

# **The impact of the sovereign debt crisis on bank lending rates in the euro area**

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## **Abstract**

Since the early part of 2010 tensions in the sovereign debt markets of some euro-area countries have progressively distorted monetary and credit conditions, hindering the ECB monetary policy transmission mechanism and raising the cost of loans to non-financial corporations and households. This paper makes an empirical assessment of the impact of the tensions on bank lending rates in the main euro-area countries, concluding that they have had a significant impact on the cost of credit in the peripheral countries. A counterfactual exercise indicates that if the spreads had remained constant at the average levels recorded in April 2010, the interest rates on new loans to non-financial corporations and on residential mortgage loans to households in the peripheral countries would have been, on average, lower by 130 and 60 basis points, respectively, at the end of 2011. These results are robust to alternative measures of the cost of credit and econometric techniques.

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## 1. Introduction

Since early 2010 tensions in the sovereign debt markets of several euro-area countries have progressively distorted monetary and credit conditions, raising the cost of credit for non-financial corporations and of residential mortgage loans to households. The financial strains spread rapidly from Greece, whose budget situation had been concealed by the official statistics, to Ireland, which suffered the consequences of a profound banking crisis, and to Portugal, penalized by its balance-of-trade deficit. In the summer of 2011, tensions in the financial markets hit Italian and Spanish government bonds and assumed systemic proportions. Banks' heightened problems with wholesale funding worsened credit supply conditions (see the Eurosystem Bank Lending Survey for the fourth quarter of 2011).<sup>1</sup>

The sovereign debt crisis has increased the heterogeneity of financial conditions within the euro area. Given the predominant role of banks in financing the private sector, these cross-border differences have posed a serious challenge to the ECB's conduct of monetary policy, making the transmission of monetary impulses to euro-area countries less uniform.<sup>2</sup>

The debate on the origins of the euro-area debt crisis has brought out several factors: the macroeconomic weaknesses of some member states, which fuelled doubts about the sustainability of their public debt; the incompleteness of the European construction (see, among others, Visco, 2012); and some form of "wake-up contagion" (Giordano *et al.*, 2013). This paper presents an econometric analysis of the transmission of the tensions in sovereign debt markets to the cost of new short-term loans to non-financial corporations and mortgage loans to households in a group of euro-area countries (Germany, France, Italy, Spain, Netherlands, Belgium, Austria, Greece, Portugal and Finland).<sup>3</sup> The analysis, based on monthly data for the 2003-2012 period, uses the seemingly unrelated regression approach (SUR), which provides more efficient estimation by taking account of the correlations between the disturbances in the equations. As a robustness check, the estimation is also performed by ordinary least squares and for the period 2008-2012. The paper complements the analysis by Albertazzi *et al.* (2012), which gauges the effects of the sovereign debt crisis on the activity of Italian banks. Neri and Ropele (2013) assess the macroeconomic impact of

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<sup>1</sup> The report is available at [http://www.ecb.int/stats/pdf/blssurvey\\_201201.pdf?a28f705bb565d645677ba8ce15ba6049](http://www.ecb.int/stats/pdf/blssurvey_201201.pdf?a28f705bb565d645677ba8ce15ba6049).

<sup>2</sup> The sovereign crisis "[...] has made difficult the transmission of impulses coming from an accommodative monetary policy through adjustments in interest rates on loans to households and firms by banks. Interest rates do not have to be identical across the euro area, but it is unacceptable if significant differences arise because of the fragmentation of capital markets or the perception of a break-up of the euro area. [...] The fragmentation of the single financial market has led to a fragmentation of the single monetary policy." See "The monetary policy of the European Central Bank and its transmission in the euro area", speech by Mario Draghi, President of the ECB, Università Bocconi, Milan, 15 November 2012.

<sup>3</sup> Ireland is excluded for lack of continuous series for confidence indexes.

the sovereign debt crisis for a set of euro-area countries using a factor augmented vector autoregressive (FAVAR) model.

The econometric analysis set out here shows that the sovereign debt tensions have had a substantial impact on bank lending rates in the peripheral countries (Italy, Spain, Greece and Portugal), but practically none in the core countries (Germany, France, Belgium, the Netherlands, Austria and Finland). A counterfactual exercise suggests that if sovereign spreads (defined as the difference between the yields on 10-year government bonds and the yield on swap contracts with the same maturity) had remained constant at their average levels of April 2010, at the end of 2011 the interest rates on new loans to non-financial corporations and residential mortgages in the peripheral countries would have averaged respectively 130 and 60 basis points lower than their actual values. For non-financial corporations in particular, rates would have been 180, 140, 130 and 50 basis points lower in Greece, Portugal, Italy and Spain respectively.

The remainder of the paper is organized as follows. Section 2 describes developments in sovereign spreads and bank rates in the course of the debt crisis, Section 3 studies the impact on bank rates, Section 4 presents some robustness checks and Section 5 concludes.

## **2. The sovereign crisis and bank lending rates in euro-area countries**

In view of the importance of banks in financing the private sector, the pass-through of changes in ECB policy rates to bank lending rates is a key element of the euro-area monetary policy transmission mechanism (see ECB, 2008b and Draghi, 2012). Normally the marginal cost of funding for banks is related to the interest rates on unsecured borrowing in the interbank market, which in turn are related to policy rates. By means of its supply of reserves through refinancing operations, the ECB can influence short-term money market rates (such as EONIA, the average overnight rate) which in turn affect lending rates and ultimately the real economy and inflation.

### **2.1 The evolution of the sovereign debt crisis**

The financial crisis has caused severe fragmentation of the European financial market along national lines, hampering the transmission of ECB monetary policy and preventing the uniform transmission of monetary impulses to the different euro-area countries. The Governing Council of the ECB responded to such malfunctions by adopting, after October 2008, a series of extraordinary measures (see Trichet, 2009, “The ECB’s enhanced credit support”) to sustain credit to the private sector and maintain the correct transmission of monetary policy (see Cecioni *et al.* 2011). These extraordinary measures helped to improve financial conditions in 2009.

Early in 2010, however, the government securities markets of some euro-area countries with weak fiscal and macroeconomic fundamentals were strained severely (Fig. 1). The sovereign spreads of several countries rose to unprecedented levels, and in some government bond markets liquidity nearly evaporated. These tensions spread to other market segments, including equity and money markets (see Trichet, 2010). The ECB responded by reinstating some measures that had been withdrawn in the preceding months and instituting the Securities Markets Programme (SMP) to ensure the proper transmission of monetary policy impulses to the economy through secondary-market purchases of government securities.

The strains spread from Greece, where they had been triggered by fears for the sustainability of the public finances, to the Irish and Portuguese government bond markets in the autumn and winter of 2010-2011. In July 2011, the spreads of Italian and Spanish government bonds vis-à-vis the German Bund increased significantly, following further downgrades of Greek bonds and the announcement by the European Council of the involvement of the private sector in the second bail-out package for Greece. In order to ease the tensions in financial markets and halt the contagion, the ECB revived the Securities Markets Programme. Banks' funding conditions worsened significantly, affecting their lending standards, particularly on loans to firms. The extraordinary measures taken in December by the ECB, including two three-year refinancing operations, and the lowering of policy rates, together with the fiscal adjustment measures of some governments, helped to allay the tensions and alleviate banks' funding difficulties.

Financial market tensions resurfaced in March 2012 as investor worries heightened over the political situation in Greece, the difficulties of the Spanish banking sector and the inability of governments to reform European Union governance arrangements or create effective crisis management tools for the euro area. The sovereign spreads of the peripheral countries increased steadily until August, when the Governing Council of the ECB announced extraordinary measures to address the bond market disruptions, which stemmed in part from concern that the euro might prove reversible ("redenomination risk"), and to preserve the singleness of the ECB monetary policy and the correct functioning of its transmission mechanism.<sup>4</sup> Di Cesare *et al.*, 2012 and Giordano *et al.*, 2013, have shown that in 2012 the sovereign spreads of several countries had reached levels that were higher than those consistent with fiscal and macroeconomic fundamentals, partly because of the perceived risk of a break-up of the euro area. After its meeting on 6 September 2012, the Governing Council described the new Outright Monetary Transactions programme for the

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<sup>4</sup> From the introductory statement to the press conference of 2 August 2012: "The Governing Council, within its mandate to maintain price stability over the medium term and in observance of its independence in determining monetary policy, may undertake outright open market operations of a size adequate to reach its objective."

purchase of government securities in secondary markets in detail. The programme, which is fully within the remit of the ECB, helps to maintain price stability.<sup>5</sup>

## 2.1. Sovereign spreads and bank lending rates

Several channels have been suggested for the transmission of government bond market tensions to the banking system.<sup>6</sup> According to the so-called price channel thesis, the interest rate on government bonds is a benchmark for determining the cost of loans to households and non-financial corporations. The balance-sheet thesis is that a capital loss on banks' government bond portfolios, via its effects on profitability and capital, may induce a tightening of credit supply. And working via the liquidity channel, the loss of value of bonds, which are typically used as collateral for interbank transactions, could reduce banks' ability to procure funds in the money market.<sup>7</sup>

As a gauge of the impact of the sovereign tensions on lending rates, Figures 2 and 3 show the mean cost of new loans to non-financial corporations and of residential mortgages in the euro area and the interval between the 10<sup>th</sup> and the 90<sup>th</sup> percentile of the distribution of these rates across countries. The heterogeneity in these costs has increased significantly during the sovereign debt crisis. The standard deviation of interest rates on new loans to non-financial corporations increased from 62 basis points in January 2003-April 2010 to 139 points in May 2010-August 2011 (Fig. 2); for households the increase was more modest, from 45 to 56 basis points (Fig. 3).

The picture as regards real interest rates (net of inflation), the relevant variable for the investment and consumption decisions of firms and households, is similar. As for the most appropriate gauge of inflation, economic theory holds that lenders require compensation for the monetary erosion produced by the expected change in the price level. This suggests that the best indicator may be the ex-ante real interest rate. However, euro-area inflation expectations, such as those of Consensus Economics, are generally available at quarterly frequency only for the four largest countries and for the area as a whole. To compute real inflation rates for more countries, one can use rates based on the Harmonized Index of Consumer Prices (HICP), which have a high correlation with expected inflation rates, and so permit the calculation of an ex-post measure of the real interest rate. Figures 4 and 5 show the mean and median real rates on loans and the 10<sup>th</sup> and 90<sup>th</sup> percentile interval of the distribution across countries. The figures confirm that the

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<sup>5</sup> Implementation of the OMT is subject to strict conditionality connected with the application to the European Financial Stability Facility (EFSF) or the European Stability Mechanism (ESM) for financial support.

<sup>6</sup> For a description of the relationship between sovereign risk and funding conditions for banks, see Committee on the Global Financial System (2011) and Trichet (2010).

