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SUPPLY TIGHTENING OR LACK OF DEMAND? AN ANALYSIS OF CREDIT DEVELOPMENTS DURING THE LEHMAN BROTHERS AND THE SOVEREIGN DEBT CRISES

by Paolo Del Giovane*, Andrea Nobili* and Federico Maria Signoretti[§]

Abstract

We estimate a structural econometric model for the credit market in Italy, using bank-level information and the responses of Italian banks to the euro-area Bank Lending Survey to identify demand and supply, focusing on the recent financial crisis. The main results are the following. First, while in normal circumstances the functioning of the Italian credit market is consistent with a standard imperfect-competition model, during phases of high tension there are credit-rationing phenomena. Second, supply restrictions have a relevant impact on lending, both when they are due to banks' balance-sheet constraints and when they are the effect of greater perceived borrower riskiness. Third, to a large extent the tightening during the sovereign debt crisis reflected the common shock of the widening sovereign spread, not idiosyncratic bank funding problems. Fourth, the role of supply was stronger during the sovereign than the global financial crisis, mainly due to greater banks' funding difficulties. In a counterfactual exercise we estimate that in the second quarter of 2012 interest rates were more than 2 percentage points higher and the stock of loans more than 8 percent lower than would have been the case without the tightening of lending standards in the course of the entire crisis.

JEL Classification: E30; E32; E51.
Keywords: credit rationing; supply tightening; financial crisis; sovereign debt crisis.

Contents

1. Introduction 5
2. BLS indicators and lending to enterprises: data and descriptive evidence 10
3. Methodology: the structural representation of the credit market 12
   3.1 Identification strategy in a partial equilibrium framework 12
   3.2 Identification strategy in a partial equilibrium framework with credit rationing 16
4. The empirical results 17
   4.1 Baseline specification using BLS supply factors 17
   4.2 Specification with credit rationing 19
   4.3 Including the sovereign spread 20
5. Assessing the role of supply and demand factors: is the sovereign debt crisis different from the global crisis? 22
6. Concluding remarks 24
References 26
Tables and figures 29

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1. Introduction[1]

Credit developments in the euro area have been powerfully affected in the last five years by the global financial crisis and the ensuing sovereign debt crisis, and by the accompanying recession. The developments were quite homogenous across countries during the first phase of the crisis, which was characterized by a generalized contraction of economic activity, a marked deterioration in borrowers' creditworthiness and a sharp increase in risk aversion in the financial and credit markets. By contrast, the sovereign debt crisis was characterized by significant heterogeneity, with a concentration of the credit contraction in the countries hit by the sovereign debt strains, where banks' access to wholesale funding worsened abruptly, while elsewhere credit continued to expand.

Understanding the determinants of credit market developments is essential to designing policy responses. In particular, during a phase of credit retrenchment, the relative contributions of weak credit demand from households and firms and supply restriction by banks have to be disentangled. And where supply factors do play a role, it is also important to assess whether the tightening of lending standards depends on a deterioration of borrowers' creditworthiness or a worsening of banks' balance sheets, in connection with financial market distress. Different types of restriction call for different policy reactions. For instance, if the main source of the tightening is a shortage of capital, then recapitalization would be the proper answer. As to monetary policy, when credit supply is mainly hampered by worries about borrowers' creditworthiness, interest rate manoeuvres can enhance credit availability by helping to foster economic recovery; when the main problem is banks' funding difficulties, exceptional liquidity provision (as in the case of the Eurosystem's three-year refinancing operations at the end of 2011) may be the proper response.

In the same spirit, from a policy perspective it is also important to understand whether the restriction of supply conditions takes place only though an increase in the cost of credit, which brings demand and supply into equilibrium, or through credit rationing, i.e. a

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condition of excess demand over supply stemming from non-price allocations of credit. In the latter case, there would be a greater risk of a downward spiral between credit shortage and the deterioration of the real economy, calling for a more urgent and a more focused policy reaction.

In this paper, we estimate a structural econometric model for credit in Italy to study the effects of demand and supply factors on both the volume and the cost of lending to enterprises, with a focus on the global financial crisis and the ensuing euro-area sovereign debt crisis. The structural model is indispensable to proper identification of supply and demand, while also making it possible to study the credit market in a partial equilibrium framework, i.e. when the changes in interest rates can clear the market, as well as in periods of credit rationing. The case of Italy is particularly relevant, as lending by Italian banks slowed sharply between 2008 and the first half of 2009 and, after a brief recovery in 2010-11, turned down again late in 2011, severely affected by the sovereign debt crisis. We focus on lending to enterprises since it was affected more strongly by the crisis than lending to households.[2]

