* have equal access to the set of financial instruments and/or services available in the market; and *iii)* receive equal treatment when they participate in the market. See, for example, European Central Bank (2014).
4 A subsection is also included covering deposit rates and bank wholesale funding costs.

2 CROSS-COUNTRY HETEROGENEITY IN BANK LENDING RATES IN THE EURO AREA

This section computes an indicator of the cost of borrowing for non-financial corporations that takes into account the financial structure of firms. The indicator is based on detailed interest rate statistics provided by Monetary Financial Institutions (MFIs) and enhances cross-country comparability, which until now has been limited owing to the differing impact of overdrafts on short-term lending rates. The indicator is then used to describe developments in interest rates on loans to non-financial corporations in the four largest euro area economies. The section also describes developments in the cost of borrowing for households for house purchase and in the cost of funds for SMEs.

2.1 AN INDICATOR OF THE COST OF BORROWING FOR EURO AREA NON-FINANCIAL CORPORATIONS

The financial crisis has led to an increasing use of country-specific bank lending rate information in the regular assessment of euro area economic conditions and in the analysis of the bank lending rate channel of the monetary policy transmission mechanism. However, current practices by euro area central banks in the use, forecasting and reporting of lending rates vary substantially across countries, compromising the accurate assessment of cost-of-borrowing developments in the euro area. For example, the ECB's official publications usually report MFI interest rates applied to new business volumes. Sometimes MFI interest rates are re-weighted using outstanding amounts to compute composite lending rates for countries and for the euro area as a whole.[5] Hence, the ECB has identified a need to develop a common methodology for the compilation of new indicators of the cost of borrowing for euro area non-financial corporations.

The calculation of cost-of-borrowing indicators using a common methodology for aggregating lending rates across countries is based on MFI interest rate statistics, which are considered the most relevant source of information for bank lending rates in the euro area. MFI interest rates are collected by the statistical departments of the Eurosystem. These data are regularly aggregated on the basis of monthly new business volumes and start in 2003. Four basic categories of lending rates per country are used in the calculations: short-term and long-term lending rates both to non-financial corporations and to households for house purchase. Long-term lending rates to non-financial corporations and short and long-term rates on loans to households for house purchase are obtained directly from the MFI interest rate statistics. The compilation of short-term lending rates to non-financial corporations, by contrast, needs to account for two additional technical factors: the importance of overdrafts as a main source of financing for firms in some large euro area economies (e.g. Italy) and the computation of an estimate of the share of long-term loans issued at floating rates, which are akin to short-term loans.[6] In particular, interest rates on short-term loans to non-financial corporations are aggregated on the basis of interest rates on overdrafts and bank lending rates on loans with a rate fixation period of less than one year, as follows:

$$CLI_{ST}^{NFC} = BLR_{overdraft}^{NFC} \frac{Overdrafts^{NFC}}{Totloans_{ST}^{NFC}} + BLR_{ST}^{NFC} \left[\frac{(Outloans_{ST}^{NFC} - Overdrafts^{NFC}) + \alpha (Outloans_{LT}^{NFC})}{Totloans_{ST}^{NFC}} \right]$$

Where:

- CLI_{ST}^{NFC} is the short-term lending rate to non-financial corporations that accounts for overdrafts;

5 See, for example, European Central Bank (2005 and 2006).
6 Data on overdrafts refer to outstanding amounts from the MFI balance sheet database.

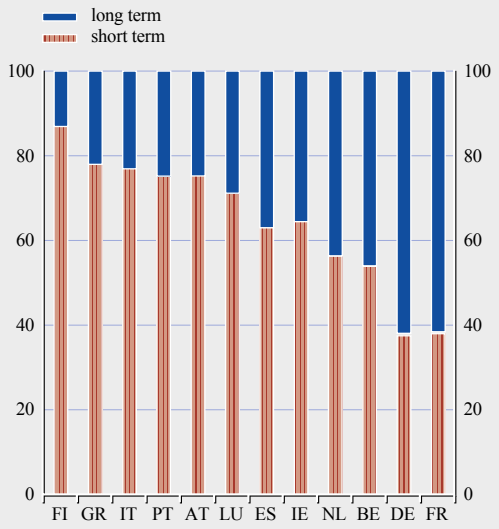
- $BLR^{NFC}_{overdraft}$ is the bank lending rate on overdrafts to non-financial corporations;
- BLR^{NFC}_{ST} is the bank lending rate on loans to non-financial corporations with an interest rate fixation period of up to one year;
- $Overdrafts^{NFC}$ is the volume of overdrafts held by non-financial corporations;
- $Outloans^{NFC}_{ST}$ is the volume of outstanding short-term loans to non-financial corporations (of up to one year), including overdrafts;
- $Outloans^{NFC}_{LT}$ is the volume of outstanding long-term loans to non-financial corporations (of more than one year);
- $\alpha = \left(\frac{1}{12}\right)\sum_{i=0}^{11}\left(\frac{Outloans^{NFC}_{LT,\,flrate}}{Outloans^{NFC}_{LT}}\right)_{t-i}$, where $Outloans^{NFC}_{LT,\,florate}$ is the volume of outstanding long-term loans issued at floating rate and $Outloans^{NFC}_{LT}$ is as defined before;[7]
- $Totloans^{NFC}_{ST}$ is the total outstanding amount of short-term loans to non-financial corporations $\left(Totloans^{NFC}_{ST} = Outloans^{NFC}_{ST} + \alpha\,(Outloans^{NFC}_{LT})\right)$.

Two weighting schemes can be used to aggregate composite lending rates at the national and the euro area level: one based on the outstanding amount of loans by MFIs (MFI balance sheet data) and the other based on new business loans by MFIs (MFI interest rate – MIR – statistics).

On the one hand, weights based on outstanding amounts capture more accurately the financing structure of the economy, as they reflect the economic importance of loans with different maturities in the financing structure of firms. However, methodological differences affect the comparability between MFI balance sheet data and the MFI interest rate statistics used in the previous section to compute the cost of borrowing indicators.[8] Hence, aggregating MFI interest rates on the basis of outstanding amounts provides only a rough estimate of the cost of borrowing for non-financial corporations and introduces an upward bias in the weight of loans with long maturities (see Chart 1 and

Chart 1 Maturity breakdown of loans to non-financial corporations based on outstanding amounts

(percentages; December 2013)



Sources: ECB and own calculations.
Notes: Short term loans are those with a maturity of up to one year, plus overdrafts and the share of long term loans issued at a floating rate.

7 Data on the volume of outstanding long-term loans at floating rates has only been available since June 2010 on a quarterly basis. Hence, the volume is assumed to remain constant in each month within the quarter. Moreover, when data are not available at the end (owing to publication lags) and at the beginning of the sample (between January 2003 and May 2010), the latest and the first observed value are applied, respectively.

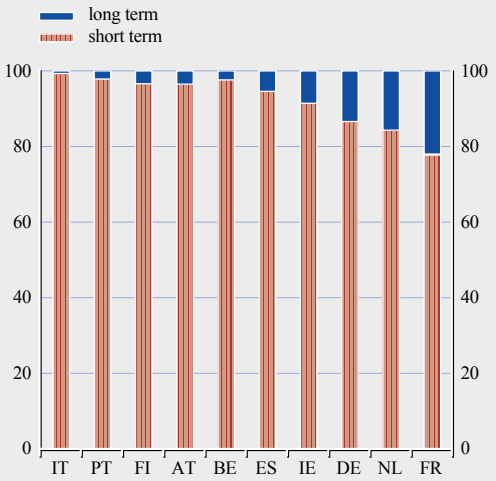
8 MFI balance sheet data classify loans based on maturity, while MFI interest rate data are based on the interest rate fixation period.

Chart 3a). Moreover, outstanding amounts do not reflect the granular statistical breakdown available in Monetary Financial Institutions Interest Rate (MIR) statistics.

On the other hand, an aggregation based on new business volumes would help overcome issues concerning database mismatches and time series granularity. It would also provide a better measure of the impact of the marginal cost of a new loan on the overall financing cost structure. However, an aggregation based on new business volumes overweighs short-term instruments, which are frequently renewed (e.g. overdrafts; see Chart 2 and Chart 3b). Moreover, new business volumes are highly volatile on a monthly basis, as they react relatively fast to current economic conditions, which may favour the issuance of short-term versus long-term loans. In turn, this volatility might make it difficult to extract the genuine underlying dynamics in retail lending rates. Furthermore, the use of one weighting scheme rather than the other has also an impact on the aggregation of lending rates for the euro area, as country shares may vary considerably depending on the scheme (see the case of Italy and Spain for lending to households for house purchase in Chart 4 and 5).

Chart 2 Maturity breakdown of loans to non-financial corporations based on new business volumes

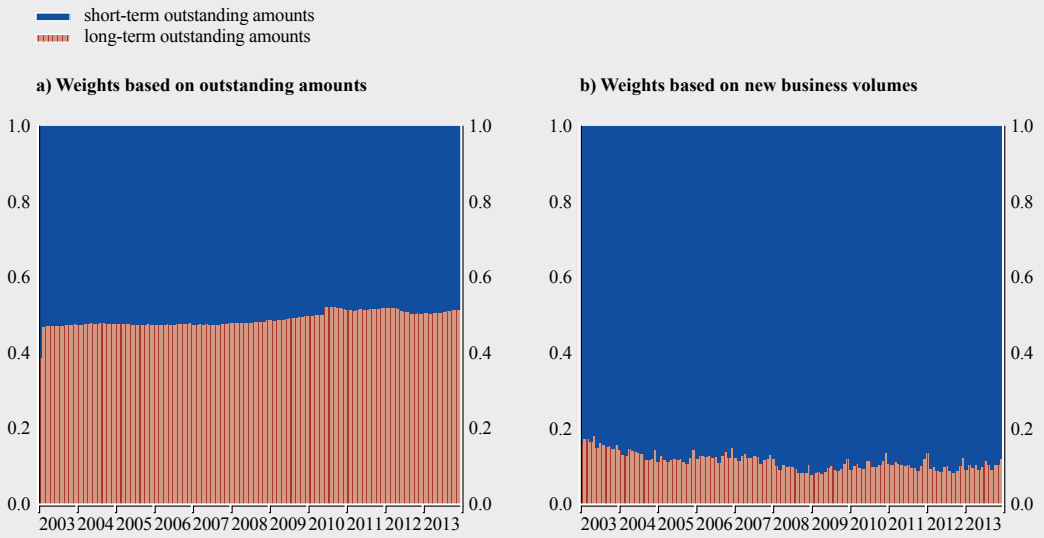
(percentages; December 2013)



Sources: ECB and own calculations.
Notes: Short-term loans are those with a maturity of up to one year, plus overdrafts and those long-term loans issued at a floating rate.

Chart 3 Maturity breakdown of loans to non-financial corporations for the euro area

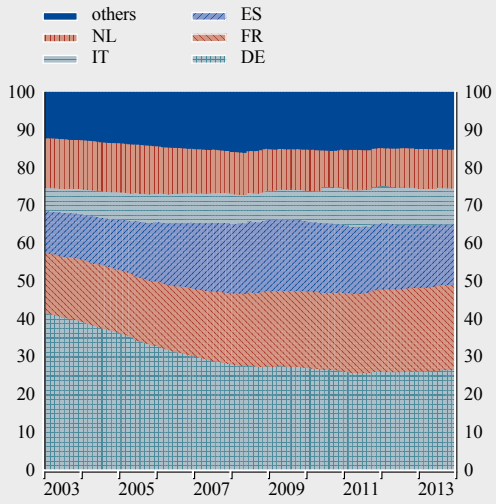
(percentage; January 2003 to December 2013)



Sources: ECB and own calculations.

Chart 4 Country weights based on outstanding amounts in total lending to households for house purchase

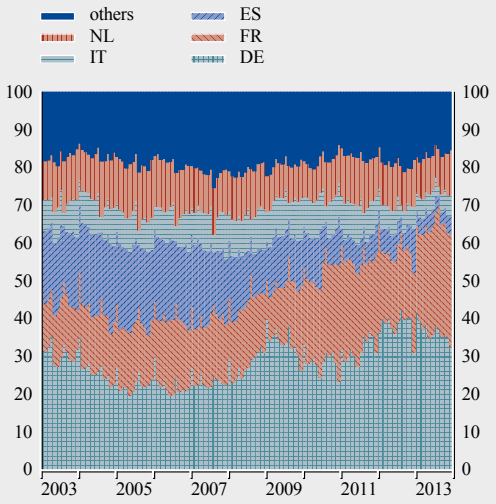
(in percentage of the euro area; January 2003 to December 2013)



Sources: ECB and own calculations.

Chart 5 Country weights based on new business volumes in total lending to households for house purchase

(in percentage of the euro area; January 2003 to December 2013)

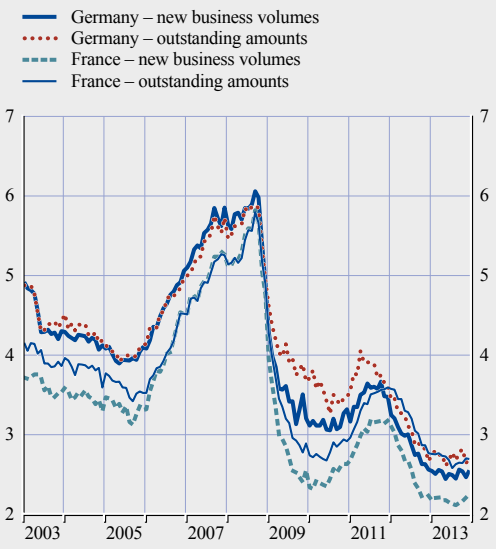


Sources: ECB and own calculations.

Hence, to strike a balance between the two weighting schemes, the 24-month moving average of new business volumes has been used in the aggregation of the cost-of-borrowing indicators. This simple transformation filters out excessive monthly volatility in new business volume flows while preserving homogeneity of methods across different levels of aggregation. The aggregation of the short-term cost-of-borrowing indicators for NFCs also accounts for overdrafts, which are a big share of firms' financing in some euro area countries. The weighting scheme leads to a marginal impact of the inclusion of overdraft for those countries in which the latter constitutes a minor source of financing.

Chart 6 Comparison between cost-of-borrowing indicator for loans to non-financial corporations aggregated with new business volumes versus outstanding amounts

(percentages per annum; March 2003 to December 2013)



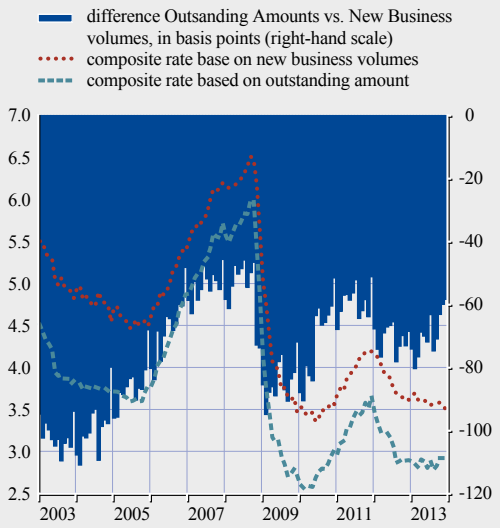
Sources: ECB and own calculations.