<sup>7</sup> Sovereign downgrades are generally followed by downgrades of domestic banks, while a weakening of the public finances reduces the availability of implicit and explicit government guarantees.

heterogeneity in the real cost of new loans to non-financial corporations increased significantly after the beginning of the sovereign debt crisis, while for households the increase was more moderate.

The increase in the dispersion of lending rates reflects the asymmetrical nature of the sovereign debt crisis. Before the crisis, lending rates were not correlated with sovereign spreads in Greece, Portugal, Spain and Italy (Fig. 6). The correlation emerged only once the crisis had broken out. The correlation is analyzed more closely, through an econometric model, in Section 3.

Despite the increase in the dispersion of bank rates, the heterogeneity in trends in loans to non-financial corporations (Fig. 7) and households (Fig. 8) diminished, albeit to varying extent, in the course of the financial and the sovereign debt crises. This diminution mainly reflected the impact of the financial crisis on banking and on the real economy, which has tended to synchronize credit developments in euro-area countries. Before the crises, these variables were driven by country-specific factors such as buoyant housing markets (Spain and Ireland), or strong corporate cash-flow (Germany).

The standard deviation of the growth rates of credit to non-financial corporations fell from 6.4 percentage points in the period from 2003 to the summer of 2007 to 3.8 points between autumn 2007 and August 2012 (Table 1). By contrast, the sovereign debt crisis did not affect the volatility of credit dynamics significantly: the standard deviation for the period from May 2010 to August 2012 is identical to that between September 2007 and April 2010. As for residential mortgage loans, the decline in volatility between these two periods was comparable (from 7.5 to 4.8 percentage points), but such decline occurred mainly during the sovereign debt crisis (3.4 percentage points between May 2010 and August 2012). As for lending rates, the statistics in Table 1 confirm these results: for non-financial corporations the standard deviation increased from 0.6 percentage points between 2003 and the summer of 2007 to 0.7 during the financial crisis (from September 2007 to April 2010) and to 1.4 during the sovereign debt crisis. For households the increase in volatility was more muted.

To sum up, the financial crisis brought a decline in the standard deviation of credit growth and almost no change in the dispersion of bank lending rates, whereas the sovereign debt crisis increased the dispersion of lending rates, in particular to non-financial corporations, while further lowering the volatility of growth rates of credit to households.

### **3. Econometric analysis**

The indicator used here for tensions in sovereign debt markets is the spread between the yields on government bonds and the 10-year swap rate of equal maturity. Unlike the German Bund yield,

the swap rate as benchmark enables us to include an equation for lending rates in Germany and to assess the possible effect on these rates of the decline of the Bund yield due to the “flight to quality” during the worst of the financial and sovereign debt crises. The system describing lending rates to non-financial corporations ( $k = f$ ) and households for house purchase ( $k = h$ ) in country  $j$ :

$$R_{j,t}^k = \bar{R}_j^k + \alpha_1 D_t^{crisis} + \alpha_2 D_t^{2008} + \alpha_3 R_{t-1}^{ov} + \alpha_4 (R_{t-1}^{3m} - R_{t-1}^{ov}) + \alpha_5 (R_{j,t-1}^{10} - R_{t-1}^{10,swap}) + \alpha_6 Y_{t-1}^k + \alpha_7 R_{j,t-1}^k + \varepsilon_t \quad (1)$$

is estimated by the SUR method.<sup>8</sup> Each equation in (1) is set up on the autoregressive distributed lags model (ARDL), which has been used extensively to assess the transmission of changes in monetary policy rates to lending rates (Cottarelli and Kourelis, 1994; Favero *et al.*, 1997; Marotta, 2010).<sup>9</sup> The explanatory variables are: the constant  $\bar{R}_j^k$ , a dummy  $D^{crisis}$  that takes the value one from the Lehman Brothers default to the end of the sample period, a dummy  $D^{2008}$  taking value one between November 2008 and February 2009 (to avoid large residuals in some of the equations), the EONIA rate, the spread between three-month Euribor and EONIA  $R^{3m} - R^{ov}$  (a proxy for credit risk in the money market), the spread between the yields on 10-year government bonds and that of swap contracts in euro of equal maturity,  $R_j^{10} - R^{10,swap}$ , a confidence indicator  $Y^k$ , and the lagged value of the bank rate.<sup>10</sup> The independent variables are introduced at time  $t-1$  in order to avoid endogeneity problems. The sovereign spread can be thought of as a summary statistic for the impact of banks’ funding difficulties on lending standards.<sup>11</sup> This thesis finds support in Del Giovane *et al.* (2013), according to which developments in banks’ balance sheet and funding conditions mainly reflect those in the sovereign debt markets.

The interest rates are the rates on new loans (excluding overdrafts) to non-financial corporations and on residential mortgages, with initial maturity up to one year (see the Appendix for a detailed description). These data are available from January 2003 onwards on the ECB website.<sup>12</sup> The monetary financial institutions interest rate statistics cover all the interest rates that credit institutions apply to euro-denominated deposits and loans (outstanding amounts and new business)

<sup>8</sup> The rationale for the seemingly unrelated regression approach is that there could be common factors not included as independent variables affecting all the equations at once, inducing correlation between the error terms.

<sup>9</sup> Depending on the nature of the dataset available, other empirical approaches are also possible. For example, panel-econometric methods have been used (Sørensen and Werner, 2006) to study heterogeneity in the pass-through of changes in money market rates to lending rates in the euro area.

<sup>10</sup> Since mid-2011 Eurepo rates have been affected by the strong demand for high-quality collateral, which has pushed them down close to or even below zero. Data on Eonia swap rate contracts are available only after mid-2005. The use of the spread between Euribor and Eurepo and between Euribor and Eonia swaps results in only marginally different coefficients; and the coefficients on sovereign spreads and counterfactual simulations are identical (Section 3.1).

<sup>11</sup> See the ad hoc questions on the impact of the sovereign debt crisis on banks’ funding conditions and credit standards in the Eurosystem Bank Lending Survey (<http://www.ecb.int/stats/money/surveys/lend/html/index.en.html>).

<sup>12</sup> See, for instance, [http://www.ecb.int/stats/pdf/mir\\_general\\_description.pdf?a13000d3717c100bef08c0c137f28bcd](http://www.ecb.int/stats/pdf/mir_general_description.pdf?a13000d3717c100bef08c0c137f28bcd).

to all households and resident non-financial corporations of all sizes.<sup>13</sup> These data have been used, among others, by Marotta (2009) to study the pass-through of changes in the ECB rate to lending rates. The rates used in the estimation are among the most responsive to changes in banks' funding costs and the policy rate.

Before estimating the model, the stationarity of the time series for lending rates was tested using the Augmented Dicky-Fuller test (Said and Dickey, 1984), which rejected the null of stationarity at the 5 per cent significance level for the interest rates on new loans to both non-financial corporations and households. These results were also confirmed by the Kwiatowski *et al.* (KPSS, 1992) and Phillips-Perron (PP, 1998) tests (see Table 2).<sup>14</sup> When the dependent variables follow unit root processes, the estimation of ARDL models is equivalent to estimating error correction models (Pesaran and Shin, 1999); the results are discussed in Section 4.4.

Tables 3 and 4 show the estimates for the period from January 2003 to August 2012.<sup>15</sup> For non-financial corporations (Table 3): (i) the adjustment of lending rates to changes in the explanatory variables is gradual (column h); (ii) both EONIA (column b) and the spread between three-month Euribor and EONIA (column e) are significant in all the equations; (iii) the transmission of changes in EONIA is incomplete in both the short and the long run; (iv) the sovereign spread (column f) is statistically significant in the peripheral but not the core countries. After one quarter, an increase of 100 basis points in these spreads raises lending rates by 33 basis points in Italy, 20 in Portugal, 16 in Spain and 7 in Greece.

For Italy, Albertazzi *et al.* (2012) estimate the effect on rates on new short-term loans (excluding overdrafts) at 35 basis points using monthly data over the period 2003-2012; the impact is greater, 50 basis points, when overdrafts are included, the period considered is 1991-2011, and the data used are quarterly rates on (outstanding) short-term loans.<sup>16</sup> Del Giovane *et al.* (2013) find that an increase of 100 basis points in the sovereign spread raises the interest rate on new short-term loans by around 30 basis points with a one-quarter lag;<sup>17</sup> Zoli (2013) estimates that between 30 and 40 per cent of the increase in the Italian sovereign spread is transmitted to the interest rates in loans

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<sup>13</sup> The MFI interest rate statistics provide monthly data on 45 instrument categories of euro-denominated deposits and loans, disaggregated by original maturity, notice periods or periods of interest rate fixation. The statistics are produced for the euro area as a whole and individually for each member country.

<sup>14</sup> KPSS is often used to confirm the results obtained from other tests in which the null hypothesis is the non-stationarity of the time series. However, inferences based on the KPSS test can be sensitive to the number of lags in the estimation of the heteroskedasticity and autocorrelation consistent covariance matrix (Maddala and Kim, 1998). In fact, with more lags the assumption of stationarity cannot be rejected for some countries, including Italy and Spain.

<sup>15</sup> The correlation between the residuals (on average 0.2, in some cases 0.6) justifies the SUR approach.

<sup>16</sup> The difference between the estimates may reflect both the different sample periods and the types of loans used.

<sup>17</sup> Del Giovane *et al.* (2013) analyze the relative role of demand and supply factors in explaining credit developments, focusing on the differences between the global financial crisis and the sovereign debt crisis.



to non-financial corporations within three months. The positive coefficients on  $D^{crisis}$  indicate that the spread between the interest rate on loans to non-financial corporations and EONIA was larger after the collapse of Lehman Brothers than before.

For new residential mortgage loans, the estimation yields the following results (Table 4): (i) in all countries, the adjustment to changes in the explanatory variables is more gradual than for non-financial corporations (column h); (ii) EONIA is significant in all equations (column b); (iii) the transmission of changes in EONIA is incomplete both in the short and in the long run; (iv) the sovereign spread is statistically and economically significant in Spain, Italy and Portugal and, among the core countries, also in Belgium and Finland (column f).

Section 4 assesses the robustness of these estimations.

### 3.1. The impact of sovereign spreads on lending rates

Using the system estimated in (1), we can quantify the effect of increases in sovereign spreads on lending rates by means of two counterfactual exercises; namely, we assume that the spreads remain constant at the values recorded in April 2010, before the heightening of the tensions on Greek bonds, or, alternatively, at the level of June 2011, before the tensions hit the markets for Italian and Spanish bonds. All the other variables are assumed to follow their actual paths. By construction, the exercises do not consider that in the absence of the sovereign crisis the ECB would have followed different (conventional and unconventional) policies and the macroeconomic outlook of the euro-area countries would also have been better.<sup>18</sup> Therefore the counterfactual exercise offers a conservative estimate of the impact of the sovereign debt market tensions.