The identification strategy is based on the individual responses of the Italian banks (though with no disclosure of individual answers) participating in the Bank Lending Survey (BLS), the quarterly survey on credit conditions carried out in all countries of the euro area since 2002.[3] The respondent banks are asked for their assessment of demand conditions and an account of their decisions on lending supply standards, including the specific factors driving them (in particular, risk perceptions vis-à-vis borrowers and own balance-sheet constraints). We use these replies as instruments to identify structural equations for credit demand and supply and to estimate their respective contributions to credit developments (the implicit underlying hypothesis, naturally, is that the banks' replies are truthful and thus a valid proxy for actual demand and supply conditions). The BLS responses are combined with individual data on banks' loans and interest rates in a panel analysis. As regards the sovereign debt crisis, we also include as an explanatory variable the spread between the yield of the 10-year Italian government bond and that of the corresponding German Bund, which

[2] An analysis of loans to households for house purchase along the same lines as the present one was performed in an earlier version of this study (Del Giovane, Nobili e Signoretti, 2013); the estimated correlation between credit market developments and the BLS indicators was much weaker than for loans to firms.

[3] The survey includes questions on credit standards, loan demand, factors driving loan supply and demand, specific terms and conditions for 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 their respective countries. A detailed description of the survey can be found in Berg et al. (2005).

has received great attention by analysts and policymakers as a sort of "sufficient statistic" to gauge the severity of the tensions.

Our paper contributes to various strands of the literature. First, it is part of the abundant literature that uses the BLS (Berg et al., 2005; de Bondt et al., 2010; Hempell, 2004; Hempell and Kok Sorensen, 2010; Ciccarelli, Maddaloni and Peydró, 2010) or other lending surveys (Schreft and Owens, 1991; Lown, Morgan and Rohatgi, 2000; Lown and Morgan, 2006; Cunningham, 2006; Bayoumi and Melander, 2008; Swiston, 2008; Basset et al., 2012) for analyses based on the Federal Reserve's Senior Loan Officer Opinion Survey) to disentangle the contributions of demand and supply to credit market developments.[4] Our paper is set apart from most of these studies, which use aggregate data both for survey information and for credit developments, by our use of bank-level information. An exception is Del Giovane, Eramo and Nobili (2011), which used comparable data to analyze the relative contribution of demand and supply factors in credit market dynamics in Italy during the global financial crisis, up to the immediate aftermath of the Lehman Brothers failure. With respect to that paper, besides using a longer sample period, which includes the sovereign debt crisis in the euro area, and a number of additional controls, we significantly improve the methodology by using a structural model that allows us to estimate the impact of demand and supply factors on both the cost and the dynamics of lending, whereas Del Giovane, Eramo and Nobili (2011) estimated reduced-form equations and only for lending quantities.

Moreover, in analyzing the impact of the sovereign spread on lending supply, our study provides additional evidence on the effects of the sovereign debt crisis on the credit market in Italy with respect to the studies based on macroeconomic data (Albertazzi et al., 2012; Neri, 2013) or on information concerning bank-firm relationships from the Central Credit Registry (Albertazzi and Bottero, 2013; Bofondi et al., 2013).

Finally, our paper relates to the literature on credit rationing, in particular the seminal "quantitative" approach developed by Fair and Jaffee (1972) and Quandt (1978), in which the amount of "excess demand" in a given market is inferred by directly relating loan quantity to some explicit exogenous variables (typically a positive change in the price level). This approach has been taken by most of the econometric studies of credit rationing episodes

[4] More generally, our paper is also related to the work on the bank lending channel during the crisis, especially papers using micro data from credit registries, both for Italy (Albertazzi and Marchetti, 2010; Bonaccorsi di Patti and Sette, 2012), and for other countries (Khwaja and Mian, 2008; Jimenez et al., 2012).

in the aftermath of financial crises in 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). Unlike these works, our paper deduces the existence of excess demand (or supply) from the BLS supply indicators, not changes in the interest rate. This approach is more consistent with the definition of credit rationing, which typically occurs when banks are unwilling to supply additional credit even when borrowers are prepared to pay a higher rate, owing possibly to asymmetric information (Stiglitz and Weiss, 1981). In this paper we formally test which BLS variable is the best indicator of credit rationing.

The main results are the following. First, the coefficients of our structural model suggest that in normal circumstances the functioning of the Italian market for lending to firms is consistent with the standard models of imperfect competition, in which the intermediaries set the interest rate based on borrowers' riskiness and their own balance-sheet constraints and fully accommodate changes in credit demand (i.e. the loan supply schedule is perfectly elastic to changes in interest rates; see Freixas and Rochet, 2008; Degryse *et al.*, 2009). However, during times of financial strain we find evidence of credit rationing (the supply schedule becomes price-inelastic), consistently with models in which lenders limit the supply of credit to borrowers even when they are willing to pay higher interest rates (Jaffee and Modigliani, 1969; Stiglitz and Weiss, 1981).

