Supply tightening or lack in demand:
Is the sovereign debt crisis different from Lehman?

Paolo Del Giovane*, Andrea Nobili* and Federico M. Signoretti§

May 2013

Abstract

This paper analyzes the relative role of demand and supply factors in explaining credit developments in Italy during the financial crisis, focusing on the differences between the "global crisis" and the "sovereign debt crisis". The identification of demand and supply is based on the individual banks' responses to the euro-area Bank Lending Survey. The results indicate that the contribution of weak demand conditions was similar in the two phases, while the supply tightening had a stronger effect during the sovereign debt crisis, as a result of a greater importance of factors related to strains in banks' balance-sheet and funding conditions. Larger effects of the supply tightening are obtained when the Italian sovereign spread is considered in addition to the BLS supply indicators. The impact of supply restrictions is stronger for lending to enterprises than for mortgages to households, reflecting the effect of credit rationing phenomena, rather than a higher elasticity of loan demand to the cost of credit.

JEL Classification: E30; E32; E51.

Keywords: credit growth; supply tightening; financial crisis, sovereign debt crisis

Paper presented at the Workshop "The Sovereign Debt Crisis and the Euro Area" organized by the Bank of Italy and held in Rome on February 15, 2013. The proceedings are available at:http://www.bancaditalia.it/studiricerche/convegni/atti.

* Bank of Italy, Economic Outlook and Monetary Policy Department.

§ Bank of Italy, Financial Stability Unit.

E-mail: paolo.delgiovane@bancaditalia.it, andrea.nobili@bancaditalia.it, federicomaria.signoretti@bancaditalia.it.
We thank Paolo Angelini, Giovanni Ferri, Eugenio Gaiotti, Alberto Franco Pozzolo and Stefano Siviero for useful comments and discussions. Ginette Eramo and Stefano Piersanti provided help with the dataset used in this analysis. The views expressed in the paper do not necessarily reflect those of the Banca d'Italia. All errors are the responsibility of the authors.

1. Introduction

Over the last five years credit developments in the euro area have been heavily affected by the global financial crisis and the following sovereign debt crisis, and by the negative cyclical evolution which accompanied the financial strains. Credit market developments have been quite homogenous across countries during the first phase of the crisis, which was characterized by a generalized contraction of economic activity, a strong worsening of borrowers' creditworthiness and a sharp increase in risk aversion in financial and credit markets. On the contrary, significant heterogeneity characterized the sovereign debt crisis period. The fall in lending has been concentrated in the countries hit by the sovereign debt tensions, where banks' access to wholesale funding worsened abruptly, while credit continued to grow in the other countries.

This paper analyzes the relative role of demand and supply factors in explaining credit developments in Italy during the financial crisis, focusing on the differences between the first phase, which we will indicate as the "global crisis" and the second phase, the "sovereign debt crisis". It also investigates the relative importance of the different supply factors, distinguishing those relating to the cost of funds and balance sheet constraints ("pure supply" factors) on the one hand and those connected to borrowers' creditworthiness and banks' risk perception on the other. This distinction is important, and bears significant policy implications, because the factors driving the tightening of supply conditions may matter for both the effects on credit dynamics and the appropriate policy reactions.

The analysis is carried out on data for Italy, considering separately loans to firms and loans to households for house purchases. Italy is a particularly relevant case in the euro area, as bank lending slowed down sharply between 2008 and the first half of 2009 and, after a brief recovery in 2010-11, fell again in the final part of 2011 and still continues to contract.

The identification of demand and supply factors, which is crucial in the analysis of credit developments, is based on the information provided by the Italian banks participating to the *Bank Lending Survey* (BLS), the quarterly survey on credit conditions carried out in all countries of the euro area since the end of 2002.[1] In particular, we exploit the individual

[1] The survey includes questions on credit standards, loan demand, factors driving loan supply and demand, specific terms and conditions in the provision of loans (such as price and non-price supply conditions). The results are published regularly by the European Central Bank (ECB) for the euro area as a whole and by the Eurosystem national central banks for the respective countries. A detailed description of the survey can be found in Berg et al. (2005).

bank's survey responses (though with no disclosure of individual answers) on loan demand and supply conditions, for the latter distinguishing between the various categories of factors, as mentioned above. This information is combined with bank-level data on loan quantities and interest rates for the same banks, as well as with additional information on interest rates on selected liabilities. The sample period goes from the fourth quarter of 2002 (the first quarter for which the BLS is available) to the second quarter of 2012, which allows us to incorporate the sovereign debt crisis and to analyze whether the role of demand and supply factors differed compared to the global crisis.

The use of bank-level information differentiates this paper from most of the other studies based on the BLS or other lending surveys, which use aggregate data both for survey information and for credit developments.[2] An exception is the paper by Del Giovane, Eramo and Nobili (2011) – henceforth DEN (2011) – which analyzed the relative contribution of demand and supply factors in credit market dynamics in the first part of the financial crisis, up to the immediate aftermath of the Lehman collapse. With respect to DEN (2011), we use a longer sample period, which also includes the sovereign debt crisis, thus allowing us to compare the relative importance of demand and supply factors in the two phases of the crisis. In addition, our paper provides an original contribution in several other respects.

First, we significantly improve the methodology. The empirical strategy consists (for each credit market segment considered in this analysis) of a two simultaneous equation model, where the dependent variables are the growth rate of loans and the change in interest rate on such loans and the various BLS indicators are used as instruments to identify a credit demand and a credit supply curve. As compared to the reduced-form approach in DEN (2011), we provide a deeper structural interpretation of the estimated relationships between hard variables and BLS indicators. In particular, our empirical model is able to describe a standard imperfect competition framework in credit markets, in which the intermediaries set loan interest rates and fully accommodate the credit demand (see the survey of theoretical and empirical contributions in Freixas and Rochet, 2008 and Degryse, Kim and Ongena, 2009). In addition, the statistical model also nests a credit rationing framework, in the spirit of Jaffee and Modigliani (1969) and following the disequilibrium approach proposed by Fair and Jaffee (1972). In this regard, we consistently estimate the relative contribution to lending

[2] See Berg et al. (2005), de Bondt et al. (2010), Hempell (2004), Hempell and Kok Sorensen (2009) and Ciccarelli, Maddaloni and Peydró (2009) for analyses on the euro area based on the BLS data, and Lown, Morgan and Rohatgi (2000) and Lown and Morgan (2006) for analyses on the U.S. based on data from the Senior Loan Officer Opinion Survey carried out by the Federal Reserve System.

dynamics of the indirect effects of supply restrictions (i.e., via the elasticity of loan demand to the loan rates) *versus* the direct ("credit-rationing") effects stemming from non-price allocations of credit. This question cannot be properly addressed using a reduced-form approach due to the endogeneity of the cost of credit as regressor in a loan quantity equation and to a "simultaneity bias" between the BLS supply indicators and the cost of credit.

During the crisis, policymakers have been particularly interested in this issue, since different types of supply restriction may call for different policy responses, i.e., official interest rate changes versus the implementation of unconventional measures. To the extent that monetary policy operates through a "credit channel" (in which contractionary policy affects the economy through a decline in the supply of funds available for banks to lend), and to the extent that changes in the terms of lending include not only changes in loan pricing but also changes in the quantities of credit available to borrowers, credit rationing may play an important role in the transmission of monetary policy effects on the economy (Blinder and Stiglitz, 1983). Evidence that some rationing occurred during the crisis is provided by both the banks' answers to the BLS and firms' replies in business surveys concerning the different ways in which they experience difficulties in obtaining bank's credit (cost vs. quantity). Practical considerations also suggest that a tightening in credit standards induced by "pure-supply" factors, such as a worsening in banks' capital position or in their access to funding conditions, can be more likely interpreted as the evidence of a "credit crunch" affecting the economy.

Second, concerning the sovereign debt crisis, we also studied whether the inclusion of the spread between the yields on 10-year Italian and German government bonds – often regarded as a sort of "sufficient statistics" to measure the intensity of tensions – has marginal predictive content over the BLS indicators and helps explaining the evolution of the cost and dynamics of bank lending. In this regard, we provide alternative and complementary evidence on the effects of the sovereign debt crisis on credit in Italy with respect to other studies carried out on macroeconomic data (Albertazzi et al., 2012; Neri, 2012) or based on bank-firm relationship information (Albertazzi and Bottero, 2012; Bofondi et al., 2012).

Third, we test the robustness of our identification of loan demand and supply curves by using the BLS answers on the specific "terms and conditions" through which banks reported to have implemented changes in their credit standards (distinguishing, in particular, between price and non-price conditions). Estimating the same equations considered above by including these BLS supply indicators as regressors instead of factors provides a particularly valuable test, since the various terms and conditions appear to be much more clearly related

to price and non-price allocations of credit than factors. Obtaining similar results with this alternative source of information – in particular as regards the estimated elasticity of loan demand and of credit rationing– would be a valid indication in support of our identification.

The rest of the paper is organized as follows. Section 2 describes the data and presents descriptive evidence. Section 3 provides new evidence on the information content of BLS indicators using standard reduced form equations. Section 4 illustrates the methodology used for the identification of loan demand and supply curves and discusses the main findings for a baseline specification – where the BLS supply and demand indicators are used as the main explanatory variables. Section 5 presents extended specifications that also include the sovereign debt spread as additional explanatory variable, while Section 6 discusses the results obtained by replacing the BLS supply indicators related to the factors behind credit standards with the BLS indicators related to the terms and conditions. Section 7 illustrates the counterfactual exercises carried out to assess the relative importance of demand and supply factors over the crisis and to compare the effects during the sovereign debt crisis with those observed in the global phase of the crisis. Section 8 offers some concluding remarks.

2. BLS indicators and lending to enterprises: data and descriptive evidence

This section provides information on the data used in the paper and some descriptive statistics. We carry out the study on data for the panel of Italian banking groups (henceforth "banks") participating in the BLS, which are among the largest in the country. The effects of mergers, which over time had tended to reduce their number, has been offset by subsequent additions. As a result, the dataset consists of an unbalanced panel of 11 Italian banks involved in the survey (with a maximum of 8 banks per quarter, including the more recent period) over a sample period of 39 quarters (from the fourth quarter of 2002 to the second quarter of 2012), providing a total of 287 observations.[3] For loans to enterprises and mortgage loans to households, the outstanding amounts granted by the banks participating in

[3] Merger and acquisitions that involved the banks participating in the survey over the sample period were carefully addressed. They were treated by using the standard reclassification methods in the computation of the lending growth rate for the acquirer, which is included in the panel over the entire sample period, while the target bank is excluded since the date of the operation (consistently with the treatment of individual bank data in the BLS). We checked the robustness of the results by also using a different approach, in which both of the banks involved are excluded from the panel since the date of the operation, and a new bank is included afterwards. The results do not change.

the survey corresponded at the end of the sample period to, respectively, around 60 and 63 percent of the total provided by the whole Italian banking system.[4]

Tables 1 and 2 show descriptive statistics for the indicators of supply and demand conditions provided by the Italian component of the BLS for, respectively, lending to enterprises and to households for house purchase. They are reported for the pre-crisis period (2002Q4–2007Q2), the crisis period (2007Q3–2012Q2), and, within the latter, the "global crisis" (2007Q3–2010Q1) and the most recent "sovereign debt crisis" (2010Q2-2012Q2). The tables report the frequency of individual banks' answers concerning supply conditions and their assessments of demand developments; all answers refer to the changes with respect to the previous three months.[5]

Concerning lending to enterprises, in the pre-crisis period, 80 percent of individual banks' responses on supply conditions fell in the "unchanged" category. Answers reporting that supply conditions had eased (either considerably or somewhat) were almost absent. Less than one fifth of responses indicated "tightened somewhat", while very few indicated "tightened considerably". In the crisis period the percentage of answers falling in the "tightened" category rose considerably, to 37 and 29 percent, respectively, in the two phases of the crisis. As to the demand assessments, extreme answers were virtually absent over the whole sample period. The frequency of responses indicating a "decrease" more than doubled in the crisis period, to 19 and 28 percent, respectively, in the two phases. Similar developments were observed for the answers concerning mortgage loans to households.

Figures 1 and 2 provide descriptive evidence on the relationship between the evolution of the BLS indicators of supply and demand conditions and that of, respectively, the dynamics and the cost of loans to both enterprises and households for house purchases.

Figure 1 shows that lending to enterprises recorded two phases of sharp slowdown: during the 2008-09 global crises and in the most recent sovereign debt crisis. In both cases the slowdown in lending went along with a fall in the BLS demand indicator and a tightening of the BLS indicator of supply conditions, the latter being particularly strong in the last two quarters of 2008 and in the last quarter of 2011, when all or almost all the

[4] The pattern of loan dynamics for the banks in the BLS panel is similar to that for the system as a whole, although the rate of growth is on average lower over of the sample period.

[5] Banks are asked the following question concerning supply conditions: "Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed?". As to demand conditions, the question is: "Over the past three months, how has the demand for loans or credit lines to enterprises changed at your bank, apart from normal seasonal fluctuations?". In both cases, they can choose their answer among five options, as reported in Tables 1 and 2.

participating banks reported a tightening. Figure 2 shows that the two phases of strongest tensions were also characterized by a strong rise of the average cost of credit to both enterprises and households, associated to the tightening of supply conditions.

The BLS supply indicator reported in Figures 1 and 2 refers to the change in the overall supply conditions reported by the banks. In the survey, however, banks are also asked to respond to more detailed questions concerning the importance of the various factors determining the changes in their supply policy, differentiating between: i) “cost of funds and balance sheet constraints” (in the case of loans to enterprises with a further distinction between “costs related to bank’s capital position”, “banks’ ability to access market financing” and “bank’s liquidity position”); ii) “pressure from competition”; iii) “perception of risk” (in turn relating to “expectations regarding general economic activity” or to more specific factors: in the case of loans to enterprises, “industry or firm-specific outlook” and “risk on collateral demanded”; for mortgage loans to households, “housing market prospects”).

Figure 3, based on the answers to these questions, shows that the relative importance of the factors affecting credit standards has been different during, respectively, the 2008-09 global crisis and the 2011 sovereign debt crisis. In the former period, the tightening mostly reflected an increase in perception of risk, while the role of banks’ cost of funds and balance sheet constraints was limited. In the latter period, risk perceptions have again played a role, but an even larger role has been played by the bank’s difficulties in obtaining market financing and by their liquidity position. This is a relevant difference, which we take into account in designing the empirical exercises of the following sections.

A general caveat, which applies to our study, as to any other analysis based on a survey, is that the quality of the results depends on both the reliability and the truthfulness of the respondents’ answers. In the case of lending surveys, on the one hand, banks may be inclined to report tighter credit standards than those actually applied. This hypothesis originates from the observation that indications of ‘‘tightening’’ have historically outnumbered those of ‘‘easing’’; in addition, banks may have an incentive to report tighter policies if they fear that the information could be exploited for supervisory purposes. On the other hand, during the crisis banks were exposed to public criticism and political pressure, being regarded as responsible for a credit crunch, and thus might have had an incentive to portray their policies as less restrictive.

3. The reduced-form representation of the credit market

3.1 Specification and methodological issues

In this section we sketch the methodology we use for the econometric analysis. The starting point is an extension of the approach proposed by DEN (2011), in which the information content of BLS indicators can be assessed by estimating reduced-form regressions in which the variables of interest, namely the growth rate of loans and the cost of credit, are regressed on BLS demand and BLS supply factors, as follows:

$$(1)\ \Delta bankspread_{it} = \alpha_{1i} + \gamma_1(L)\Delta bankspread_{it} + \beta_1(L)BLS\_S_{it} + \lambda_1(L)BLS\_D_{it} + \varepsilon_{it}$$

$$(2)\ \Delta loans_{it} = \alpha_{2i} + \gamma_2(L)\Delta loans_{it} + \beta_2(L)BLS\_S_{it} + \lambda_2(L)BLS\_D_{it} + \eta_{it}\ .$$

The variables $\Delta bankspread_{it}$ and $\Delta loans_{it}$ are, respectively, the first difference of the spread between bank *i* average rate on new loans and the Eonia rate[6] in quarter *t* and the quarter-on-quarter (henceforth q-o-q) rate of growth in bank lending for the same bank in the same quarter. BLS_S_{it} is a vector of credit supply indicators based on the bank *i*'s BLS answers concerning the influence that the various factors (cost of funds and balance sheet constraints, and risk perceptions) have had on its decisions on supply policy. The variable BLS_D_{it} is the overall indicator of credit demand conditions based on the banks' assessment.

In the equations we chose to separately include supply factors considered in the BLS, rather than the overall indicator of supply conditions – which has been used in most works based on the BLS – for a number of important reasons. First, it is important to distinguish whether banks modified their credit standards as a result of changes in their own conditions (balance sheet constraints, ability to access market financing) or instead in reaction to the risks connected with economic developments and borrowers' creditworthiness for a number of reasons. This distinction has indeed significant policy implications, since both the effects of the supply tightening on credit dynamics and the appropriate policy reactions can depend on the factors driving it. Factors belonging to the first group can unambiguously be interpreted as "pure" supply factors, while the case is less clear for the second group. A more prudent attitude on the part of banks may in fact reflect a reduction in banks' ability or willingness to assess borrowers' creditworthiness properly, or an increase in banks' risk aversion beyond what is warranted by economic developments; but it may also be the proper

[6] We consider the difference between the bank loan rate and the Eonia rate in order to rule out the effects of monetary policy.

reaction to a worsening in the borrowers' creditworthiness. Therefore, only in the former case it can be characterized as a "pure" supply factor.[7]

Second, DEN (2011) showed that the indicators for the specific factors can be more informative in certain phases. In the BLS, in fact, there is not always a clear correspondence between the banks' answers to the general question on the changes in their credit standards and the replies concerning the factors behind these changes. In particular, there are cases in which a bank signals no change in its own overall supply policy but reports that a specific factor has contributed to a change in its credit standards. This suggests that the banks' replies to the other specific questions concerning credit supply are not always "conditional" on their answers on the general question concerning their overall supply policy (although this is what the formulation of the questionnaire would imply).[8]

Since the BLS indicators are qualitative variables, BLS_S_{it} *and* BLS_D_{it} are defined as vectors of dummy variables, each of which corresponds to one of the possible alternative answers in the survey.[9] As shown by DEN (2011), this choice helps capturing non-linearity in the estimated relations between endogenous and exogenous variables, which may be particularly relevant in the case of the BLS supply indicators. Both the supply and the demand indicators may enter with the contemporaneous and/or lagged values; the lag order for each of them is chosen by trying a range between 0 and 4, on the basis of the fit of the regression and the indications derived from standard information criterion.