The differences between the actual values of bank rates and those obtained with the two counterfactual exercises are set out in Tables 5 and 6 and Figures 9-12. If sovereign spreads had remained constant at the levels recorded in April 2010, the average interest rates on loans to non-financial corporations in 2011 would have been lower than the actual rates by around 50 basis points in Italy and 40 in Spain; and at the end of the year the rates would have been lower than their actual values by 130 and 50 basis points respectively (Table 5). Albertazzi *et al.* (2012), using quarterly data, estimate that if the sovereign debt crisis had not occurred the interest rate on short-term (outstanding) loans in the last quarter of 2011 would have been lower than actual rates by 170 basis points.<sup>19</sup> They would have been about 140 basis points lower in Greece and 180 points lower

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<sup>18</sup> Using the actual data for business and household confidence and the Euribor-Eonia spread, we ignore the fact that if our counterfactual scenarios had been realized, these variables would probably have taken a different course.

<sup>19</sup> An update of these results, presented in Banca d'Italia, Financial Stability Report No. 4, November 2012, shows that if the spread had remained at the same level as in the first quarter of 2010, the interest rate on new loans to firms in the second quarter of 2012 would have been lower than the actual value by 160 basis points.

in Portugal. The average rate in the peripheral countries would have been 130 basis points lower, while the average dispersion of rates on new loans to non-financial corporations would have been equal to 1 percentage point, compared with an actual value of 1.39 (Table 1).

For households, the counterfactual exercise suggests that the effects of the tensions on lending rates were somewhat smaller than for non-financial corporations. Had the spreads remained constant at the levels recorded in April 2010, then in December 2011 the lending rates in Italy, Portugal and Spain would have been lower than the actual values by around 120, 110 and 30 basis points respectively. The average rate in the peripheral countries would have been 60 basis points lower, while the average dispersion of bank rates on new loans to households between May 2010 and August 2012 would have not changed much (0.60, compared with 0.56).

Qualitatively similar results both for non-financial corporations and for households are obtained with the counterfactual exercise taking July 2011 as reference level (Table 6). Comparing the two simulations, we see that in Italy a large part of the rise in banks' lending rates occurred after July 2011. In Spain, by contrast, a good part of the increase in lending rates came after the renewed tensions for Spanish bonds in the spring of 2012. In Greece and Portugal, the effects on lending rates are already largely incorporated in the exercise taking May 2010 as reference date, suggesting that the cost of credit in these countries increased mainly in the first part of the sovereign crisis.

#### **4. Robustness checks**

In this section we assess the robustness of the results to changes in sample period, to an alternative econometric approach and to different data on the cost of loans.

##### **4.1. Sub-sample analysis**

Here we give the results obtained by estimating our system of equations over the entire crisis period (2008-2012). Comparing the results on the cost of new loans to non-financial corporations (Table 7 and Table 3) suggests that the results are qualitatively robust to the choice of the sample period; the adjustment to changes in EONIA is, on average, slightly greater in the shorter sample, and the sensitivity of bank rates to changes in sovereign spreads is almost identical in the two periods. The speed of adjustment (measured by the coefficient of the lagged bank rate), is on average slower. The similarity in the coefficients of the system of equations translates into similar results for the counterfactual exercises described in Section 3.1 as well.

Similarly, a look at the results for the rates on new residential mortgages (Table 8 and Table 4) indicates very little difference between the two sample periods. The sensitivity of lending rates to sovereign spreads is slightly greater in the peripheral countries in the shorter sample, whereas the

results of the counterfactual simulations are similar to those discussed in Section 3.1. Interestingly, if the system of equations in (1) is estimated over the period 2003-2007 the parameters measuring the pass-through of changes in sovereign spreads to bank lending rates in all the countries considered are not statistically different from zero. This is in accordance with the thesis that prior to the crisis government bond yields had little importance for banks' price-setting policies for short-term loans.

#### **4.2. Single equation ordinary least squares**

In this section we test for robustness of the results using ordinary least squares (OLS) instead of the seemingly unrelated regression approach to estimate the system of equations in (1). There are two reasons for choosing the SUR methodology: a gain in efficiency thanks to combining information from the different equations and the possibility of testing restrictions across equations (Moon and Perron, 2006). There is no theoretical result that applies to our case, as the equations have different explanatory variables and the disturbances are allowed to be correlated. However, it can be shown (Greene, 2011) that the gain in efficiency tends to be greater when the correlation among the disturbances is stronger and when the explanatory variables are not strongly correlated. One potential problem with the SUR approach is that it may propagate misspecification and inconsistency across equations. For if even one of the equations is misspecified then under SUR all the parameters are estimated inconsistently. This danger suggests the advisability of estimating each equation separately.

In our case, despite the potential disadvantages of the SUR methodology, comparison of Tables 3-4 with Tables 9-10 shows that our results are robust to the use of OLS. The coefficients on the sovereign spreads and EONIA are, on average, marginally higher with OLS, but the results of the counterfactual simulations are nearly identical both for non-financial corporations and for households.

#### **4.3 Alternative measures of the cost of loans**

The dependent variable in the foregoing analysis has been interest rates on new loans. But the overall impact of the sovereign spread on the debt-service burden of non-financial corporations and households depends on the interest paid on existing loans as well. While for firms the fraction of variable rates – which naturally react more rapidly and strongly to changes in banks' funding costs – is above 90 per cent in all the countries considered, for households the proportion averages only 60 per cent.

In this light it is important to test the robustness of our results to alternative definitions of lending rates. For non-financial corporations the system in (1) is estimated using the interest rate on outstanding loans (up to one year) including overdrafts; for households, the dependent variable is the average cost of outstanding loans at both variable and fixed rates. The results, which are not reported, are qualitatively similar albeit with some quantitative differences. The coefficient of the EONIA rate is lower, on average across countries, than in the estimation discussed in Section 3; the coefficient of the sovereign spreads is lower and that of the lagged value of the bank rate is higher. The counterfactual exercises confirm that the sovereign debt tensions had a significant effect on the cost of loans to non-financial corporations.

For households, when the dependent variable is the average rate on existing loans at variable and fixed rates, the coefficients of the sovereign spreads are positive and significant also in the core countries, while those of EONIA are much smaller. The former finding can be explained by the fact that fixed rates on loans to households are generally set on the basis of long-term yields, including government bond yields. In fact, if sovereign spreads are replaced with the yields, the associated coefficients are high and significant in some core countries as well.

#### **4.4 Error correction models**

Error correction models have been used extensively in the literature on the bank interest rate pass-through (Sørensen and Werner, 2006 and Marotta, 2010). Changes in a specific bank rate are regressed on simultaneous and lagged changes in a relevant market rate and on an error correction term that captures the divergence of the bank rate from its long-run equilibrium relationship with the market rate.

Section 3 shows that all lending rates are non-stationary and follow unit root processes. Here we test for the presence of cointegration relationships between lending rates and EONIA. The Engle and Granger (1987) tests reported in Table 11 find no cointegrating relationship between the interest rate on new loans to non-financial corporations and EONIA. A graphical analysis of the residuals of the first-step regression (Figures 11 and 12) suggests that the sovereign crisis may have caused a break in the cointegrating relationship in the peripheral countries. If instead of EONIA we use three-month Euribor, a cointegrating relationship is found for households only for Germany and Finland; for non-financial corporations, only for Austria, Germany, Finland and the Netherlands. In these cases, the estimation of an error correction model shows that the sovereign spreads are not statistically significant, confirming the findings of Section 3.

## 5. Conclusion

Since the beginning of 2010, the strains in some sovereign debt markets have progressively distorted monetary conditions in the euro area as a whole and in some member countries. The fragmentation of financial markets along national lines has prevented the homogeneous transmission of the ECB monetary policy stance to the interest rates on new bank loans to households and firms. The three-year refinancing operations, the expansion of eligible collateral in late 2011 and more recently the introduction Outright Monetary Transactions have been designed to preserve the singleness of monetary policy of the ECB and the correct functioning of its transmission mechanism.

This paper presents the results of an econometric assessment of the transmission of sovereign tensions to lending rates in the main euro-area countries. The model estimated finds that the sovereign debt tensions have had a significant impact on lending rates in the peripheral but not in the core countries. A counterfactual exercise suggests that, all else constant, if the sovereign crisis had not occurred, then the rates on new bank loans to non-financial corporations and residential mortgages loans to households in the peripheral countries would have been significantly lower.

The analysis is based on the estimation of simple interest-rate equations. Future research might explore the role of time variation in the parameters and the possibility of non-linear effects of the sovereign spreads. An extension of the analysis by means of Vector Auto-Regressive models, moreover, could quantify the impact of the sovereign debt crisis not only on the cost of credit but also on the main macroeconomic variables, including money, credit and economic activity.

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## Appendix: Data

All the data are available in the ECB *Statistical Dataware House* (SDW) or in the OECD.StatExtracts webpage. Data in the SDW for each country can be obtained by replacing the percentage sign % with the following codes:

Austria	=	AT	Belgium	=	BE
Germany	=	DE	Spain	=	ES
Finland	=	FI	France	=	FR
Greece	=	GR	Italy	=	IT
The Netherlands	=	NL	Portugal	=	PT