Second, the effect of a supply restriction is relevant and statistically significant both when it is due to banks' balance-sheet constraints and when it reflects a heightened perception of borrower risk. We estimate that a tightening of lending standards due to funding constraints reported by all the banks in the panel is associated with an interest rate increase of about 40 basis points on impact (i.e. in the same quarter in which the tightening is recorded), compared with an increase of 20 or 50 points when the restriction is due to increased risk perception (depending on whether this factor is judged to have contributed "somewhat" or "considerably" to the tightening). Considering the interest rate elasticity of credit demand, the resulting effects on the quarter-on-quarter growth rate of lending would amount to a reduction of, respectively, 0.8 percentage points and 0.4 or 1.0 percentage points. The credit-rationing effect on lending growth, i.e. that associated with a supply restriction due to a worsening in banks' capital position, is estimated to be -1.9 percentage points. By contrast, the easing of supply conditions – rarely reported in the BLS – does not have statistically significant effects. Changes in the BLS demand indicators instead have symmetric effects: an increase of demand reported by all banks in the panel is associated

with an increase of about 1 percentage point in the growth rate of lending, while a reported demand decrease is associated with a negative impact of the same order of magnitude.

Third, the inclusion of the sovereign spread erases the significance of the BLS supply indicator related to funding conditions, suggesting that – especially during the sovereign debt crisis – the credit supply tightening largely reflected the common sovereign debt shock and not idiosyncratic bank conditions at individual banks. Changes in the sovereign spread have a significant impact effect on the cost of loans to firms and households: a 100-basis-point rise in the spread is associated with a 25 basis points increase in the cost of new loans and a 0.4-percentage-point reduction in the quarterly loan growth rate.

Fourth, a counterfactual exercise comparing the fitted values from our estimates with those that would have obtained had supply and demand indicators remained unchanged at their pre-crisis levels (i.e., 2007QQ2) indicates that both demand weakness and supply restraints played significant roles throughout the crisis. The effects of the credit tightening on the interest rate on loans to firms were stronger in the sovereign debt crisis than in the global crisis: the cumulative effect is estimated at more than 2 percentage points through the second quarter of 2012, of which a third came during the global crisis and two thirds during the sovereign debt crisis. As to loan dynamics, both weak demand and tight supply exerted significant negative effects on lending to firms in both phases of the crisis; the estimated supply effects were stronger during the peaks of the crisis (2008Q4 and 2011Q4). At the end of the sample period, supply factors are estimated to have had a cumulative negative impact on the stock of loans of more than 8 percent, which can be attributed in about the same proportion to the adjustment of loan demand to the increase in the cost and to credit rationing. Moreover, whereas during the global crisis supply effects on the cost of credit were mostly related to the banks' risk perception, during the sovereign crisis funding conditions became predominant. The effects on the growth rate of loans via the elasticity of demand to cost differed correspondingly. Credit rationing effects related to the banks' capital position were instead similar in the two phases of the crisis.

The rest of the paper is organized as follows. Section 2 describes the data and presents descriptive evidence. Section 3 illustrates the methodology used to define the loan demand and supply curves. Section 4 discusses the empirical findings, for both the baseline specification – in which the BLS supply and demand indicators are used as the main explanatory variables – and the extended specifications that also include the sovereign spread. Section 5 illustrates the counterfactual exercises assessing the relative importance of

demand and supply factors and comparing the effects during the sovereign debt crisis with those during the global financial crisis. Section 6 offers some concluding remarks.

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

This section provides information on the data and some descriptive statistics. The data are for the panel of major Italian banking groups ("banks") participating in the BLS. The number of banks changes over time, due to mergers and additions of new respondents.[5] The dataset consists in an unbalanced panel of 11 groups involved in the survey (with a maximum of 8 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. For loans to enterprises, the outstanding amounts at the end of the sample period corresponded to around 60 percent of the total provided by the entire Italian banking system.[6]

Table 1 shows descriptive statistics for the indicators of supply and demand conditions derived from the Italian BLS banks' responses on lending to enterprises. 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 more recent "sovereign debt crisis" (2010Q2-2012Q2). The table reports 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.[7]

In the pre-crisis period, 80 percent of the responses on supply conditions were in the "unchanged" category. Indications of an easing (either considerably or somewhat) were almost absent. Less than one fifth of the responses indicated "tightened somewhat", while very few indicated "tightened considerably". In the crisis period the percentage of answers in the "tightened" category rose sharply, to 37 and 29 percent, respectively, in the two phases

[5] Mergers 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 as of the date of the operation (in the same way that individual bank data are treated in the BLS). We checked the robustness of the results by using a different approach, in which both of the banks involved are excluded from the panel and a new bank is included as of the date of the operation. The results do not change.

[6] 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.

[7] 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 Table 1.

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 during the crisis, to 19 and 28 percent, respectively, in the two phases.