The equations are further enriched along several dimensions.[10] First, we consider dynamic models by including autoregressive components, if statistically significant. Second, we also add seasonal dummies and bank-specific fixed effects. The latter may be crucial to

[7] We follow DEN (2011) in using the expression "pure" supply rather than the expression "credit crunch" since, as argued convincingly in that paper, there is no universally accepted definition of "credit crunch".

[8] Banks are asked the following question: "Over the past three months, how have the following factors affected your bank's credit standards as applied to the approval of loans or credit lines to enterprises (as described in question 1)?", where "question 1" is the general question concerning supply conditions (see footnote 6 in Section 2).

[9] It is worth noting that an alternative could be to include the cumulated levels of the BLS indicators, rather than the indicators themselves. As remarked by DEN (2011), this definition would be more consistent with a literal reading of the BLS questions and answers; however, the robustness analysis carried out in that paper shows that the inclusion of the cumulated indicators provides unclear results or worsens the fit of the estimates (depending on the approach), which argues against following this alternative specification.

[10] We also explored specifications aimed at investigating whether the effects found for the entire sample period were magnified during the crisis or during specific phases of tensions. To this purpose, we included in our equations a Crisis_dummy variable or, alternatively, a Lehman_dummy variable and a Sovereign_dummy variable – which take value 1, respectively, from 2008Q3 to 2012Q2, from 2008Q3 to 2010Q1 and from 2010Q2 onwards –, as well as the respective interaction terms with the BLS supply factors. However, none of the estimated coefficients of the interaction terms proved to be statistically significant.

control for unobserved bank-specific factors that may be correlated with the BLS variables, thus leading to inconsistent estimated coefficients. In this regard, banks could interpret the qualitative BLS questions in different ways or make systematic mistakes in their answers.

For the coefficients of equations (1) and (2) we report the SURE estimations in order to take into account the correlation between the residuals of the regressions and to gain in efficiency with respect to OLS. By construction, the unobserved panel-level effects may be correlated with lagged dependent variables, making standard estimators inconsistent. To test the robustness our estimates, we also report the coefficients using the generalized method of moments (GMM) estimator designed by Arellano and Bond (1991) for linear dynamic panel-data models. In this case, we perform single-equation regressions and the test statistics for the significance of the coefficients are based on robust standard errors.

3.2 The results for loans to enterprises

Panel (a) of Table 3 reports the results of the econometric analysis for the dynamic and the cost of loans to enterprises. In the loan spread equation, a worsening in banks' access to funding, as captured by the BLS answers concerning this specific factor, exerts a statistically significant effect on the cost of credit on impact and with a one-quarter lag: responses of a tightening related to this factor by all banks in the panel is associated with an increase in the bank mark-up by about 45 and 18 basis points, respectively, with respect to the spread that would have been observed had all banks signalled no such effect on credit standards. A supply tightening related to risk perception also exerted a significant effect: responses of a tightening related to this factor by all banks would be associated to a contemporaneous increase in the loan spread of 55 basis points when it was reported to have contributed with the "considerably" qualification to a tightening and of around 10 basis points when it was reported to have contributed with the "somehow" qualification to a tightening. Neither the BLS supply factor related to banks' capital position nor the BLS demand indicator resulted to be statistically significant in this equation. The coefficients of the lagged values of the loan spread are negative and highly significant. This likely results from the fact that the effects of the reductions of the spread observed over the sample period are not properly captured by the BLS supply indicators, which are characterized by a strong asymmetry (in several periods they point to a tightening of credit standards, never or very rarely, depending on the indicator, to an easing, a feature that the BLS shares with other similar surveys).

In the reduced-form equation for loan quantities, the BLS demand indicator enters significantly and with the expected sign. We do no find evidence of non-linearity in the

estimated relationship. Even if distinguishing between responses of an "increase in demand" and "a decrease in demand", the resulting estimated coefficients are opposite in sign but the same in magnitude: responses of an increase (decrease) in demand by all banks are related to an immediate increase (decrease) in credit growth by about 0.9 percentage points. The BLS supply indicators are also highly significant: a tightening in credit standards related to banks' funding conditions, capital position or risk perception with the "considerably" qualification would be associated to an immediate decline in loan growth rate by about 1.1-1.3 percentage points. The negative effect is not statistically significant if the credit supply restriction is related to banks' risk perception with the "somehow" qualification.[11]

3.3 The results for mortgage loans to households

Panel (b) of Table 3 reports the results of the econometric analysis for the dynamic and the cost of mortgage loans to households. In the loan-spread equation, the dependent variable is the difference between a weighted average of a mortgage rate on new fixed-rate contracts and that on new floating-rate contracts and the Eonia rate. Since the mortgage rate on fixed-rate contracts reflects mostly changes in long-term market risk-free rates rather than the policy rate, we also included in the regression the 10-year swap rate as additional regressor. The coefficient resulted to be negative and statistically significant, since long-term rates adjust less to policy rate changes.

As for the BLS indicators, a change in supply conditions related to the banks' cost of funds and balance sheet conditions – they are considered as single factor in the BLS question concerning supply conditions for mortgage loans – exerts a positive effect on the cost of credit and a negative one on loan quantity with a one quarter lag. The estimated coefficients are about one half in magnitude than those recorded for BLS "pure-supply" factors in the regressions for loans to enterprises. In the case on loan quantity, they are not statistically significant. There is evidence, therefore, that the effects of the "pure-supply" factors transmit more rapidly and with a greater intensity to credit standards granted on loans to firms than on mortgage loans to households. A supply tightening due to a higher risk perception[12] is

[11] We also examined whether the inclusion of macro variables usually used in reduced-form equation for loans to Italian firms affects our identification scheme, just to be sure that there is no bias in the estimated coefficients due to omitted variables. Following Casolaro et al. (2006) and Albertazzi et al. (2012) we consider nominal GDP and firms' financing needs for loans to enterprises. Neither the nominal GDP nor firms' financing needs resulted to be statistically significant, meaning that the bank-specific BLS demand indicators dominates the aggregate variables. A similar result has been also found by DEN (2011).

[12] As for the indicator on "perception of risk", in the case of mortgage loans to households, banks' answers may refer to their expectations on general economic developments and housing market prospects. Similarly to the case of loans to enterprises, we collapsed all this information into just one variable. We also carried out a

associated to an immediate rise in the loan spread and to a decline in quantity, when it has been reported by banks with the "considerably" qualification. The estimated effect on the cost of credit is comparable in magnitude to that for loans to enterprises; the effect on loan quantity is instead much stronger. Risk perception considerations reported by banks with the "somehow" qualification seem to exert a significant effect only on the cost of credit.

The BLS demand indicator enters the loan quantity equation in a non-linear way: it is marginally significant both contemporaneously and with a one-quarter lag only when banks reported that they have experienced a "decrease" in demand. The estimated coefficients suggest a weaker effect with respect to loans to enterprises. Surprisingly, a decrease in the BLS demand is also significant in the loan spread equation but with the wrong sign, since a decrease in demand is associated to an increase in the loan spread. One possibility is that in some periods the BLS demand indicator may capture risk considerations that instead should be reported by banks in their answers to supply factors behind changes in credit standards. Figure 3 shows that, during the sovereign debt crisis, only very few banks reported that the risk perception related to the housing market prospects have contributed to a tightening in credit standards.[13] Finally, in the loan quantity equation, the lagged values of the dependent variable are highly significant reflecting the strong persistence in the dynamics of mortgage loans to households.

4. The structural representation of the credit market

4.1 Identification strategy in a partial equilibrium framework

The reduced-form approach, even if informative, cannot provide a deeper structural interpretation of the estimated relationships between the "hard" variables and the BLS indicators. During a financial crisis policymakers have been particularly interested in assessing whether the supply restriction affected lending dynamics through their increase in the cost of credit (i.e., via the elasticity of loan demand to the bank mark-up) or through a

regression including the BLS supply factor related to competition among banks or non-banks; the coefficient, however, did not turn out to be statistically significant.

[13] We checked the robustness of our results by including aggregate variables related to the housing market dynamics. We considered the quarterly change in house prices, a variable that was often used in empirical studies with aggregate data in the case of Italy (see Casolaro and Gambacorta, 2005; Albertazzi et al., 2012; Nobili and Zollino, 2012). Alternatively, we used the quarterly change in housing transactions, as they usually react more promptly than prices to shocks in the economy and that was found to perform relatively better. These variables enter significantly the estimated regressions for loan quantity and tend to offset the BLS demand indicator, while leaving unchanged the coefficients of the BLS supply indicators. On the contrary, they have no significant effects on the cost of credit.

direct “credit-rationing”. Different supply restrictions call for different policy responses, as, for example, changes in official interest rates vs. unconventional monetary policy measures.

A structural representation of the reduced-form equations can be described by the following system of simultaneous equations, in which the cost and the growth rate of lending become the endogenous variables linked by a two-way causality and expressed as functions of all the exogenous and predetermined variables:

$$(3)\ \Delta bankspread_{it} = \alpha_{1i} + \gamma_1(L)\Delta bankspread_{it} + \beta_1(L)BLS\_S_{it} + \lambda_1(L)BLS\_D_{it} + \theta \cdot \Delta loans_{it} + \varepsilon_{it}$$

$$(4)\ \Delta loans_{it} = \alpha_{2i} + \gamma_2(L)\Delta loans_{it} + \beta_2(L)BLS\_S_{it} + \lambda_2(L)BLS\_D_{it} + \rho \cdot \Delta bankspread_{it} + \eta_{it}.$$

This system of equations cannot be estimated using OLS, since it is not identified. In this paper identification is reached using exclusion restrictions on both exogenous regressors (the BLS indicators) and predetermined variables (the lagged values of the endogenous variables). The necessary and sufficient condition for identification of each equation is the *rank condition*, which states that the matrix of coefficients for the set of excluded variables from one equation must have full row rank in the other equation. A simpler way to think about the identification is in terms of the instrumental variable approach: an equation is identified if and only if there are enough instruments for the right-hand-side endogenous variables that are fully correlated with these variables. In general, exclusion restrictions are only necessary for identification (they satisfy the *order condition*), but in a two-equation system they also satisfy the rank condition (see, e.g., Wooldridge, 2002).

In our framework, the BLS indicators may represent an appropriate solution to the identification problem. Indeed, a reasonable strategy is to assume that the BLS demand indicators are excluded from equation (3), while the BLS supply factors are excluded from equation (4). More specifically, the system of equations would become:

$$(5)\ \Delta bankspread_{it} = \alpha_{1i} + \gamma_1(L)\Delta bankspread_{it} + \beta_1(L)BLS\_S_{it} + \theta \cdot \Delta loans_{it} + \mu_{it}^{S}$$

$$(6)\ \Delta loans_{it} = \alpha_{2i} + \gamma_2(L)\Delta loans_{it} + \lambda_2(L)BLS\_D_{it} + \rho \cdot \Delta bankspread_{it} + \mu_{it}^{D}.$$

The coefficients of the structural equations (5) and (6) can be estimated consistently and efficiently using the 3-Stage Least Squares (3SLS) estimator, which takes into account the endogeneity among the dependent variables, as well as the correlation between the estimated residuals of the two equations. If BLS_S_{it} and BLS_D_{it} are statistically significant (e.g. they are reliable instruments) and θ and ρ are, respectively, positive and negative, identification is reached. Accordingly, equation (5) can be interpreted as a credit supply curve where the bank mark-up on the monetary policy rate may vary reflecting the banks’ balance sheet conditions and their perception of the borrowers’ riskiness (these terms are

captured by the BLS supply indicators), which act as credit supply "shifters". A tightening in credit standards implies an increase in banks' margins and a decline in loan growth rate via the elasticity of loan demand (e.g. the coefficient ρ). Equation (6) would instead represent the credit demand curve, where loan quantity depends on a demand shifter and negatively on the cost of credit. A downward (upward) shift in credit demand, as captured by the BLS indicator, leads to a reduction (increase) in both the loan growth rate and the bank mark-up via the elasticity of the loan supply (the coefficient θ).

A special case of this structural model occurs for θ=0, which is consistent with the widely used representation of the credit market in an imperfect competition framework. Accordingly, the credit supply is flat and the intermediaries set loan interest rates and fully accommodate the credit demand (Freixas and Rochet, 2008; Degryse, Kim and Ongena, 2009).[14] In this theoretical framework, a shift in credit demand would affect quantities while leaving unchanged the cost of credit. This assumption could be particularly debatable during a crisis when funding becomes sluggish and costly for banks, thus inducing the latter to accommodate an increase in demand by raising the mark-up. The distinction between a flat versus an upward sloping credit supply curve is, therefore, tested empirically in this paper.

Notice that actually we may deal with *over-identified* equations, in which the number of excluded instruments exceeds the number of endogenous variables. Precisely, in equation (5) we use not one but a set of BLS supply indicators (the various factors behind changes in credit standards) and, for some of them, different variables capturing the various categories of answers (for example, the qualification of "contributed considerably to a tightening" and "contributed somehow to a tightening"). This implies that the loan demand equation is over-identified. Similarly, in equation (6) we may potentially include the BLS demand indicator as distinguished between the "increase" and "decrease" qualification, thus implying that the loan supply equation is also over-identified. We discuss the reliability of the over-identified restrictions by reporting the Sargan-Hansen test for each structural equation. The joint null hypothesis tested is that the instruments are correctly excluded from the structural equation to be identified. Under the null hypothesis the test statistic is distributed as chi-squared in the number of over-identifying restrictions.

We also address the issue of "weak identification". When the excluded instruments are weakly correlated with the endogenous variables, the estimates may be not consistent, tests

[14] See Panetta and Signoretti (2010) for a simple illustration of this theoretical framework and its possible use to interpret credit developments during the global crisis.

of significance have large size distortions and the confidence intervals are wrong: the estimated variance of the estimator tend to be biased downward in finite samples and the bias become large when the instruments are weak, thus tending to reject too often the null hypothesis of a zero coefficient. Staiger and Stock (1997) formalized the definition of "weak instruments" and argued that if the F-statistic on the excluded instruments in the first stage regression is greater than 10, one need worry no further about weak instruments.

4.1 Identification strategy in a disequilibrium framework

The system based on equations (5) and (6) represents an empirical framework that is useful to describe a partial equilibrium model, in which the credit market clears continuously and the interest rate changes ensure that the supplied quantity equals the demanded quantity at each point in time. An important limitation is the inability of the system to capture "credit rationing" episodes. Broadly speaking, credit rationing occurs when lenders limit the supply of credit to borrowers, even if the latter are willing to pay higher margins. In the spirit of Jaffee and Modigliani (1969), "credit rationing" is a situation in which the demand for loans exceeds the supply of loans at the loan rate quoted by the banks. Key to this definition is that changes in the interest rate cannot be used to clear excess demand for loans in the market. In essence, this definition treats credit rationing as a supply side phenomenon, with the lender's supply function becoming perfectly price inelastic at some point.

The seminal theory developed by Stiglitz and Weiss (1981), however, made a proper distinction between a situation in which a lender eventually restricts the size of loan to any potential individual borrower and one in which lenders fully fund some borrowers but deny loans to others, because of the presence of asymmetric information between lenders and borrowers. Banks may not raise lending rates above a certain level to avoid financing more risky borrowers (adverse selection) or to discourage firms to take more risk (moral hazard).[15] Albeit there are two main working definitions of "credit rationing", it is more useful for the purpose of our analysis to consider a broader definition of "credit rationing", in which other phenomena, such as regulatory constraints (for example, liquidity and capital requirements) or banks' inability to access to market funding[16,] in addition to informational problems, lead to non-price allocations of credit.

[15] See Freixas and Rochet (2008) for a survey of the theoretical contributions on this issue.

[16] Seminal theories may link "credit rationing" to a worsening in banks' funding conditions. The experience of the Great Depression in the US suggests that banking crisis principally arose due to depositors' panic, which caused a run on the banks. The source of a bank-run may emerge from liquidity shocks (Diamond and Dybvig,

In most recent econometric analyses, the authors followed the seminal disequilibrium approach for macroeconomics developed by Fair and Jaffee (1972) to assess loan dynamics and to identify credit crunch episodes in the aftermath of financial crises for a number of countries (Pazarbasioglu, 1996; Ghosh and Ghosh, 1999; Kim, 1999; Barajas and Steiner, 2002; Ikhide, 2003; Baek, 2005; Bauwens and Lubrano, 2007; Allain and Oulidi, 2009). These statistical models relied on the voluntary exchange principle, namely that the observed traded quantity in a specific good market is determined by a short-side rule, i.e. by the minimum of supplied and demanded quantity. The basic disequilibrium approach can be described by the following equations:

$$(7)\ Q_t^S = D(X_t^S, p_t) + \mu_{it}^S$$

$$(8)\ Q_t^D = D(X_t^D, p_t) + \mu_{it}^D$$

$$(9)\ Q_t = min(Q_t^S, Q_t^D),$$

where Q_t is the observed traded quantity, p_t is the price level, X_t^S, X_t^D vectors of exogenous variables. In this model the price level is assumed to be exogenous and no prior information about the excess demand state of the credit market is available, meaning that we not known the periods when loan quantity lies on the demand curve and the periods when it lies on the supply curve. Under the additional assumption that the error terms in equations (7) and (8) are uncorrelated and normally distributed, several maximum-likelihood estimation methods have been developed in order to provide the probabilities that each observation belongs to the supply or demand regime and the estimates of the structural parameters. [17]

However, the maximum likelihood estimation of models where the sample separation is unknown often leads to the likelihood function being unbounded in parameter space, which results in the computation procedure breaking down.[18] Moreover, without information about the interest rate adjustment the equilibrium set-up and the disequilibrium set-up will be two non-nested models (Quandt, 1978) and it would not be feasible to perform a statistical test to discriminate among the two cases. To overcome the unboundedness of the likelihood function problem, some authors employed limited maximum likelihood estimates where the unbounded regions of the parameter space are avoided by simply assuming that the change

---

1983) or shocks to the banks' asset value (Calomiris and Khan, 1991) in a theoretical framework of information asymmetry between banks and depositors.

[17] See Amemiya (1974), Fair and Kelejian (1974), Maddala and Nelson (1974), Goldfeld and Quandt (1975), Bauwens and Lubrano (2007).