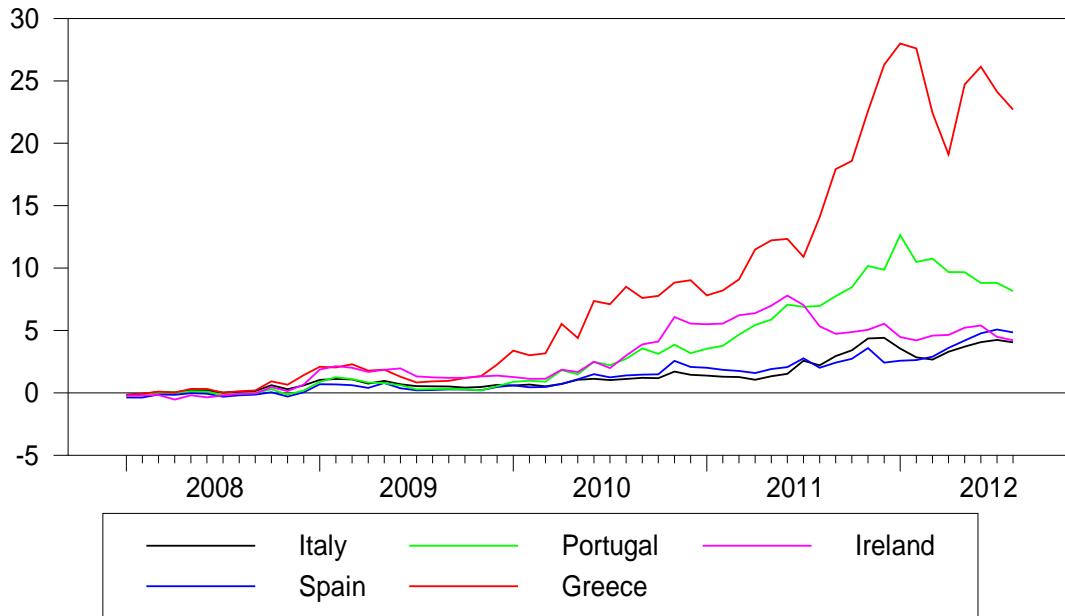
- **Interest rate on loans to non-financial corporations:** Annualised agreed rate / Narrowly defined effective rate, credit and other institutions (Monetary Financial Institutions, MFIs, except money market funds and central banks) reporting sector - loans other than revolving loans and overdrafts, convenience and extended credit card debt, initial maturity up to one year maturity, total amount, new business coverage, euro, non-financial corporations sector.  
*Statistical Dataware House:* MIR.M.% .B.A2A.F.R.A.2240.EUR.N
- **Interest rate on residential mortgages (loans to households for house purchase):** Annualised agreed rate / Narrowly defined effective rate, credit and other institutions (MFIs except money market funds and central banks) reporting sector - lending for house purchase excluding revolving loans and overdrafts, initial maturity up to one year maturity, new business coverage, euro, households and non-profit institutions serving households.  
*Statistical Dataware House:* MIR.M.% .B.A2C.F.R.A.2250.EUR.N
- **Loans to non-financial corporations:** Index of notional stocks, MFIs excluding the ESCB reporting sector - loans, total maturity, all currencies combined - euro area (changing composition) counterpart, non-financial corporations sector, annual growth rate, data not adjusted for seasonal or calendar effects.  
*Statistical Dataware House:* BSI.M.% .N.A.A20.A.I.U2.2240.Z01.A
- **Loans to households:** Index of notional stocks, MFIs excluding ESCB reporting sector - loans, total maturity, all currencies combined - euro area (changing composition) counterpart, households and non-profit institutions serving households sector, annual growth rate, data not adjusted for seasonal or calendar effects.  
*Statistical Dataware House:* BSI.M.% .N.A.A20.A.I.U2.2250.Z01.A
- **EONIA rate:** Eonia rate - Historical close, average of observations through period - provided by ECB  
*Statistical Dataware House:* FM.M.U2.EUR.4F.MM.EONIA.HSTA
- **Three-month EURIBOR rate:** Euribor three-month - Historical close, average of observations through period - Euro, provided by Reuters  
*Statistical Dataware House:* FM.M.U2.EUR.RT.MM.EURIBOR3MD\_.HSTA
- **Non-financial corporations' confidence indicator:** Main Economic Indicators (OECD); monthly; business tendency surveys, seasonally adjusted. Available at <http://stats.oecd.org/>
- **Households' confidence indicator:** Main Economic Indicators (OECD); monthly; consumer opinion surveys, seasonally adjusted. Available at <http://stats.oecd.org/>



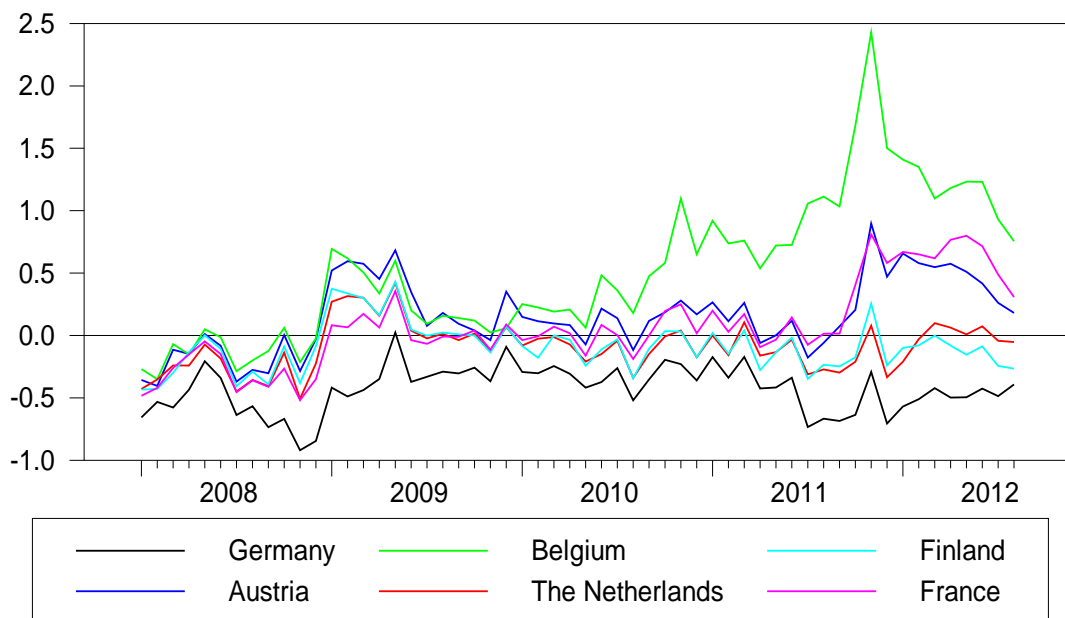
## Figures and Tables

**Fig. 1** Spreads between 10-year yields on sovereign bonds and the 10-year swap rate in euro

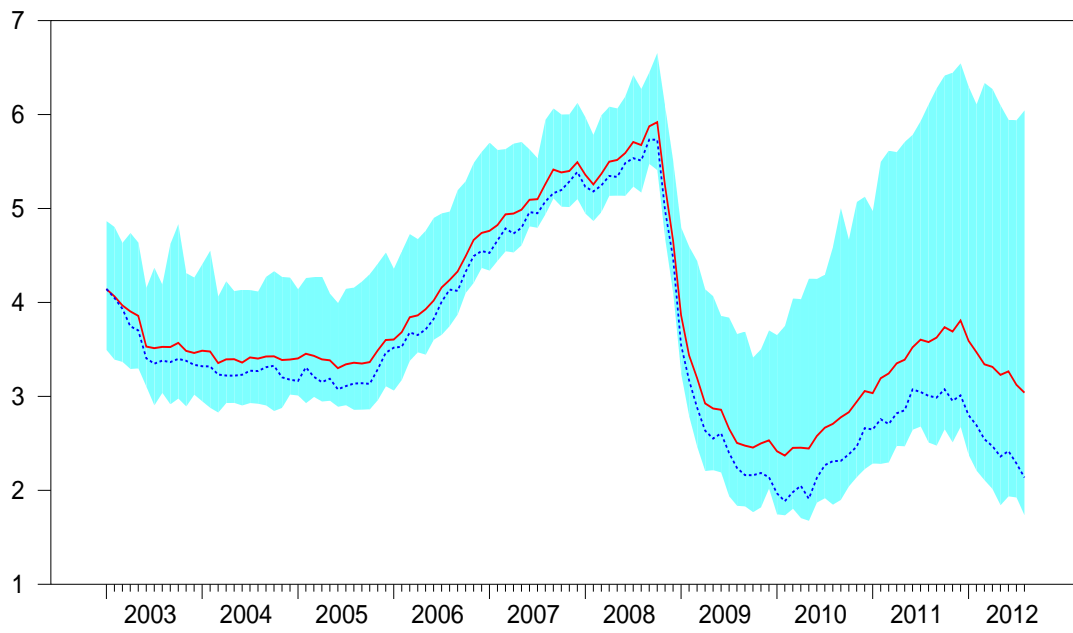
(a) Peripheral countries



(b) Core countries

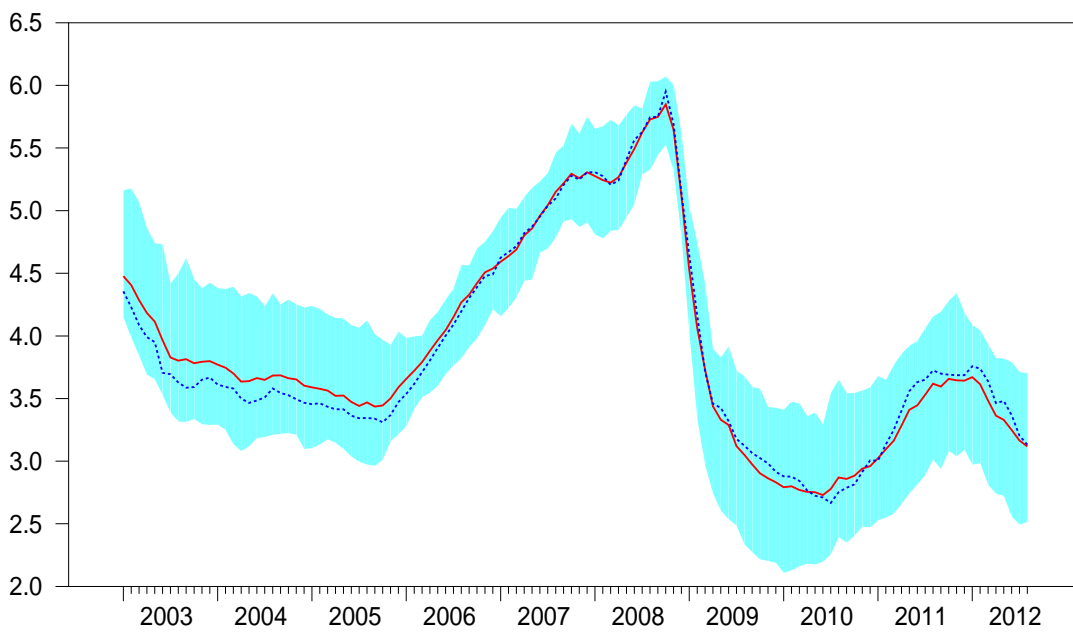


**Fig. 2** Interest rates on new loans to non-financial corporations



Note: blue shaded area: 10<sup>th</sup>-90<sup>th</sup> percentiles; blue dotted line: median; red line: mean. Percentage points.