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 volume and the cost of loans. More specifically, Figure 1 shows two sharp slowdowns in lending to firms: during the 2008-09 global crisis and then during the sovereign debt crisis. In both cases the slowdown in lending corresponded to a fall in the BLS demand indicator and a tightening of the supply conditions indicator, the latter being particularly marked in the last two quarters of 2008 and in the last quarter of 2011, when all or almost all the respondents reported a tightening. Figure 2 shows that the two phases of the most severe strains were also marked by sharp rises in the cost of new credit to enterprises (net of the effects of monetary policy), associated with the tightening of supply conditions.

The supply indicator in Figures 1 and 2 refers to the change in the overall supply conditions reported by the banks. But the banks are also asked to respond to more detailed questions concerning the importance of the various factors in their supply policy, differentiating between: i) "cost of funds and balance sheet constraints" (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, such as "industry or firm-specific outlook" and "risk on collateral demanded").[8]

Figure 3, based on the answers to these questions, shows that the relative importance of the factors affecting credit standards differed between the global crisis and the sovereign debt crisis. During the former, the tightening mostly reflected an increase in perception of risk, while the relevance of banks' cost of funds and balance-sheet constraints was limited. In the latter, risk perceptions again played a role, but difficulties in obtaining market funding and banks' liquidity position were more important. This relevant difference was taken into account in designing the empirical exercises described below.

[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 7).

A general caveat, which applies to the data described in this Section, as to all survey-based data, is that their quality depends on the reliability and the truthfulness of the respondents' answers. In the case of lending surveys, banks might be inclined to report tighter credit standards than those they actually apply. 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, seen as responsible for a credit crunch, and so might have wished to portray their policies as less restrictive.

3. Methodology: the structural representation of the credit market

3.1 Identification strategy in a partial equilibrium framework

The econometric analysis involves estimating a system of two equations. The dependent variables are the cost and the growth rate of lending, which are expressed as functions of the BLS supply and demand indicators and other independent macro or bank-specific variables, as follows:

$$(1)\ \Delta bankspread_{it} = \alpha_{1i} + \beta_1(L)BLS\_S_{it} + \theta_1 \cdot \Delta loans_{it} + \gamma_1 X^1_{it} + \mu^S_{it}$$

$$(2)\ \Delta loans_{it} = \alpha_{2i} + \beta_2(L)BLS\_D_{it} + \theta_2 \cdot \Delta bankspread_{it} + \gamma_2 X^2_{it} + \mu^D_{it}.$$

More specifically, the variables $\Delta bankspread_{it}$ and $\Delta loans_{it}$ are, respectively, the first difference of the spread between the average rate on new loans of bank *i* and the Eonia rate[9] in quarter *t* and the quarter-on-quarter rate of growth in bank lending for the same bank in the same quarter (corrected for the impact of securitization activity).

BLS_D_{it} and BLS_S_{it} are vectors of dummy variables based on bank *i*'s replies in the BLS survey carried out at time *t*.[10] In particular, the variables in BLS_D_{it} are based on the answers concerning the banks' assessment of *overall* demand conditions. The variables in BLS_S_{it} are based on the replies concerning the specific *factors* affecting supply conditions (see Section 2). The use of the specific factor indicators rather than the overall indicator is

[9] We consider the difference between the bank loan rate and the Eonia rate in order to rule out the effects of monetary policy. Alternatively, one could consider the spread with respect to a longer-term interbank rate, such as 3-month Euribor. In a crisis period, however, the latter would be a less appropriate measure of the monetary stance, since it would also be affected by the increase in banks' risk aversion.

[10] An alternative to replies at time *t* would be the *cumulative* levels of the BLS indicators through time *t*. As remarked by Del Giovane, Eramo and Nobili (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 cumulative indicators either gives unclear results or worsens the fit of the estimates (depending on the approach).

important because in principle different sources of supply restriction call for different policy reactions. For example, if shortage of capital is the main cause of the tightening, recapitalization is the right response; in terms of monetary policy, acting on official interest rates could make more credit available by helping to pull the economy out of recession, when credit supply is impeded mainly by worries about borrowers' creditworthiness, whereas exceptional liquidity provision may be the proper course when the main problem is banks' funding difficulties. An additional reason for using the answers on the specific factors is that they can be more informative in certain phases, when banks reported unchanged overall supply conditions but indicated specific factors as contributing to a change in lending standards (Del Giovane, Eramo and Nobili 2011).