At the country level, four composite lending rates by maturity and sector were constructed: total short-term and long-term lending rates and total lending rates to non-financial corporations and households for house purchase. As an example, Chart 6 shows for France and Germany the comparison between the cost-of-borrowing indicator for total loans to non-financial corporations based on the smoothed new business volume weights and the corresponding indicator aggregated with outstanding amounts. The latter tends to be more sensitive to variations in long-term interest rates than the former, as the share of

long-term loans based on outstanding amounts is higher than that based on new business volumes (see Charts 1 and 2). This greater sensitivity is evident in the periods where lending rates aggregated on the basis of outstanding amounts are higher than those aggregated on the basis of new business volumes.

Chart 7 Comparison between cost-of borrowing indicator for total loans to non financialcorporations aggregated with new business volumes versus outstanding amounts

(percentages per annum; March 2003 to December 2013)



Sources: ECB and own calculations.

At the euro area level, eight composite lending rates by maturity and sector were constructed: short-term and long-term lending rates to non-financial corporations and to households for house purchase, total short-term and long-term lending rates, and total lending rates to non-financial corporations and households for house purchase. Again, as an example, the difference between the two weighting schemes applied to short-term lending rates for the euro area as a whole is illustrated in Chart 7. The composite rate aggregated with outstanding amounts is generally lower than the one based on new business volumes, as the latter, as mentioned before, introduces a bias towards shorter maturities, which are associated to higher interest rates. These composite lending rates also make it possible to compute a total-cost-of-borrowing indicator for the euro area.[9]

2.2 CHANGES IN BANK LENDING RATES TO NON-FINANCIAL CORPORATIONS AND HOUSEHOLDS

The cost-of-borrowing indicators for non-financial corporations and households in the euro area are presented in Charts 8 and 9, respectively. The charts show that the cost of bank borrowing for non-financial corporations and households has exhibited not only different levels, but also different dynamics over time since the start of the financial crisis, and particularly since the intensification of sovereign debt concerns.

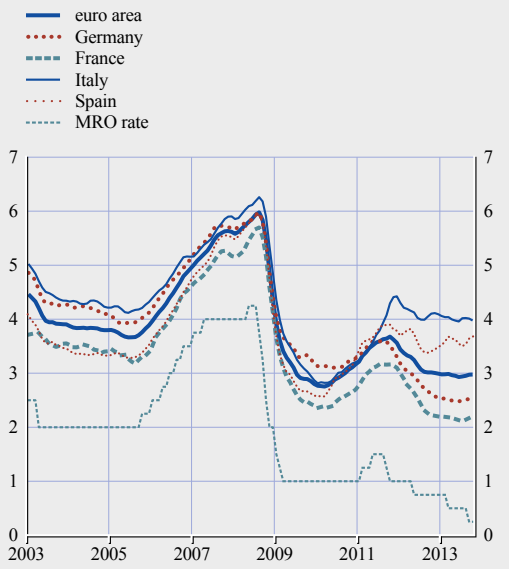
Bank lending rates to non-financial corporations broadly tracked the ECB's main refinancing rate in the four largest euro area economies in the early stages of the financial crisis – late 2008 and in 2009 (see Chart 8). Thereafter, in 2010, following the intensification of sovereign debt tensions and in response to the increase in policy interest rates in early 2011, bank interest rates on loans to non-financial corporations started to rise more rapidly in Spain and Italy than in France and Germany. Since late 2011, the cuts made to policy interest rates have translated broadly into lower interest rates on loans to non-financial corporations in France and Germany. However, the pass-through has been much more sluggish in the case of Spain and Italy, where interest rates remain at a higher level than those recorded in the other two large euro area economies.

The cost-of-borrowing indicator for households for house purchase is presented in Chart 9. The chart shows that bank lending rates in Spain and Italy reacted particularly strongly to the cuts in policy interest rates in late 2008 and in 2009. The strong reaction reflects the higher share

9 The new harmonised indicators are available to external users via the Statistical Data Warehouse.

Chart 8 Composite indicator of the cost of borrowing for non-financial corporations

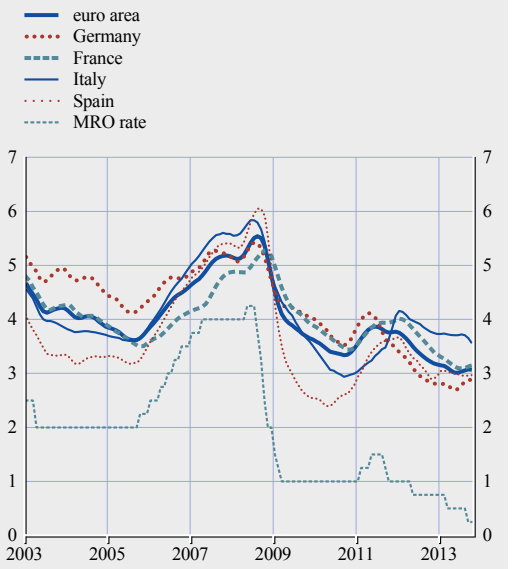
(percentages per annum; three-month moving averages; March 2003 to December 2013)



Sources: ECB and ECB calculations.
Note: MRO rate stands for "main refinancing operations rate".

Chart 9 Composite indicator of the cost of borrowing for households for house purchase

(percentages per annum; three-month moving averages; March 2003 to December 2013)



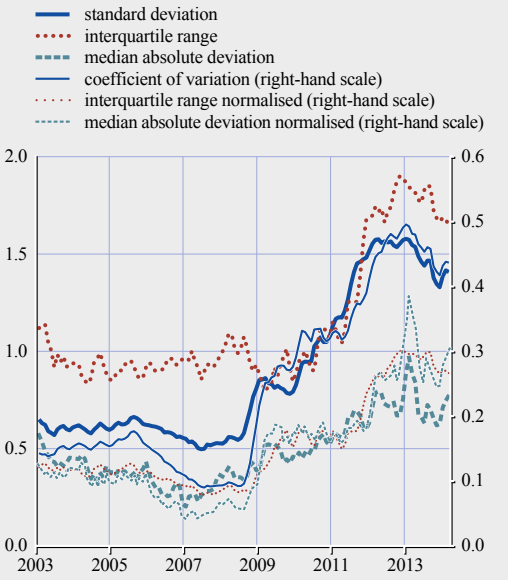
Sources: ECB and ECB calculations.
Note: MRO rate stands for "main refinancing operations rate".

of floating mortgage rate loans in these two countries than in other large economies in the euro area. After the start of the sovereign debt crisis in early 2010, however, interest rates in these two countries increased more sharply than in Germany and France. Following the policy rate cuts implemented since late 2011, mortgage interest rates have tended to contract across countries, as expected. Nevertheless, in spite of monetary policy rates having reached record low levels, mortgage rates in Italy and Spain remain above the levels observed in 2010.

The heterogeneous developments in the composite indicator of the cost of borrowing for non-financial corporations and households are reflected in measures of dispersion of lending rates across countries. Box 1 describes six traditional measures of dispersion and assesses their relative advantages and disadvantages. It also describes how the six measures can be combined into a synthetic measure of dispersion. Charts 10 and 11 present the six measures for non-financial corporations and households,

Chart 10 Dispersion measures for the cost-of-borrowing indicator of non-financial corporations

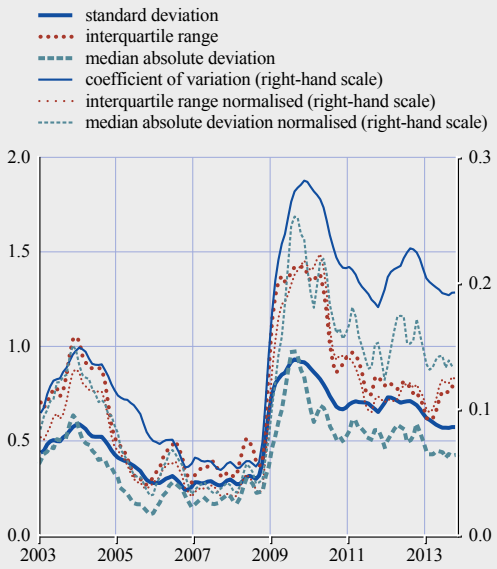
(three month moving averages; March 2003 to December 2013)



Sources: ECB and ECB calculations.
Note: Dispersion measures are computed for a fixed composition of countries (euro area 12 countries).

Chart 11 Dispersion measures for the cost-of-borrowing indicator of households for house purchase

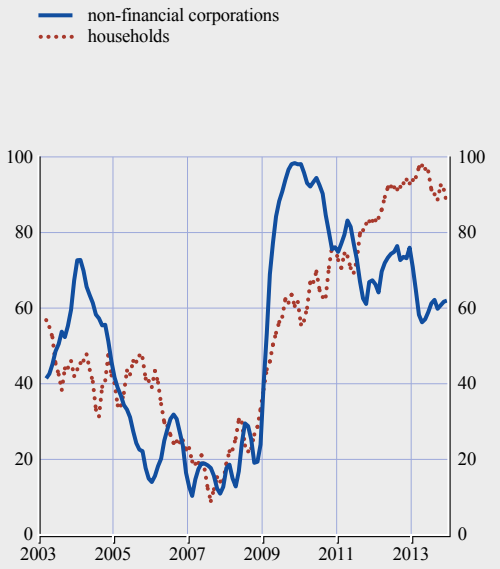
(three month moving averages; March 2003 to December 2013)



Sources: ECB and ECB calculations.
Notes: Dispersion measures are computed for a fixed composition of countries (euro area 12 countries).

Chart 12 Synthetic measures of the dispersion of cost-of-borrowing indicators for non-financial corporations an households

(index scaled between 0 and 100; three-month moving averages; March 2003 to December 2013)



Sources: ECB and ECB calculations.
Note: See Box 1 for more details regarding the calculation of the synthetic measures of dispersion.

respectively, while Chart 12 presents the synthetic measures of dispersion. Dispersion in borrowing rates to non-financial corporations and households declined over the period 2003-07, reaching low levels in 2007 (Charts 10, 11 and 12). However, dispersion of composite borrowing rates to non-financial corporations and households increased significantly in the early stages of the crisis in late 2008 and in 2009. In the case of non-financial corporations, some measures point to stabilisation in 2010, only to start rising again in 2011. More recently, indicators of dispersion for non-financial corporations point to a reduction in dispersion since end-2012 and early 2013. In the case of the composite lending rate to households, dispersion has declined substantially from the peak reached in 2009 and 2010, but remains elevated by historical standards (Charts 11 and 12). However, one has to be cautious when interpreting these measures, as they are based on a sample of 12 countries, which makes some indicators highly volatile.

Box 1[1]

CONSTRUCTING A SYNTHETIC MEASURE OF DISPERSION IN RETAIL LENDING RATES

The financial crisis and the ensuing sovereign debt crisis have led to financial fragmentation in the euro area. Measuring the extent of dispersion accurately in a small group of countries such as those participating in the euro area is not straightforward. Several statistical measures can be used, each of which has advantages and disadvantages. This box presents and compares six

1 This box was prepared by Piotr Bojaruniec.

traditional measures of dispersion to assess the level of heterogeneities in bank lending rates across euro area countries. The box also describes how the six measures can be combined into a synthetic measure of dispersion.

Measuring dispersion in retail lending rates

Six statistical measures can be used to assess the level of cross-country dispersion in bank lending rates in the euro area. The measures are defined as follows:

Standard deviation (STD): $STD = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$, where N is the number of countries, x_i is the value of the variable of interest in country i, and $\mu = \frac{1}{N}\sum_{i=1}^{N} x_i$ is the cross-country mean of these variables.

Coefficient of variation (CV): $CV = \frac{STD}{\mu}$. The coefficient of variation (CV) equals the standard deviation (STD) divided by the mean.

Interquartile range (IQR): $IQR = Q3 - Q1$, where Q3 and Q1 are the third and the first quartiles of the distribution of the variables of interest, respectively. The first quartile is defined as the value of the variable for which the cumulative number of observations exceeds for the first time 25% of the total number of observations, whereas the third quartile is defined as the value for which the cumulative number of observations exceeds for the first time 75%.

Interquartile range normalised (IQRN): $IQRN = IQR/(Q1+Q3)$. The interquartile range normalised (IQRN) equals the interquartile range divided by the sum of the first and third quartiles.

Median absolute deviation (MAD): $MADN = median_{i(xi\ -\ mediani\ (xi)/\ mediani\ (xi)}$, where $median_{i\ (\bullet)}$ is the median of the objects of interest, either the variables themselves or the absolute differences between the variables and their median.

Median absolute deviation normalised (MADN): **MADN = mediani(xi − mediani (xi)/ mediani (xi)**. The median absolute deviation normalised is the median absolute deviation divided by the median of the variable.

If all the variables of interest would adopt the same value across countries, then all these measures would equal zero, while they would adopt a higher positive value as variables become more disperse across countries.

The six measures of dispersion are presented in Charts 10 and 11 in the main text for the cost-of-borrowing indicator of non-financial corporations and households for house purchase.

Advantages and disadvantages of different measures of dispersion

The six measures above are among the most common statistical measures used to evaluate dispersion across variables. They differ across two important dimensions:

Normalisation: The first, third and fifth measures are expressed in the same units as the quantity being measured. However, the second, fourth and sixth measures are normalised, in the sense that they control for the mean, the sum of the quartiles or the median of the variable

of interest. The advantage of normalised measures is that they allow immediate comparison between data sets with different means. This property is particularly relevant in the present case because bank interest rates have varied substantially over the years.[2] However, a disadvantage of normalised measures is that they are sensitive to changes in the value used to perform the normalisation. In particular, when this value falls towards zero, the measure will increase rapidly. This critique might be more relevant in the case of the normalised median absolute deviation than in the case of the coefficient of variation or the normalised interquartile range.[3]

Robustness: While extensively used in the statistical literature, the first and second measures may be greatly influenced by a small number of large observations.[4] For example, large observations in bank lending rates may be due to low transaction volumes which make developments at the country level non-representative. By contrast, robust measures of dispersion overcome this weakness and are unaffected by the presence of outliers. The interquartile ranges (third and fourth measures) and the median absolute deviations (fifth and sixth measures) control for extreme values that can affect the standard deviation or the coefficient of variation. However, when the sample is small, as in the present case, these measures can be sensitive to changes in the composition of countries that fall within the interquartile range.

Constructing a synthetic measure of dispersion

Because each of the measures has advantages and disadvantages, there is no strong reason to prefer any single measure to the others. Hence, in what follows a synthetic measure of dispersion will be constructed out of the six individual measures mentioned before. A difficulty in this respect is that the measures are expressed in different scales (some of the measures are normalised, while others are not). Hence, in order to combine them into a synthetic measure of dispersion, a two-step approach was followed.

First, the cumulative empirical distribution function was computed for each of the measures of dispersion based on their observations for the entire sample period (January 2003 to December 2013). This transformation sets the range of each of the variables to the interval between 0 and 1, allowing comparability across them. As the set of observations is finite, the cumulative empirical distribution function was computed using the following formula:

$$F(x) = P(X \leq x) = \sum_{xi \leq x} P(X = x_i)$$

where: $P(X \leq x)$ is the probability that the random variable X will not exceed a given value x and $P(X \leq x_i)$ is the probability that the random variable X equals x_i. The probability of occurrence of a certain value is estimated from its relative frequency over the sample period: $P(X = x_i) = \frac{n_i}{N}$, where: n_i is the number of occurrences in a sample of size N.