**Fig. 3** Interest rate on new loans to households for house purchases



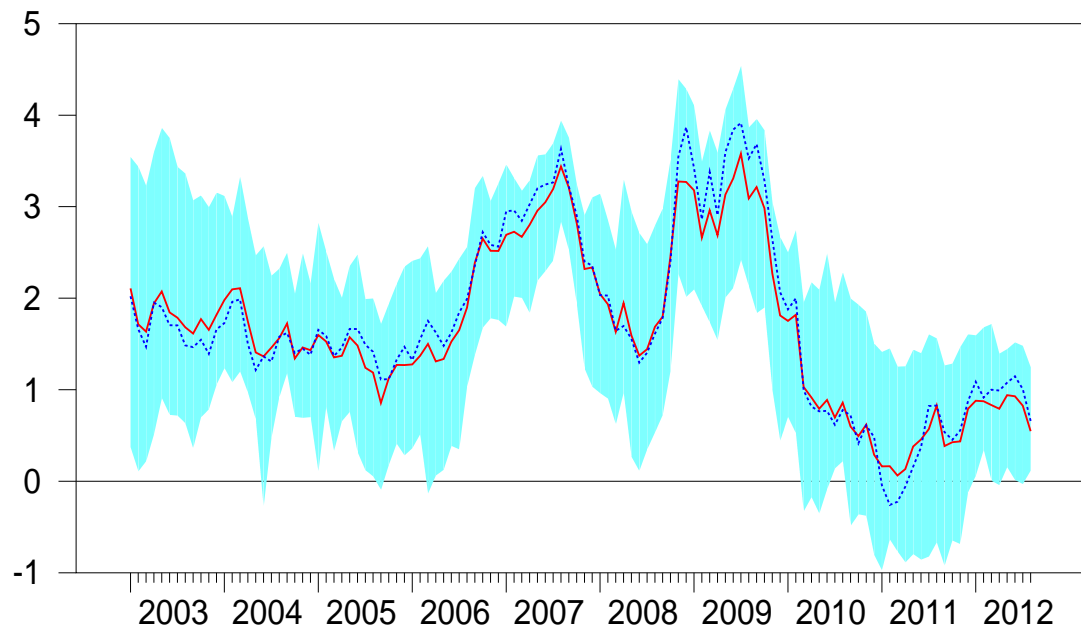
Note: blue shaded area: 10<sup>th</sup>-90<sup>th</sup> percentiles; blue dotted line: median; red line: mean. Percentage points.

**Fig. 4** Real interest rates on new loans to firms, deflated with current HICP inflation rates



*Note:* blue shaded area: 10<sup>th</sup>-90<sup>th</sup> percentiles; blue dotted line: mean; red line: median. Percentage points.

**Fig. 5** Real interest rates on new loans to households for house purchase, deflated with current HICP inflation rates

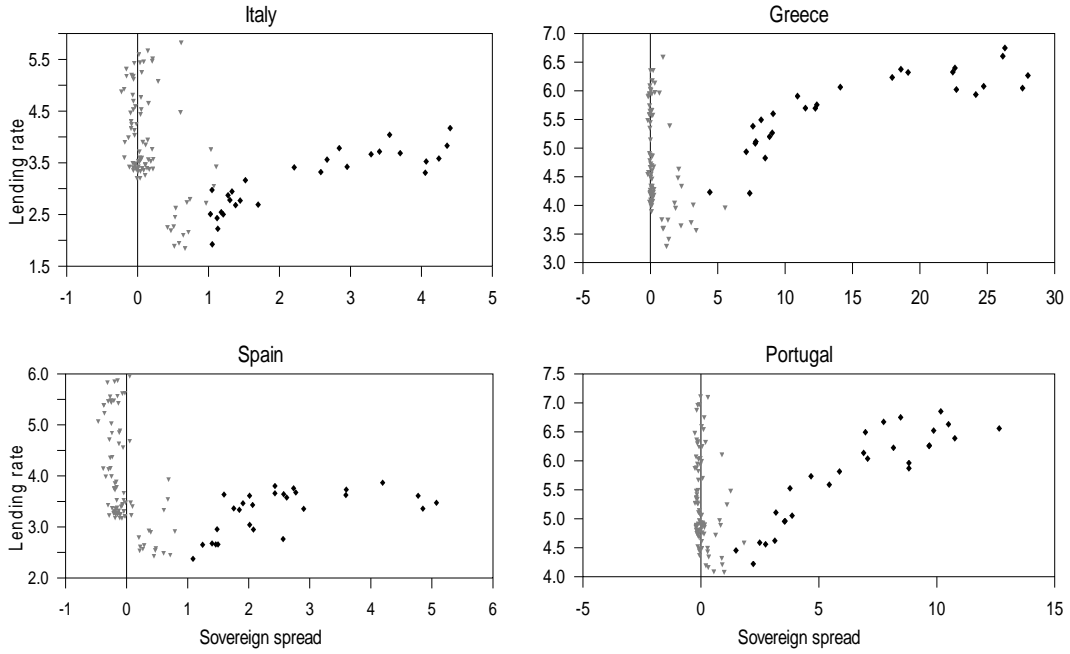


*Note:* blue shaded area: 10<sup>th</sup>-90<sup>th</sup> percentiles; blue dotted line: mean; red line: median. Percentage points.

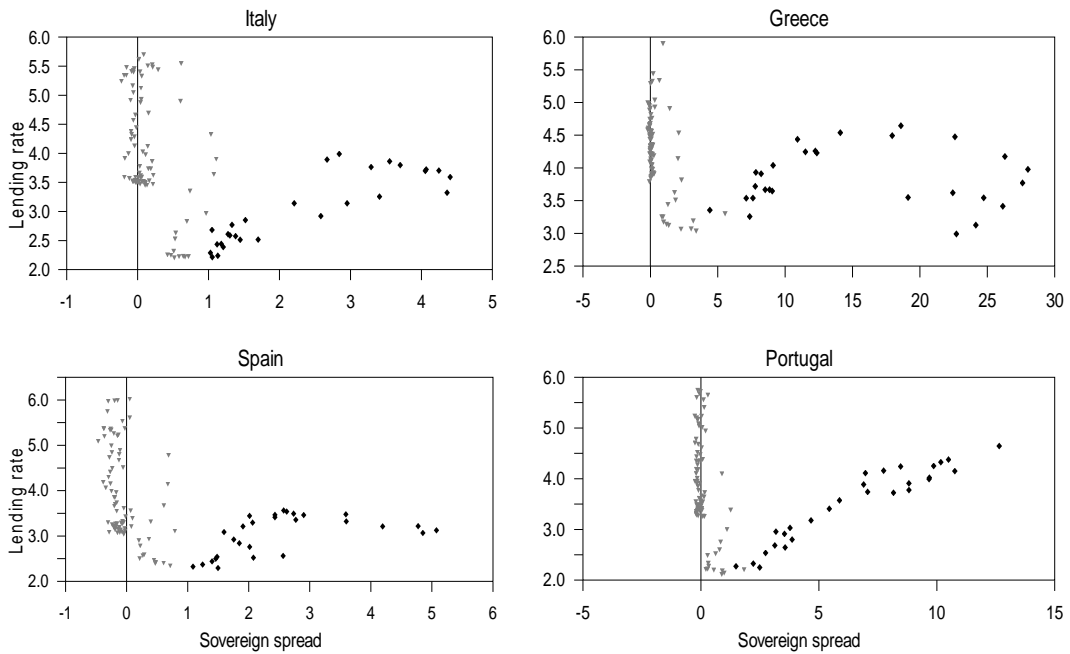
**Fig. 6** Sovereign spreads and interest rates on new loans

(grey triangles: 2003:01 – 2010:04; black diamonds: 2010:5 – 2012:08; percentage points)