The variables included in BLS_S_{it} and BLS_D_{it} are dummies indicating whether banks reported an increase/decrease in demand or a tightening/easing of supply conditions (due to specific factors). For example, BLS_D_{it} includes dummy variables ($BLS\_D\_decrease_{it}$ and BLS$_D_increase_{it}$) that take value 1 if bank i at time t reported, respectively, that demand decreased or increased (either "considerably" or "somewhat"). A similar structure applies to the dummies for the supply factors, where the question is whether the factor contributed (either "somewhat" or "considerably") to tighten or ease supply conditions. As is shown by Del Giovane, Eramo and Nobili (2011), the choice of dummy variables – rather than single discrete variables for each indicator – helps capture non-linearity in the estimated relations between endogenous and exogenous variables, which may be particularly relevant in the case of the BLS supply indicators.[11]

All the variables in BLS_S_{it} and BLS_D_{it} may enter contemporaneously and/or with a lag. The lag order for each variable is chosen by trying a range between 0 and 4 on the basis of the regression's fit and the indications derived from standard information criteria.

We also add bank-specific fixed effects (α_{ki}, k=1,2) to control for unobserved bank-specific factors that might be correlated with the BLS variables and could result in inconsistent estimated coefficients. For example, different banks could interpret the qualitative BLS questions in different ways, so that their answers differ systematically.

The equations are further enriched with additional explanatory variables (X^k_{it}, k=1,2). First, we include the lagged value of the dependent variable, if statistically significant, to

[11] For the supply factor connected with risk perception we distinguish the case in which it affects credit standard "somewhat" from the case in which it does so "considerably". For this factor, there will thus be four dummies: $BLS\_S\_risk\_perception\_tightening\_somewhat_{it}$, $BLS\_S\_risk\_perception\_tightening\_considerably_{it}$, $BLS\_S\_risk\_perception\_easing\_somewhat_{it}$, $BLS\_S\_risk\_perception\_easing\_considerably_{it}$.

capture the autoregressive component of the correlations. Second, we include the individual bank's marginal cost of funding, which is computed as the difference between the weighted average of the interest rates paid by the bank on its new sources of funding (customer deposits and debt securities) and the Eonia rate, with the weights reflecting the relative importance of each type of liability. This addresses concerns that the BLS indicator of funding conditions, as a dummy, may capture banks' funding difficulties only in part and that the Eonia rate used as the base for computing the bank's mark-up, may also depend on other bank-specific variables not included in the equation.[12] If there are omitted bank-specific variables correlated both with the bank mark-up and with the BLS supply conditions, the estimates could be biased. Third, in order to allow for potential non-linearity in the impact of the BLS indicators during specific phases of tension, we introduce time dummies. Specifically, we include a variable that takes value 1 from 2008Q3 to 2012Q2 (*Crisis_dummy*) or, alternatively, two different variables taking value 1 from 2008Q3 to 2010Q1 (*Lehman_dummy*) and from 2010Q2 onwards (*Sovereign_dummy*). The respective interaction terms with the BLS supply factors capture changes in the estimated relationship between the dependent variables and the BLS supply and demand indicators. Finally, all equations include seasonal dummies. We also run a number of robustness checks, including additional controls for business cycle conditions not captured by the BLS indicators and typically included in reduced-form loan equations, such as nominal GDP and firms' financing needs.[13]

In the structural system (1)-(2) described above we use exclusion restrictions on the BLS indicators (and on the lagged dependent variables) in order to achieve identification.[14] The necessary and sufficient condition for identification in a system of simultaneous equations is the *rank condition*, i.e. that the matrix of coefficients for the set of variables

[12] Angelini et al. (2011) and Affinito (2011) have shown that the interbank rates at longer maturities charged to Italian banks during the crisis depended significantly on some specific characteristics of borrowers and lenders and that some of the estimated correlations increased dramatically after the outbreak of the 2007-08 crisis. This might also be the case for overnight rates.

[13] For Italy, see Casolaro et al. (2006) and Albertazzi et al. (2012). The inclusion of these two variables in the equations does not change the results. Firms' financing needs are not statistically significant in any of the regressions. GDP only partly offsets the significance of the BLS demand decrease dummy. This is consistent with the fact that GDP is generally used as an explanatory variable in models of credit demand. The fact that the BLS demand indicator has additional explanatory power with respect to GDP is consistent with Del Giovane, Eramo and Nobili (2011); presumably this is because this indicator also reflects banks' assessment of demand factors not captured by GDP, such as the demand for inventories and working capital, debt restructuring and mergers and acquisitions.

[14] In a system of simultaneous equations the lagged dependent variables are, by definition, pre-determined. In principle, they can be used as instruments in both equations. In our system, the exclusion restrictions on pre-determined variables are based upon the statistical significance of their coefficients and the indications provided by the Sargan test.

excluded from one equation must have full row rank in the other equation. If BLS_S_{it} and BLS_D_{it} are statistically significant (i.e. are reliable instruments), this condition is satisfied.[15] If θ_1 and θ_2 are, respectively, non-negative and non-positive, then equation (1) can be interpreted as a credit supply curve: a tightening in credit standards implies an increase in banks' margins and a decline in the rate of growth in lending, via the elasticity of loan demand (coefficient θ_2). Equation (2) can be read as a credit demand curve, where loan quantity depends negatively on the cost of credit. A downward (upward) shift in credit demand, as captured by the BLS indicator, leads to a decrease (increase) in both the loan growth rate and the bank mark-up, via the elasticity of the loan supply (coefficient θ_1).