[18] As argued by Maddala (1983), when it is not known which observations are on the demand function and which are on the supply function, too much may be asked of the data. Monte Carlo methods found that there is considerable loss of information if sample separation is not known.

in the price level is linearly related to the size of excess demand. The basic disequilibrium model is, therefore, extended by specifying a price adjustment equation (see Fair and Jaffee, 1972; Laffont and Garcia, 1977; Bowden, 1978) as follows[19]:

(10) $p_t - p_{t-1} = \gamma(Q_t^D - Q_t^S)$,

In analysis for the credit market, this implies the inclusion of a dynamic equation for the evolution of the interest rates that become an endogenous variable in the system (see Laffont and Garcia, 1977; Ito and Ueda, 1981). While not properly rooted in theoretical considerations, a price equation makes the statistical model more tractable and allows for a disequilibrium model to encompass an equilibrium one (see Quandt, 1978).

In this paper, we essentially rely on the quantitative approach proposed by Fair and Jaffee (1972) but use the BLS information for the identification of the periods characterized by excess demand or excess supply because. The model of equations (7) through (10) is, indeed, only one of possible way in which disequilibrium might be modelled. As already mentioned, we aim at capturing non-price allocation of credit. In particular, we assume that the credit markets may be characterized by excess demand when a bank reported a tightening in credit standards. Correspondingly, we consider as periods of excess supply those specific quarters in which a bank reported an easing in credit standards. Accordingly, the system is defined by the following equations:

(11) $\Delta bankspread_{it} = a_{1i} + \theta \cdot \Delta loans_{it}^S + \beta(L)BLS\_S_{it} + \mu_{it}^S$

(12) $\Delta loans_{it}^D = a_{2i} + \rho \cdot \Delta bankspread_{it} + \lambda(L)BLS\_D_{it} + \mu_{it}^D$

(13) $\Delta loans_{it}^D - \Delta loans_{it}^S = \sigma_1(L)BLS\_S\_tightening_{it}$

(14) $\Delta loans_{it}^S - \Delta loans_{it}^D = \sigma_2(L)BLS\_S\_easing_{it}$

(15) $\Delta loans_{it} = min(\Delta loans_{it}^S, \Delta loans_{it}^D)$.

In the system, $\Delta loans_{it}^S$ and $\Delta loans_{it}^D$ are the demanded and supplied quantities, which are not observable, while $\Delta loans_{it}$ are observed traded quantities. Notice that we are dealing with a linear framework with stationary variables. In general, the disequilibrium model of equations (7) through (10) reflects a valid theory only if variables are expressed in levels. In the empirical literature, the issue of non-stationarity is barely explicitly addressed and the

[19] Fair and Jaffee (1972) assumes that the change in the price level is directly proportional to the difference between demand and supply. Laffont and Garcia (1977) suggested a price-setting rule allowing for different downward and upward adjustment speeds. Bowden (1978) used a partial-adjustment scheme for the price level dynamics.

significant relationships may arise from spurious regressions[20]. With our dataset, it would be hard to defend a co-integration framework between hard quantitative variables for the credit market and qualitative survey data.[21] One may argue that imposing a minimum condition on variables in quarterly growth rates may lack of proper theoretical foundations, since the quarterly growth rate of credit demand may exceeds the growth rate of credit supply not necessarily when the credit supply level is the binding constraint.[22] In our specific case, since the disequilibrium indicators are the BLS supply variables, the quarterly growth rate of credit demand exceeds the growth rate of credit supply as a result of a binding constraint in the credit supply level.

Following the discussion in Fair and Jaffee (1972), the system of equations (11)-(15) can be reduced to a system with a single demand and a single supply equation, as follows:

$$(16)\ \Delta bankspread_{it} = a_{1i} + \theta \cdot \Delta loans_{it} + \beta(L)BLS\_S_{it} - \sigma_2(L)BLS\_S\_easing_{it} + \mu_{it}^{S}$$

$$(17)\ \Delta loans_{it} = a_{2i} + \rho \cdot \Delta bankspread_{it} + \lambda(L)BLS\_D_{it} - \sigma_1(L)BLS\_S\_tightening_{it} + \mu_{it}^{D}.$$

The system of equations (16) and (17) can be estimated consistently and efficiently over the entire sample period using a 3SLS approach. Notice that the interest rate-setting mechanism operates in each period but it does not necessarily clears the market. According to this framework, at a given point in time the credit market can exhibit temporary credit rationing owing to imperfect flexibility in the interest rates. The usual test of the statistical significance of the coefficients $\sigma_1(L)$ and $\sigma_2(L)$ can be, indeed, interpreted as a direct test for the presence of credit rationing in the credit market at each point in time: if these coefficients are statistically significant, changes in supply conditions exert a direct effect on lending dynamics beyond that occurring via the changes in interest rates. Since banks rarely reported an easing in credit standards, our model will be essentially a test of whether the credit market is in equilibrium or in a regime of excess demand. Our estimates will provide evidence about which of the different BLS supply factors capture credit rationing.

[20] Exceptions are in Ghosh and Ghosh (1999) and Allain and Oulidi (2009).

[21] One possibility, however, would be to specify the system in the levels of "hard" credit variables and using the cumulated version of the BLS indicators (see DEN, 2011).

[22] If the true data generating process of $Q(t)$ is such that $Q(t)=\min(S(t), D(t))$, the first-differences series $\Delta Q(t)$ follows a four-regime dynamics where there are two regimes characterized by a demand higher (lower) than supply at two points in time (t and $t-1$) and two regimes of switch from demand to supply and viceversa.

4.2 The market for loans to enterprises

Table 4 reports the results of the econometric analysis for the dynamic and the cost of loans to enterprises. We begin the discussion with the system specification reported in columns (a) and (a'), which represents a credit market equilibrium with no credit rationing.

Accordingly, all the BLS supply factors enter as instruments the loan supply equation (see column (a)), while the BLS demand indicators and the lagged values of loan quantities enter as instruments the loan demand equation (see column (b)). The estimated effects of the BLS supply variables on the cost of credit are remarkably very similar to those obtained with the reduced form equation. The loan growth rate enters the supply equation with a positive coefficient but it is not statistically significant, thus suggesting a flat credit supply curve. In the demand equation, the BLS demand indicators enter significantly and with the expected sign; the coefficient for the loan spread is highly significant and negative, suggesting that we are correctly identifying a downward sloping credit demand curve. The estimated loan demand elasticity to the bank mark-up is high: a 100 basis points increase in the cost of credit would lead to a reduction in the loan growth rate by more than 2 percentage points.

According to this structural representation, a tightening in credit standards related to banks' funding conditions would be associated to a decline in the loan growth rate by about 1.0 and 0.5 percentage points on impact and with a one quarter lag. The lagged estimated effect is much lower than the one obtained with the reduced-form equations. In the case of the BLS indicator related to banks' capital position there would be no significant effect. As for the risk perception, the negative effect on loan growth rate is higher when reported with the "considerably" qualification while lower with the "somehow" qualification (it was null in the reduced-form equations). The various diagnostics suggest that the identification scheme is only partly satisfactory. In particular, the Sargan-Hansen test suggests that not all the exclusion restrictions imposed in the credit demand equation are valid. The "difference-in-Sargan" statistics[23], which allow a test of the exclusion restrictions on each instrument separately, suggest that both the BLS supply factor related to capital position and the lagged value of the BLS indicator of funding conditions could be included in the demand equation.

We now explore this alternative system specification. This structural representation of the market would be consistent with the presence of credit rationing. Results are reported in

[23] The statistics is defined as the difference of the Sargan-Hansen statistic of the equation with the smaller set of instruments (valid under both the null and alternative hypotheses) and the equation with the full set of instruments, i.e., including the instruments whose validity is suspect. Under the null hypothesis the statistic is distributed as chi-squared in one degree of freedom.

columns (b) and (b'). The coefficient for BLS supply indicators, indeed, turns out to be negative and highly significant: responses of a tightening related to these factors by all banks in the panel is associated with a decline in the loan growth rate by about 1.4 percentage points. The various diagnostics fully support this specification, including the Sargan-Hansen test that now definitively accepts all the over-identifying restrictions at any significance level. We notice that the slope of the loan demand curve reduces, while the outcome of a flat credit supply curve is still confirmed. Overall, this specification appears to capture credit market conditions both in normal times and in a crisis period, also providing evidence of a direct credit rationing on loans to enterprises.

One concern regarding our estimated coefficients is that the BLS indicator of funding conditions, being a dummy variable, may capture only partially the banks' difficulties in obtaining funds. In addition, the Eonia rate used for the computation of the bank mark-up may also depend on other bank-specific variables not included in the equation. Angelini et al. (2010) and Affinito (2011) showed that the interbank rates at longer maturities faced by Italian banks depend significantly on the specific characteristics of borrowers and lenders and that some of the estimated relationships dramatically magnified after the breakout of the 2007-08 crisis. This might also be the case for overnight interbank rates. If there are omitted variables correlated with both the bank mark-up and the supply conditions, as captured by the BLS indicators, we could obtain biased estimates.

To investigate whether this is indeed the case, and possibly improve the estimation, we include the individual bank's marginal cost of funding as an additional instrument in the mark-up equation. This variable is computed as the difference between the weighted average of the interest rates paid by the bank on its sources of funding (customer deposits and bank debt securities) and the Eonia rate, with the weights reflecting the relative importance of each type of liability. The estimated coefficients for this alternative system specification are reported in columns (c) and (c'). They indicate that a one percentage point increase in the marginal cost of funding is associated to a rise of the cost of credit of about 10 basis points. The effect measured by the BLS supply indicators related to funding conditions and risk perception remain highly significant, meaning that these variables have marginal information content over that of the marginal cost of funding. The estimated loan demand elasticity to the bank mark-up remains broadly unchanged, thus suggesting no relevant bias in our previous specification.

It is interesting to note that demand conditions, as captured by the BLS indicator, have no effect on the cost of credit, as a result of the flat credit supply curve, an outcome that is

fully consistent with what we found in the reduced form equations. During a crisis, demand conditions may affect directly the bank mark-up when they reflect changes in the borrowers' composition (i.e. banks may face a demand for loans characterized by a larger fraction or riskier borrowers, thus inducing them to increase margins). This issue has been better addressed for Italy by recent works using bank-firm data from the Credit Register (see Albertazzi and Marchetti, 2010; Dimitri, Gobbi and Sette, 2010). We cannot exclude that the BLS risk perception indicator also captures a change in the borrowers' composition, since this variable is related not only to the general economic activity but also to the outlook for some specific sectors or firms.[24]

4.3 The market for mortgage loans to households

In Table 5 we present the estimated regressions for the cost and the growth rate of mortgage loans to households. Similarly to the strategy followed for loans to enterprises, we first investigate an identification scheme in which the various BLS supply factors enter as instruments the loan supply equation, while the BLS demand indicators enter as instrument the loan demand equation. The estimated coefficients are reported in columns (a) and (a').

The main difference with respect to the reduced-form equations is that the estimated effects of the various BLS supply factors become highly significant, while very similar in magnitude. This outcome reflects the gains in efficiency stemming from the 3SLS estimation with respect to the SURE estimation. The BLS demand indicators enter significantly the loan demand equation only with a one quarter lag and in a non-linear fashion: it is, indeed, highly significant only when banks reported to have experienced a "decrease" in loan demand.

The estimated loan demand elasticity to the bank spread is somehow lower to that obtained for loans to enterprises, albeit characterized by a higher level of uncertainty. In the loan supply equation the coefficient for the loan growth rate is not statistically different from zero, thus, suggesting a flat supply curve also for mortgage loans to households. The various diagnostic tests suggest that the identification scheme is overall satisfactory, but the Sargan-Hansen test rejects the exclusion restrictions imposed on the loan supply curve, in particular, those related to the BLS demand indicators.

[24] We address more deeply this concern by exploring a system specification in which the BLS demand indicator also enters the credit supply equation. Only a decline in demand has a significant and positive effect on the cost of credit, which is estimated to be by 20 basis points. However, the fit of the supply equation dramatically worsens and the various test for a correct identification (especially the weak identification test) become largely unsatisfactory, thus, casting serious doubts on this alternative specification. However, all the estimated coefficients remain virtually unchanged.

We did not find a significant direct effect on mortgage loan dynamics neither for the BLS "pure-supply" factor nor for the "risk-perception" factor. This possibility has been tested by considering alternative specifications in which these factors enter, one at the time, the loan demand equation. As for the "pure-supply" factor, this outcome might reflect the fact that for mortgage loans to households the BLS collects under a single heading ("cost of funds and balance sheet constraints") factors which are instead investigated separately in the case of loans to enterprises (for the latter, as mentioned above, banks are asked to indicate separately the importance of "liquidity position", "access to funding conditions" and "capital position"). It is possible that this choice results in an imprecise identification of the factors that concurred to credit rationing phenomena with respect to those affecting the credit cost.

We report in columns (b) and (b'), the estimated coefficients based on an alternative specification in which the BLS indicator capturing a "decrease" in loan demand also enters the supply equation. The estimated coefficients are negative and highly significant, consistently with the findings with the reduced-form equations. The fit of the loan supply equation improves and the various diagnostics test accept this specification. As for the interpretation of these results, the same considerations expressed in Section 3.3 still hold. Overall, the estimated loan supply and demand elasticity remains slightly affected.

In columns (c) and (c') we report the estimated coefficients for an alternative system in which the individual bank's marginal cost of funding enters as instrument the bank mark-up equation. A one percentage point increase in the marginal cost of funding is associated to a contemporaneous and lagged rise in the bank mark-up by, respectively, about 15 and 8 basis points. The estimated elasticity of loan demand to the cost of credit declines considerably, thus suggesting a relevant bias in our previous specification. This outcome may also be related to the fact that the BLS indicators capture only partially the "pure-supply" factors.

5. Including the sovereign spread

During the sovereign debt crisis great attention has been paid by analysts and policymakers to the developments of the spreads between sovereign bond yields of the euro-area countries hit by the tensions and those of Germany. This spread has indeed been regarded as a sort of "sufficient statistics" to measure the intensity of tensions. Recently, Albertazzi et al. (2012) have analysed reduced-form relationships between the BTP-Bund spread and developments in various credit market segments in Italy using macro data for the entire banking system. Neri (2013) and Zoli (2013) also found a significant role played by the sovereign spread on bank loan rates for a number of countries, including Italy.

In the light of this – and of the fact that in answering ad hoc questions recently included in the BLS several banks reported a specific effect of the sovereign debt crisis on their credit policy – we deemed it useful to investigate the information content of the spread for both credit demand and supply curves. In addition, the economic theory suggests that, both in crisis and in non-crisis times, the yield on sovereign bonds and the cost of credit are imperfect substitutes one another, meaning that both credit demand and supply may be decreasing functions in the sovereign bond yields (see Bernanke and Blinder, 1988).

We first test the role of the sovereign spread as a credit supply shifter. To this end, we consider systems of equations for both loans to enterprises and mortgage loans to households in which the change in the difference between the yield on the 10-year Italian government bond and the yield on the German bond of the same maturity enter as instrument in the loan supply equation. Since the sovereign spread is a macro variable common across banks, the estimated standard errors for its coefficients are lower than the true ones (see Moulton, 1990). We, therefore, report the statistical significance referring to standard errors computed by clustering observations over time periods. Results are presented in Tables 6 and 7.

The coefficient of the sovereign spread is positive and highly significant in the loan-spread equation for both loans to enterprises and mortgage loans to households: a 100 basis point increase in the spread is associated with a pass-through after one quarter of, respectively, 60 and 45 basis points. The estimated effect on the cost of new loans to enterprises is essentially the same as those obtained by recent studies based on aggregate data (see Albertazzi et al., 2012; Zoli, 2013; Neri, 2013).[25]

In the estimates for loans to enterprises the coefficients of the BLS funding condition indicator and the bank-specific marginal cost are no longer significant, while the coefficient of the supply conditions related to risk perception remain significant with the "considerably" qualification. For mortgage loans to households, the coefficient of the BLS indicator of cost of funds and balance sheet conditions is no longer significant. The marginal cost of funding and the indicator of risk perceptions, instead, remain statistically significant, though the coefficient of the former becomes smaller. The model now would suggest an upward sloping supply curve, albeit characterized by a higher degree of uncertainty.

Interestingly, the sovereign spread appears to have predictive content over the entire sample period and not only during the more recent period of sovereign debt tensions (an

[25] Albertazzi et al. (2012) fond that the impact is larger (50 basis points) when data for the period 1991-2011 on bank rates on outstanding short-term loans to non-financial corporations (including credit lines) are used.

interaction term between the sovereign spread and the sovereign dummy variable resulted not to be statistically significant when included in the regression). By contrast, for both loans to enterprises and mortgages to households the sovereign spread does not appear to have played a significant direct effect in the loan quantity equation, beyond that occurring through its effects on the cost of credit. The Sargan-Hansen test accepts the restrictions used for the identification of the loan demand, including the exclusion of the sovereign spread from that equation. However, a direct credit rationing effect was also tested by including the sovereign spread in the loan demand equation: its coefficient resulted to not be statistically significant, even if interacted with a "sovereign dummy". For loans to enterprises, the coefficients of the BLS supply indicators remain significant and of approximately the same magnitude. The coefficient for the bank mark-up becomes not statistically significant and both the weak identification and under-identification test strongly reject this system specification.

All in all, these results suggest that the relationship between banks' funding difficulties and credit developments reflected to a large extent the strains in the sovereign debt market, in particular concerning the cost of loans to enterprises. For these loans, the common shock hitting the banking system, as captured by the changes in the sovereign debt spread, prevailed over the more idiosyncratic components as potentially captured by the individual bank's answers on their funding difficulties and their marginal cost of funding. The evidence is less clear cut for mortgage loans to households, also due to the absence (as recalled above) of a BLS indicator which only measures the cost of fund supply factor.[26]

A potential concern in the interpretation of these results is that the effects of changes in the spread could be different depending on whether they reflect variations in the yield of the Italian government bonds or in the yield of the German Bunds. Indeed, during the crisis the spread reflected both idiosyncratic factors related to economic and public finance evolution in Italy and more general "flight-to-quality" phenomena connected with the investors' worries about the possible reversibility of the euro (the so-called "redenomination risk"). Although both factors have likely affected both yields (given the link between doubts about the sustainability of member countries' public debts and redenomination fears), one could

[26] A potential concern is that the sovereign spread may be endogenous, as also reflecting the worsening in the outlook for economic activity, as well as the worsening in banks' balance sheet conditions. As a further robustness check, we run an alternative system in which the sovereign spread is also considered as endogenous variable and regressed on all the BLS supply and demand indicators. As a result, the contemporaneous effect of the sovereign spread on the cost of credit becomes not statistically significant, while the lagged coefficient remains highly significant and of the same magnitude. In general, however, the fit of the model worsens and the various diagnostic tests are not always fully satisfactory. This implies that the most of the changes in the sovereign spread can be considered exogenous in our systems of simultaneous equations.

expect idiosyncratic factors to have exerted a stronger effect on the BPT yield and the Bund yield to have mostly reflected the latter type of phenomenon. Taking this into account, we ran an alternative regression, in which the BTP and the Bund yields were included separately among the explanatory variables, in the place of the sovereign spread.