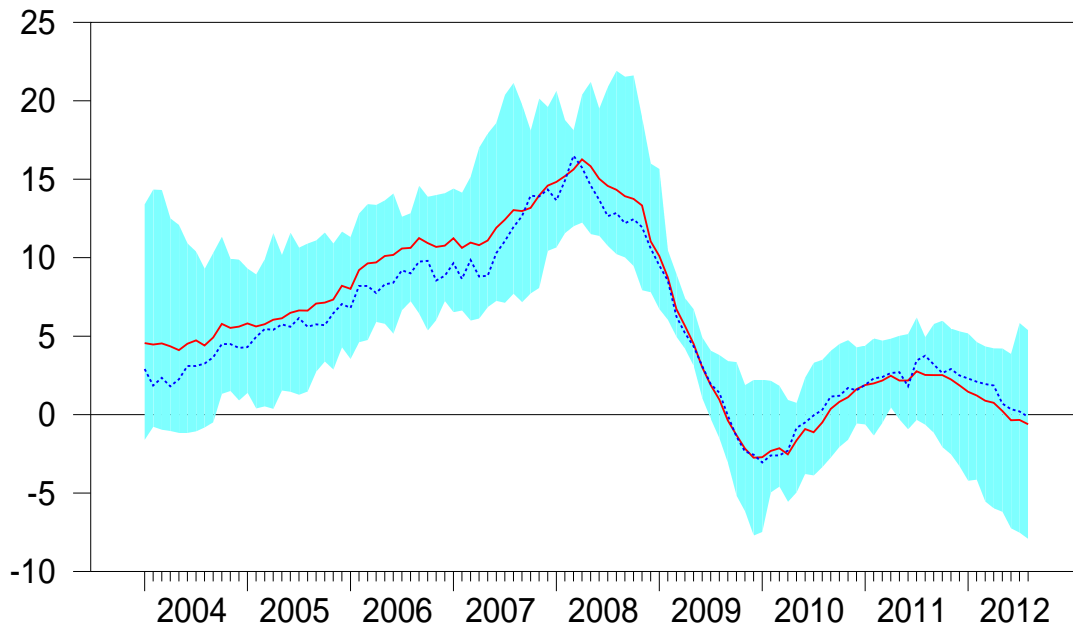
a) Non-financial corporations



b) Households

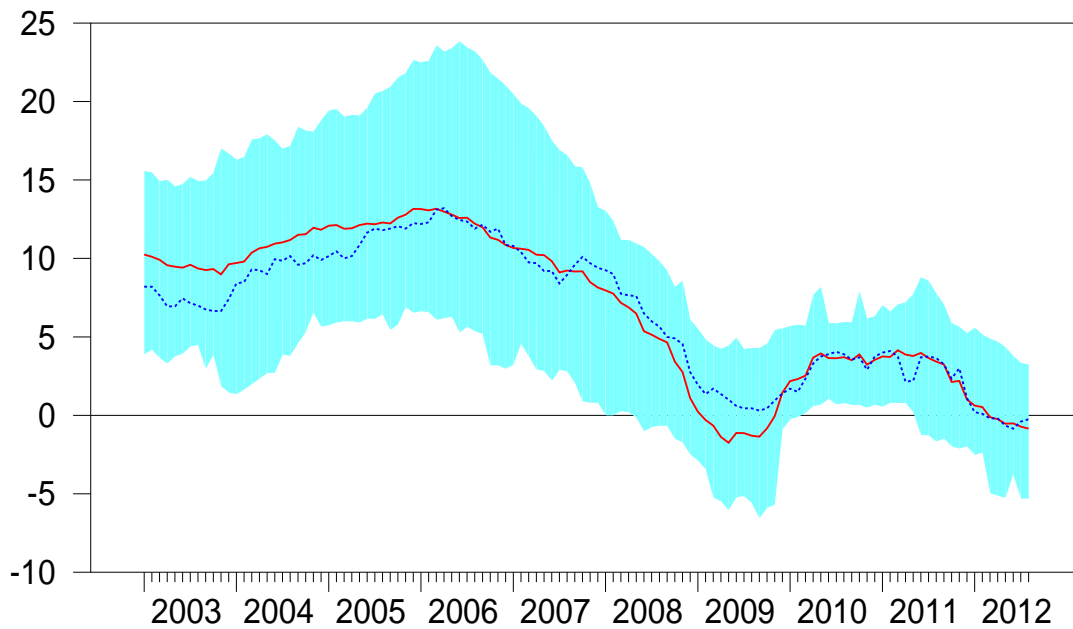


**Fig. 7** Loans to non-financial corporations  
(*twelve-month growth rates; per cent*)



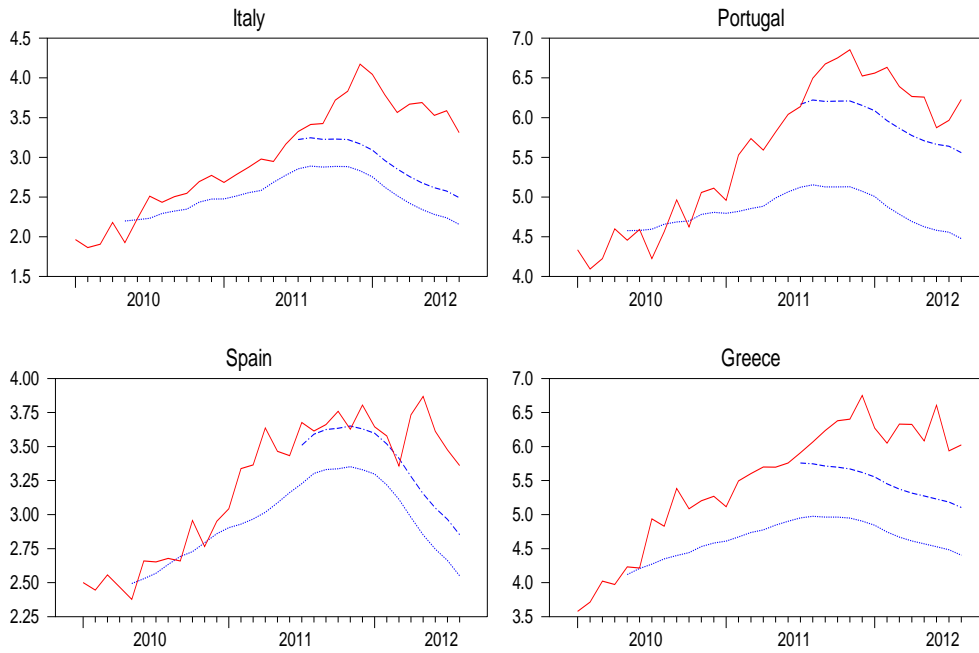
Note: blue area: 10<sup>th</sup>-90<sup>th</sup> percentiles; blue dotted line: median; red line: mean.

**Fig. 8** Loans to households for house purchase  
(*twelve-month growth rates; per cent*)



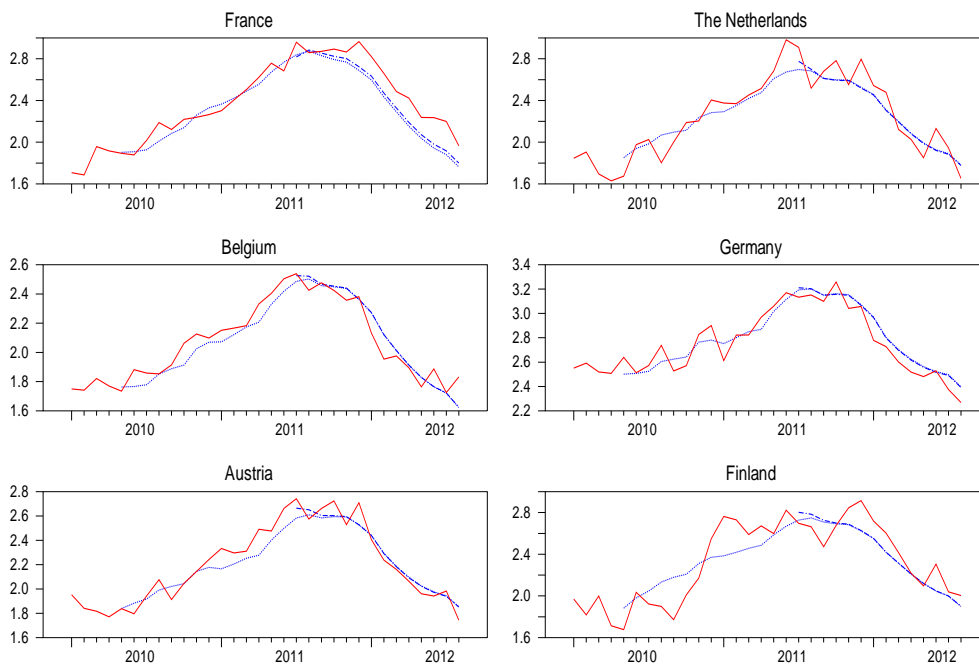
Note: blue area: 10<sup>th</sup>-90<sup>th</sup> percentiles; blue dotted line: median; red line: mean.

**Fig. 9** Interest rates on new loans to non-financial corporations:  
counterfactual simulations - peripheral countries



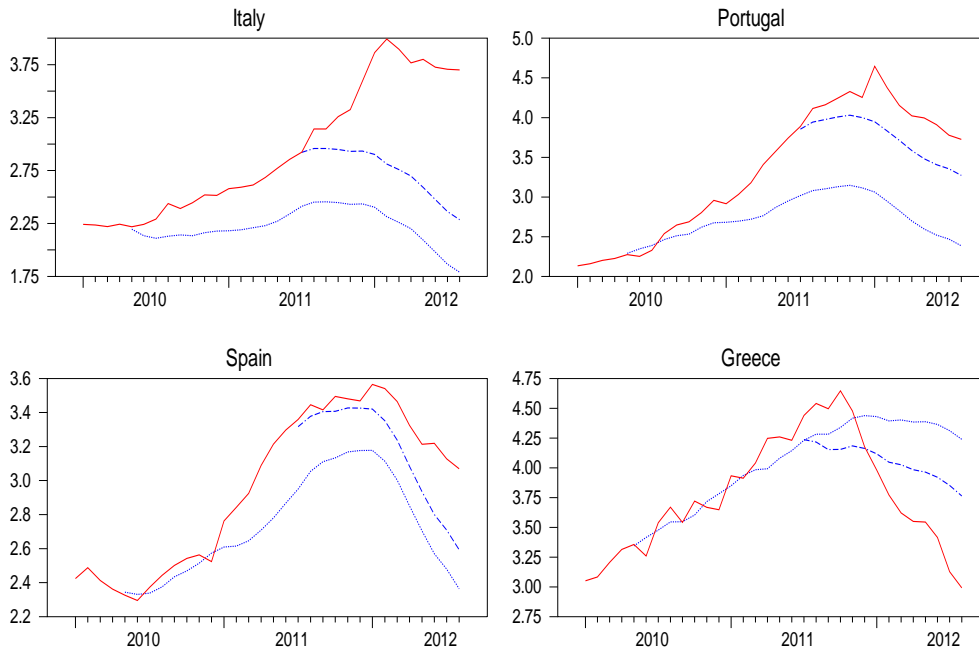
*Note:* red lines: actual data; blue dotted lines: simulated data starting from May 2010; blue dashed lines: simulated data starting from July 2011. Percentage points.

**Fig. 10** Interest rates on new loans to non-financial corporations:  
counterfactual simulations - core countries



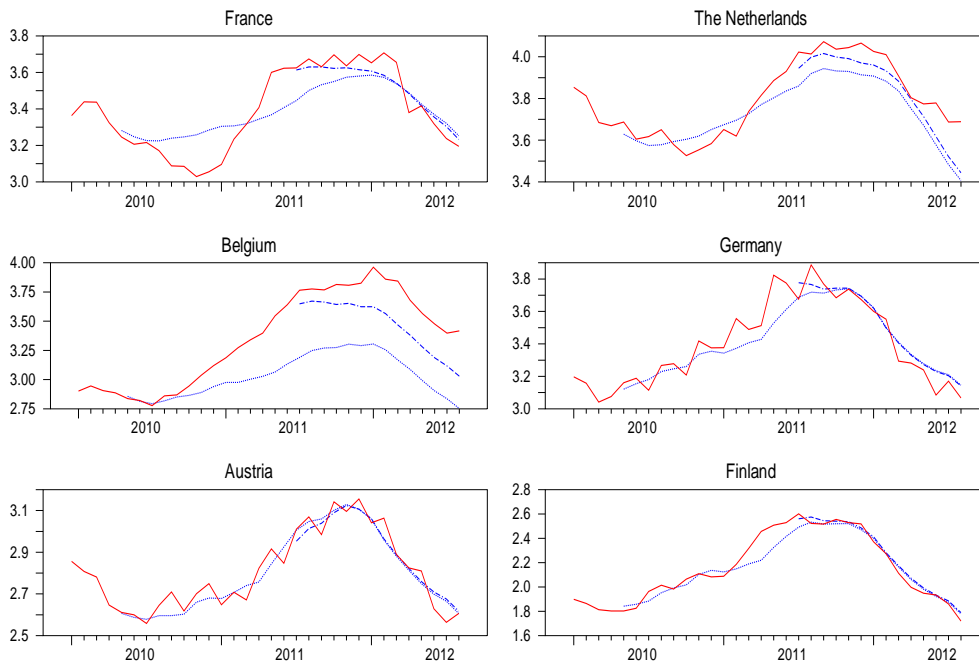
*Note:* red lines: actual data; blue dotted lines: simulated data starting from May 2010; blue dashed lines: simulated data starting from July 2011. Percentage points.