2 For example, mean interest rates fell substantially following the implementation of both standard and non-standard measures. Indeed, while the standard deviation (a non-normalised measure) might remain unchanged, the coefficient of variation (a normalised measure) would imply a higher level of dispersion if the average of the series falls over time.
3 When the mass of the distribution shifts to the left, the median will tend to be lower than the mean, as most of the observations will lie on the left of the mean.
4 The standard deviation or the coefficient of variation can be made arbitrarily large by increasing only one observation.

Second, a synthetic measure of dispersion was computed as the simple average of the values of the cumulative distribution function for each of the six dispersion measures at each point in time, as follows:

$$Disp = \left(\frac{1}{6}\right)\left(\sum_{i=1}^{6} F(x_t)_i\right)$$

where is the value of the cumulative empirical distribution function for dispersion measure i at time t. This aggregated measure also takes values in the range from 0 to 1.

The synthetic measures of dispersion constructed out of the six individual measures mentioned before are presented in Chart 12 for non-financial corporations and households for house purchase (in the Chart, the measures have been rescaled to range from 0 to 100, rather than from 0 to 1).

2.3 HETEROGENEITIES IN BANK LENDING RATES FOR SMALL AND MEDIUM-SIZED ENTERPRISES

The spread between lending rates on small and large loans to non-financial corporations has also been heterogeneous across countries since the start of the financial crisis. On the basis of the assumption that loans to small and medium-sized enterprises (SMEs) are generally smaller than loans to large corporations, a breakdown of lending rates into those applied to small loans and those applied to large loans permits a more detailed analysis of the borrowing costs of SMEs.[10] A data series on MFI interest rates distinguishing between lending rates on loans of up to €1 million and those on loans of over €1 million is available in the ECB's Statistical Data Warehouse (Chart 13).[11] The chart shows that lending rates on smaller loans are higher than those on large loans for all the countries considered.[12] It also shows that bank financing conditions for SMEs deteriorated sharply during the crisis, in late 2008 and in 2009, in the four largest euro area countries with the exception of Germany. Bank financing conditions deteriorated particularly in France and Spain. The situation improved across countries during 2010, but deteriorated again after 2011. The spread reached record high levels in 2012 in Italy and Spain, although it has declined since the autumn of that year, particularly in Spain.

Because the €1 million ceiling used to define small loans may be too high as a proxy for lending to SMEs, since June 2010 the ECB has collected more refined data on bank interest rates applied to small loans. The category of loans of up to €1 million is broken down into two sub-categories: loans of up to €0.25 million and loans of over €0.25 million and up to €1 million. This additional breakdown affords a more precise measure of the borrowing costs of SMEs (see Box 2 for a description of improvements in the collection of MFI interest rates over time). The spread between interest rates on very small loans and those on large loans is shown in Chart 14. The spread has increased since the summer of 2011, particularly in the case of Italy and Spain. In France and Germany, the spread has also increased since the beginning of 2012, although to a much lesser extent. The spread between bank lending rates for very small loans and those for large loans currently stands above its long-term average for the euro area as a whole.

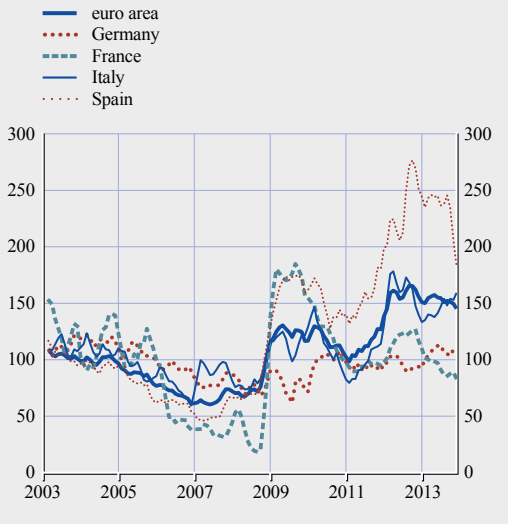
10 The size of a loan may also be related, to some extent, to its purpose (e.g. inventory financing, working capital, long-term investment) and duration.

11 These data can be downloaded from the Statistical Data Warehouse at http://sdw.ecb.europa.eu/browse.do?node=9484266

12 It is more difficult and more expensive for SMEs and young firms to access external financing owing to their higher transaction costs, weaker bargaining power, higher business risk and low ratio of collateral to liabilities. See Berger and Udell (2003), Rauh (2006) and Fee *et al.* (2009).

Chart 13 The spread between lending rates on small and large loans to non-financial corporations

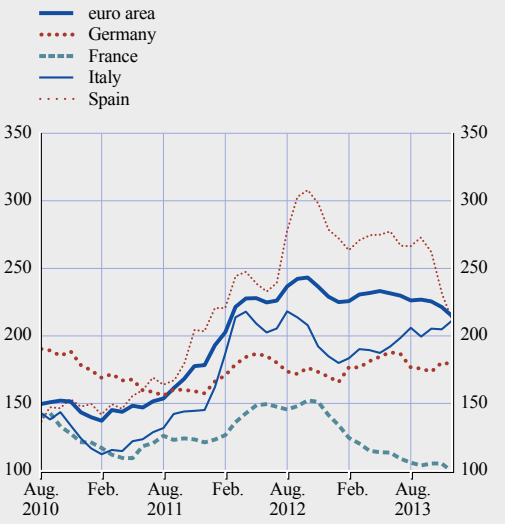
(percentages per annum; three-month moving averages; March 2003 to December 2013)



Sources: ECB and own calculations.
Note: Small loans are loans of up to €1 million, while large loans are loans of above €1 million.

Chart 14 The spread between lending rates on very small and large loans to non-financial corporations

(percentages per annum; three-month moving averages; August 2010 to December 2013)



Sources: ECB and own calculations.
Note: Very small loans are loans of up to €0.25 million, while large loans are loans of above €1 million.

When assessing the cross-country dispersion of MFI interest rates on small and large loans, it should be kept in mind that business volumes differ widely across countries. In particular, in some countries certain market segments are very small or virtually non-existent. In such cases, the underlying new business volume may be very volatile and the interest rate may reflect occasional transactions granted under atypical conditions. Hence, such lending rates might not be representative of actual lending conditions in these countries. Table 1 reports an overview of the importance of the various bank lending categories (loan size and maturity) for non-financial corporations for the four largest economies and the euro area. The table uses the more refined data on bank interest rates applied to small loans available since June 2010.[13] The non-existence or "thinness" of a particular market segment in one country means that the corresponding interest rate will receive a lower rate when computing an aggregate for that country. Hence, this "thinness"

Table 1 Business volumes of bank lending within countries by instrument category

(percentage of total; averages between June 2010 and December 2013)

	Loans up to €0.25 million			Loans between €0.25 and €1 million			Loans above €1 million		
	up to one year	over one and up to five years	over five years	up to one year	over one and up to five years	over five years	up to one year	over one and up to five years	over five years
euro area	11	1	1	10	1	1	68	3	4
Germany	4	2	1	8	1	2	71	4	8
France	5	5	6	7	1	6	59	3	7
Italy	20	0	0	16	0	0	62	1	0
Spain	24	1	0	6	0	0	62	3	2

Sources: ECB and own calculations.

13 See European Central Bank (2006) for a previous analysis of differences in business volumes of bank lending across countries.

calls for care when assessing fragmentation in lending rates based on developments in granular interest rates. For example, focusing only on small loans (loans of up to €1 million), it can be seen from Table 1 that a comparison across countries between lending rates with an interest rate fixation period of more than one year makes sense only for Germany and France, whereas for Spain and Italy such market segments are almost non-existent. More generally, interest rates on loans to non-financial corporations with an interest rate fixation period of more than one year do not appear highly representative of the marginal financial structure of euro area non-financial corporations because they tend to rely heavily on loans with a shorter fixation period.

Box 2[1]

IMPROVEMENTS IN THE COLLECTION OF MFI INTEREST RATE STATISTICS

Monetary and financial statistics must be accurate, timely and reliable in order to enable the effective implementation of monetary policy. Financial innovation calls for a continuous effort to improve the statistical framework of the Eurosystem. In this context, harmonised MFI interest rate statistics have been produced since January 2003 and were further improved in June 2010.[2] This box describes developments in the collection of MFI interest rate statistics since their introduction in 2003.

The introduction of MIR statistics in 2003

In January 2003 the Eurosystem started compiling harmonised statistics on euro-denominated lending and deposits of domestic credit institutions (the largest component of MFIs) vis-à-vis households and non-financial corporations resident in the euro area. Previously, retail interest rate statistics were not harmonised, which hampered comparison across countries. The new framework introduced in 2003 addressed these drawbacks and therefore represented an important step towards better describing the retail banking system across euro area countries.

The enhancements introduced in 2010

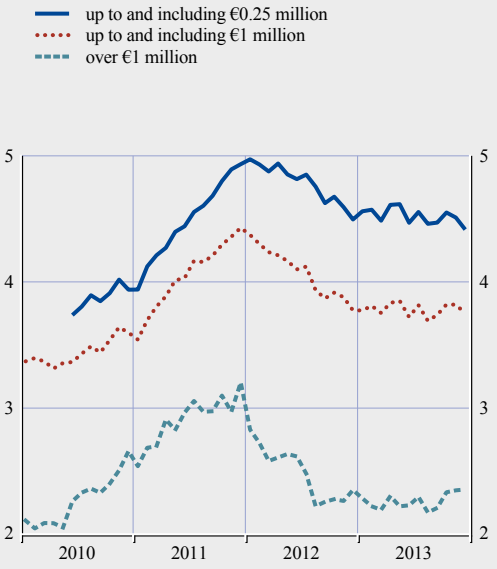
In light of a changing macroeconomic environment and as part of the efforts to further improve the quality, reliability and accuracy of interest rate statistics, a number of enhancements were introduced in June 2010.[3] These were:

- A more detailed breakdown of bank interest rates applied to small loans to non-financial corporations. The threshold of the category of small loans (defined as up to and including €1 million) was considered too high to identify loans granted to SMEs. Therefore two sub-categories were introduced which capture loans of up to €0.25 million and loans of over €0.25 million and up to €1 million (see Chart A for the euro area and Charts 13 and 14 in the main text for a cross-country analysis).

1 This box was prepared by Silvia Scopel.
2 See Regulation ECB/2008/32.
3 For a more detailed description of all the changes introduced in 2010, see European Central Bank (2011).

Chart A MFI interest rates on loans to non-financial corporations broken down by size of the loan

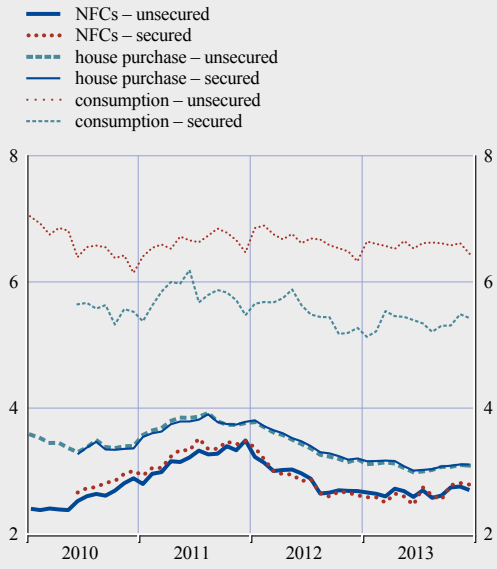
(percentages per annum; January 2010 to December 2013)



Source: ECB.

Chart B MFI interest rates on loans broken down by borrower and guarantee

(percentages per annum; January 2010 to December 2013)



Source: ECB.

- Separate information on interest rates on guaranteed and collateralised loans. These statistics are of interest when studying the dynamics behind banks' behaviour in setting interest rates (see Chart B).

- Information on the original maturity of new loans. The new statistics distinguish business volumes within the category of new loans to non-financial corporations with an initial rate fixation period of up to one year and with an original maturity of up to one year from those with an original maturity of over one year.

- Identification of interest rates on loans to sole proprietors within the household sector. The new statistics bring clarity into the household sector by identifying and separating these micro-firms, which are often run by one person only.

- A harmonised method of compiling rates on overdrafts and revolving loans, separately from credit card debt.

3 THE RETAIL BANK INTEREST RATE PASS-THROUGH AT TIMES OF FINANCIAL FRAGMENTATION

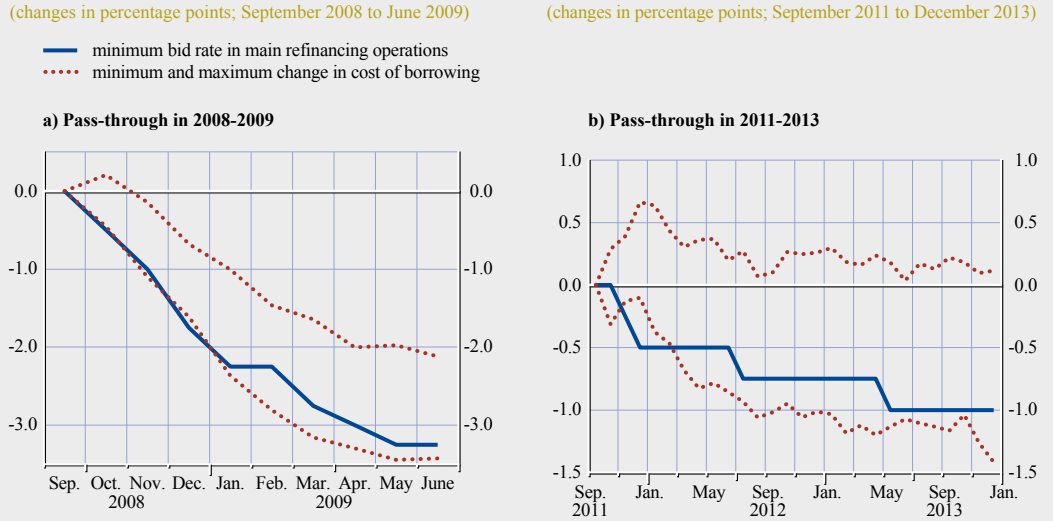
The effectiveness of monetary policy has been hindered by financial fragmentation, as suggested by the increased heterogeneity in bank lending rates observed since the start of the financial crisis in 2008, in spite of a single monetary policy. A number of factors seem to be at play to explain cross-country divergences in MFI lending rates. Lending rates tend to be lower in economies where bank competition is stronger and alternative, market-based sources of finance are available through more developed financial sectors. The observed heterogeneity in MFI lending rates may also reflect product heterogeneity, which may be difficult to classify in homogeneous categories in MFI interest rate statistics. Moreover, it may also reflect country-specific institutional factors, such as fiscal and regulatory frameworks, enforcement procedures and collateral practices. Other factors affecting divergence in lending rates might reflect the amplifying effects of increasing credit risk and bank risk aversion in an environment of weak economic growth, potential constraints on bank capital and the impact of bank funding fragmentation.

The following sub-sections will focus on those factors which may have had a bearing on bank lending rates over and above the traditional pass-through of policy interest rates. These factors include fragmentation in bank funding conditions, the quantity and quality of bank capital, and credit risk and risk perceptions for bank lending rates and bank lending policies more generally.[14]

3.1 THE BREAKDOWN OF STANDARD PASS-THROUGH RELATIONSHIPS

The interest rate pass-through of monetary policy has weakened during the sovereign debt crisis in some euro area countries, suggesting that the stance of monetary policy is not being transmitted appropriately across countries. Chart 15a shows that the composite indicator of the cost of

Chart 15 Cumulative changes in the ECB policy rate and in the composite indicator of the cost of borrowing for non-financial corporations



Sources: ECB and own calculations.