The results, reported in columns (b) and (b') of each table, show that the effect of an increase in the sovereign spread on the cost of loans to enterprises is somehow stronger if it reflects a rise in the BTP yield, compared to the case in which it reflects a reduction in the Bund yield: the implied one-quarter pass-through of a 100 basis points increase in the sovereign spread is about 35 basis points when the increase only reflects a rise in the BTP yield and 20 basis points if the increase is entirely determined by a decline in the Bund yield. For the cost of mortgage loans to households, instead, the coefficients of the BTP and the Bund yields implied a pass-through by 38 and 27 basis points, respectively, after one quarter.

6. Using BLS terms and conditions

In this section we carry out a robustness check of the results obtained above, concerning in particular the identification of the direct (credit-rationing) effects on the dynamics of loans vis-à-vis the indirect effects taking place through the cost of credit. To this purpose, we use the BLS responses regarding the specific terms and conditions through which banks report to have changed their credit standards.

In the BLS banks are asked to indicate whether a change took place through a variation in price (bank's margin on average or on riskier loans) or in other non-price conditions (for loans to enterprises, non-interest rate charges, size of the loan or credit line, collateral requirements, loan covenants, maturity; for mortgage loans to households, non-interest rate charges, collateral requirements, loan-to-value ratio, maturity). Estimating the same equations considered above by including these BLS supply indicators as regressors instead of factors provides a particularly valuable test, since the various terms and conditions appear to be much more clearly related to, respectively, the cost and the quantity of credit than factors. Obtaining similar results with this alternative source of information – in particular as regards the estimated elasticity of loan demand and supply – would be a valid indication in support of our identification.

We also include the bank marginal cost of funding in the system specification to control for bank-specific omitted variables correlated with the bank spread, as discussed in Section 4. Interestingly, in occasion of some rounds of the BLS we have informally asked the respondent banks to state how they interpret the notion of "margin" when replying to the

questionnaire. It turned out that some groups included in the Italian sample define margins with respect to market rates. Others, on the contrary, define margins with respect to some notion of cost of funding.

Table 8 reports the results of the estimates of the structural system carried out with the BLS indicators of terms and conditions for loans to firms.[27] We start the analysis in a partial equilibrium framework and assume that all the various BLS terms and conditions are instruments for the identification of the loan demand equation. For loans to firms, the estimated coefficients for the loan supply equation suggest that a considerable tightening of margins on riskier loans – that dominates the indicator related to margins on average loans - reported by all banks in the panel would be associated with a rise of about 88 basis points of the spread on impact, while the effect of a moderate tightening would be smaller (about 13 basis points). For the change in marginal cost of funding the estimated effect is 10 basis points and similar to that obtained in Table 4. In the loan demand equation, the coefficients of the BLS demand and the elasticity to the bank mark-up are significant and similar to those reported with the system of equations based on the BLS factors. The Sargan-Hansen test again rejects this identification since, as expected, the BLS supply indicator related to size of the loan enters directly the loan demand equation.

Therefore, we moved to a disequilibrium framework as reported in columns (b)-(b'), in which the non-price condition enters directly the demand equation. This variable has a significant negative effect on the loan growth rate by about -4.0 and -1.6 percentage points, respectively, when banks reported a tightening with the "considerably" and the "somehow" qualification. The elasticity of demand to the loan rate becomes much lower and not statistically significant. However, the latter coefficient becomes significant (about -1.1) if one considers a specification which also includes the sovereign spread.

Table 9 reports the results of the estimates of the regressions carried out with the BLS indicators of terms and conditions for mortgage loans to households. The impact of the BLS indicator related to the price conditions (that has been reported by banks in the sample period only with the "somehow" qualification) is similar, when compared to loans to enterprises. A reported tightening of the margins on average loans by all banks would be associated with an increase of 15 basis points in the loan spread. We find that the estimated effect of the BLS demand indicator remains alike to those estimated in the different specifications of Table 5. Consistently with the results obtained with the regressions including the BLS factors, we

[27] The quarterly net percentage of each BLS term and condition during the crisis is reported in Figure 4.

find no evidence of a "direct" rationing effect: the "loan-to-value ratio" does not enter significantly in the loan demand equation. The elasticity of loan demand to the bank mark-up remains also very similar, especially when the sovereign spread is included in the system.

7. Assessing the role of supply and demand factors: is the sovereign debt crisis different from the global crisis?

In order to quantify the role played by supply and demand factors in credit developments in Italy during the two phases of the financial crisis, we performed counterfactual exercises in which we compared the fitted values obtained from our estimates with those we would have obtained had supply and demand indicators remained unchanged at their pre-crisis levels (i.e., at the levels observed in 2007q2).

We performed the analysis using three different specifications. The models differ in the set of supply indicators used for the exercise: *i*) based on the BLS supply factors that provide a simple structural interpretation of the forces driving the cost and dynamics of loans during the crisis and allows us to better distinguish between "pure" and "risk-related" supply factors; *ii*) based on the BLS supply factors and the sovereign spread, which are in general characterized by a better fit and allow us to assess the relative importance of the common shock captured by the sovereign spread vis-à-vis the idiosyncratic bank-specific factors; based on the BLS terms and conditions and the sovereign spread, which offers a comparison on the relative role of credit rationing and indirect supply effects on the growth rate of credit.

Figures 5 and 6 highlight the results for the cost and the amount of loans to firms and of mortgage loans to households. All charts show the impact of the various driving forces in each quarter of the period under consideration, by depicting the effects on the quarterly change in bank interest rate margin and on the quarterly growth rate of loan quantities. Complementary information is provided by Figures A1 and A2 in the Appendix, which show the corresponding cumulated effects on the same credit variables.

7.1 Loans to firms

The results of the counterfactual exercises indicate that supply factors – as measured by the BLS indicators – exerted a relevant effect on both the cost and the availability of credit throughout the crisis. The magnitude of these effects was, on average, somehow stronger during the sovereign debt crisis than in the aftermath of the Lehman collapse. The tightening of supply conditions is estimated to have determined a quarterly rise in the cost of credit of 60 basis points at the peak of the sovereign debt crisis (2011q4), compared to 25 basis points at the peak of the global crisis (2008q4). The cumulated effect since the

beginning of the crisis (until 2012q2) is estimated at 165 basis points, of which one half occurred during the global crisis and one half during the sovereign debt crisis.

As to loan dynamics, both weak demand and tight supply exerted a relevant negative effect on loans to enterprises over both phases of the crisis, but the estimated supply effects were much stronger during the sovereign debt crisis. The impact of supply factors reached its peak in the last quarter of 2011, when it reduced the q-o-q growth rate of loans to enterprises by about 2.0 percentage points, compared to around 1.1 percentage points in 2008q4. At the end of the sample period considered (2012Q2), supply factors are estimated to have had a cumulated negative impact on the stock of loans of about 10 percent, of which one third occurred during the global crisis and two thirds during the sovereign debt crisis. The largest effect on loan volumes is ascribed by a credit rationing rather than to the adjustment of the loan demand to the increase in the cost of credit.

The two phases of the crisis have been characterized by a different relative importance of the "pure" supply factors with respect to "risk perception". During the global crisis supply effects were mostly related to risk perception, while the impact of "pure" supply factors was smaller (consistently with the findings in DEN, 2011). By contrast, during the sovereign debt crisis "pure" supply factors, related to difficulties in the access to funding and to the capital position, became much more relevant: on average, these factors have determined around two thirds of the increase in interest rates and three fourths of the reduction in granted loans that can be attributed, as a whole, to all supply factors. The effect of "pure" supply factors, after reaching a peak in the last quarter of 2011, decreased sharply in the following quarters, as a result of a large improvement in funding conditions (which eventually stopped exerting an unfavourable influence on credit standards); this is a clear indication of the effectiveness of the exceptional measures adopted by the ECB at the end of 2011.[28]

Demand provided a strong negative contribution to loan dynamics throughout the crisis. Its negative contribution was greater than that of supply in most quarters of the period considered, with the notable exceptions of the periods around the tension peaks, at the end of 2008 and in the second half of 2011. Demand conditions were particularly weak during 2009 and 2012. On average, the quarterly contribution of demand to the rate of change of loans has been similar in two phases of the crisis. At the end of the sample period (2012q2)

[28] In December 2011, the Governing Council of the ECB announced two longer-term refinancing operations with maturity at 3 years and full allotment (which took place on 21 December and 29 February 2012, respectively) and an expansion of the range of assets eligible as collateral in refinancing operations.

demand conditions are estimated to have determined a cumulated reduction of the stock of loans by about 11 percent.

The counterfactual exercise conducted with the specification including the sovereign spread provides a similar picture about the relative importance of the pure-supply factors and risk perception. However, the contribution of the supply restriction on the cost of loans during the sovereign debt crisis is estimated to be higher, reaching 80 basis points at the peak (2011Q4). The cumulated effect over the entire crisis period rises to 180 basis points. As a consequence, the negative contribution of supply factors to the growth rate of loans to enterprises is also larger, reaching to 2.3 percentage points in the last quarter of 2011 and implying a cumulated negative impact on the stock of loans by 11 percent. The estimated contribution of the BLS demand indicator remains almost unchanged when we introduce the spread, confirming our interpretation of the latter as a credit supply shifter.

The decomposition of the effect of the sovereign spread changes between the parts attributable, respectively, to the changes in the BTP yield and in the Bund yield indicates that the impact of the domestic yield changes was stronger, counting for roughly two thirds of the total. We estimate that in 2012q2, absent "flight-to-quality" effects, which were particularly strong in 2011 and 2012, in connection with the risk of a euro-area breakup and a currency redenomination, the level of the bank margin would have been 1 percentage point lower and the stock of loans would have been higher by roughly the same amount.

Finally, the counterfactual exercise based on the specification including the BLS terms and conditions and the sovereign spread suggests that during the global crisis the "credit rationing" effects played a more relevant role than suggested by the previous exercise based on the BLS factors, while they are very similar during the sovereign debt crisis. A visual comparison of Figures 3a and 4a shows that the former finding reflects the higher frequency with which banks have reported to have tightened supply conditions by acting on the "size of the loan or the credit line" during the global crisis, compared to the frequency with which they reported the factors "capital position" and "funding conditions" (these are the BLS supply factors capturing credit rationing) to have influenced their decisions. All in all, these results suggest that the credit rationing effects during the global crisis might be somewhat underrated by our estimates based on supply factor indicators.

7.2 Mortgage loans to households

The results of the counterfactual exercises for mortgage loans to households suggest that the supply factors played a significant role also on both the cost and the availability of

credit to this sector. Since the interpretation of the BLS demand indicator in the loan supply equation is not clear, we did not consider this factor as a driving force in the counterfactual exercises for the cost of credit.

For the loan rate, the magnitude of these effects, as captured by only the BLS factors, was broadly similar in the two phases of the crisis and comparable to what observed in the case of loans to enterprises. At the two peaks of the supply restriction (2008q4 and 2011q4) the contribution to the increase in the bank margin was, respectively, 20 and 45 basis points. However, the effects were more persistent over time. As a result, the cumulated effect of the supply restriction since the beginning of the crisis (until 2012q2) is estimated at about 130 basis points, distributed in equal proportion among the two phases of the crisis. The "pure" supply factors result to have played the most important role over the entire crisis period.

When we conduct the counterfactual exercise with the specification that includes the sovereign spread the contribution of supply factors to the cost of credit during the sovereign debt crisis roughly doubles at the peak of the sovereign debt crisis (the quarterly contribution of supply restriction reaches 85 basis points in 2011q4). The cumulated effect in 2012q2 is estimated at 210 basis points. These results remain virtually unchanged when using BLS terms and conditions in the place of the BLS supply factors.

As to loan quantities, the most striking result is that loan demand conditions provided the strongest negative contribution to loan dynamics throughout the crisis period, with the usual exceptions at the peaks. At the end of the sample period (2012q2) demand conditions are estimated to have determined a cumulated reduction of the stock of loans by about 6 percent for all the considered specifications.

Notwithstanding the large effects on the cost of credit, the restriction of supply exerted a more muted effect on quantities, compared to what observed for loans to enterprises. At the end of 2012q2, the cumulated effect of supply restrictions on the stock of loans amounted to about -6 percent. Since the estimated loan demand elasticity to the cost of credit is similar in the two credit market segments, this smaller impact of the supply restrictions on mortgage loans to households is entirely explained by the lack of direct "credit rationing" effects.

8. Conclusions

In this paper we provided new evidence on the information content of the BLS for the cost and the growth rate of loans to enterprises and mortgage loans to households, with a special focus on the main differences between the "global crisis" and the "sovereign debt crisis". The analysis was performed using a system of simultaneous equations that allowed a

structural identification of loan demand and supply curves and a deeper understanding of the functioning of the credit markets. In particular, the statistical models are able to describe a standard partial equilibrium framework in which the restrictions of credit supply lead to an adjustment of the traded quantities via the elasticity of loan demand to the cost of credit, as well as a disequilibrium framework in which the credit market is characterized by credit rationing phenomena typical of the financial crises.

We found that supply tensions, as captured by banks' difficulties in funding conditions and risk perception, mostly affected the dynamics of loans to enterprises via the elasticity of loan demand to the bank margin. A worsening in banks' capital position and access to funding exerted a direct negative effect on credit growth, thus suggesting credit rationing phenomena. In the case of mortgage loans to households the supply tensions affected loan quantities only through their impact on bank interest rates.

When the sovereign spread is included in the system specification, it tends to offset much of the significance of the BLS indicators in the cost of credit equations, thus, suggesting that the evolution in the sovereign debt markets dramatically affect banks' funding conditions and risk aversion. Interestingly, changes in the sovereign spread affect credit conditions when they reflect a rise in the yield of Italian government bonds (which reflects idiosyncratic factors relating to economic and public finance evolution in Italy together with common euro-area developments), as well as when it originates from a reduction in the yield on the German government bonds (e.g. as a result of a "flight to quality"). This is not surprising, given the strict interconnections between national and euro-area developments, in particular during the sovereign debt crisis.

A counterfactual exercise in which demand and supply conditions (as measured by the BLS indicators and by the sovereign spread) are assumed to have remained at their pre-crisis levels over the entire crisis period indicates that the negative contribution of supply factors to the growth rate of loans has been smaller than that of demand conditions on average, but much higher in the quarters around the peaks of the two crisis periods (2008q4 and 2011q4). The exercise suggests that at mid-2012, had supply conditions remained at the pre-crisis levels, interest rates would have been almost 200 basis points lower for both loans to firms and mortgages to households; the stock of credit would have been higher by 11 and 8 percent. The effect of "pure-supply" factors reached an unprecedented peak in the last quarter of 2011, while decreasing sharply in the next quarter, as the result of the large improvement in liquidity conditions following the exceptional measures adopted by the ECB

at the end of 2011 (the introduction of three-year, full-allotment refinancing operations and the expansion of the range of assets eligible as collateral in the operations).

Overall, the supply factors exerted a stronger effect on credit developments during the sovereign debt crisis than during the global crisis, as the result of a larger influence of the "pure-supply" factors as opposed to "risk-perception" ones. The estimated effects on the cost of credit are very large and of comparable magnitude for both enterprises and households. On the contrary, the corresponding effects on loan quantities are significantly more muted in the case of mortgage loans to households. Our structural models suggest that this smaller impact is explained mostly by the lack of "credit rationing" effect in the households' sector. The estimated loan demand elasticity to the cost of credit is, indeed, similar in the two credit markets for all specifications we considered.

References

Allain, L. and N. Oulidi. 2009. Credit market in Morocco: a disequilibrium approach. IMF Working Papers No. 09/53.

Albertazzi, U., Ropele, T., Sene, G. and F.M. Signoretti. 2012. The impact of the sovereign debt crisis on the activity of Italian banks. Bank of Italy Occasional Papers No. 133.

Affinito, M. 2011. Do interbank customer relationships exist? And how did they function in the crisis? Learning from Italy. Bank of Italy, Economic Working Papers No. 826.

Amemiya, T. 1974. A note on the Fair and Jaffee model. *Econometrica*, 42, 759-762.

Angelini, P., A. Nobili and C. Picillo. 2011. The interbank market after August 2007: what has changed, and why?. *Journal of Money, Credit and Banking*, 43(5), 923-958.

Arellano, M. and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58, 277-297.

Baek, E.G. 2005. A disequilibrium model of the Korean credit crunch. *The Journal of the Korean Economy*, 6(2), 313-336.

Barajas, A. and S. Steiner. 2002. Credit stagnation in Latin America. IMF Working Papers No. 02/53.

Bauwens, L and M. Lubrano. 2007. Bayesian inference in dynamic disequilibrium models: an application to the Polish credit market. *Econometric Reviews*, 26, 469−486.

Berg, J., A. van Rixtel, A. Ferrando, G. de Bondt and S. Scopel. 2005. The bank lending survey for the euro area. ECB Occasional Paper Series No. 23.

Blinder, A.S. and J.E. Stiglitz. 1983. Money, credit constraints, and economic activity. *American Economic Review*, 73, 297–302.

Bofondi, M., Carpinelli, L., E. Sette. 2012. Credit supply during a sovereign crisis. Paper presented at the Bank of Italy Workshop "The Sovereign Debt Crisis and the Euro Area".

Calomiris, C.W. and Kahn, C.M. 1991. The role of demandable debt in structuring optimal banking arrangements. *American Economic Review*, 81, 497–513.

Casolaro, L., Eramo, G., Gambacorta, L., 2006. Un modello econometrico per il credito bancario alle imprese in Italia. *Moneta e Credito*, 59, 83–151.