**Fig. 11** Interest rates on new loans to households for house purchase: counterfactual simulations - peripheral countries



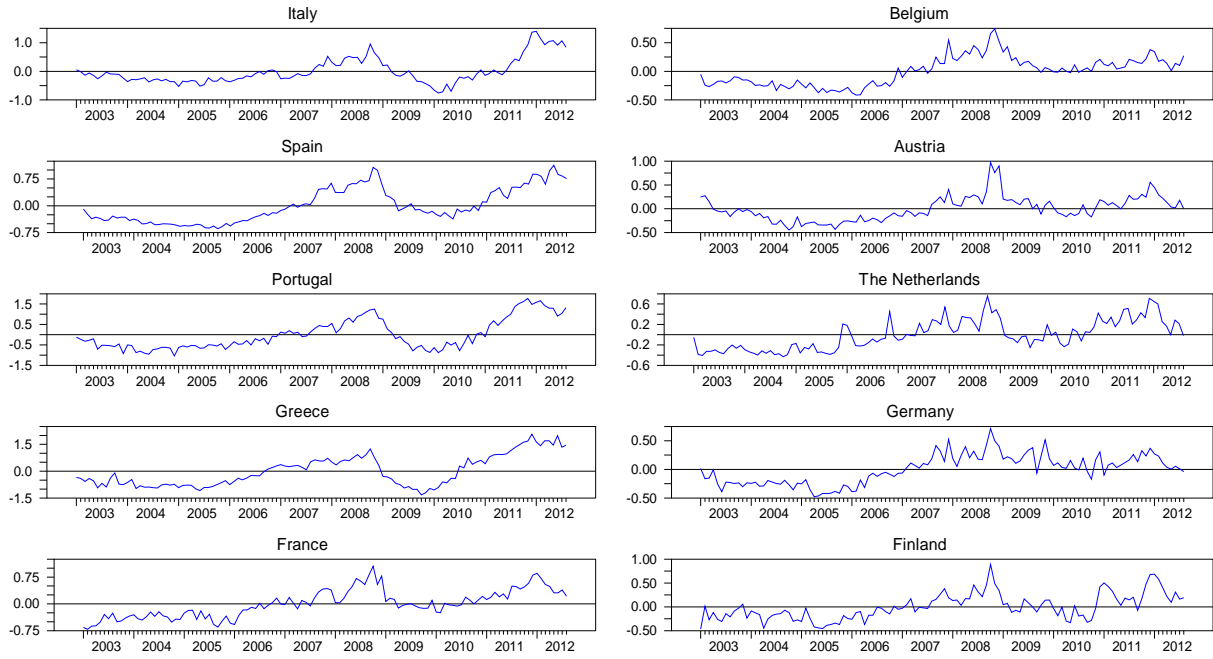
*Note:* red lines: actual data; blue dotted lines: simulated data starting from May 2010; blue dashed lines: simulated data starting from July 2011. Percentage points.

**Fig. 12** Interest rates on new loans to households for house purchase: counterfactual simulations - core countries



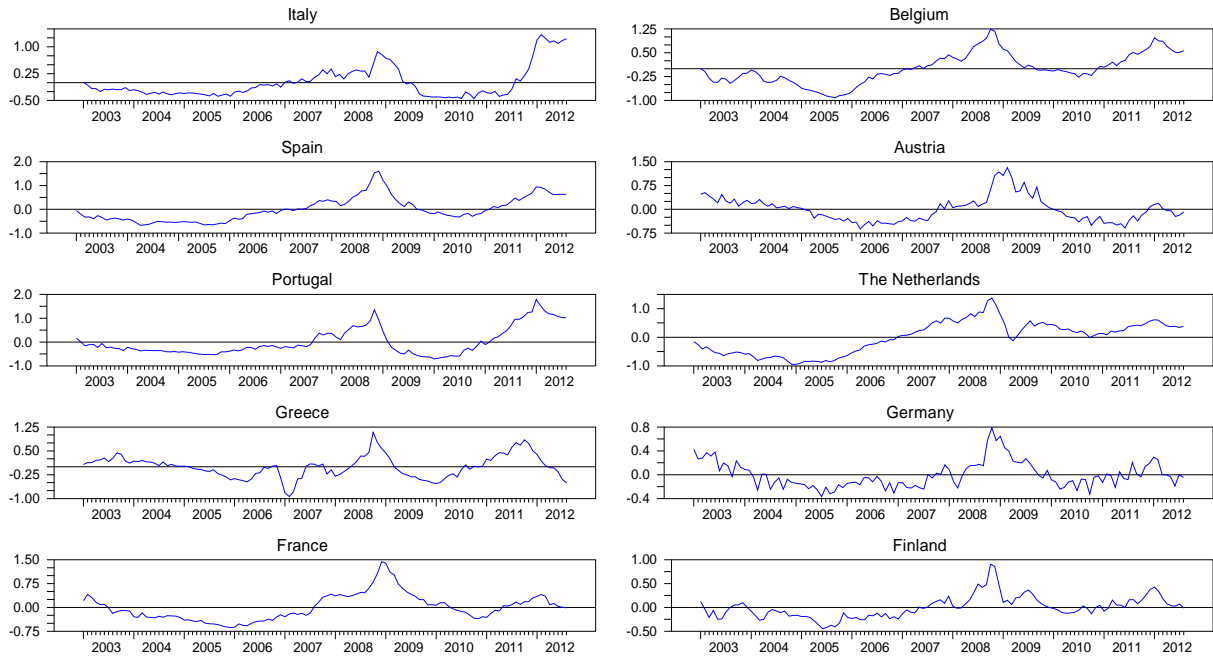
*Note:* red lines: actual data; blue dotted lines: simulated data starting from May 2010; blue dashed lines: simulated data starting from July 2011. Percentage points.

**Fig. 13** Disequilibrium term: interest rates on new loans to non-financial corporations



*Note:* The graphs report the residual of the regression of each lending rate on EONIA. Percentage points.

**Fig. 14** Disequilibrium term: interest rates on new loans to households for house purchase



*Note:* The graphs report the residual of the regression of each lending rate on EONIA. Percentage points.



**Table 1.** Standard deviation of lending rates and credit growth

	Interest rate on new loans to non-financial corporations	Interest rate on new loans to households	Loans to non-financial corporations	Loans to households for house purchase
2003:1-2012:8	0.81	0.47	5.03	6.08
2003:1-2007:8	0.58	0.43	6.36	7.48
2003:1-2010:4	0.62	0.45	5.41	6.95
2007:9-2012:8	1.02	0.51	3.78	4.78
2007:9-2010:4	0.69	0.46	3.74	6.02
2010:5-2012:8	1.39	0.56	3.82	3.35
2011:7-2012:8	1.60	0.58	4.41	3.67

Note: percentage points.

**Table 2.** Unit root tests

	ADF	KPSS	PP
Non-financial corporations			
Italy	-1.963	0.460	-1.474
Spain	-2.097	0.366	-1.448
Portugal	-1.995	0.540*	-1.521
Greece	-1.733	0.781**	-1.352
France	-2.019	0.556*	-1.215
Belgium	-2.042	0.781**	-0.995
Austria	-1.567	0.797**	-1.114
Netherlands	-1.486	0.691*	-1.102
Germany	-1.517	0.739**	-0.966
Finland	-1.478	0.757**	-1.144
Households			
Italy	-2.320	0.574*	-1.267
Spain	-2.174	0.434	-1.356
Portugal	-2.398	0.267	-1.672
Greece	-2.525	0.407	-1.264
France	-2.077	0.567*	-1.716
Belgium	-2.158	0.343	-1.519
Austria	-1.549	1.118**	-0.841
Netherlands	-1.844	0.567*	-1.488
Germany	-1.918	1.041**	-0.997
Finland	-1.410	0.845**	-1.092

Note: ADF = Augmented Dickey–Fuller; KPSS = Kwiatkowski–Phillips–Schmidt–Shin.

PP = Phillips-Perron. \* = significance at 5 per cent; \*\* = significance at 1 per cent. In all three tests 3 lags are used. The tests follow the procedures for WinRats 8.0 available on the webpage of Estima; dfunit.src for the ADF test, kpss.src for the KPSS and ppunit.src for the PP.

**Table 3.** Interest rates on loans to non-financial corporations: estimated coefficients

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$\bar{R}$	$R^{ov}$	$D^{crisis}$	$D^{2008}$	$R^{3m} - R^{ov}$	$R^{10} - R^{10,swap}$	$Y$	$R_{-1}$
Italy	0.592**	0.360**	0.008	-0.518**	0.138*	0.165**	0.014	0.604**
Spain	0.480**	0.314**	0.176**	-0.586**	0.331**	0.079**	0.045**	0.648**
Portugal	2.040**	0.459**	0.352**	-0.200**	0.280**	0.130**	0.012	0.371**
Greece	0.816**	0.246**	0.443**	-0.651**	0.067	0.033**	0.047*	0.675**
France	0.481**	0.501**	0.259**	-0.655**	0.366**	0.151**	0.088**	0.475**
Belgium	0.556**	0.509**	0.140**	-0.502**	0.249**	0.001	0.034**	0.458**
Austria	0.539**	0.453**	0.194**	-0.612**	0.172**	-0.048	0.009	0.512**
Netherlands	0.875**	0.609**	0.229**	-0.558**	0.386**	-0.108	0.071**	0.268**
Germany	1.045**	0.564**	0.306**	-0.623**	0.200**	0.108*	0.010	0.368**
Finland	0.679*	0.466**	0.136**	-0.690**	0.295**	0.035	0.024*	0.476**

Note: Standard errors are computed using the heteroskedasticity and autocorrelation consistent estimate of the covariance matrix of the coefficients. \* = significance at 10 per cent; \*\* = significance at 5 per cent. Sample period: 2003:1 – 2012:8.

**Table 4.** Interest rates on loans to households for house purchase: estimated coefficients

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$\bar{R}$	$R^{ov}$	$D^{crisis}$	$D^{2008}$	$R^{3m} - R^{ov}$	$R^{10} - R^{10,swap}$	$Y$	$R_{-1}$
Italy	0.395**	0.230**	-0.135**	-0.272**	0.145**	0.155**	0.004**	0.750**
Spain	0.385**	0.287**	0.079*	-0.329**	0.373**	0.052**	0.001	0.689**
Portugal	0.809**	0.390**	-0.054	-0.310**	0.320**	0.081**	-0.001	0.521**
Greece	0.386**	0.091**	0.079	-0.453**	-0.149**	-0.010**	-0.004**	0.879**
France	0.421**	0.115**	0.091**	-0.110**	0.170**	-0.050**	0.001	0.806**
Belgium	0.279**	0.170**	0.058	-0.515**	0.224**	0.097**	0.003	0.810**
Austria	0.648**	0.249**	-0.020	-0.070**	0.035	0.098	-0.001	0.713**
Netherlands	0.181**	0.099**	0.109**	-0.512**	0.204**	0.074	0.002**	0.883**
Germany	1.220**	0.343**	0.041	-0.299**	0.114**	0.075	0.000	0.563**
Finland	0.526**	0.412**	0.088**	-0.678**	0.217**	0.266**	0.001	0.558**

Note: Standard errors are computed using the heteroskedasticity and autocorrelation consistent estimate of the covariance matrix of the coefficients. \* = significance at 10 per cent; \*\* = significance at 5 per cent. Sample period: 2003:1 – 2012:8.