14 Structural differences in bank lending rate-setting behaviour have been extensively analysed in previous ECB publications. For an analysis of heterogeneities in mortgage interest rates in the euro area, see Kok Sørensen and Lichtenberger (2007). See also European Central Bank (2005 and 2006) for a statistical approach to differences in interest rates in the euro area. For the analysis of the impact of sovereign and credit risk on convergence of bank lending and deposit interest rates, see Arnold and van Ewijk (2014).

borrowing for non-financial corporations responded rapidly and relatively homogeneously across countries to the 325 basis point cut in key ECB interest rates implemented between October 2008 and May 2009. By contrast, following the 100 basis point cut implemented between November 2011 and May 2013, bank lending rates to non-financial corporations have not responded in the same manner across euro area countries (see Chart 15b). As shown in that Chart, the lower bound of the range of changes in the cost of borrowing for non-financial corporations declined, broadly in line with the change in the policy rate during this period. However, the upper bound of changes increased despite lower key ECB interest rates.

Standard pass-through models consider policy interest rates and market interest rates to be the most direct determinants of retail bank lending rates. Retail bank lending rates have traditionally been modelled in a simple error correction framework with the following structure:

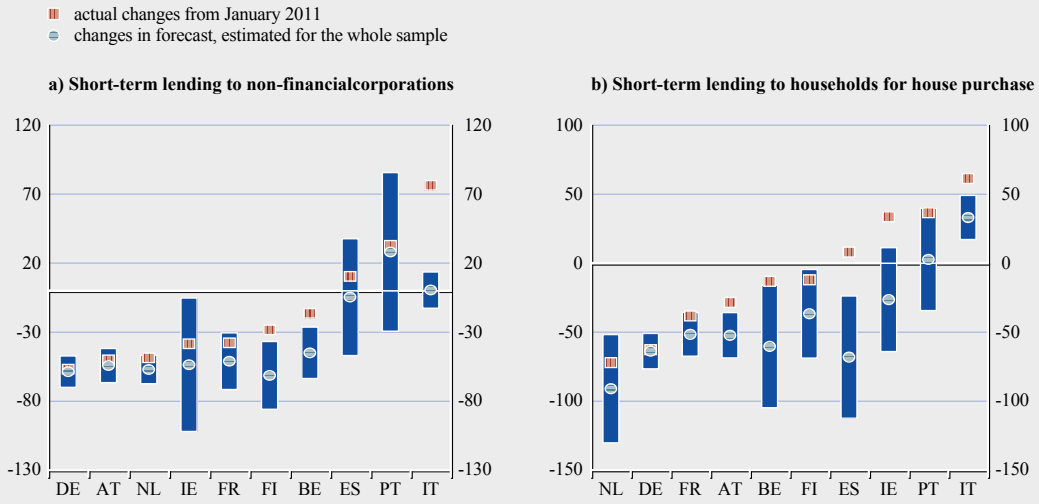
$$\Delta br_t = \sum_{k=0}^{K} \delta_k \Delta r_{t-k} + \sum_{m=1}^{M} \lambda_k \Delta br_{t-m} + \alpha(br_{t-1} - \beta r_{t-1} - \mu) + u_t \qquad (1)$$

where br_t denotes the bank lending rate and r_t is the reference market interest rate, i.e. the rate which serves as reference for the banks' cost of funding. Coefficient α represents the speed of adjustment to the long-term equilibrium, while coefficient β captures the long-run elasticity of bank lending rates to market reference rates. The coefficients regarding the lags of the first difference of market reference rates capture the short-run pass-through. Finally, Δ represents the first difference operator.[15]M

Model-based evidence tends to confirm that standard pass-through models are ill-equipped to explain increasing levels of heterogeneity in bank lending rates across euro area countries during the crisis. Chart 16 shows actual and projected changes in short-term lending rates for non-financial corporations and households between January 2011 (when the sovereign debt crisis intensified) and December 2013

Chart 16 Forecasted and actual changes in short-term lending rates between 2011 and 2013

(changes in basis points from January 2011 to December 2013)



Sources: ECB and own calculations.
Notes: Simple pass-through model. Rectangles show the average 95% confidence interval over the forecast period for a model estimated over the full sample. Countries are ordered from the lowest to the highest actual change in lending rates.

15 For a review of the academic literature, see European Central Bank (2009).

based on Equation (1). The estimation sample covers the period from January 2003, when data on harmonised MFI lending rates started to be collected, to December 2013. The chart shows that actual changes in short-term lending rates tend to be higher than those projected by the standard pass-through models, thus highlighting the potential presence of omitted variables in those models.

The next sub-section explores several factors that may help explain this breakdown in traditional pass-through relationships.

3.2 FACTORS AFFECTING THE MONETARY POLICY TRANSMISSION MECHANISM AT TIMES OF FINANCIAL FRAGMENTATION

The analysis of the monetary policy transmission mechanism has typically assumed that policy rates and market interest rates were the most direct determinants of retail bank lending rates. This analysis has been based on the assumption that there is no fragmentation in bank funding conditions, that financial institutions are well capitalised and that there is a low and stable level of risk. The focus has been on how fast and how extensively changes in policy interest rates are passed through to bank lending rates, while ignoring other factors such as access to bank funding, the quality and quantity of bank capital, and credit risk.[16] However, the financial crisis and the euro area sovereign debt crisis have brought to the fore the importance of fragmentation in bank funding conditions, low levels and poor quality of bank capital, and credit risk and risk perceptions for bank lending rates and bank lending policies more generally.

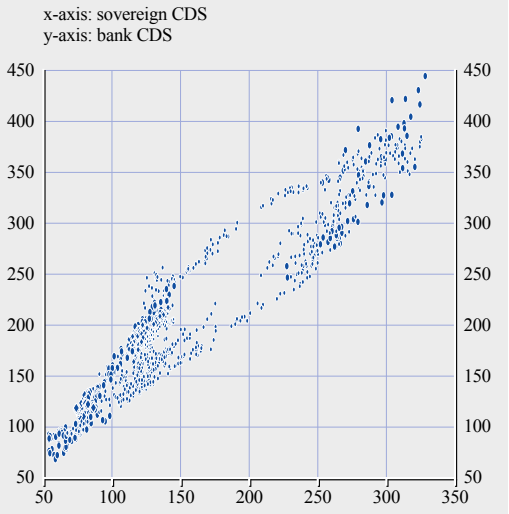
The next three sub-sections analyse the role of fragmentation in bank funding conditions, bank capital and the risk environment in the pass-through of monetary policy in the euro area over the recent past.

3.2.1 BANK COSTS AND ACCESS TO FUNDING

Fragmentation in banks' funding conditions arising from sovereign debt concerns is a factor that may help to explain the divergence observed in MFI lending rates and bank lending policies. One clear illustration of this phenomenon can be seen in the pricing of credit default swaps (CDSs) of sovereigns and resident financial institutions, where there has been a clear co-movement between sovereign stress and funding conditions of the financial sector (see Chart 17).[17] Moreover, in setting the remuneration on their deposits and the return on bonds issued in the market, banks "compete" at the retail level with high yields on bonds and Treasury bills issued by governments.

Chart 17 Bank and sovereign credit default swap spreads in the euro area

(1 January 2010 to 22 February 2014)



Sources: Thomson Reuters and own calculations.
Notes: The sovereign CDS spreads for the euro area are calculated as a weighted average of the five-year CDS spreads of 11 euro area countries using the ECB's capital key as weights. The countries included are Belgium, Germany, Ireland, Spain, France, Italy, the Netherlands, Austria, Portugal, Slovakia and Finland. The bank CDS spreads are calculated as the simple average across ten large banks in the euro area. Each dot represents both the sovereign and the bank CDS spreads on a certain day in each quarter.

16 Although such factors could still explain differences in the pass-through across countries; see Gropp *et al.* (2007).
17 See European Central Bank (2012c) for a more detailed analysis of financial market fragmentation and financial stability.

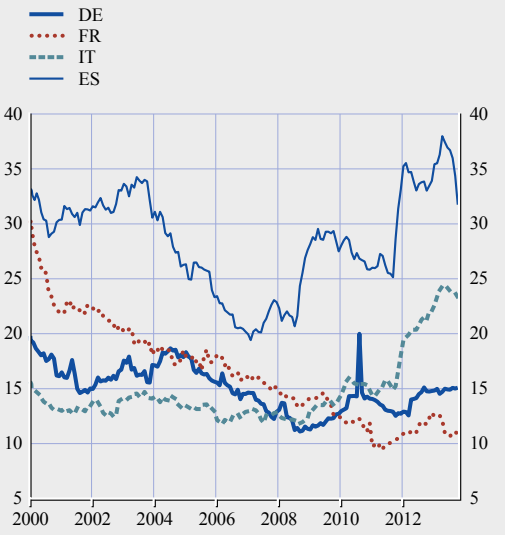
In countries where such yields have increased or have not declined at the same pace and to the same extent as policy rates, this association contributes to increase banks' funding costs, which may be passed through to bank lending rates.[18]

A factor that accentuates the inter-connection between bank and sovereign risks is the exposure of banks to domestic sovereigns through their holding of government debt securities. Since the outbreak of the financial crisis, a trend has been observed towards increasing the domestic base of banks' sovereign bond holdings, including in Italy and Spain (see Chart 18). In France and Germany the increase has been more modest.[19]

Euro area banks' composite cost of private unsecured funding (which combines interest rates on deposits and yields on bank debt) increased substantially in the early stages of the financial crisis in 2008 and in 2009, as well as

Chart 18 Share of domestic government debt securities held by Monetary Financial Institutions (MFIs) in individual countries

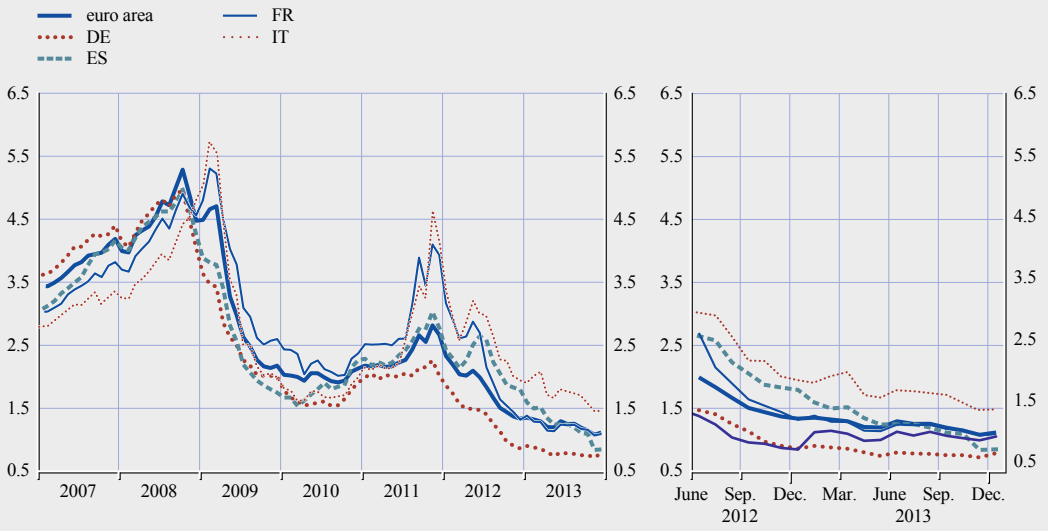
(percentage of amount outstanding of government debt securities; March 2000 to December 2013)



Sources: ECB and own calculations.

Chart 19 Banks' composite cost of deposit and non-secured market debt funding

(composite cost of deposit and non-secured market debt funding; annual percentages; January 2009 to December 2013)



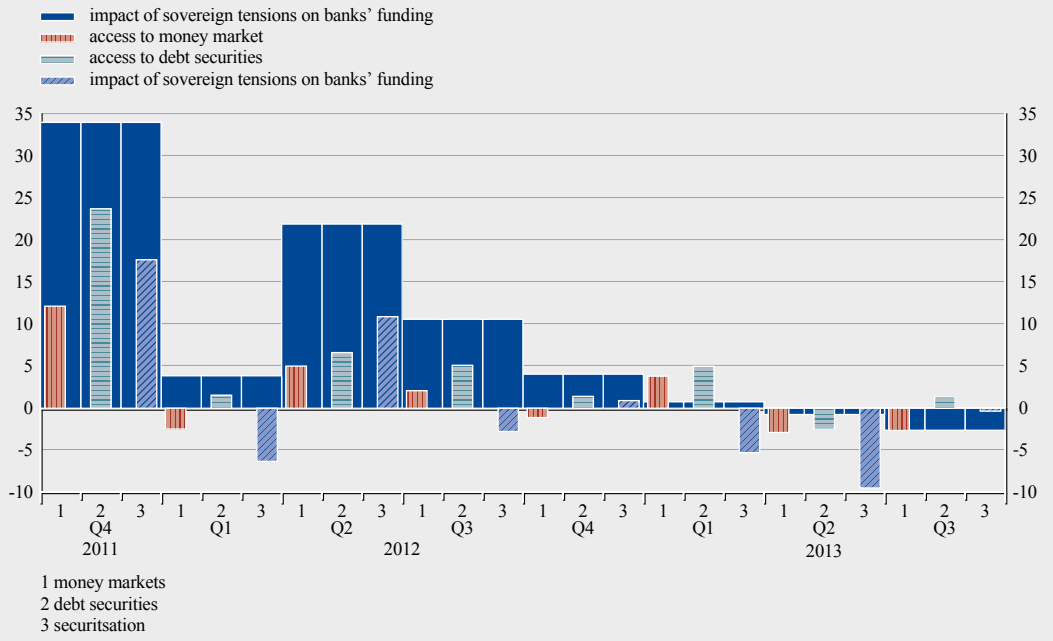
Sources: ECB, Merrill Lynch Global Index and own calculations.
Notes: Deposit rates (for both retail and institutional investors) and cost of market-based debt financing, weighted using outstanding amounts taken from MFI balance sheet statistics. An extreme value relating to the collapse of Lehman Brothers in September 2008 has been smoothed out.

18 Moreover, secured lending among banks in the interbank market is usually conducted using sovereign debt as collateral. Tensions in sovereign debt markets therefore reduce the collateral base of banks and thus their access to liquidity. See European Central Bank (2012a and 2012d).

19 This new trend represents a break from the dynamics observed right after the introduction of the euro, which led to the elimination of currency risk across euro area countries, increasing incentives to reduce their holdings of domestic government debt securities so as to achieve a more favourable risk-return trade-off.

Chart 20 Impact of sovereign tensions on funding and deterioration in access to specific funding markets

(net percentages; 2011Q4 to 2013Q3)



Source: BLS.

during the sovereign debt crisis in 2011 and the first half of 2012. During the latter period, the increases were particularly high in countries with distressed sovereigns. This increase was due primarily to the rise in the cost of bank debt. At the same time, in a low interest rate environment, banks may fail to pass lower policy interest rates onto interest rates on deposits (see Box 3). This rigidity is important because deposits are the most important funding source for banks, effectively setting a lower floor on banks' lending rates. However, the announcement of Outright Monetary Transactions (OMTs) in September 2012 and the gradual normalisation in the funding costs of some governments contributed to a lowering of the cost of bank funding and improved access to funding (see Chart 19).[20] At the same time, evidence from the ECB's bank lending survey (BLS) shows that banks' access to retail and wholesale funding improved across all funding categories and that the impact of the sovereign tensions on their funding has lessened since the second half of 2012 (see Chart 20). As a result of these favourable developments, banks have been able to reduce their dependence on the Eurosystem. Nonetheless, the funding situation of banks is still significantly heterogeneous across countries.