A special case of this structural model is θ_1=0, which is consistent with the common representation of the credit market under imperfect competition, where credit supply is flat and the intermediaries set interest rates and fully accommodate credit demand (Freixas and Rochet, 2008; Degryse, Kim and Ongena, 2009).[16] In this theoretical framework, a shift in credit demand would affect the quantity but not the cost of credit. Thus the distinction between a flat and an upward-sloping credit supply curve is tested empirically in this paper.

The structural equations (1) and (2) are estimated consistently using the two-step efficient generalized method of moments (GMM) estimator. This estimator minimizes the GMM criterion function $J=N*g'*W*g$, where N is sample size, g comprises the orthogonality or moment conditions (specifying that all the explanatory variables, or instruments, in the equation are uncorrelated with the error term) and W is a weighting matrix. In the two-step efficient GMM, the efficient or optimal weighting matrix is the inverse of the estimated covariance matrix of the orthogonality conditions. This estimator is more efficient than the traditional IV/2SLS estimator for an over-identified system of equations and when the residuals present heteroskedasticity and arbitrary intra-group correlation (see Hayashi, 2000). The selection of the model is based on a general-to-specific approach, where non-significant variables and/or lags are removed sequentially.

Notice that in the empirical analysis we deal with *over-identified* supply and demand equations, in which the number of excluded instruments is greater than the number of endogenous variables. The reliability of the over-identified restrictions is examined by

[15] A simpler way to think about the identification via instrumentals: 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 necessary only for identification (they satisfy the *order condition*), but in a two-equation system they also satisfy the *rank condition* (see, e.g., Wooldridge, 2002).

[16] 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.

running the Sargan-Hansen test for each structural equation separately. 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 report the Wald version of the Kleibergen-Paap (2006) statistic for testing underidentification. Under the null hypothesis that the equation is *underidentified*, the matrix of the reduced-form coefficients on the L1 instruments excluded has rank equal to (K1-1) where K1 is the number of endogenous regressors. Under the null hypothesis, this statistic is distributed as chi-squared with (L1-K1+1) degrees of freedom. A rejection of the null indicates that the matrix is full column-rank and that the model is identified.

3.2 Identification strategy in a partial equilibrium framework with credit rationing

The system of equations (1) and (2) describes a framework in which the changes in the interest rate always ensure that the quantity supplied is equal to that demanded at every point in time, clearing the market. A clear, important shortcoming of this approach is its inability to capture "credit rationing". Broadly speaking, credit rationing occurs when, at the interest rate charged by the banks, the demand for loans exceeds the supply and lenders will not provide additional credit even if the borrowers are willing to pay higher rates. Essentially, credit rationing is a situation in which the lender's supply function has become perfectly price-inelastic, so interest rate adjustments do not clear the market. The possible causes of credit rationing include banks' balance-sheet constraints, risk aversion and asymmetric information.[17]

Most of the recent empirical analyses of credit rationing have taken the "quantitative approach" developed by Fair and Jaffee (1972).[18] This approach posits that the quantity traded in a given market is the minimum between the amounts supplied and demanded ("short-side" rule) and that excess demand (or supply) is related to exogenous variables (in most cases, the change in the price level). Taking this approach, we use BLS data to determine the amount of excess credit demand (or supply). Accordingly, the system of equations (1)-(2) is modified as follows:

$$(3)\ \Delta bankspread_{it} = a_{1_i} + \theta_1 \cdot \Delta loans_{it}^{S} + \beta(L) BLS\_S_{it} + \gamma_1 X_{it}^{1} + \mu_{it}^{S}$$

[17] Banks may not want to raise lending rates above a certain level in order to avoid exposure to riskier borrowers (adverse selection) or to discourage firms from taking excessive risk (moral hazard). See the seminal work by Stiglitz and Weiss (1981).

[18] See among others, Pazarbasioglu (1996); Ghosh and Ghosh (1999); Kim (1999); Barajas and Steiner (2002); Ikhide (2003); Baek (2005); Bauwens and Lubrano (2007); Allain and Oulidi (2009).

$$(4)\ \Delta loans_{it}^{D} = a_{2i} + \theta_2 \cdot \Delta bankspread_{it} + \lambda(L)BLS\_D_{it} + \gamma_1 X_{it}^{2} + \mu_{it}^{D}$$

$$(5)\ \Delta loans_{it} = min(\Delta loans_{it}^{S}, \Delta loans_{it}^{D})$$

$$(6)\ \Delta loans_{it}^{D} - \Delta loans_{it}^{S} = \sigma_1(L)BLS\_S\_tightening_{it}$$

$$(7)\ \Delta loans_{it}^{S} - \Delta loans_{it}^{D} = \sigma_2(L)BLS\_S\_easing_{it}$$