**Table 5.** The impact of sovereign spreads on bank rates on loans to non-financial corporations and households: counterfactual exercise starting in May 2010

	(a)	(b)	(c)	(d)	(e)	(d)	(e)
	$R^{10} - R^{10,swap}$	NFCs	households	NFCs	households	NFCs	households
	April 2010	2011 <sup>(a)</sup>	2011 <sup>(a)</sup>	Dec. 2011	Dec. 2011	Aug. 2012	Aug. 2012
Italy	0.71	0.54	0.62	1.34	1.16	1.15	1.91
Spain	0.71	0.37	0.33	0.47	0.29	0.81	0.70
Portugal	1.82	1.08	0.80	1.45	1.14	1.75	1.34
Greece	5.53	1.07	0.12	1.85	-0.26	1.62	-1.25
<i>peripheral</i> <sup>(b)</sup>	2.19	0.77	0.47	1.28	0.58	1.33	0.68
France	0.02	0.05	0.08	0.28	0.12	0.20	-0.06
Belgium	0.21	0.03	0.45	0.02	0.53	0.21	0.67
Austria	0.10	0.10	0.00	0.18	0.05	-0.11	0.00
Netherlands	-0.10	0.09	0.07	0.27	0.15	-0.13	0.28
Germany	-0.30	-0.01	0.08	-0.01	-0.02	-0.13	-0.08
Finland	-0.05	0.10	0.07	0.29	0.05	0.10	-0.06
Euro area <sup>(c)</sup>	0.87	0.35	0.26	0.61	0.32	0.55	0.35

Note: Based on coefficients estimated over the period 2003:1 – 2012:8. The sovereign spreads are assumed to remain constant at their April 2010 levels over the period between May 2010 and August 2012. Columns from (b) to (g) report the differences between actual and simulated values. <sup>(a)</sup> Average in 2011. <sup>(b)</sup> Simple average over the peripheral countries. <sup>(c)</sup> Simple average.

**Table 6.** The impact of sovereign spreads on bank rate on loans to non-financial corporations and households: counterfactual exercise starting in July 2011

	(a)	(b)	(c)	(d)	(e)	(d)	(e)
	$R^{10} - R^{10,swap}$	NFCs	households	NFCs	households	NFCs	households
	June 2011	2011 <sup>(a)</sup>	2011 <sup>(a)</sup>	Dec. 2011	Dec. 2011	Aug. 2012	Aug. 2012
Italy	1.52	0.43	0.29	1.00	0.66	0.82	1.42
Spain	2.06	0.08	0.05	0.18	0.04	0.51	0.48
Portugal	7.06	0.38	0.20	0.37	0.25	0.67	0.45
Greece	12.34	0.59	0.28	1.13	0.01	0.92	-0.77
peripheral <sup>(b)</sup>	5.74	0.37	0.20	0.67	0.24	0.73	0.39
France	0.14	0.08	0.04	0.24	0.08	0.17	-0.04
Belgium	0.73	-0.03	0.14	0.02	0.20	0.21	0.39
Austria	0.12	0.05	0.02	0.18	0.05	-0.11	-0.01
Netherlands	-0.03	0.07	0.06	0.28	0.09	-0.13	0.24
Germany	-0.34	-0.03	-0.01	-0.01	-0.02	-0.12	-0.07
Finland	-0.02	-0.01	0.00	0.29	0.03	0.10	-0.07
Euro area <sup>(c)</sup>	2.36	0.16	0.11	0.37	0.14	0.30	0.20

Note: Based on coefficients estimated over the period 2003:1 – 2012:8. The sovereign spreads are assumed to remain constant at their June 2011 levels over the period between July 2011 and August 2012. Columns from (b) to (g) report the differences between actual and simulated values. <sup>(a)</sup> Average in 2011. <sup>(b)</sup> Simple average over the peripheral countries. <sup>(c)</sup> Simple average.

**Table 7.** Interest rates on loans to non-financial corporations: estimated coefficients

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$\bar{R}$	$R^{ov}$	$D^{crisis}$	$D^{2008}$	$R^{3m} - R^{ov}$	$R^{10} - R^{10,swap}$	$Y$	$R_{-1}$
Italy	0.578**	0.409**	0.093	-0.496**	0.013	0.176**	0.027**	0.585**
Spain	0.713**	0.306**	0.077	-0.473**	0.202*	0.072**	0.057**	0.634**
Portugal	1.549**	0.360**	0.292**	-0.184**	0.141	0.103**	0.045**	0.527**
Greece	0.840**	0.108**	0.341**	-0.451**	-0.194	0.019**	0.098**	0.787**
France	0.598**	0.496**	0.206**	-0.601**	0.221	0.142**	0.078**	0.478**
Belgium	1.688**	1.031**	-0.052*	-0.256**	0.381**	0.009	0.038**	-0.167
Austria	1.039**	0.808**	0.292**	-0.479**	0.476**	0.025	0.036**	0.085
Netherlands	1.048**	0.680**	0.245**	-0.486**	0.387**	-0.123	0.081**	0.167
Germany	2.050**	0.775**	0.140**	-0.458**	0.166*	0.169**	0.001	0.041
Finland	0.591**	0.428**	0.156**	-0.669**	0.277**	0.055	0.034**	0.525**

Note: Standard errors are computed using the heteroskedasticity and autocorrelation consistent estimate of the covariance matrix of the coefficients. \* = significance at 10 per cent; \*\* = significance at 5 per cent. Sample period: 2008:1 – 2012:8.

**Table 8.** Interest rates on loans to households for house purchase: estimated coefficients

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$\bar{R}$	$R^{ov}$	$D^{crisis}$	$D^{2008}$	$R^{3m} - R^{ov}$	$R^{10} - R^{10,swap}$	$Y$	$R_{-1}$
Italy	0.441**	0.228**	-0.149**	-0.229**	0.067	0.157**	0.004**	0.750**
Spain	0.403**	0.285**	0.065	-0.327**	0.444**	0.057**	0.001	0.675**
Portugal	1.005**	0.644**	0.085	-0.236**	0.484**	0.134**	0.000	0.271**
Greece	0.195**	0.067**	0.065	-0.469**	-0.286**	-0.012**	-0.004**	0.959**
France	0.687**	0.155**	0.095**	-0.054	0.215**	-0.025	0.000	0.713**
Belgium	0.510**	0.203**	0.020**	-0.438	0.067**	0.123**	0.001	0.764**
Austria	0.835**	0.303**	-0.017	-0.030	0.001	0.080	-0.002*	0.646**
Netherlands	0.592**	0.134**	0.075**	-0.431**	0.189**	0.008	0.001	0.779**
Germany	2.200**	0.616**	0.095**	-0.224**	0.466**	0.036	-0.001	0.168**
Finland	0.691**	0.537**	0.142**	-0.672**	0.287**	0.208**	0.000	0.410**

Note: Standard errors are computed using the heteroskedasticity and autocorrelation consistent estimate of the covariance matrix of the coefficients. \* = significance at 10 per cent; \*\* = significance at 5 per cent. Sample period: 2008:1 – 2012:8.

**Table 9.** Interest rates on loans to non-financial corporations: estimated coefficients

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$\bar{R}$	$R^{ov}$	$D^{crisis}$	$D^{2008}$	$R^{3m} - R^{ov}$	$R^{10} - R^{10,swap}$	$Y$	$R_{-1}$
Italy	0.599**	0.353**	0.016	-0.476**	0.153*	0.167**	0.035**	0.603**
Spain	0.500**	0.336**	0.192	-0.555**	0.357**	0.094**	0.059**	0.624**
Portugal	2.061**	0.463**	0.355**	-0.180	0.277**	0.133	0.016	0.364**
Greece	0.650**	0.192**	0.443**	-0.624**	0.050	0.027**	0.061**	0.735**
France	0.541**	0.560**	0.292**	-0.600**	0.412**	0.213**	0.115**	0.411**
Belgium	0.564**	0.508**	0.141**	-0.460**	0.245**	0.012	0.051**	0.455**
Austria	0.632**	0.518**	0.215**	-0.554**	0.191**	0.011	0.025**	0.437**
Netherlands	0.912**	0.621**	0.240**	-0.518**	0.394**	-0.037	0.085**	0.249**
Germany	1.028**	0.550**	0.318**	-0.564**	0.197**	0.184**	0.022**	0.385**
Finland	0.627**	0.433**	0.139**	-0.670**	0.275**	0.074	0.030	0.515**

Note: Equation-by-equation estimation. Standard errors are computed using the heteroskedasticity and autocorrelation consistent estimate of the covariance matrix of the coefficients. \* = significance at 10 per cent; \*\* = significance at 5 per cent. Sample period: 2003:1 – 2012:8. Each equation is estimated with ordinary least squares.

**Table 10.** Interest rates on loans to households: estimated coefficients

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$\bar{R}$	$R^{ov}$	$D^{crisis}$	$D^{2008}$	$R^{3m} - R^{ov}$	$R^{10} - R^{10,swap}$	$Y$	$R_{-1}$
Italy	0.431**	0.260**	-0.143**	-0.249**	0.145**	0.180**	0.005**	0.721**
Spain	0.435**	0.350**	0.109**	-0.261**	0.416**	0.078**	0.003	0.631**
Portugal	0.807**	0.400**	-0.058	-0.287**	0.308**	0.088**	-0.001	0.515**
Greece	0.327**	0.091**	0.076	-0.449**	-0.165**	-0.009**	-0.004**	0.893**
France	0.483**	0.124**	0.100**	-0.102**	0.181**	-0.066**	0.001	0.783**
Belgium	0.234**	0.164**	0.036	-0.494**	0.234**	0.111**	0.004**	0.826**
Austria	0.632**	0.236**	-0.022	-0.068	0.051	0.065	0.000	0.723**
Netherlands	0.199**	0.094**	0.110**	-0.496**	0.222**	-0.011	0.002**	0.876**
Germany	1.238**	0.343**	0.038	-0.268**	0.116*	0.097	0.000	0.561**
Finland	0.422**	0.349**	0.069	-0.660**	0.211**	0.157**	0.002**	0.628**

Note: Equation-by-equation estimation. Standard errors are computed using the heteroskedasticity and autocorrelation consistent estimate of the covariance matrix of the coefficients. \* = significance at 10 per cent; \*\* = significance at 5 per cent. Sample period: 2003:1 – 2012:8. Each equation is estimated with ordinary least squares (OLS).

**Table 11.** Testing for cointegration

	Interest rate on new loans to non-financial corporations <sup>a)</sup>	Interest rate on new loans to households <sup>b)</sup>
Italy	-1.395	-0.972
Spain	-0.979	-1.690
Portugal	-0.781	-1.527
Greece	-0.719	-3.377
France	-2.293	-2.145
Belgium	-1.831	-1.657
Austria	-2.718	-2.290
Netherlands	-2.971	-1.343
Germany	-2.484	-2.866
Finland	-3.040	-2.563

Note: test based on Engle and Granger (1987). Critical values from MacKinnon (1991). Tests carried out in WinRats with the procedure `egtest.src`. <sup>a)</sup> The number of lags is set to 1. <sup>b)</sup> The number of lags is set to 3. \* = significance at 5 per cent; \*\* = significance at 1 per cent. Critical values are from MacKinnon, "Critical Values for Cointegration Tests", in R. F. Engle and C. W. J. Granger (eds.), Long-Run Economic Relationships, London, Oxford U. Press, 1991, pp 267–276.