20 The Governing Council of the ECB announced the Eurosystem's Outright Monetary Transactions (OMTs) in September 2012. The goal of OMTs is to safeguard an appropriate monetary policy transmission mechanism and the singleness of the monetary policy. In particular, OMTs enable the Eurosystem to address severe distortions in government bond markets stemming from unfounded investor fears regarding the reversibility of the euro, as observed, inter alia, in the widening of short-term sovereign bond spreads across euro area countries up to July 2012.

Box 3

INTEREST RATES ON DEPOSITS IN A LOW INTEREST RATE ENVIRONMENT

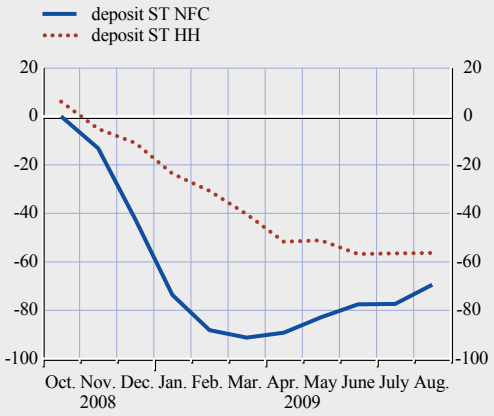
The traditional pass-through of policy interest rates on deposit rates may weaken when interest rates approach low levels, as banks fail to pass further cuts in policy rates onto bank deposit rates. In particular, retail customers may decrease their holdings of deposits when faced with a fall in the opportunity cost of holding banknotes, effectively setting a limit on how low interest rates on deposits may fall. Against this background, this box analyses the pass-through properties of policy interest rates on interest rates on deposits for the euro area in a low interest rate environment compared with normal times.

Empirical evidence on the recent slowdown in the pass-through process to deposit rates

The observed changes in the properties of the pass-through in a low interest rate environment compared with normal times can help to shed light on the presence of downward rigidities in deposit rates at low levels of interest rates. The focus is on short-term deposits from euro area households and non-financial corporations.[1] Two episodes of monetary policy loosening in the euro area are considered. The first one spans the period from October 2008 to May 2009, when policy interest rates were slashed from 4.25% to 1.0%. The second period (low policy interest rate environment) starts in November 2011 and lasts until August 2013, when policy rates were cut from 1.5% to 0.5%. In both cases, the outturn of interest rates on deposits is compared with

Chart A Accumulated forecast error for the first episode of policy rate cuts in a normal interest rate environment

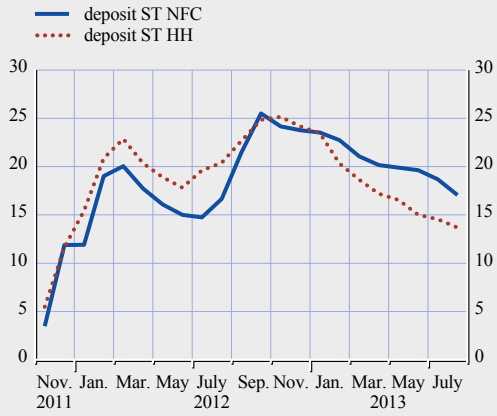
(aggregated from October 08; basis points; October 2008 to August 2009)



Sources: ECB and own calculations.
Notes: For every month since the start of the sample, the chart reports the accumulated difference between actual and projected values from the simple pass-through model. A negative value means that the actual deposit interest rate is below the one predicted by the model.

Chart B Accumulated forecast error for the second episode of policy rate cuts in a low interest rate environment

(aggregated from November 11; basis points; November 2011 to August 2013)



Sources: ECB and own calculations.
Notes: For every month since the start of the sample, the chart reports the accumulated difference between actual and projected values from the simple pass-through model. A negative value means that the actual deposit interest rate is below the one predicted by the model.

1 Short-term deposit rates from households and non-financial corporations are constructed as a weighted average of the following deposit rates: overnight deposits, deposits with an agreed maturity less than one year, deposits redeemable at notice up to three months and deposits redeemable at notice over three months using the weighting scheme based on new business volumes.

the one-month-ahead forecast from a simple pass-through model. Charts A and B present the accumulated forecast error over both episodes.[2]

During the first episode of monetary policy loosening, the forecast errors for the two deposit rates are negative, pointing to lower actual rates than those predicted based on previous regularities. Negative forecast errors suggest a strong pass-through of policy rate cuts to deposit rates during this period. However, during the second episode of monetary policy loosening, in an already low interest rate environment, the forecast errors are positive. These positive forecast errors suggest that bank deposit rates remained higher than what would have been expected based on previous regularities, hence indicating banks' resistance to pass the policy rate cuts through to retail deposit rates.[3]

All in all, the empirical analysis for the euro-area confirms the theoretical considerations mentioned before regarding the weakening in the pass-through mechanism for deposit rates in a context of interest rates approaching low levels, thus reflecting banks' increasing resistance to passing policy rate cuts through to retail rates.

2 The pass-through models assume the absence of any explanatory variables in the lending (or deposit) rate adjustment mechanism, except the market reference rate. The 3-month OIS rate was used as the market reference rate; it is closely linked to the policy rates and does not encompass any potential risk premium.

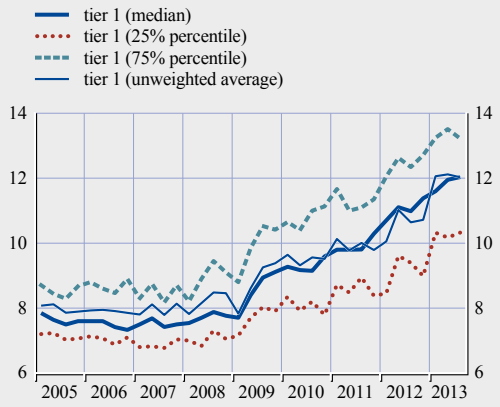
3 A similar exercise was performed for several euro-area countries and short-term deposit rates for households and non-financial corporations. Empirical evidence at the country level also shows banks' resistance to passing the policy rate cuts through to retail deposit rates in a low interest rate environment.

3.2.2 BANK CAPITAL

Bank capital has been depleted during the crisis in several countries as a result of valuation losses on securities holdings and, more significantly, loan losses. Tensions in sovereign bond markets and the resulting funding difficulties for banks impaired the ability of banks to provide credit in many countries, with adverse implications for bank lending rates. Euro area banks have made progress in strengthening their resilience to adverse economic developments since late 2009. The increase

Chart 21 Capital ratio (Tier 1) for euro area listed banks

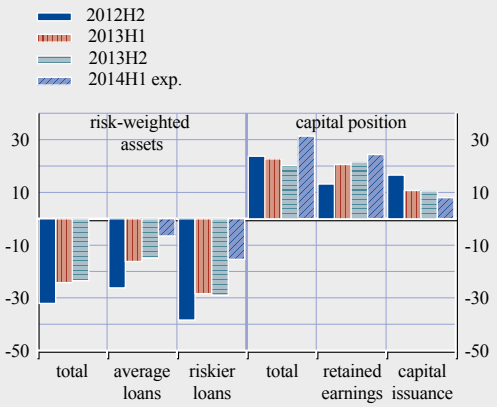
(percentages; Q1 2005 to Q3 2013)



Sources: Thomson Reuters and own calculations.

Chart 22 Impact of the capital requirements and other specific capital regulations on banks' risk-weighted assets and capital position

(net percentages of banks)



Source: BLS.
Note: The net percentages are defined as the difference between the sum of the percentages for "increase considerably" and "increase somewhat" and the sum of the percentages for "decreased somewhat" and "decreased considerably".

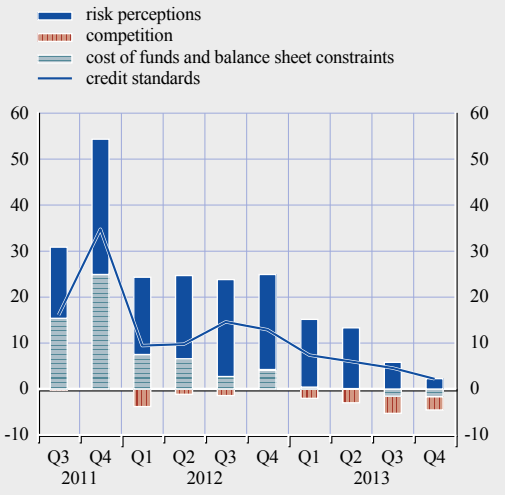
in banks' capital ratios resulted mainly from substantial capital-raising efforts by banks and from large injections of capital by euro area governments (see Chart 21).[21] More recently, progress has also reflected adjustment to the capital requirements in the EU banking legislation, which are more stringent and rely on a stricter definition of capital, and a reduction in risk weights. In particular, evidence from the ECB's bank lending survey shows that in order to comply with new regulatory requirements, banks have reduced their risk-weighted assets, including both riskier loans and loans with average risks. They have also responded by adjusting their capital positions, through retained earnings and capital issuance (Chart 22).

3.2.3 RISK ENVIRONMENT

Increasing credit risk and bank risk aversion can also help to explain divergences in lending rates in an environment of weak economic growth. Protracted periods of weak economic conditions and continued uncertainty regarding the duration of the sovereign debt crisis have weighed on the profitability and the financial buffers of non-financial corporations. Weak economic activity increases the probability of default of non-financial corporations and impairs their debt-servicing capacity. Moreover, high unemployment rates in some countries make bank lending to households risky, especially via long-term mortgage contracts. As a result, banks will tend to charge higher lending rates and tighten credit conditions for borrowers, particularly in those countries where economic conditions are weaker.[22] Evidence from the bank lending survey

Chart 23 Factors contributing to a tightening of credit standards for loans to non-financial corporations

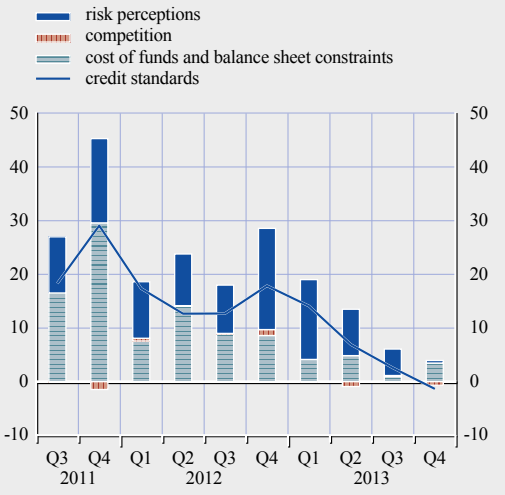
(average net percentages per category; Q1 2011 to Q4 2013)



Source: BLS.
Notes: Cost of funds and balance sheet constraints as unweighted average of "capital position", "access to market funding" and "liquidity position"; risk perception as unweighted average of "expected economic activity" and "industry-specific risk"; competition as "bank competition", "non-bank competition" and "competition by market financing".

Chart 24 Factors contributing to a tightening of credit standards for loans to households for house purchase

(average net percentages per category; Q1 2011 to Q4 2013)



Source: BLS.
Notes: Cost of funds and balance sheet constraints as unweighted average of "capital position", "access to market funding" and "liquidity position"; risk perception as unweighted average of "expected economic activity" and "housing market prospects"; Competition as "competition from other banks", "competition from non-banks".

21 In addition to the capital raised by banks in private markets, since 2007 many euro area banks have also received capital injections in various forms from their governments. For example, direct capital injected by governments between 2007 and mid-2013 is estimated at around €270 billion. Furthermore, implicit state aid with capital implications for banks has also been provided in the context of asset protection schemes and asset transfers to asset management companies.

22 The April 2013 ECB bank lending survey showed that banks' perceptions of high macroeconomic uncertainty and the creditworthiness of borrowers have continued to gain importance, relative to other credit supply factors, as factors explaining developments in the credit standards applied to loans to both households and non-financial corporations.

suggests that the effects of the cost of funds and balance sheet constraints have recently eased substantially by comparison with mid-2012, while risk perceptions are now the main factor contributing to tighter credit conditions on loans to non-financial corporations and households (see Charts 23 and 24).[23]

3.3 NEW EMPIRICAL EVIDENCE ON RETAIL BANK INTEREST RATE PASS-THROUGH

The previous section highlighted the importance of risk factors, bank capital and fragmentation in banks' funding conditions owing to tensions in government bond markets as potential drivers of bank lending rates since the beginning of the international financial crisis. At the same time, standard pass-through models assume the absence of any explanatory variables in the lending rate adjustment mechanism other than market interest rates. As mentioned before, such models are ill-equipped to explain the increasing levels of heterogeneity in bank lending rates which have been observed during the crisis. Hence, this section provides new empirical evidence on pass-through models to assess the degree of impairment in the monetary policy transmission mechanism in the four largest euro area economies arising from tensions in sovereign debt markets and risk factors. In particular, the new models make it possible to differentiate between the various factors affecting lending rates to non-financial corporations and households for house purchase, apart from the impact of market interest rates.[24]

The standard pass-through model presented before can be extended to accommodate the impact of other factors affecting the pricing of bank loans. In particular, reflecting tensions in sovereign bond markets, models can also be estimated including the spread of sovereign bond yields with respect to a risk-free rate of corresponding maturity as a factor of risk (denoted by s_t):[25]

$$\Delta br_t = \sum_{k=0}^{K} \delta_k \Delta r_{t-k} + \sum_{j=1}^{J} \lambda_k \Delta br_{t-j} + \sum_{n=1}^{N} \omega_s \Delta s_{t-n} + \alpha(br_{t-1} - \beta r_{t-1} - \beta_s s_{t-1} - \mu) + u_t \quad (2)$$

Different financial and banking structures among euro area countries might result in different risk factors affecting the demand and supply side of the lending process, which should be considered when modelling lending rates. Proxies for supply-side risk factors are banks' expected default frequencies, their capital-to-asset and liquidity-to-asset ratios, the cost of equity for financial companies and banks, and the spread between BBB and AAA corporate bond yields for financial companies. Demand-side risk indicators include the probabilities of default of non-financial corporations and households, non-financial corporations' expected default frequencies, employment expectations and unemployment rates, the aggregate cost of equity, and the spread between BBB and AAA corporate bonds yields for financial companies.[26] However, considering the relatively short time span of lending rate statistics, introducing more than two risk factors into a lending rate model, on top of sovereign bond yields, might exhaust degrees of freedom. Hence, risk factors are included in econometric models one at a time and the final model is selected on the basis of econometric diagnosis criteria (see below). Equation (2) can then be extended to accommodate the possible impact of risk factors in a model as follows:

23 At the same time, empirical evidence shows that in periods of restricted bank lending, non-financial corporations have tended to replace bank credit with alternative sources of financing. In particular, depending on the financing environment, companies replaced during the crisis bank loans with market-based financing, financing via unquoted equity and inter-company loans. See European Central Bank (2013).

24 The methodology underlying the estimation of the new pass-through models is developed in more detail in Banerjee et al. (2014).

25 The spread between sovereign bond yields and a risk-free rate captures country-specific sovereign tensions, as well as flight-to-quality effects and liquidity premia.