Equations (3) and (4) are the supply and the demand equations respectively, where $\Delta loans_{it}^{S}$ and $\Delta loans_{it}^{D}$ are the non-observable quantities supplied and demanded. Equation (5) is the short-side rule. Equations (6) and (7) relate excess demand and excess supply to the banks that report a tightening or an easing of the different BLS supply factors considered. We allow all the factors potentially to capture the credit rationing. If the coefficients σ_1 and σ_2 are statistically significant, this indicates that a tightening or an easing of the specific factor considered is correlated with, respectively, excess demand or supply.

Following the discussion in Fair and Jaffee (1972), the system of equations (3)-(7) can be reduced to a system with a single supply and a single demand equation, as follows:

$$(8)\ \Delta bankspread_{it} = a_{1i} + \theta_1 \Delta loans_{it} + \beta(L)BLS\_S_{it} + \gamma_1 X_{it}^{1} - \sigma_2(L)BLS\_S\_easing_{it} + \mu_{it}^{S}$$

$$(9)\ \Delta loans_{it} = a_{2i} + \theta_2 \Delta bankspread_{it} + \lambda(L)BLS\_D_{it} + \gamma_1 X_{it}^{2} - \sigma_1(L)BLS\_S\_tightening_{it} + \mu_{it}^{D}.$$

Notice that the mechanism for setting interest rates operates in each period but it does not necessarily clear the market. In each quarter the credit market may exhibit temporary credit rationing owing to imperfect flexibility in interest rates.

In practice, Figure 3 shows that our sample banks very rarely reported that some factor contributed to an easing of credit standards, making it impossible to estimate the coefficients $\sigma_2(L)$. Our test thus reduces to estimating whether the data are consistent with a credit market that is always in equilibrium (i.e., $\sigma_1(L)$=0) or instead is characterized by episodes of credit rationing ($\sigma_1(L)$<0).

4. The empirical results

4.1 Baseline specification using BLS supply factors

This section reports the results of the econometric estimation, first for the model with no credit rationing (described by equations (1)-(2)). The results for the supply equation are reported in column (a) of Table 2, those for the demand equation in column (a'). As mentioned, the specifications are obtained following a general-to-specific approach.

Starting with the structural parameters, the coefficient for the loan spread in the demand equation is highly significant and negative, suggesting that we are correctly

identifying a downward-sloping demand curve. The estimated elasticity is high: a 100-basis-point increase in the loan mark-up is associated with a reduction in the quarterly growth rate of loans of more than 2 percentage points. In the loan supply equation, the coefficient of loan growth is positive but not statistically significant, suggesting that the credit market is characterized by a flat supply curve.[19]

As to the exogenous variables, in the supply equation none of the "easing" dummies is significant. This reflects the great asymmetry of the BLS supply indicators, which signal tightening on a number of occasions but very rarely easing. In fact, the reductions in the loan spread that are often observed in our sample period are captured by the negative and significant coefficients of its lagged values. "Tightening" replies, instead, are associated with significant effects on the loan spread. Diminished access to funding for banks – as captured by the BLS answers – has a statistically significant effect on the cost of credit, both on impact and with a one-quarter lag. The estimated coefficients indicate that the mark-up would be 40 basis points higher on impact if all the banks reported a tightening related to this factor than if none did. A tightening related to worsening risk perception is also found to exert a significant effect on loan rates, estimated at 50 basis points when banks reported that this factor contributed "considerably" to the tightening, and 20 basis points when it contributed "somewhat". Considering the interest rate elasticity of credit demand, the resulting contemporaneous effects on quantities would amount to a reduction of 0.8 percentage points in the quarter-on-quarter growth rate of lending for funding conditions and 0.4 and 1.0 percentage points, respectively, for risk perception. A tightening connected with the banks' capital position turns out not to be statistically significant. Finally, a 1-percentage-point increase in the marginal cost of funding is associated with a 10-basis-point rise in the mark-up.

In the loan demand equation, the dummies of the BLS demand indicator are significant and have the expected signs in the case of both an "increase" and a "decrease". The coefficients suggest that the relationship is symmetric: the case in which all banks report an

[19] An important implication of a flat credit supply curve is that demand conditions, as captured by the BLS indicator, have no effect on the cost of credit via the elasticity of the loan supply curve to the loan growth rate. During a crisis, however, demand conditions may affect the bank mark-up directly when they reflect changes in the composition of borrowers (i.e. loan demand may be characterized by a larger fraction of riskier borrowers, inducing banks to increase margins). This would generate an omitted-variable problem in our model, which could be fully addressed only using bank-firm data from the Central Credit Registry, as was done for Italy in Albertazzi and Marchetti (2010) and De Mitri, Gobbi and Sette (2010). In the present paper, however, it is possible that the BLS risk perception indicator at least partly captures a change in borrower composition; moreover, the banks in our sample are relatively large and have a similar business model, so that this concern is possibly weaker than in other studies based on bank-level data.

increase (a decrease) in demand is associated to a rise (fall) in the quarter-on-quarter credit growth of 1 percentage point.