Casolaro, L. and L. Gambacorta. 2005. Un modello econometrico per il credito bancario alle famiglie in Italia, *Moneta e Credito*, 58, pp. 29-56.

Ciccarelli, M., Maddaloni, A., J. L. Peydró, 2010. Trusting the bankers: a new look at the credit channel of monetary policy. ECB Working Paper Series No. 1228.

Cragg, J. G. and S. G. Donald, 1993. Testing identifiability and specification in instrumental variable models. *Econometric Theory*, 9, 222-240.

Davidson, R. and MacKinnon, G. 1993. *Estimation and Inference in Econometrics*. New York, Oxford University Press.

de Bondt, G., Maddaloni, A., Peydró, J.L., S. Scopel. 2010. The euro area Bank Lending Survey matters: empirical evidence for credit and output growth. European Central Bank, Working Paper Series No. 1160.

Degryse, H, Kim, M. and Ongena, S. 2009. *Microeconometrics of Banking Methods, Applications, and Results*, Oxford University Press.

Del Giovane, P., G. Eramo, A. Nobili. 2011. Disentangling demand and supply in credit developments: a survey-based analysis for Italy. *Journal of Banking & Finance*, 35, 2719-2732.

Diamond, D.W. and P. H. Dybvig. Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*. 91(3), 401-419.

Fair, R.C. and D.M. Jaffee. 1972. Methods of Estimation for Markets in Disequilibrium, *Econometrica*. 40, 3, 497−514.

Freixas, X. and J.C., Rochet. 2008. *Microeconomics of Banking*, 2nd Edition, MIT Press.

Ghosh, S., and A. Ghosh, 1999. East Asia in the aftermath: was there a crunch? IMF Working Papers, No. 99/38.

Hempell, H.S., 2004. New bank lending survey of the Eurosystem: Interpretation and use of first results for Germany. *Journal of Business Cycle Measurement and Analysis*, 1, 3, 387-408.

Hempell, H.S., Kok Sorensen, C., 2010. The impact of supply constraints on bank lending in the euro area – crisis induced crunching? European Central Bank, Working Paper Series No. 1262.

Ikhide, S. 2003. Was there a credit crunch in Namibia between 1996-2000?. *Journal of Applied Economics*, 2, 269-290.

Ito, T. and K. Ueda. 1981. Tests of the equilibrium hypothesis in disequilibrium econometrics: an international comparison of credit rationing. *International Economic Review*, 22, 3, 691−708.

Jaffee, D.M. and F. Modigliani. 1969. A theory and test of credit rationing. *American Economic Review*, 59, 850–72.

Kim, H. 1999. Was credit channel a key monetary transmission mechanism following the recent financial crisis in the Republic of Korea?. World Bank Policy Research Working Paper, No. 3003.

Laffont, J. and R. Garcia. 1977. Disequilibrium econometrics for business loans, *Econometrica*, 45,1187−1204.

Lown, C.S. and D.P. Morgan. 2006. The credit cycle and the business cycle: New findings using the loan officer opinion survey. *Journal of Money Credit and Banking*, 38, 6, 1575-1597.

Lown, C., Morgan, D.P., Rohatgi, S., 2000. Listening to loan officers: The impact of commercial credit standards on lending and output. Federal Reserve Bank of New York Economic Policy Review, 6, 1-16.

Maddala, G.S. 1983. *Limited-dependent and Qualitative Variables in Econometrics*, Cambridge University Press, Cambridge.

Maddala, G.S. and F D. Nelson. 1974. Maximum likelihood methods for models of markets in disequilibrium. *Econometrica*, 42(6), 1013−1030.

Moulton, B.R., 1990. An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *The Review of Economics and Statistics*, 72(2), 334-338.

Neri, S. 2012. L'impatto delle tensioni sui mercati del debito sovrano sui tassi bancari nei principali paesi dell'area dell'euro. Paper presented at the Bank of Italy Workshop "The Sovereign Debt Crisis and the Euro Area".

Nobili, A., F. Zollino. 2012. A structural model for the housing and credit markets in Italy. Bank of Italy, Economic Working Papers No. 887.

Owens, R.E., Schreft, S.L., 1991. Survey evidence of tighter credit conditions: What does it means? Federal Reserve Bank of Richmond, Working Paper No. 91-5

Pazarbasioglu, C., 1996. A credit crunch? A case study of Finland in the aftermath of the banking crisis. IMF Working Paper No. 96/135.

Poghosyan, T., 2010. Slowdown of Credit Flows in Jordan in the Wake of the Global Financial Crisis: Supply or Demand Driven?. IMF Working Paper No. 10/256.

Panetta, F., Signoretti, F.M., 2010. Credit demand and supply in Italy during the financial crisis. Occasional Papers No. 63, Bank of Italy.

Quandt, R.E. 1978. Tests of the equilibrium vs. disequilibrium hypotheses. *International Economic Review*, 19, 435-452.

Stiglitz, J. and A. Weiss. 1981. Credit Rationing in Markets with Imperfect Information. *The American Economic Review*, 71(3), 393-410.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA, The MIT Press.

Zoli, E. (2013). Italian sovereign spreads: their determinants and pass-through to bank funding costs and lending conditions. IMF Working Papers No. 13/84.

Tables and Figures

Table 1

BLS supply and demand conditions for loans to enterprises: descriptive statistics

(frequency of responses and, in brackets, percentages with respect to total in each period)

Supply				Demand			
	Pre-crisis 02Q4-07Q2	During crisis 07Q3-12Q2			Pre-crisis 02Q4-07Q2	During crisis 07Q3-12Q2	
		global crisis 07Q3-10Q1	sovereign debt crisis 10Q2-12Q2			global crisis 07Q3-10Q1	sovereign debt crisis 10Q2-12Q2
1="eased considerably"	0 *(0.0)*	0 *(0.0)*	0 *(0.0)*	1="decreased considerably"	0 *(0.0)*	0 *(0.0)*	1 *(1.4)*
2="eased somewhat"	2 *(1.5)*	1 *(1.2)*	0 *(0.0)*	2="decreased somewhat"	12 *(9.2)*	16 *(19.0)*	19 *(26.4)*
3="basically unchanged"	105 *(80.2)*	52 *(61.9)*	50 *(69.4)*	3="basically unchanged "	88 *(67.2)*	54 *(64.3)*	37 *(51.4)*
4="tightened somewhat"	21 *(16.0)*	31 *(36.9)*	21 *(29.2)*	4="increased somewhat"	31 *(23.7)*	14 *(16.7)*	15 *(20.8)*
5="tightened considerably"	3 *(2.3)*	0 *(0.0)*	1 *(1.4)*	5="increased considerably"	0 *(0.0)*	0 *(0.0)*	0 *(0.0)*
Total observations	131 *(100.0)*	84 *(100.0)*	72 *(100.0)*	Total observations	131 *(100.0)*	84 *(100.0)*	72 *(100.0)*

Table 2

BLS supply and demand conditions for mortgage loans to households: descriptive statistics

(frequency of responses and, in brackets, percentages with respect to total in each period)

Supply				Demand			
	Pre-crisis 02Q4-07Q2	During crisis 07Q3-12Q2			Pre-crisis 02Q4-07Q2	During crisis 07Q3-12Q2	
		global crisis 07Q3-10Q1	sovereign debt crisis 10Q2-12Q2			global crisis 07Q3-10Q1	sovereign debt crisis 10Q2-12Q2
1="eased considerably"	0 *(0.0)*	0 *(0.0)*	0 *(0.0)*	1="decreased considerably"	0 *(0.0)*	4 *(4.8)*	5 *(6.9)*
2="eased somewhat"	18 *(13.7)*	3 *(3.6)*	2 *(2.8)*	2="decreased somewhat"	6 *(4.6)*	26 *(31.0)*	22 *(30.6)*
3="basically unchanged"	104 *(79.4)*	54 *(64.3)*	51 *(70.8)*	3="basically unchanged "	70 *(53.4)*	41 *(48.8)*	31 *(43.1)*
4="tightened somewhat"	9 *(6.9)*	27 *(32.1)*	19 *(26.4)*	4="increased somewhat"	50 *(38.2)*	13 *(15.5)*	14 *(19.4)*
5="tightened considerably"	0 *(0.0)*	0 *(0.0)*	0 *(0.0)*	5="increased considerably"	5 *(3.8)*	0 *(0.0)*	0 *(0.0)*
Total observations	131 *(100.0)*	84 *(100.0)*	72 *(100.0)*	Total observations	131 *(100.0)*	84 *(100.0)*	72 *(100.0)*

Table 3a
Reduced-form regressions for loans to enterprises

	Δmark-up (t)	Δloan (t)	Δmark-up (t)	Δloan (t)
	(a)	(b)	(a')	(b')
Δ(loan) (t-1)		0.008		0.032
Δ(loan) (t-2)		0.195 ***		0.181 ***
Δ(mark-up) (t-1)	-0.381 ***		-0.381 ***	
Δ(mark-up) (t-2)	-0.234 ***		-0.234 ***	
BLS demand, increase (t)	0.101	0.916 **	0.097	0.898 ***
BLS demand, decrease (t)	0.060	-0.912 **	0.061	-0.851 ***
BLS supply, capital position, tightening (t)	-0.081	-1.107 *	-0.085	-1.291 ***
BLS supply, funding conditions, tightening (t)	0.441 ***	-1.356 **	0.443 ***	-1.209 *
BLS supply, funding conditions, tightening (t-1)	0.176 *	-1.271 **	0.178 *	-1.068 **
BLS supply, risk perception, strong tightening (t)	0.545 ***	-1.709 *	0.542 ***	-1.778 ***
BLS supply, risk perception, moderate tightening (t)	0.095 *	-0.052	0.092	-0.042
Constant	0.147 **	1.557 ***	0.079	1.456 ***
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation	SURE	SURE	GMM	GMM
Observations	247	247	247	247
R-squared	0.313	0.311	-	-

Notes: The dependent variables, *"Δloan"* and *"Δ(mark-up)"* are, respectively, the quarterly change of the loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). "*BLS supply funding conditions, tightening"*, *"BLS supply, risk perception, tightening"*, *"BLS supply, capital position, tightening"* are dummy variables taking the value of 1 if the bank reported that the respective factor contributed to a tightening in credit supply conditions (also distinguishing, when applicable, whether the bank reported that the specific factor contributed considerably/somewhat to the tightening; *risk perception* is related to the general economic activity and/or industry of firm-specific outlook). "*BLS demand, decrease"*, *"BLS demand, increase"* are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

Table 3b

Reduced-form regressions for mortgage loans to households

	Δmark-up (t)	Δloan (t)	Δmark-up (t)	Δloan (t)
	(a)	(b)	(a')	(b')
Δ(loan) (t-1)	-0.018		-0.010	
Δ(loan) (t-2)	-0.229 ***		-0.230 ***	
Δ(mark-up) (t-1)		0.303 ***		0.258 ***
Δ(mark-up) (t-2)		0.283 ***		0.307 ***
Δ(10year swap rate) (t)	-0.282 ***		-0.281 ***	
BLS demand, decrease (t)	0.137 **	-0.722 *	0.138 **	-0.621 ***
BLS demand, decrease (t-1)	0.110 *	-0.773 **	0.111 *	-0.889 ***
BLS demand, increase (t)	-0.029	0.173	-0.032	0.162
BLS "pure-supply", tightening (t-1)	0.185 **	-0.737	0.185 **	-0.477 *
BLS supply, risk perception, strong tightening (t-1)	0.427 *	-3.274 ***	0.420 *	-3.170 ***
BLS supply, risk perception, moderate tightening (t)	0.126 **	0.023	0.122 **	0.099
Constant	0.075	1.676 ***	0.020	1.955 ***
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation	SURE	SURE	GMM	GMM
Observations	247	247	247	236
R-squared	0.463	0.312	-	-

Notes: The dependent variables, "*Δloan*" and "*Δ(mark-up)*" are, respectively, the quarterly change in loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). "*BLS pure-supply, tightening*", "*BLS risk perception, tightening*", are dummy variables taking the value of 1 if the bank reported that the respective factor contributed to a tightening in credit supply conditions (also distinguishing, when applicable, whether the bank reported that the specific factor contributed considerably / somewhat to the tightening; "*pure-supply*" is related to cost of funds and balance-sheet constraints; *risk perception* is related to the general economic activity and/or housing market prospects). "*BLS demand, decrease*", "*BLS demand, increase*" are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

Table 4

Structural equations for loans to enterprises

	(a)	(a')	(b)	(b')	(c)	(c')
Endogenous variables:	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**
Δ(loan) (t)		**0.029**		**0.032**		**0.029**
Δ(mark-up) (t)	**-2.061 *****		**-1.567 ****		**-1.483 ****	
Predetermined variables:						
Δ(loan) (t-1)	0.038		0.013		0.015	
Δ(loan) (t-2)	0.216 ***		0.221 ***		0.218 ***	
Δ(mark-up) (t-1)		-0.368 ***		-0.377 ***		-0.331 ***
Δ(mark-up) (t-2)		-0.211 ***		-0.214 ***		-0.183 ***
Exogenous variables:						
BLS demand, increase (t)	1.002 **		1.002 **		0.960 **	
BLS demand, decrease (t)	-1.089 **		-0.759 **		-0.708 *	
BLS supply, capital position, tightening (t)		-0.021	-1.456 **		-1.526 **	
BLS supply, funding conditions, tightening (t)		0.490 ***		0.481 ***		0.381 ***
BLS supply, funding conditions, tightening (t-1)		0.242 **	-1.442 **	0.225 **	-1.377 **	0.269 **
BLS supply, risk perception, strong tightening (t)		0.578 ***		0.561 ***		0.486 ***
BLS supply, risk perception, moderate tightening (t)		0.107 *		0.106 *		0.093 *
ΔMarginal cost of funding (t)						0.106 ***
Constant term	1.533 ***	0.111	1.624 ***	0.111	1.638 ***	0.105
Fixed-effects	yes	yes	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes	yes	yes
Estimation technique	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS
Number of observations (N)	247	247	247	247	245	245
Number of regressors (K)	8	11	10	10	10	11
Number of endogenous regressors (K1)	1	1	1	1	1	1
Number of instruments (L)	14	14	14	14	15	15
Number of excluded instruments (L1)	7	4	5	4	6	5
R-squared	0.210	0.270	0.281	0.265	0.282	0.294
Identification-diagnostics:						
Underidentification test	56.32	26.11	55.02	26.11	58.68	27.95
Chi-sq(L1-K1+1) P-value	0.00	0.00	0.00	0.00	0.00	0.00
Weak identification test (Cragg-Donald statistic)	9.94	6.90	14.50	6.14	12.22	5.94
Overidentification test (Sargan-Hansen statistic)	16.77	4.87	3.33	4.96	3.94	5.09
Chi-sq(L-K) P-value	0.01	0.18	0.50	0.29	0.56	0.28

Notes: The dependent variables, *"Δloan"* and *"Δ(mark-up)"* are, respectively, the quarterly change of the loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). "*BLS supply funding conditions, tightening"*, *"BLS supply, risk perception, tightening"*, *"BLS supply, capital position, tightening"* are dummy variables taking the value of 1 if the bank reported that the respective factor contributed to a tightening in credit supply conditions (also distinguishing, when applicable, whether the bank reported that the specific factor contributed considerably/somewhat to the tightening; *risk perception* is related to the general economic activity and/or industry of firm-specific outlook). *"BLS demand, decrease"*, *"BLS demand, increase"* are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

The "*Underidentification test*" is a Lagrange-Multiplier test aiming at check if the equation is identified. The null hypothesis is that the equation is under-identified (i.e. the matrix of reduced form coefficients on the L1 excluded instruments has rank K1-1), while the alternative hypothesis is that the equation is identified (i.e. the matrix has rank exactly equal to K1). Under the null hypothesis, the test statistic is distributed as chi-squared in (L1-K1+1) degrees of freedom. A rejection of the null indicates that the equation is identified. The "*Weak identification test*" is the F-version of the Cragg-Donald Wald statistic. The "*Overidentification test*" is based on the Sargan-Hansen statistics; the null hypothesis tested is that the exclusion restrictions are valid. Under the null hypothesis, the test statistic is distributed as chi-squared in the number of (L-K) over-identifying restrictions. A rejection casts doubt on the validity of the instruments used for the equation identification.

Table 5

Structural equations for mortgage loans to households

	(a)	(a')	(b)	(b')	(c)	(c')
Endogenous variables:	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**
Δ(loan) (t)		**0.005**		**0.013**		**0.014**
Δ(mark-up) (t)	**-1.714 ***		**-1.968 ****		**-1.257 ***	
Predetermined variables:						
Δ(loan) (t-1)	0.306 ***		0.312 ***		0.308 ***	
Δ(loan) (t-2)	0.286 ***		0.290 ***		0.295 ***	
Δ(mark-up) (t-1)		0.064		0.006		0.000
Δ(mark-up) (t-2)		-0.164 ***		-0.197 ***		-0.190 ***
Exogenous variables:						
ΔSwap10y(t)		-0.346 ***		-0.299 ***		-0.305 ***
BLS demand, decrease (t)				0.159 **		0.099 *
BLS demand, decrease (t-1)	-1.100 ***		-0.853 **	0.112 *	-0.906 **	0.172 **
BLS "pure-supply", tightening (t-1)		0.220 ***		0.200 ***		0.169 **
BLS supply, risk perception, strong tightening (t-1)		0.476 **		0.532 **		0.355 *
BLS supply, risk perception, moderate tightening (t)		0.175 ***		0.122 *		0.119 *
ΔMarginal cost of funding (t)						0.156 ***
ΔMarginal cost of funding (t-1)						0.083 ***
Constant term	1.813 ***	0.059	1.786 ***	0.014	1.714 ***	0.002
Fixed-effects	yes	yes	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes	yes	yes
Estimation technique	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS
Number of observations (N)	247	247	247	247	247	247
Number of regressors (K)	7	10	7	12	7	14
Number of endogenous regressors (K1)	1	1	1	1	1	1
Number of instruments (L)	12	12	13	13	15	15
Number of excluded instruments (L1)	6	3	7	2	9	2
R-squared	0.418	0.270	0.408	0.306	0.436	0.398
Identification-diagnostics:						
Underidentification test	47.12	65.75	51.55	63.81	75.43	64.75
Chi-sq(L1-K1+1) P-value	0.00	0.00	0.00	0.00	0.00	0.00
Weak identification test (Cragg-Donald statistic)	9.31	28.84	8.90	41.32	11.57	41.90
Overidentification test (Sargan-Hansen statistic)	8.09	7.69	8.55	0.04	12.65	0.30
Chi-sq(L-K) P-value	0.15	0.02	0.20	0.84	0.12	0.59

Notes: The dependent variables, "*Δloan*" and "*Δ(mark-up)*" are, respectively, the quarterly change in loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). "*BLS pure-supply, tightening*", "*BLS risk perception, tightening*", are dummy variables taking the value of 1 if the bank reported that the respective factor contributed to a tightening in credit supply conditions (also distinguishing, when applicable, whether the bank reported that the specific factor contributed considerably / somewhat to the tightening; "*pure-supply*" is related to cost of funds and balance-sheet constraints; *risk perception* is related to the general economic activity and/or housing market prospects). "*BLS demand, decrease*", "*BLS demand, increase*" are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

The "*Under-identification test*" is a Lagrange-Multiplier test aiming at check if the equation is identified. The null hypothesis is that the equation is under-identified (i.e. the matrix of reduced form coefficients on the L1 excluded instruments has rank K1-1), while the alternative hypothesis is that the equation is identified (i.e. the matrix has rank exactly equal to K1). Under the null hypothesis, the test statistic is distributed as chi-squared in (L1-K1+1) degrees of freedom. A rejection of the null indicates that the equation is identified. The "*Weak identification test*" is the F-version of the Cragg-Donald Wald statistic. The "*Over-identification test*" is based on the Sargan-Hansen statistics; the null hypothesis tested is that the exclusion restrictions are valid. Under the null hypothesis, the test statistic is distributed as chi-squared in the number of (L-K) over-identifying restrictions. A rejection casts doubt on the validity of the instruments used for the equation identification.