26 Some of the risk factors are available at the country level, while others are only available at the euro area level.

$$\Delta br_t = \sum_{k=0}^{K} \delta_k \Delta r_{t-k} + \sum_{j=1}^{J} \lambda_k \Delta br_{t-j} + \sum_{n=1}^{N} \gamma_k \Delta k_{t-n} + \sum_{m=1}^{M} \sigma_k \Delta p_{t-m} + \sum_{n=1}^{N} \omega_s \Delta s_{t-n} + \\ + \alpha(br_{t-1} - \beta r_{t-1} - \beta_2 k_{t-1} - \beta_3 p_{t-1} - \beta_s s_{t-1} - \mu) + u_t \quad (3)$$

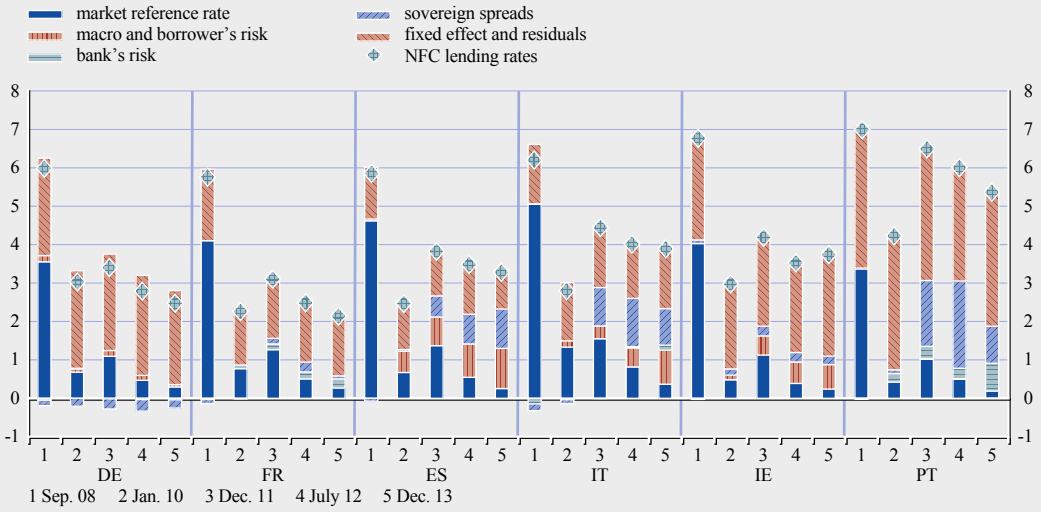
where *kt* and *pt* denote the demand and supply-side risk factors of the lending process.

The risk factors and market reference rates, as well as the lag structure in the model, are selected on the basis of econometric diagnosis criteria. The Annex develops the methodology to choose the models and gives an overview of the selected models in terms of the specific benchmark rates, risk factors and sovereign yield spreads included in the equations. As before, the model is estimated over the sample period running from January 2003 to December 2013.

Charts 25 and 26 show the level of lending rates to non-financial corporations and households between September 2008 and December 2013 in the four largest euro area economies and in Ireland and Portugal, together with the contribution of market reference rates, macro and borrower risk factors, sovereign debt spreads and bank risk. The fall in the composite lending rates to non-financial corporations and households has proceeded in line with the usual historical patterns in France and Germany. This means that downward adjustments in market reference rates have translated into a concomitant reduction in bank lending rates.[27] In the case of Spain, Italy, Ireland and Portugal, the fall in market reference rates associated with the drop in policy interest rates over the same time period has also put downward pressure on retail bank lending rates, as expected. However, the monetary policy pass-through in these countries appears to have been obstructed by the increases in macro and borrower risks, the impact of sovereign tensions and increasing bank risk.

Chart 25 Breakdown of lending rates to non-financial corporations by explanatory factors

(percentages per annum; September 2008 to December 2013)

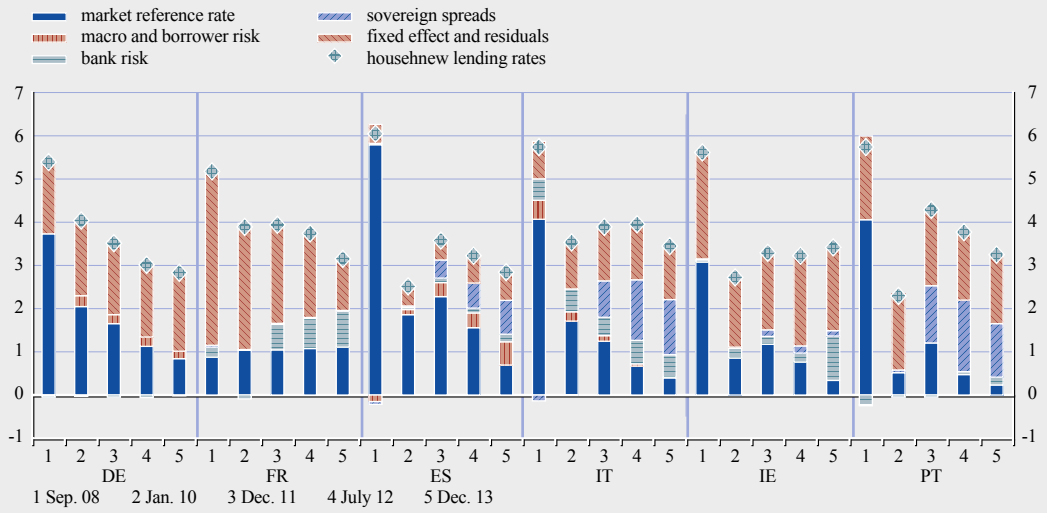


Sources: ECB and own calculations.
Notes: The chart shows the lending rates to non-financial corporations and the contribution of each explanatory variable for several time points between September 2008 and December 2013. Contributions of banks and macro and borrower risk factors for some countries are demeaned by the average contribution of these factors in the pre-crisis period. Composite lending rates for non-financial corporations are compiled from short- and long-term rates using a weighting scheme based on smoothed new business volumes.

27 Another factor that put downward pressure on bank lending rates during the crisis is the fall in long-term government bond yields due to flight-to-quality effects observed in Germany.

Chart 26 Breakdown of lending rates to households for house purchase by explanatory factors

(percentages per annum; September 2008 to December 2013)



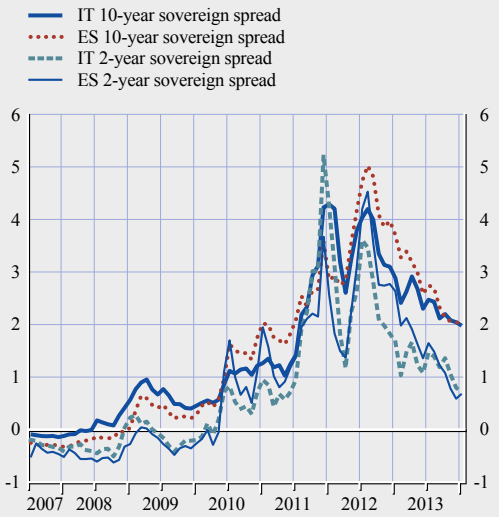
Sources: ECB and own calculations.
Notes: The chart shows the lending rates to households for housing purposes and the contribution of each explanatory variable for several time points between September 2008 and December 2013. Contributions of bank and macro and borrower risk factors for some countries are demeaned by the average contribution of these factors in the pre-crisis period. Composite lending rates for households are compiled from short- and long-term rates using a weighting scheme based on smoothed new business volumes.

Therefore, lending rates in Spain, Italy, Ireland and Portugal could have declined at a faster pace, absent the impact of these factors.

The pass-through models presented before can also shed light on the temporal impact of sovereign bond market tensions on retail bank interest rates in Spain and Italy, countries where such tensions have been acute. Chart 27 shows, for these two countries, the spread between the 2-year and 10-year sovereign bond yields and swap rates of corresponding maturities over the June 2007-December 2013 period. Sovereign bond market tensions increased after mid-2010 and escalated particularly in the second half of 2011. After the implementation of the LTROs at the end of 2011 and the beginning of 2012, stress in sovereign bond markets receded, though only temporarily, to increase again until the summer of 2012.[28] The announcement of OMTs in September 2012 has led to a significant decline in government bond yields in Italy and Spain. As a consequence, the contribution of sovereign spreads to the composite cost of borrowing to NFCs and households for house purchase

Chart 27 Spread between the 2-year and the 10-year sovereign bond yields of Italy and Spain and swap rates of corresponding maturities

(percentages; June to December 2013)



Sources: ECB and own calculations.

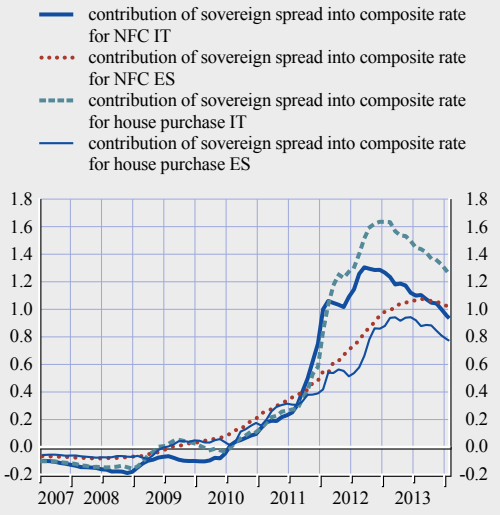
28 Two long-term refinancing operations (LTROs) with maturities of three years were conducted in December 2011 and in February 2012 to support the ability of banks to maintain and expand lending to euro area households and non-financial corporations.

increased until end-2012, to decrease thereafter, hence supporting the transmission of monetary policy in the euro area (Chart 28). From both charts it can be seen that sovereign bond spreads are estimated to have a lagged impact on retail bank interest rates. Hence, recent declines in sovereign bond yields are expected to keep putting downward pressure on retail bank lending rates over the near future.

Finally, Charts 29 and 30 show the response of bank lending rates to a one percent upward shock in market reference rates for non-financial corporations and households, respectively. The charts compare the response at a 12-month horizon from a model estimated using data until 2007 with a model estimated until 2011. The comparison of the impulse-response functions before and after the international financial crisis may shed light on the potential weakening of the pass-through mechanism in the euro area. From the charts it can be seen that in spite of having weakened somewhat during the crisis, the pass-through of monetary policy is still operational, including in countries subject to strong stress in sovereign debt markets. Hence, absent the impact of risk factors and sovereign tensions, the fall in market reference rates would have implied a concomitant reduction in retail bank lending rates in agreement with historical regularities. In turn,

Chart 28 Contribution of sovereign spreads to composite cost of borrowing of non-financial corporations and households for house purchase

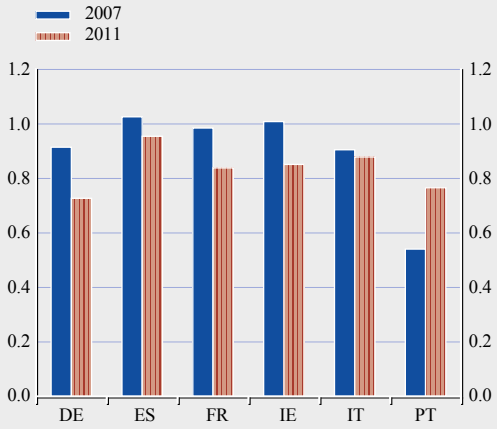
(percentages; June to December 2013)



Sources: ECB and own calculations.

Chart 29 Response of composite lending rate to non-financial corporations to a 1% shock in market reference rate in 2007 and 2011

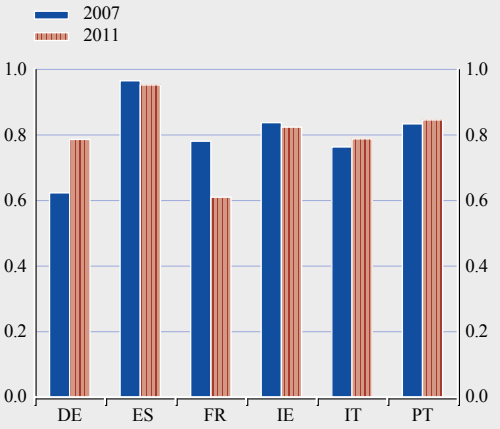
(percentage points)



Sources: ECB and own calculations.
Notes: The chart shows the response after 12 months to a 1% shock in market reference rate for two time periods. Impulse responses for composite lending rates for households for housing purposes are compiled from impulse responses for short- and long-term rates using a weighting scheme based on smoothed new business volumes.

Chart 30 Response of composite lending rate to households for house purchase to a 1% shock in market reference rate in 2007 and 2011

(percentage points)



Sources: ECB and own calculations.
Notes: The chart shows the response after 12 months to a 1% shock in market reference rate for two time periods. Impulse responses for composite lending rates for households for housing purposes are compiled from impulse responses for short- and long-term rates using a weighting scheme based on smoothed new business volumes.

an operational pass-through mechanism is a necessary condition for the successful implementation of policies aiming at ensuring that market expectations of future monetary policy are consistent with the policy intentions of the respective central bank.

4 THE PROPAGATION OF BANK LENDING RATES TO THE BROADER ECONOMY: PERSPECTIVES FROM A DGSE MODEL

The previous sections have shown that bank lending rates have propagated the financial tensions that characterised the international financial crisis and the euro area sovereign debt crisis. This section complements the previous analysis by shedding light on the propagation of bank lending rates to the broader economy using a Dynamic Stochastic General Equilibrium (DSGE) model with financial frictions. In particular, subsection 4.1 focuses on the macroeconomic implications emanating from an upward adjustment in bank lending rates, while subsection 4.2 disentangles the actual quantitative contribution of financial factors to the euro area business cycle and assesses the macroeconomic impact arising from receding fragmentation and lower bank lending rate spreads across the euro area.

Accounting for real-financial interactions in a DSGE model has three main advantages in the current economic context. First and foremost, the financial crisis has brought to the forefront the role of the financial system as an autonomous source of economic disturbances. Widening lending rate spreads and rising cross-country dispersion of bank lending rates are pervasive and constitute a powerful shock to the economy at large, with sizeable effects on spending decisions and inflation dynamics. Second, the banking system may amplify the impact of shocks to the economy and the business cycle, particularly in periods of lacklustre economic activity and fragile balance sheets in the corporate sector. In a bank-based economy such as the euro area, the compensation of risk priced in lending rates is a powerful propagation mechanism of adverse demand shocks. Third, current impairments to the monetary policy transmission mechanism and cross-country heterogeneity in bank lending rates across the euro area are holding back economic momentum.

4.1 THE TRANSMISSION OF BANK LENDING RATE SHOCKS TO THE BROADER ECONOMY

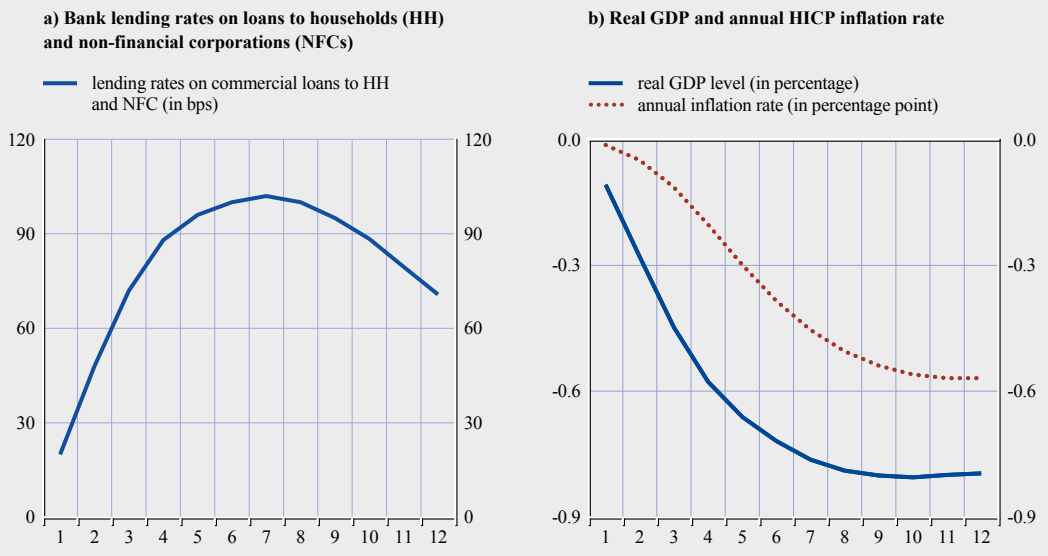
This subsection analyses the macroeconomic implications emanating from an upward adjustment in bank lending rates based on a DSGE model estimated on euro area data.[29] The DSGE model allows formalising the setting of bank lending rates based on a series of intermediation wedges which are affected by a variety of exogenous shocks (see Box 4 for more details). The source of upward pressure on lending rates is captured in the model by an exogenous mark-up shock to the staggered nominal lending rates set by the loan-book financing branches on the credit extended to the commercial branches.[30] Moreover, on top of that, commercial banks apply a credit risk premium when extending loans to households and firms.

The transmission mechanism embedded in the model is one in which an increase in interest rate mark-ups manifest smoothly into higher lending rates on loans to households and firms. Because borrowers are financially constrained, the increase in lending rates weighs negatively on consumption and investment, dampening real economic activity and inflation.

29 For more details, see Darracq-Paries et al. (2011).
30 More specifically, loan book financing branches set lending rates in a staggered manner with some degree of nominal rigidity (modelled á la Calvo).

Chart 31 Macroeconomic impact of higher lending rate margins

(deviation from baseline)

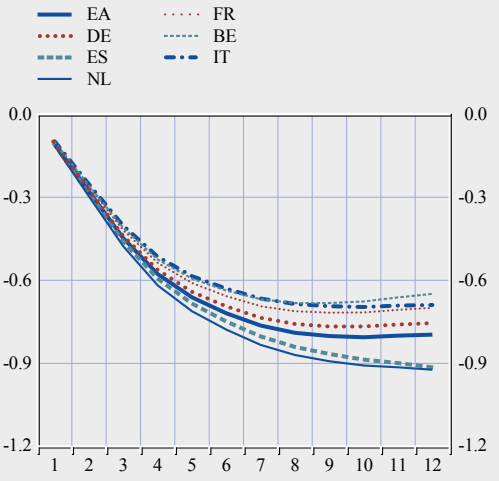


Sources: ECB and own calculations.
Note: Simulations based on the model of Darracq Paries et al. (2011) under unchanged monetary policy.

The final macroeconomic impact depends crucially on the assumption regarding the response of monetary policy. A more accommodative monetary policy stance would help mitigate the initial rise in the cost of financing. In turn, the strength of the impact of the monetary policy response will depend, among other things, on the degree of sluggishness of the bank interest rate pass-through. A high degree of stickiness in retail interest rate setting behaviour implies that the monetary policy response is transmitted only partially, and more slowly. Its stabilising effect is less powerful. The macroeconomic simulations presented in this subsection are derived under the assumption of unchanged monetary policy.

Chart 32 Impact of bank lending rate shock on real GDP level

(deviation from baseline in percentage points)



Sources: ECB and own calculations.
Note: Simulations based on the model of Darracq Paries et al. (2011) under unchanged monetary policy.

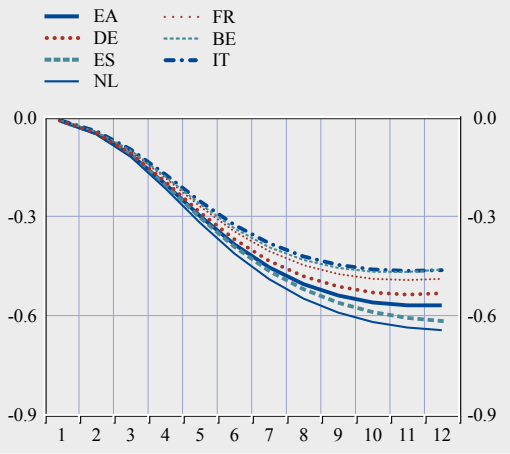
Chart 31 shows the impact of higher lending rate margins on bank lending rates to households and non-financial corporations and on euro area real GDP and HICP annual inflation. Considering a three-year projection horizon, retail lending rates on commercial loans to households and non-financial corporations peak at 100 basis points during the second year of the projection horizon, before reverting back smoothly to the long-term equilibrium (see Chart 31a). Regarding economic activity and inflation, the impact on euro area real GDP reaches a trough of around

-0.8% at the end of the second year, while annual inflation is 0.6 percentage points lower than in the baseline (see Chart 31b).

The euro area developments presented in the previous paragraph conceal substantial cross-country heterogeneity attributable to country specificities that affect the transmission mechanism. Charts 32 and 33 report the impact of a bank lending rate shock on real GDP and HICP inflation at the country level. The impact on the real GDP level ranges from – 0.9% in the Netherlands to around – 0.7% in Belgium and Italy (see Chart 32). For inflation, the impact ranges from – 0.6 for the Netherlands to – 0.5 percentage points for Italy (see Chart 33). This heterogeneity is largely due to substantial differences in private non-financial sector indebtedness (in the form of bank loans) in those countries.[31]

Chart 33 Impact of bank lending rate shock on annual HICP inflation

(deviation from baseline in percentage points)



Sources: ECB and own calculations.
Note: Simulations based on the model of Darracq Paries et al. (2011) under unchanged monetary policy.

31 Specifically, the loan-to-GDP ratio (considering both households and corporates) ranges from around 57% in Belgium and Italy to around 100% in the Netherlands and Spain (see Box 4).

Box 4

BANK LENDING RATE SETTING IN A LARGE-SCALE DSGE MODEL: SPECIFICATION AND CROSS-COUNTRY CALIBRATION

This box discusses the determination of bank lending rates in a DSGE model as presented in Darracq-Paries et al. (2011).

Retail lending rate setting in a DSGE model

In the model presented in Darracq Paries et al. (2011), bank lending rates are determined by a series of intermediation wedges and are affected by a variety of exogenous "shocks". Focusing specifically on the credit intermediation process, bank lending rates originate mainly from three distinct layers related to the demand and the supply of credit:

- *Riskiness of borrowers:* The possibility for households and firms to default on their loans means that lending rates compensate for the associated credit risk. While default rates vary endogenously in the model as a result of fluctuations in asset prices, the time-varying nature of the riskiness of borrowers is induced in the model by considering specific credit risk shocks. In turn, this triggers time variation in the credit risk premium and hence in bank lending rates.

- *Imperfect competition and nominal rigidities in lending rate setting:* One segment of the model's banking system consists of loan book financing branches which receive funding from the wholesale branches and allocate them to the commercial lending branches. Operating under some degree of market power, monopolistically competitive loans book branches set staggered nominal lending rates, which are subject to exogenous mark-up shocks. This source of time variation in the mark-up over the marginal cost manifests itself ultimately in the lending rates that commercial branches apply on loans to households and firms.

- *Bank capital:* Conditions related to bank balance sheet positions also influence lending rate setting behaviour. The pressure by market disciplining forces and regulatory requirements on banks to hold adequate capital buffers is captured in the model by assuming adjustment costs on bank's leverage. Technically speaking, such costs constrain banks' decisions on deposits and loans. When facing adverse shocks to their capital base, banks react by exploiting their market power and raising their lending margins, so as to ensure stable profits and hence preserve adequate capital buffers.

Country-specific calibration

In order to derive macroeconomic simulations at the country level, the calibration of the model is fine-tuned to capture selected country-specific structural conditions. While cross-country heterogeneity may manifest itself in several dimensions, the focus here is on: *i*) corporate and household indebtedness (in the form of bank loans); and *ii*) MFI interest rate lending spreads (vis-à-vis the short-term money market rate). The focus on these dimensions stems primarily from their relevance in shaping how the economy responds to disturbances to lending rates.

Table A reports the average bank loan-to-GDP ratio for corporates and households in the euro area as well as in the six largest economies for the period from 1999 to 2010. Technically speaking, higher steady-state debt levels are achieved by calibrating a larger fraction of borrowers and/or a higher loan-to-collateral ratio than banks are willing to grant.

Table B reports the average spread between MFI interest rates on loans to corporates and households and the short-term money market rate in euro area countries, also for the period from 1999 to 2010.

High debt levels make economies particularly vulnerable to lending rate adjustments. Importantly, an endogenous monetary policy appears relatively more effective in stabilising those economies characterised by higher indebtedness. Intuitively, this is due to the fact that higher

Table A Euro area and country-specific (steady-state) bank loans to corporates and households

(ratio to GDP; average 1999-2010)

	Loans to non-financial corporations	Loans for house purchase
EA	41.9	32.8
Belgium	31.2	25.6
Germany	35.4	40.8
Spain	57.9	42.3
France	35.6	26.6
Italy	44.0	14.3
Netherlands	47.9	54.6

Table B Euro area and country-specific (steady-state) spreads of MFI interest rates vis-à-vis the three-month Euribor on loans

(average 1999-2010)

	Loans to non-financial corporations	Loans for house purchase
EA	1.7	1.9
Belgium	1.3	1.9
Germany	2.0	2.2
Spain	1.2	1.5
France	1.2	1.7
Italy	1.7	1.5
Netherlands	1.7	2.0

debt levels imply that a given lending rate shock has a much larger impact on macroeconomic variables under unchanged monetary policy; in other words, keeping monetary policy unchanged at the baseline de facto means a wider policy misalignment, thus implying a larger scope for an effective stabilisation by an endogenous monetary policy response. [1]

1 This Box is based on the model presented in Darracq-Paries et al. (2011).

4.2 RETAIL LENDING RATE SETTING AND REAL-FINANCIAL INTERACTIONS IN EURO AREA BUSINESS CYCLE FLUCTUATIONS

This section analyses the pro-cyclicality of the financial system, focusing on the nature of real-financial interactions. First, model simulations illustrate the amplification of real shocks through the behavioural response of the banking system. Second, the potential macroeconomic impact of receding financial fragmentation is analysed.

4.2.1 TYPOLOGY OF REAL-FINANCIAL INTERACTIONS

Real-financial interactions refer to the amplification of certain shocks through the interplay between financial variables (such as asset prices, firms' net worth and the external financial premium) and real variables (such as investment and economic activity). Such amplification mechanisms arise because of the presence of financial frictions, notably in the form of informational frictions in credit intermediation.

One prominent type of real-financial interaction, commonly formalised in macroeconomic models, is the *"financial accelerator"* mechanism. Intuitively, a negative shock hitting a firm's net worth constrains the firm's ability to borrow via its adverse impact on creditworthiness and a higher external finance premium. The resulting adverse impact on investment leads, in turn, to a further deterioration in the firm's net worth and thus to a more severe impact on economic activity. In essence, the main implication of this channel is that large and persistent fluctuations in economic activity may arise from seemingly small shocks because of real-financial feedback loops.

In addition to these real-financial interactions stemming from the side of borrowers, the pro-cyclicality of the financial system may also be exacerbated by a second channel, related to bank-specific vulnerabilities in the form of weak capital positions and funding constraints. This second channel could be referred to as the "bank balance sheet" channel.[32]

4.2.2 EMPIRICAL RELEVANCE OF FINANCIAL FACTORS FOR EURO AREA BUSINESS CYCLE FLUCTUATIONS

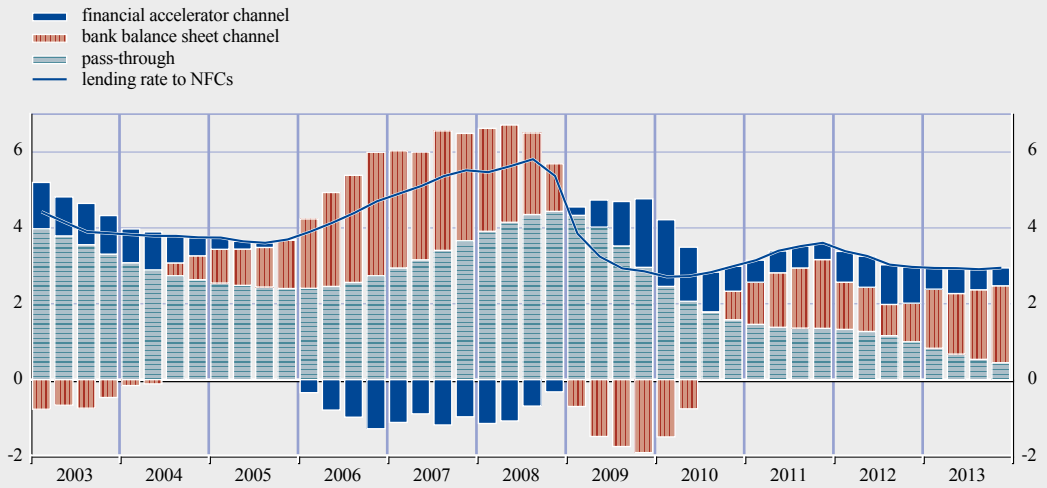
The analysis in this subsection focuses on disentangling the actual quantitative contribution of financial factors to euro area business cycle fluctuations. In particular, euro area developments are interpreted through the lens of the model presented in Darracq-Paries et al. (2011) and estimated on euro area data, which makes it possible to decompose a number of macroeconomic variables into the contributions of various structural (unobserved) shocks, including financial shocks.

Chart 34 reports the decomposition of bank lending rates to non-financial corporations into different wedges representing the financial accelerator and the bank balance sheet channels, as well as the pass-through from policy interest rates. Regarding the latter, it can be seen that policy interest rates contributed to downward pressure on bank lending rates to non-financial corporations following

32 While macro-financial models of the types just illustrated initially placed financial frictions on the side of the borrowers (see Bernanke et al., 1999), more recently the emphasis has shifted towards the balance sheet vulnerabilities (funding or capital driven) of financial intermediaries (see, for example, Gertler and Kiyotaki, 2011).