Table 6

Structural equations for loans to enterprises including the sovereign spread

	(a)	(a')	(b)	(b')
Endogenous variables:	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**
Δ(loan) (t)		**0.014**		**0.004**
Δ(mark-up) (t)	**-1.498 ****		**-1.279 ****	
Predetermined variables:				
Δ(loan) (t-1)	0.012		0.011	
Δ(loan) (t-2)	0.212 ***		0.205	
Δ(mark-up) (t-1)		-0.406 ***		-0.409 ***
Δ(mark-up) (t-2)		-0.148 ***		-0.140 ***
Exogenous variables:				
BLS demand, increase (t)	0.951 **		0.925 **	
BLS demand, decrease (t)	-0.796 *		-0.857 *	
BLS supply, capital position, tightening (t)	-1.497 **		-1.486 **	
BLS supply, funding conditions, tightening (t)		0.061		0.005
BLS supply, funding conditions, tightening (t-1)	-1.368 **	0.065	-1.400 **	0.040
BLS supply, risk perception, strong tightening (t)		0.343 **		0.347 **
BLS supply, risk perception, moderate tightening (t)		0.057		0.053
ΔMarginal cost of funding (t)		0.039		0.034
Δsovereign spread (t)		0.245 ***		
Δsovereign spread (t-1)		0.389 ***		
ΔItalian BTP yield (t)				0.310 ***
ΔItalian BTP yield (t-1)				0.464 ***
ΔGerman Bund yield (t)				-0.239 ***
ΔGerman Bund yield (t-1)				-0.306 ***
Constant term	1.670 ***	0.077	1.667 ***	0.111
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation technique	3SLS	3SLS	3SLS	3SLS
Number of observations (N)	247	247	247	247
Number of regressors (K)	10	13	10	15
Number of endogenous regressors (K1)	1	1	1	1
Number of instruments (L)	17	17	19	19
Number of excluded instruments (L1)	8	5	10	5
R-squared	0.282	0.417	0.302	0.437
Identification-diagnostics:				
Underidentification test	83.27	29.02	87.01	25.04
Chi-sq(L1-K1+1) P-value	0.00	0.00	0.00	0.00
Weak identification test (Cragg-Donald statistic)	14.99	6.14	12.73	5.15
Overidentification test (Sargan-Hansen statistic)	4.03	5.20	7.30	6.05
Chi-sq(L-K) P-value	0.78	0.27	0.60	0.20

Notes: The dependent variables, *"Δloan"* and *"Δ(mark-up)"* are, respectively, the quarterly change in loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). *"BLS supply funding conditions, tightening", "BLS supply, risk perception, tightening", "BLS supply, capital position, tightening"* are dummy variables taking the value of 1 if the bank reported that the respective factor contributed to a tightening in credit supply conditions (also distinguishing, when applicable, whether the bank reported that the specific factor contributed considerably/somewhat to the tightening; *risk perception* is related to the general economic activity and/or industry of firm-specific outlook). *"BLS demand, decrease", "BLS demand, increase"* are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

The *"Under-identification test"* is a Lagrange-Multiplier test aiming at check if the equation is identified. The null hypothesis is that the equation is under-identified (i.e. the matrix of reduced form coefficients on the L1 excluded instruments has rank K1-1), while the alternative hypothesis is that the equation is identified (i.e. the matrix has rank exactly equal to K1). Under the null hypothesis, the test statistic is distributed as chi-squared in (L1-K1+1) degrees of freedom. A rejection of the null indicates that the equation is identified. The *"Weak identification test"* is the F-version of the Cragg-Donald Wald statistic. The *"Over-identification test"* is based on the Sargan-Hansen statistics; the null hypothesis tested is that the exclusion restrictions are valid. Under the null hypothesis, the test statistic is distributed as chi-squared in the number of (L-K) over-identifying restrictions. A rejection casts doubt on the validity of the instruments used for the equation identification.

Table 7

Structural equations for mortgage loans to households including BLS supply factors and the sovereign spread

	(a)	(a')	(b)	(b')
Endogenous variables:	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**
Δ(loan) (t)		**0.022 ***		**0.021 ***
Δ(mark-up) (t)	**-1.429 ****		**-1.408 ****	
Predetermined variables:				
Δ(loan) (t-1)	0.289 ***		0.289 ***	
Δ(loan) (t-2)	0.322 ***		0.322 ***	
Exogenous variables:				
ΔSwap10y(t)		-0.217 ***		-0.376 ***
BLS demand, decrease (t)		0.007		0.000
BLS demand, decrease (t-1)	-0.887 **	0.150 ***	-0.891 **	0.152 ***
BLS "pure-supply", tightening (t-1)		0.049		0.028
BLS supply, risk perception, strong tightening (t-1)		0.469 **		0.483 **
BLS supply, risk perception, moderate tightening (t)		0.082		0.092
ΔMarginal cost of funding (t)		0.089 ***		0.090 ***
ΔMarginal cost of funding (t-1)		0.036		0.027
Δsovereign spread (t)		0.135 **		
Δsovereign spread (t-1)		0.330 ***		
ΔItalian BTP yield (t)				0.116 *
ΔItalian BTP yield (t-1)				0.380 ***
ΔGerman Bund yield (t-1)				-0.267 ***
Constant term	1.653 ***	-0.066	1.650 ***	-0.057
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation technique	3SLS	3SLS	3SLS	3SLS
Number of observations (N)	256	256	256	256
Number of regressors (K)	7	14	7	15
Number of endogenous regressors (K1)	1	1	1	1
Number of instruments (L)	15	15	16	16
Number of excluded instruments (L1)	9	2	10	2
R-squared	0.427	0.432	0.428	0.430
Identification-diagnostics:				
Underidentification test	92.34	66.61	91.71	66.45
Chi-sq(L1-K1+1) P-value	0.00	0.00	0.00	0.00
Weak identification test (Cragg-Donald statistic)	15.46	42.94	13.70	42.62
Overidentification test (Sargan-Hansen statistic)	8.82	0.51	9.01	0.37
Chi-sq(L-K) P-value	0.36	0.48	0.44	0.54

Notes: The dependent variables, "*Δloan*" and "*Δ(mark-up)*" are, respectively, the quarterly change in loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). "*BLS pure-supply, tightening*", "*BLS risk perception, tightening*", are dummy variables taking the value of 1 if the bank reported that the respective factor contributed to a tightening in credit supply conditions (also distinguishing, when applicable, whether the bank reported that the specific factor contributed considerably/somewhat to the tightening; "*pure-supply*" is related to cost of funds and balance-sheet constraints; *risk perception* is related to the general economic activity and/or housing market prospects. "*BLS demand, decrease*", "*BLS demand, increase*" are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

The "*Under-identification test*" is a Lagrange-Multiplier test aiming at check if the equation is identified. The null hypothesis is that the equation is under-identified (i.e. the matrix of reduced form coefficients on the L1 excluded instruments has rank K1-1), while the alternative hypothesis is that the equation is identified (i.e. the matrix has rank exactly equal to K1). Under the null hypothesis, the test statistic is distributed as chi-squared in (L1-K1+1) degrees of freedom. A rejection of the null indicates that the equation is identified. The "*Weak identification test*" is the F-version of the Cragg-Donald Wald statistic. The "*Over-identification test*" is based on the Sargan-Hansen statistics; the null hypothesis tested is that the exclusion restrictions are valid. Under the null hypothesis, the test statistic is distributed as chi-squared in the number of (L-K) over-identifying restrictions. A rejection casts doubt on the validity of the instruments used for the equation identification.

Table 8

Structural equations for loans to enterprises: using BLS indicators on "terms and conditions"

	(a) Δ(loan)(t)	(a') Δ(mark-up)(t)	(b) Δ(loan)(t)	(b') Δ(mark-up)(t)	(c) Δ(loan)(t)	(c') Δ(mark-up)(t)
Endogenous variables:						
Δ(loan) (t)		**0.014**		**0.016**		**0.018**
Δ(mark-up) (t)	**-1.896 *****		**-0.729**		**-1.060 ***	
Predetermined variables:						
Δ(loan) (t-1)	0.037		0.033		0.035	
Δ(loan) (t-2)	0.207 ***		0.200 ***		0.204 ***	
Δ(mark-up) (t-1)		-0.286 ***		-0.304 ***		-0.434 ***
Δ(mark-up) (t-2)		-0.131 **		-0.140 **		-0.143 **
Exogenous variables:						
BLS demand, decrease (t)	-1.096 **		-0.905 **		-0.913 **	
BLS demand, increase (t)	0.926 **		0.960 **		0.975 **	
BLS supply, margin on riskier loans, strong tightening (t)		0.875 ***		0.797 ***		0.413 **
BLS supply, margin on riskier loans, moderate tightening (t)		0.130 **		0.138 ***		0.129 ***
BLS supply, size of the loan, strong tightening (t)		-0.144	-4.705 **		-4.519 **	
BLS supply, size of the loan, moderate tightening (t)		0.188 **	-1.627 ***	0.167 **	-1.550 ***	0.055
Δ(marginal cost of funding) (t)		0.104 ***		0.108 ***		0.037
Δ(sovereign spread) (t)						0.220 ***
Δ(sovereign spread) (t-1)						0.401 ***
Constant term	1.571 ***	0.051	1.710 ***	0.056	1.741 ***	0.016
Fixed-effects	yes	yes	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes	yes	yes
Estimation technique	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS
Number of observations (N)	245	245	245	245	245	245
Number of regressors (K)	8	11	10	10	10	12
Number of endogenous regressors (K1)	1	1	1	1	1	1
Number of instruments (L)	14	14	14	14	16	16
Number of excluded instruments (L1)	7	4	5	5	7	5
R-squared	0.218	0.311	0.295	0.308	0.290	0.430
Identification-diagnostics:						
Underidentification test	58.29	27.12	51.34	27.87	84.20	27.78
Chi-sq(L1-K1+1) P-value	0.00	0.00	0.00	0.00	0.00	0.00
Weak identification test (Cragg-Donald statistic)	10.43	7.21	12.37	5.95	17.51	5.87
Overidentification test (Sargan-Hansen statistic)	17.57	4.97	5.39	5.19	5.77	6.72
Chi-sq(L-K) P-value	0.00	0.17	0.25	0.27	0.45	0.15

Notes: The dependent variables, "*Δloan*" and "*Δ(mark-up)*" are, respectively, the quarterly change in loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). *"BLS supply margin on riskier loans, strong tightening", "BLS supply, margin on riskier loans, moderate tightening", "BLS supply, size of the loan, strong tightening", "BLS supply, size of the loan, moderate tightening"* are dummy variables taking the value of 1 if the bank reported that the respective term or condition was tightened/eased also distinguishing, when applicable, with considerably/ somewhat qualification. *"BLS demand, decrease", "BLS demand, increase"* are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

The *"Under-identification test"* is a Lagrange-Multiplier test aiming at check if the equation is identified. The null hypothesis is that the equation is under-identified (i.e. the matrix of reduced form coefficients on the L1 excluded instruments has rank K1-1), while the alternative hypothesis is that the equation is identified (i.e. the matrix has rank exactly equal to K1). Under the null hypothesis, the test statistic is distributed as chi-squared in (L1-K1+1) degrees of freedom. A rejection of the null indicates that the equation is identified. The *"Weak identification test"* is the F-version of the Cragg-Donald Wald statistic. The *"Over-identification test"* is based on the Sargan-Hansen statistics; the null hypothesis tested is that the exclusion restrictions are valid. Under the null hypothesis, the test statistic is distributed as chi-squared in the number of (L-K) over-identifying restrictions. A rejection casts doubt on the validity of the instruments used for the equation identification.

Table 9

Structural equations for mortgage loans to households: using BLS indicators on "terms and conditions"

	(a) Δ(loan)(t)	(a') Δ(mark-up)(t)	(b) Δ(loan)(t)	(b') Δ(mark-up)(t)
Endogenous variables:				
Δ(loan) (t)		**0.015**		**0.019**
Δ(mark-up) (t)	**-1.716 ****		**-1.367 ****	
Predetermined variables:				
Δ(loan) (t-1)	0.290 ***		0.288 ***	
Δ(loan) (t-2)	0.320 ***		0.322 ***	
Exogenous variables:				
Δ(swap10y) (t)		-0.388 ***		-0.247 ***
BLS demand, decrease (t)		0.058		-0.014
BLS demand, decrease (t-1)	-0.831 **	0.119 **	-0.900 **	0.142 ***
BLS supply, margin on loans, moderate tightening (t)		0.152 ***		0.105 **
BLS supply, margin on loans, moderate easing (t)		-0.039		-0.022
BLS supply, loan-to-value ratio, moderate tightening (t)		0.083		0.093
BLS supply, loan-to-value ratio, moderate easing (t)		0.050		0.061
Δ(marginal cost of funding) (t)		0.177 ***		0.100 ***
Δ(marginal cost of funding) (t-1)		0.113 ***		0.050 *
Δ(sovereign spread) (t)				0.155 ***
Δ(sovereign spread) (t-1)				0.317 ***
Constant term	1.693 ***	0.000	1.643 ***	-0.065
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation technique	3SLS	3SLS	3SLS	3SLS
Number of observations (N)	256	256	256	256
Number of regressors (K)	7	13	7	15
Number of endogenous regressors (K1)	1	1	1	1
Number of instruments (L)	14	14	16	16
Number of excluded instruments (L1)	8	2	10	2
R-squared	0.419	0.345	0.429	0.435
Identification-diagnostics:				
Underidentification test	66.56	68.01	92.50	67.69
Chi-sq(L1-K1+1) P-value	0.00	0.00	0.00	0.00
Weak identification test (Cragg-Donald statistic)	10.77	44.38	13.90	43.71
Overidentification test (Sargan-Hansen statistic)	9.25	0.05	10.06	0.27
Chi-sq(L-K) P-value	0.24	0.83	0.35	0.60

Notes: The dependent variables, "*Δloan*" and "*Δ(mark-up)*" are, respectively, the quarterly change in loan quantities and the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate). *"BLS supply margin on loans, moderate tightening", "BLS supply, margin on loans, moderate easing", "BLS supply, loan-to-value ratio, moderate tightening", "BLS supply, loan-to-value ratio, moderate easing"* are dummy variables taking the value of 1 if the bank reported that the respective term or condition was tightened/eased also distinguishing, when applicable, with considerably/ somewhat qualification. *"BLS demand, decrease", "BLS demand, increase"* are dummy variables taking the value of 1 if the bank reported, respectively, decrease/increase in demand. *, ** and *** denote significance, respectively, at 10%; * 5% and 1% confidence level.

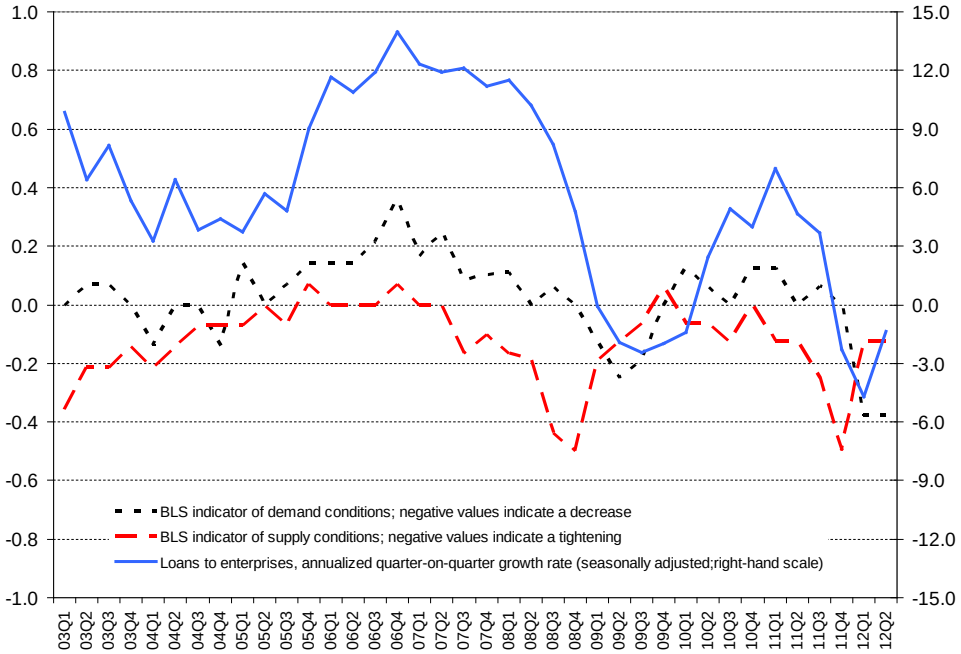
The *"Under-identification test"* is a Lagrange-Multiplier test aiming at check if the equation is identified. The null hypothesis is that the equation is under-identified (i.e. the matrix of reduced form coefficients on the L1 excluded instruments has rank K1-1), while the alternative hypothesis is that the equation is identified (i.e. the matrix has rank exactly equal to K1). Under the null hypothesis, the test statistic is distributed as chi-squared in (L1-K1+1) degrees of freedom. A rejection of the null indicates that the equation is identified. The *"Weak identification test"* is the F-version of the Cragg-Donald Wald statistic. The *"Over-identification test"* is based on the Sargan-Hansen statistics; the null hypothesis tested is that the exclusion restrictions are valid. Under the null hypothesis, the test statistic is distributed as chi-squared in the number of (L-K) over-identifying restrictions. A rejection casts doubt on the validity of the instruments used for the equation identification.

Figure 1

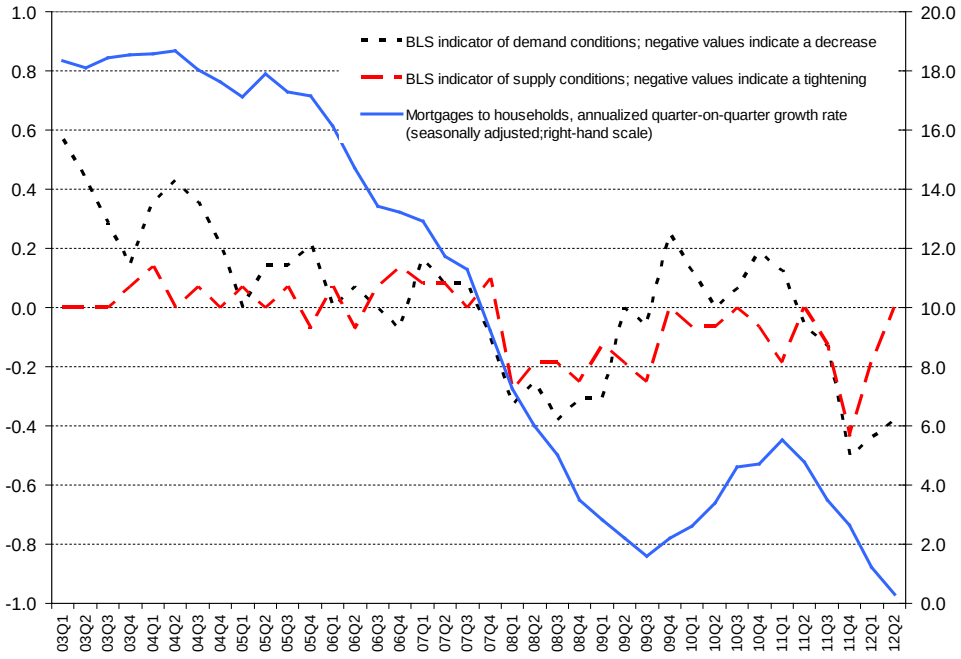
BLS supply and demand indicators and lending dynamics in Italy

(quarterly data; percentage points; diffusion indexes)

a) Loans to enterprises



b) Mortgage loans to households



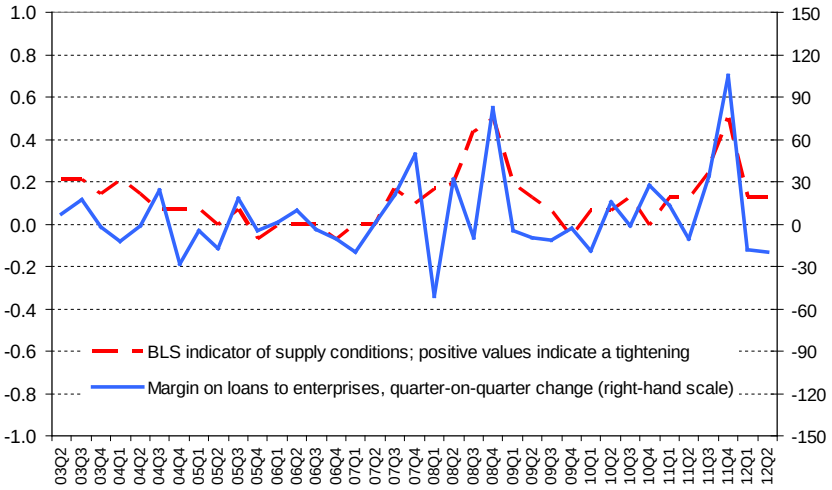
Source: Bank of Italy; the euro area bank lending survey.

Fugure 2

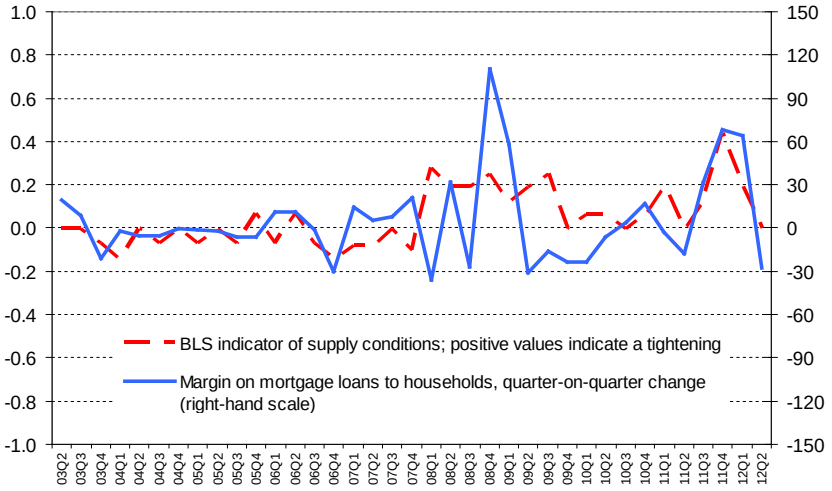
BLS supply indicator and margins on new loans

(quarterly data; basis points; diffusion indexes)

a) Loans to enterprises



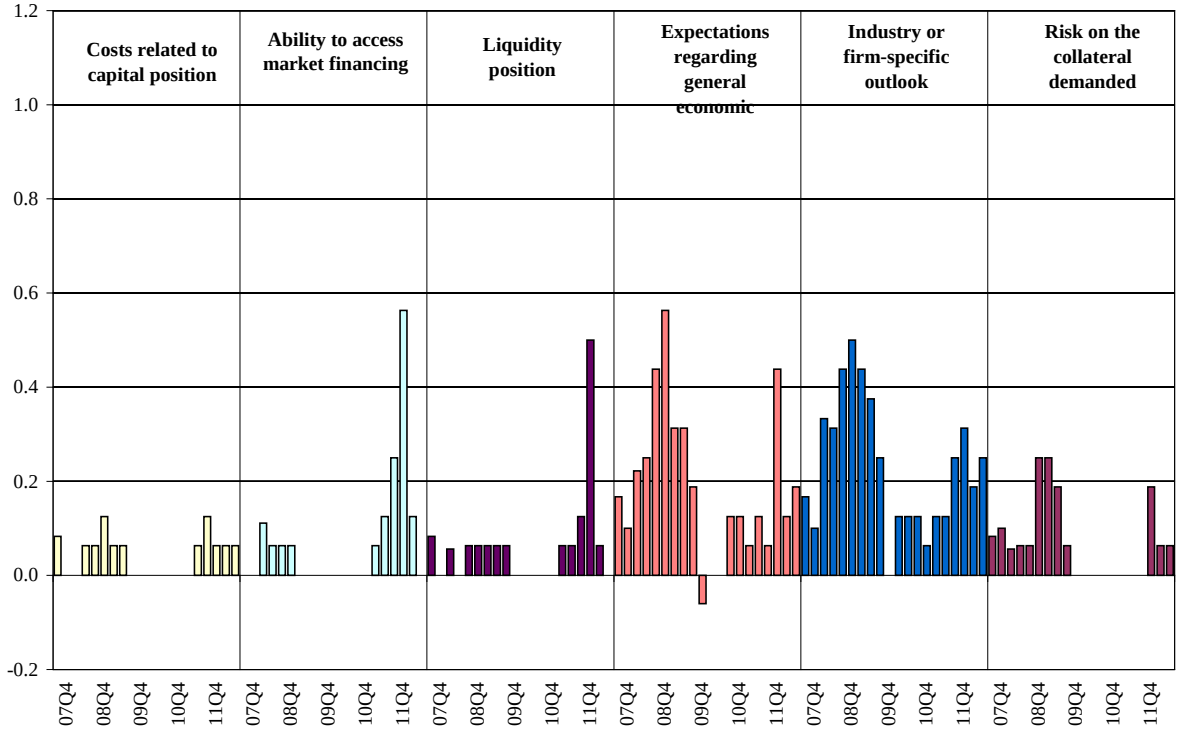
b) Mortgage loans to households



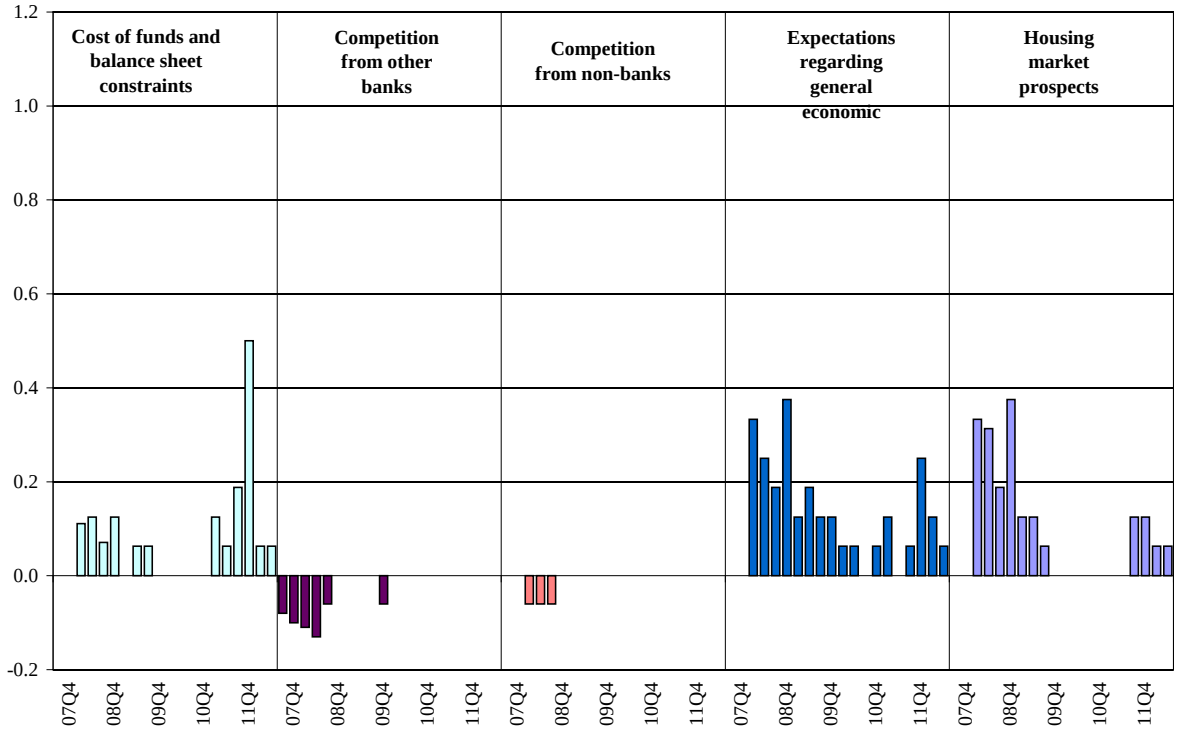
Source: Bank of Italy; the euro area bank lending survey.

Figure 3
Factors behind changes in credit supply conditions in Italy
(diffusion indexes)

a) Loans to enterprises



b) Mortgage loans to households



Source: The euro area bank lending survey.

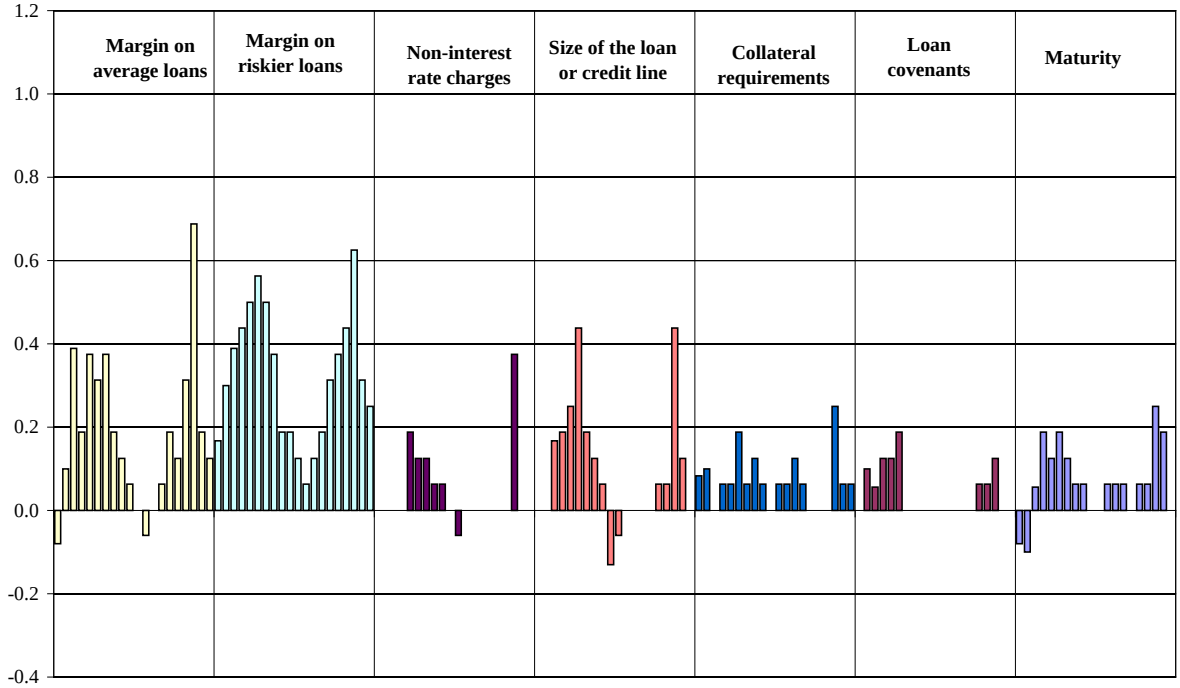
Notes: Positive values indicate supply restriction compared with the previous quarter. Diffusion indices are constructed on the basis of the following weighting scheme: 1 = contributed considerably to a tightening, 0.5 = contributed somewhat to a tightening, 0 = contributed to basically unchanged, -0.5 = contributed somehow to an easing, -1 = contributed considerably to an easing. The range of variation of the index is from -1 to 1.

Figure 4

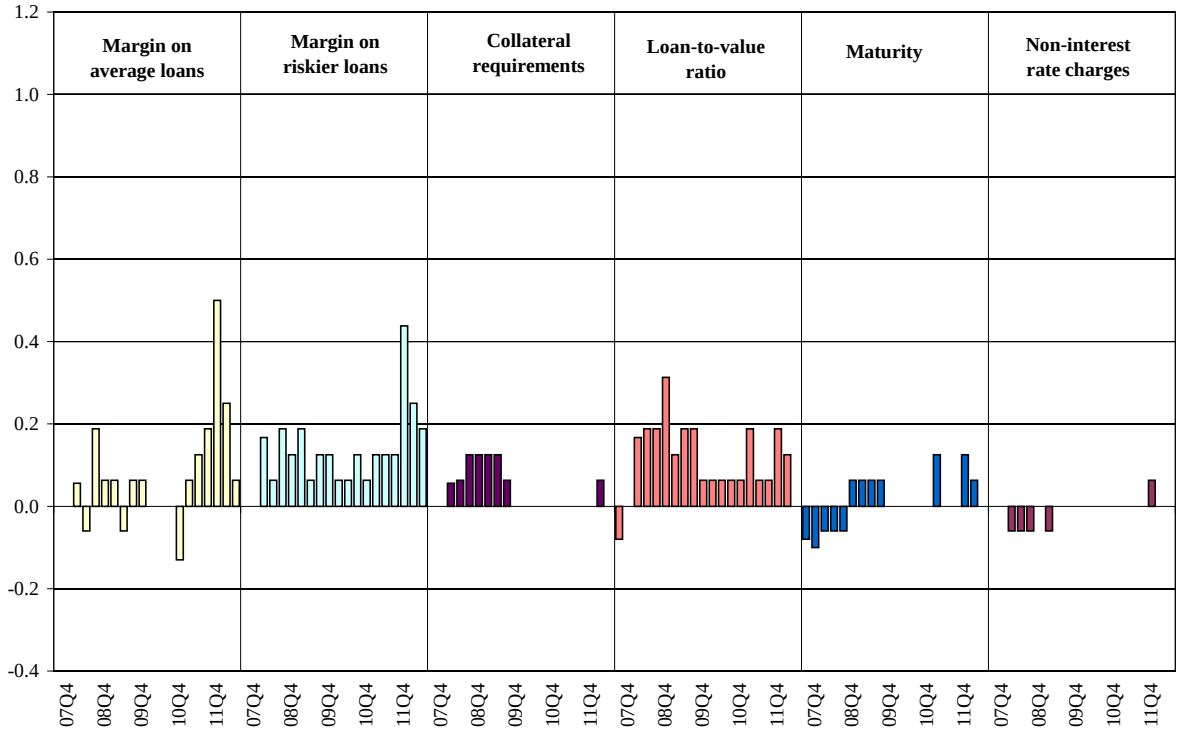
Terms and conditions behind changes in credit supply conditions in Italy

(diffusion indexes)

a) Loans to enterprises



b) Mortgage loans to households



Source: The euro area bank lending survey.

Notes: Positive values indicate supply restriction compared with the previous quarter. Diffusion indices are constructed on the basis of the following weighting scheme: 1 = tightened considerably, 0.5 = tightened somewhat, 0 = remained basically unchanged, -0.5 = eased somewhat, -1 = eased considerably. The range of variation of the index is from -1 to 1.