Chart 34 "Financial wedges" and lending rate to non-financial corporations

(annual rate, in percentage)



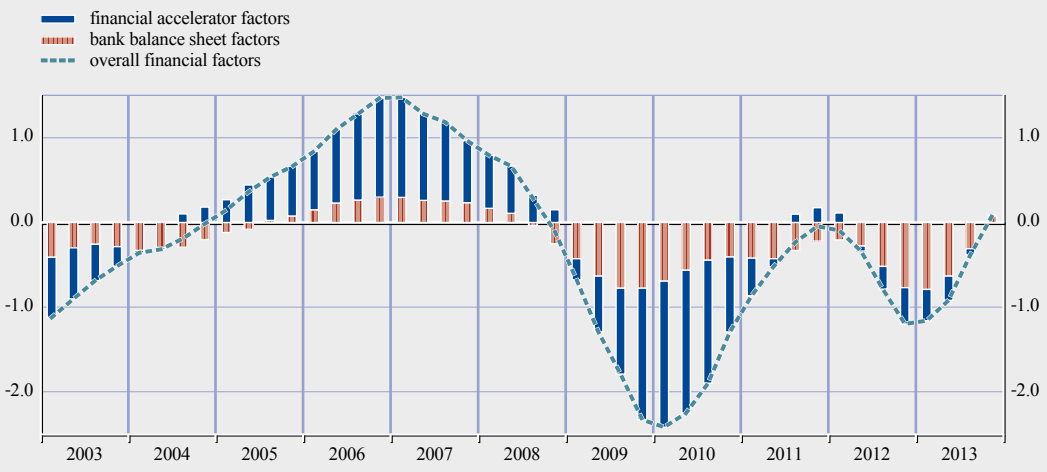
Sources: ECB and own computations.

the worldwide relaxation in monetary policy that started in late 2008. However, bank lending rates to non-financial corporations did not contract to the same extent and even increased between 2010 and 2011 owing to vulnerabilities associated with banks' balance sheets and borrowers' increased riskiness (bank balance sheet and financial accelerator channel).

Chart 35 depicts the contribution of financial shocks to real GDP growth, together with the two sub-categories of financial accelerator factors (red bars) and bank balance-sheet factors (blue bars). Overall, financial factors (black line), which mainly operate through bank lending rate spreads, appear to have played a key role during the crisis. Specifically, their contribution to euro area real

Chart 35 Contribution of "financial shocks" to real GDP growth

(annual growth in percentage points)



Sources: ECB and own computations.

GDP growth is estimated to amount to -2.5 percentage points at the peak of the crisis, namely around mid-2009. At that time, the adverse impact of financial factors can be equally attributed to financial accelerator factors (related to borrowers' probability of default and associated external finance premium) and bank balance sheet factors (related to bank capital and cost of bank funding factors). After receding in the first quarters of 2011, financial factors subsequently have weighed on economic activity in 2012, on the back of heightening financial market tensions and sovereign debt crisis in some parts of the euro area, mainly captured by adverse bank balance-sheet factors.

4.2.3 MACROECONOMIC BENEFITS OF RECEDING FRAGMENTATION IN THE BANK LENDING CHANNEL ACROSS THE EURO AREA

This final section analyses the potential macroeconomic impact of receding financial fragmentation, whereby cross-country dispersion in bank lending rates would resolve itself into a lower average lending rate for the euro area as a whole. The economic rationale for such an analysis could notably be related to the ECB's comprehensive assessment of the balance sheets of credit institutions, and more generally, the steps taken towards a European Banking Union. In principle, the comprehensive assessment could be thought of as having both supportive and adverse effects on economic activity. In the short run, the comprehensive assessment can be expected to unveil further needs for bank balance sheet consolidation, together with some eventual frontloading towards regulatory requirements. Everything else being equal, this would weigh on bank credit supply and economic activity. Over the medium term, it has the potential for significantly improving investors' confidence in the euro area banking sector, resolving the opacity in bank balance sheets. Ultimately, a sizeable step could be made to address bank funding fragmentation in the euro area, support a better functioning of the bank lending channel of monetary policy, and create the conditions for self-sustained recovery in the euro area.

The analysis presented here will focus on the medium-term benefits and provide illustrative simulations of the macroeconomic impact of narrowing lending rate dispersion, together with a downward shift to the whole distribution. More precisely, it is assumed that the time-varying risk factor contributions in the lending rate pass-through models revert back to their historical means. The corresponding decline in lending rates ranges from 12.5 basis points for Germany to 200 basis points for Portugal (see first row in Table 2). The macroeconomic impact of this scenario is derived from country-level simulations, using the same macro-financial model and country-specific calibration as before. As seen in Table 2, the macroeconomic impact is stronger for countries under stress, such as Italy, Portugal and Spain, than for Germany and France. In particular, at the country level, the positive impact on HICP annual inflation ranges from 0.1 percentage points in Germany

Table 2 Macroeconomic impact of lower lending rate spreads

(in percentage, difference from baseline)

	EA	ES	IT	PT	IE	DE	FR
Lending spread (in bps at the peak: 1.5y)	-50	-100	-150	-200	-50	-12.5	-25
Real GDP level (in percentage at the peak: 2y)							
Lending spread scenario	0.4	0.9	1.0	1.8	0.5	0.1	0.2
Lending rates on loans to corporates	*0.3*	*0.7*	*0.9*	*1.4*	*0.4*	*0.1*	*0.2*
Lending rates on loans to households	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*	*0.0*	*0.1*
HICP Annual Inflation (in percentage point at the peak: 2.5y)							
Lending spread scenario	0.3	0.6	0.7	1.2	0.3	0.1	0.2
Lending rates on loans to corporates	*0.2*	*0.4*	*0.5*	*0.8*	*0.2*	*0.0*	*0.1*
Lending rates on loans to households	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*	*0.0*	*0.1*

Sources: ECB and own estimates.
Notes: Simulations are carried out with the DKR model, under unchanged monetary policy. The simulations are calibrated based on the contribution of risk factors from the lending rate pass-through models.

to 1.2 percentage points in Portugal, after two and a half years. Regarding the level of real GDP, the impact ranges from 0.1% in Germany to 1.8% in Portugal, after two years. For the euro area as a whole, the narrowing of lending rate dispersion, together with a downward shift in the distribution, implies a positive impact on annual HICP inflation and the level of real GDP of 0.3 percentage points and 0.4%, respectively.

This illustration of the macroeconomic impact arising from lower bank lending spreads is extremely stylised. It implicitly assumes a successful break of the sovereign-bank nexus and the removal of heterogeneities due to borrower risk. This benefit of the European Banking Union may be seen as too optimistic. However, it may be seen as too restrictive given that quantity channels involved in receding fragmentation are not considered. Overall, the macroeconomic simulations emphasise the potential scope for significant, albeit limited, support to the economic recovery coming from receding fragmentation in the bank lending channel.

5 CONCLUSION

The divergence in bank lending rates observed in the euro area since the outbreak of the financial crisis in 2008 and the sovereign debt crisis in 2010, and their sluggish response in some countries to the policy interest rate reductions to levels close to zero, reflect in part asynchronous business cycles and differing perceptions of credit risk across countries over the last few years. Country evidence based on the four largest euro area countries shows that downward adjustments in ECB policy rates and in market reference rates have translated into a concomitant reduction in bank lending rates. In the cases of Spain and Italy, however, sovereign bond market tensions and a deteriorating macroeconomic environment have put upward pressure on composite lending rates to non-financial corporations and households. At the same time, simulations using a DSGE model show that increasing financial fragmentation and higher lending rates have propagated to the broader economy by depressing economic activity and inflation. Financial shocks have also contributed to amplify business cycles in the euro area through the financial sector.

The ECB has sought to resist downside risks to price stability in a context of increasing financial fragmentation by introducing several standard and non-standard monetary policy measures. All these measures have helped to alleviate bank funding constraints and the risk of a disorderly bank deleveraging process. In order to ensure the adequate transmission of monetary policy to financing conditions in euro area countries, it is essential that the fragmentation of euro area credit markets is reduced further and the resilience of banks strengthened where needed.[33]

33 See European Central Bank (2012e).

6 REFERENCES

Arnold, I.J.M. and van Ewijk, S.E. (2014), "The impact of sovereign and credit risk on interest rate convergence in the euro area", *DNB Working Paper Series*, No. 425, June.

Berger, A.N. and Udell, G. F. (2003), "Small Business and Debt Finance", in Z.J. Acs and D.B. Audretsch (eds.), *Handbook of Entrepreneurship Research*, Kluwer Academic Publishers, Dordrecht, pp. 299-328.

Banerjee, A., Darracq Pariès, M. and Krylova, E. (2014), "Monetary policy transmission channel at times of financial fragmentation: evidence from the euro-area retail bank lending", Mimeo, European Central Bank, Frankfurt am Main.

Bernanke, B.S., Gertler, M. and Gilchrist, S. (1999), "The Financial Accelerator in a Quantitative Business Cycle Framework", in J.B. Taylor and M. Woodford (eds.), *Handbook of Macroeconomics*, Volume 1C, Elsevier/North-Holland, Amsterdam, pp. 1341-1393.

Darracq Pariès, M., Kok Sørensen, C. and Rodriguez Palenzuela, D. (2011), "Macroeconomic propagation across different regulatory regimes: evidence from an estimated DSGE model for the euro area", *International Journal of Central Banking*, Vol. 7, No. 4, pp. 49-113.

Gertler, M. and Kiyotaki, N. (2011), "Financial Intermediation and Credit Policy in Business Cycle Analysis", in B.M. Friedman and M. Woodford (eds.), *Handbook of Monetary Economics*, Volume 3A, Elsevier/North-Holland, Amsterdam, pp. 547-599.

European Central Bank (2005), "The use of harmonised MFI interest rate statistics", *Monthly Bulletin*, ECB, Frankfurt am Main, July.

European Central Bank (2006), *Differences in MFI interest rates across euro area countries*, ECB, Frankfurt am Main, September.

European Central Bank (2009), "Recent developments in the retail bank interest rate pass-through in the euro area", *Monthly Bulletin*, ECB, Frankfurt am Main, August.

European Central Bank (2011), "Keeping the ECB's monetary and financial statistics fit for use", *Monthly Bulletin*, ECB, Frankfurt am Main, August.

European Central Bank (2012a), "Cross-country heterogeneity in MFI interest rates on loans to non-financial corporations in the euro area", *Monthly Bulletin*, ECB, Frankfurt am Main, November.

European Central Bank (2012b), "Assessing the financing conditions for the euro area private sector during the sovereign debt crisis", *Monthly Bulletin*, ECB, Frankfurt am Main, August.

European Central Bank (2012c), "The impact of bank funding market fragmentation on credit intermediation during the sovereign debt crisis", *Financial Stability Review*, Special Feature, ECB, Frankfurt am Main, December.

European Central Bank (2012d), "Monetary policy measures decided by the Governing Council on 6 September 2012", *Monthly Bulletin*, ECB, Frankfurt am Main, September.

European Central Bank (2012e), "Heterogeneity in euro area financial conditions and policy implications", *Monthly Bulletin*, ECB, Frankfurt am Main, August.

European Central Bank (2014), *Financial integration in Europe*, ECB, Frankfurt am Main, April.

Fee, C.E., Hadlock, C.J. and Pierce, J.R. (2009), "Investment, Financing Constraints, and Internal Capital Markets: Evidence from the Advertising Expenditures of Multinational Firms", *Review of Financial Studies*, Vol. 22, Issue 6, pp. 2361-2392.

Gropp, R., Kok Sørensen, C. and Lichtenberger, J-D (2007), "The dynamics of bank spreads and financial structure", *Working Paper Series*, No 714, ECB, Frankfurt am Main, January.

Kok Sørensen, C. and Lichtenberger, J-D. (2007), "Mortgage interest rate dispersion in the euro area", *Working Paper Series*, No 733, ECB, Frankfurt am Main, February.

Rauh, J.D. (2006), "Investment and Financing Constraints: Evidence from the Funding of Corporate Pension Plans*", Journal of Finance*, Vol. 61, Issue 1, February, pp. 33-71.

ANNEX SELECTION OF ECONOMETRIC MODELS

The criteria used to select the models follow Banerjee et al. (2014). A large range of models are estimated including different lags specifications, different market reference rates and different measures of risk.

Regarding the specific benchmark rates, the three-month and 12-month EURIBOR are used for short-term loans, and the market rates of higher maturities (from the 12-month EURIBOR up to ten-year yields) are used for long-term loans. To disentangle the impact of policy rates or euro area "risk-free" interest rates of higher maturities from the impact of the country-specific sovereign tensions, only the euro area swap or EURIBOR (and not the country-specific sovereign yields) are used as market reference rates.

As mentioned in the body of the text, other factors apart from market reference rates have affected bank lending rates since the start of the financial crisis. These include sovereign spreads, macro and borrower risk, and bank risk. Sovereign spreads are computed as the difference between government bond yields for maturities of 2, 5 and 10 years and the corresponding swap rates for the euro area. Macro and borrower risk is proxied by the unemployment rate, employment expectations, the total cost of equity, NFCs' expected default frequencies, probability of default for NFCs and households, and corporate spreads for non-financial corporations. Finally, the measures of bank risk are the capital-to-asset ratio and the liquidity-to-asset ratio, the cost of equity for financial corporations, banks' expected default frequencies, and corporate financial spreads.

Risk factors and market reference rates, as well as the lag structure, are selected on the basis of econometric diagnosis criteria which place a high weight on in-sample fit. Because the deterioration of economic conditions, and bank balance sheet weakening, and the sovereign debt crisis only recently started to influence the pass-through, the emphasis is put on the estimations over the whole period. Other econometric diagnosis criteria are also considered, including the out-of-sample performance, stability and significance of coefficients in the co-integrating vector, the sign of sensitivities to risk in the long-term equilibrium pass-through and impulse responses. As before, the model is estimated over the sample period running from January 2003 to December 2013. Table A1 provides the qualitative information about the selected models for the subset of countries.

Table A1 Market reference rates, risk factors and sovereign bond spreads in the selected country-specific models

		Loans to NFCs		Mortgage lending	
		short-term	long-term	short-term	long-term
BE	reference rate	3m Euribor	12m Euribor	12m Euribor	5-year swap rate
	risk factor	Capital ratio EA	Capital ratio EA		
	sov spread		2-year sovereign spread	10-year sovereign spread	10-year sovereign spread
DE	reference rate	3m Euribor	5y swap rate	12m Euribor	5y swap rate
	risk factor	EDF NFC DE	EDF NFC DE		EDF banks DE
	risk factor 2	EDF banks DE	BBB-AAA fin spread		
	sov spread	5-year sov. spread	2-year sov. spread	2-year sov. spread	
ES	reference rate	3m Euribor	3m Euribor	12m Euribor	12m Euribor
	risk factor	Unemployment ES		Unemployment ES	Capital ratio ES
	sov spread	10-y ES spread	10-y ES spread	10-y ES spread	10-y ES spread
FR	reference rate	3m Euribor	2y swap rate	12m Euribor	5y swap rate
	risk factor	Capital ratio FR	EDF banks FR	Capital ratio FR	Liquidity ratio FR
	sov spread	10-year sov. spread	10-year sov. spread	2-year sov. spread	2-year sov. spread
IT	reference rate	3m Euribor	2y swap rate	3m Euribor	5y swap rate
	risk factor	Unemployment IT	Unemployment IT	EDF NFC IT	Capital ratio IT
	risk factor 2	EDF banks IT		Liquidity ratio IT	
	sov spread	2-year sov. spread	10-year sov. spread	2-year sov. spread	5-year sov. spread
PT	reference rate	3-month Euribor	2y swap rate	3-month Euribor	5y swap rate
	risk factor	Capital ratio EA	EDF NFC PT	EDF NFC PT	Cost of equity
	risk factor 2		Capital ratio EA		
	sov spread	10-year sov. spread		10-year sov. spread	

Source: Authors' specifications.
Notes: EDF NFC/banks denote the median value of Moody's Expected Default Frequency (EDF) at a one-year horizon for non-financial and financial sectors. Capital-to-asset and liquidity-to-asset ratios for selected countries and for the euro area are taken from the euro-area accounts. The cost of equity for selected countries and for the euro area are compiled on the basis of the ECB dividend discount model.