Figure 5

Estimated effects of supply and demand indicators on the cost and the amount of loans to enterprises

(quarterly data; percentage points)

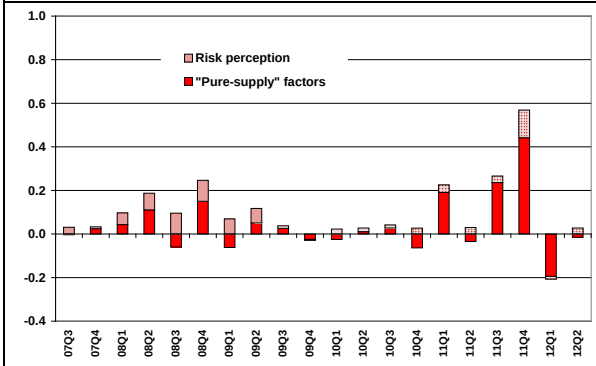
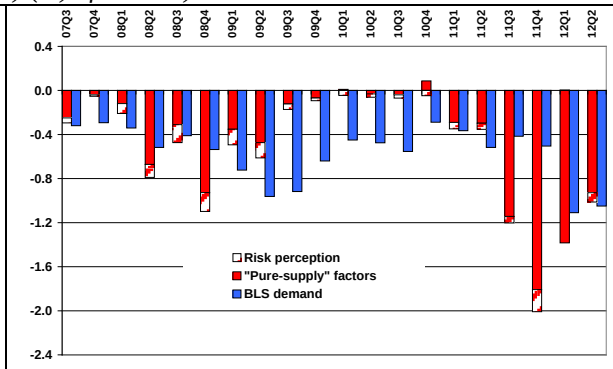
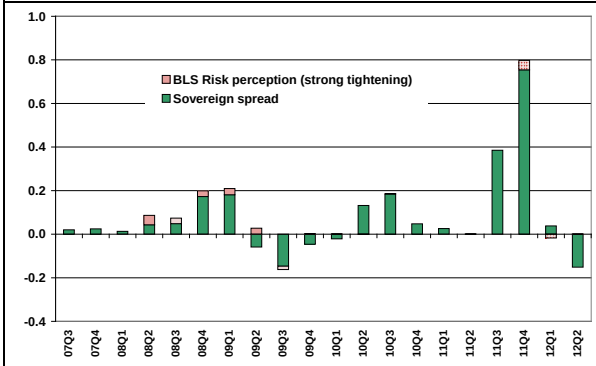
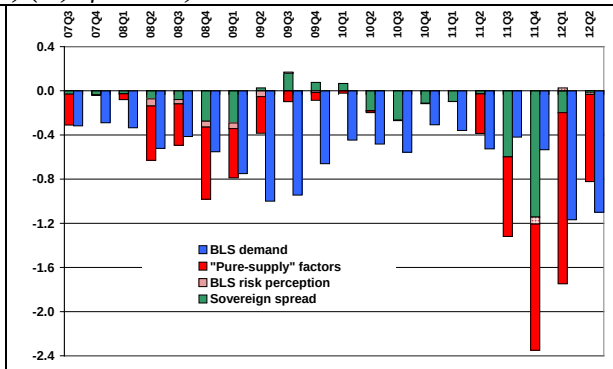
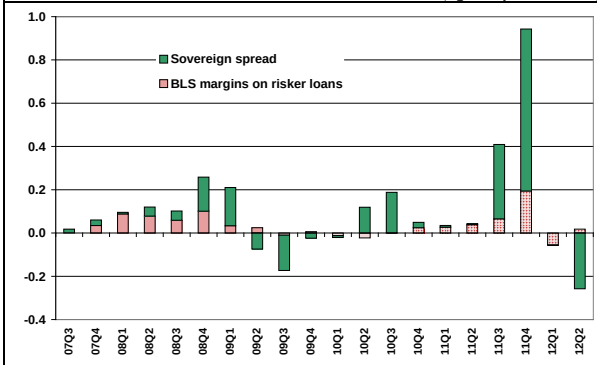
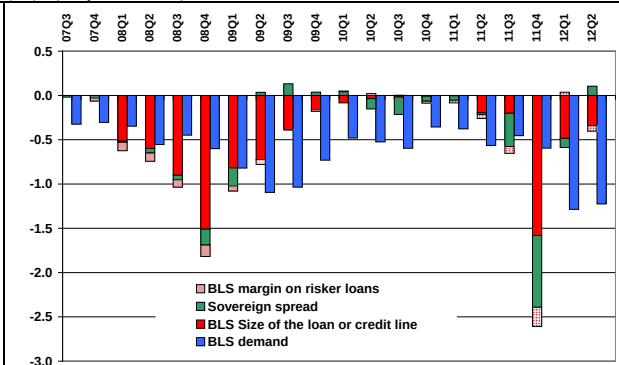
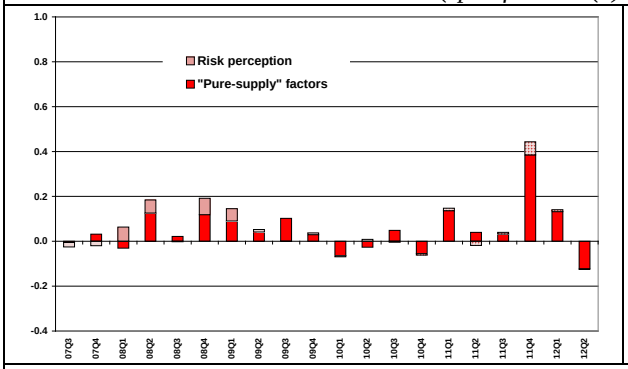
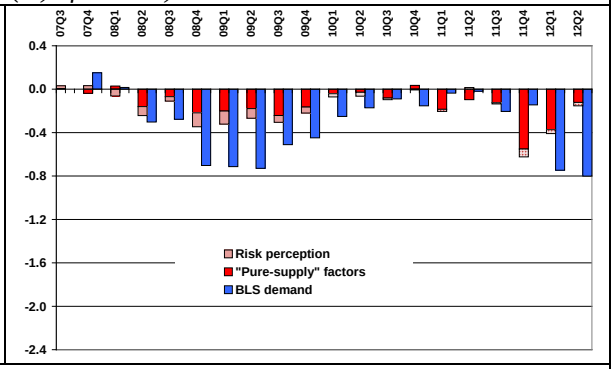
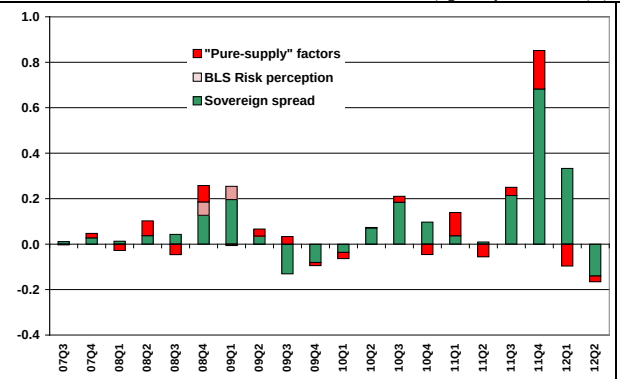
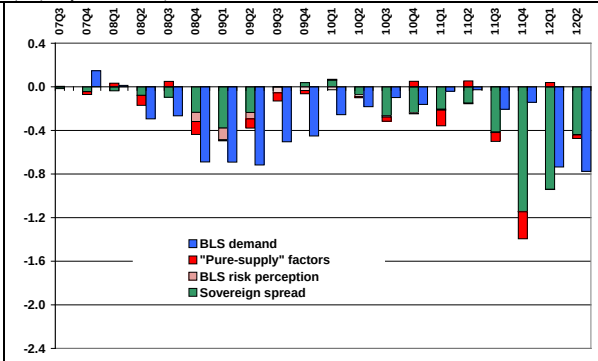
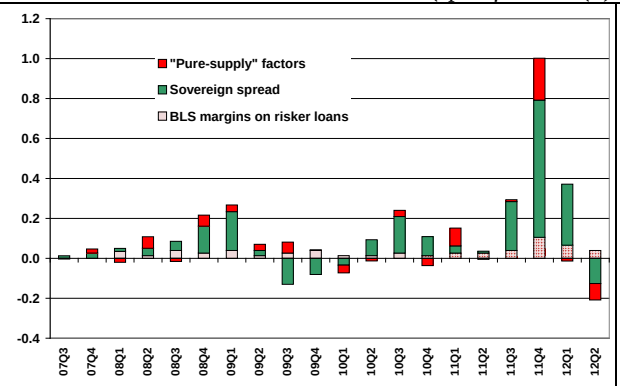
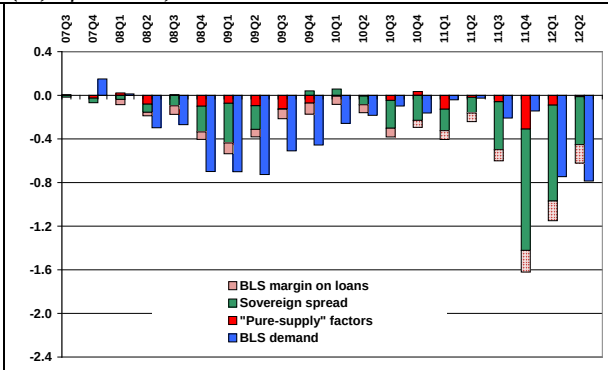
i) Cost of loans: q-o-q change in bank margin on new loans	ii) Amount of loans: q-o-q growth rate
Using BLS supply factors *(specification (c)-(c') of Table 4)*	
	
Using BLS supply factors and the sovereign spread *(specification (a)-(a') of Table 6)*	
	
Using BLS terms and conditions and the sovereign spread *(specification (c)-(c') of Table 8)*	
	

Figure 6

Estimated effects of supply and demand indicators on the cost and the amount of mortgage loans to households

(quarterly data; percentage points)

i) Cost of loans: q-o-q change in bank interest rate margin	ii) Amount of loans: q-o-q growth rate
Using BLS supply factors *(specification (c)-(c') of Table 5)*	
	
Using BLS supply factors and the sovereign spread *(specification (a)-(a') of Table 7)*	
	
Using BLS terms and conditions and the sovereign spread *(specification (b)-(b') of Table 9)*	
	

Appendix

Figure A1
Cumulated effects of BLS supply factors and demand indicators on the cost and the amount of loans to enterprises
(quarterly data; percentage points)

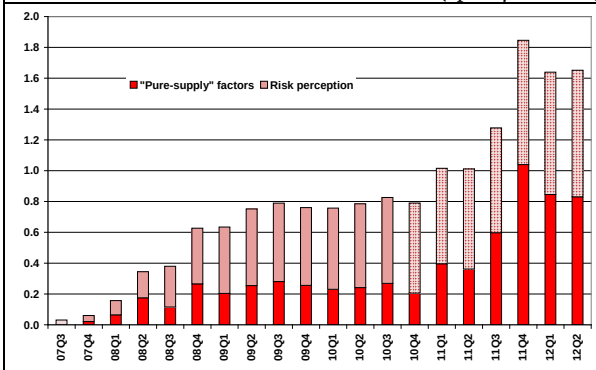
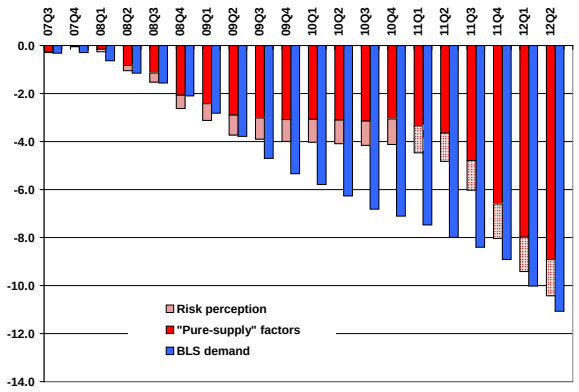
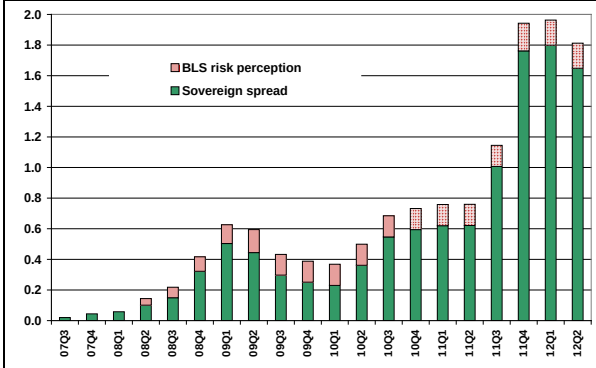
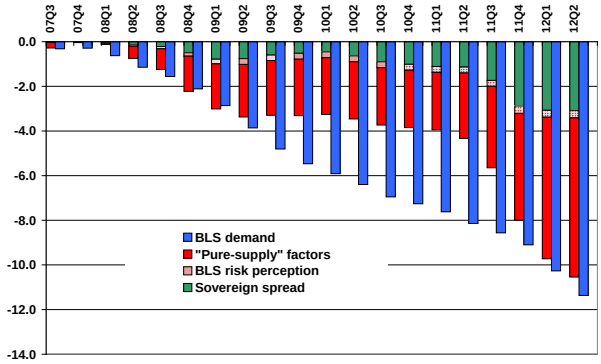
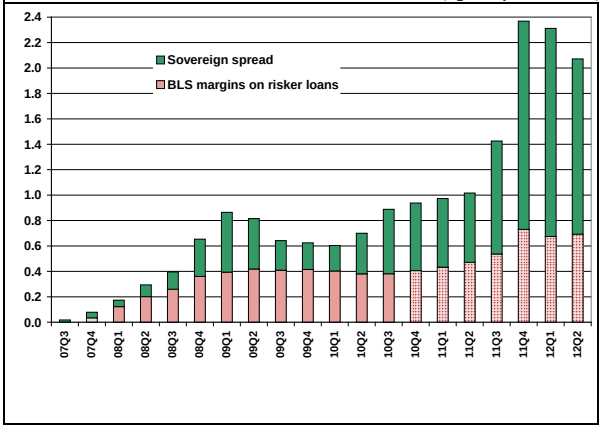
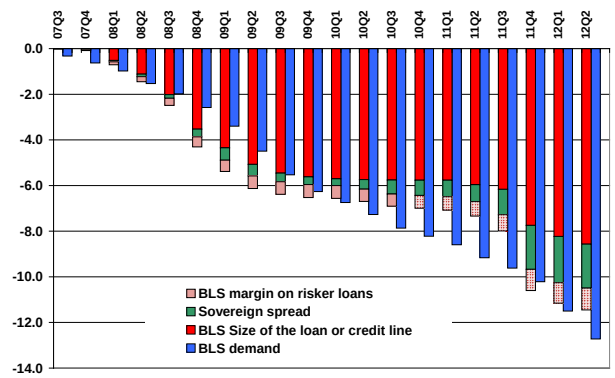
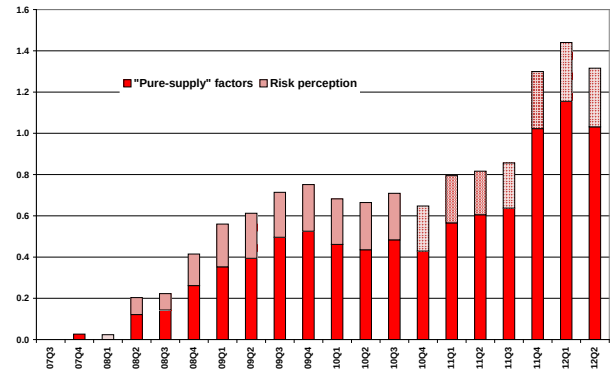
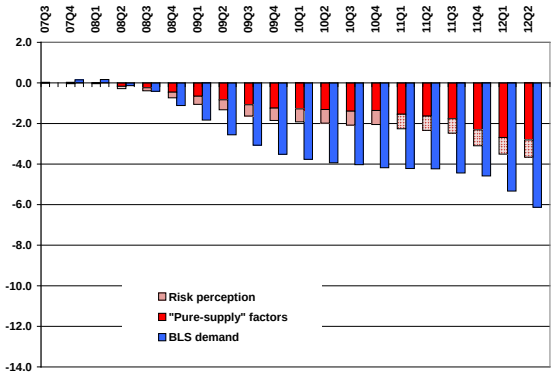
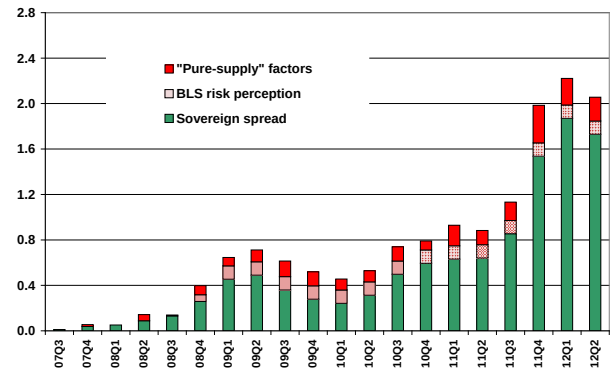
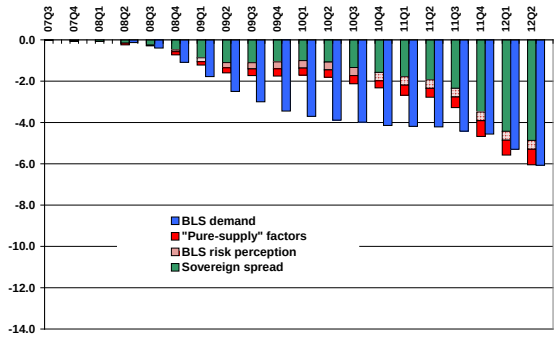
i) Cost of loans: q-o-q change in bank interest rate margin	ii) Amount of loans: q-o-q growth rate
Using BLS supply factors *(specification (c)-(c') of Table 4)*	
	
Using BLS supply factors and the sovereign spread *(specification (a)-(a') of Table 6)*	
	
Using BLS terms and conditions and the sovereign spread *(specification (c)-(c') of Table 8)*	
	

Figure A2
Cumulated effects of BLS supply factors and demand indicators on the cost and the amount of mortgage loans to households
(quarterly data; percentage points)

i) Cost of loans: q-o-q change in bank interest rate margin	ii) Amount of loans: q-o-q growth rate
Using BLS supply factors *(specification (c)-(c') of Table 5)*	
	
Using BLS supply factors and the sovereign spread *(specification (a)-(a') of Table 7)*	
	
Using BLS terms and conditions and the sovereign spread *(specification (b)-(b') of Table 9)*