4.2 Specification with credit rationing

All in all, the signs of the structural parameters and the exogenous variables suggest that the identification provided by the system of equations (1)-(2) could be correct. But the more formal Sargan-Hansen test suggests that the scheme is only partly satisfactory. In particular, not all the exclusion restrictions used to identify the loan demand equation are valid. The "difference-in-Sargan" statistics[20] – which allows us to test each instrument separately – suggest that the failure of the Sargan-Hansen test is mainly related to the exclusion from the demand equation of the supply factor connected with the banks' capital position.

In light of the discussion in Section 3, this result is consistent with the thesis that the implicit assumption of this identification scheme – namely that changes in interest rates always clear the credit market – could not be valid. Instead, the BLS indicator of bank's capital position could carry information on credit rationing phenomena and, as such, directly affect loan quantities. Accordingly, we estimate a system consistent with the representation given by equations (8)-(9), in which the BLS supply factor related to the capital position conditions is part of the equation for loan demand. The results are displayed in columns (b) and (b') of Table 2.

The direct effect of the BLS capital position indicator on loan demand is negative and highly significant; a tightening of this factor is associated with a decline of about 1.9 percentage points in the quarter-on-quarter loan growth rate. The coefficients of the remaining variables in the equation, including the estimated slope of the loan demand curve, do not change substantially compared with the previous specification.

The diagnostic tests fully support this identification scheme. In particular, the Sargan-Hansen test and the Kleibergen-Paap statistics accept the identifying restrictions in both equations at any conventional significance level. Overall, this system specification provides evidence that the credit supply curve is flat in normal times, becoming temporarily price-

[20] The statistic is defined as the difference between 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 that both the smaller set of instruments and the additional, suspect instruments are valid, the statistic is distributed as chi-squared in the number of excluded instruments tested.

inelastic when banks reported a worsening in their capital position, which is consistent with the thesis of credit rationing during financial crisis.

4.3 Including the sovereign spread

During the sovereign debt crisis analysts and policymakers have paid considerable attention to developments in the spreads between the sovereign bond yields of the euro-area countries hit by the tensions and those of Germany. Indeed, this spread has been seen as a sort of "sufficient statistic", an adequate gauge of the severity of the strains. During the crisis period the BLS survey added a number of ad hoc questions about its impact on the banks' credit policy. The responses suggest that the overall impact was significant.[21] 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. Their results indicate that the effects were quite substantial. Neri (2013) and Zoli (2013) have also found that the sovereign spread significantly affected banks' lending rates in a number of countries, including Italy.

In light of the foregoing, we deemed it useful to investigate the information content of the spread for both the credit demand and supply curves. We first test the role of the sovereign spread as a credit supply shifter. To this end, we re-estimate the system of equations (8)-(9) including as an instrument in the loan supply equation the change in the difference between the yields on the 10-year Italian and German government bonds. Since the sovereign spread is a macro variable common to all banks, the estimated standard errors may be lower than the true ones (see Moulton, 1990). Accordingly we computed the standard errors by clustering observations over periods of time. The results are reported in columns (a)-(a') of Table 3.

The estimated coefficients of the sovereign spread are positive and highly significant: a 100-basis-point increase in the spread is associated with an immediate pass-through of around 25 basis points and (as a result of the lag structure of the model) with a cumulative effect of about 30 basis points after one quarter, similar to the findings of the studies based on aggregate data (see Albertazzi et al., 2012; Neri, 2013; Zoli, 2013). Considering the interest rate elasticity of credit demand, the corresponding effects on quantities would

[21] Tensions in the sovereign debt market may affect banks' balance sheets and lending conditions through several channels: banks hold sizeable portfolios of their own country's government bonds; government securities are used as collateral in secured interbank transactions; yields on government bonds may be a benchmark for alternative assets; and the creditworthiness of the government affects the value of the explicit or implicit guarantee provided to the banking sector. See BIS (2011).

amount to a reduction in quarter-on-quarter growth of, respectively, around 0.4 and 0.5 percentage points.[22] The sovereign spread appears to have predictive power over the entire sample period, not only during the crisis: the interaction between the spread and the crisis or the sovereign-crisis dummy is not statistically significant. This is not really surprising, however, as such a large part of the entire sample period is made up of the crisis years.

An important result is that including the sovereign spread wipes out the significance of the BLS funding conditions indicator and the bank-specific marginal cost and also reduces the coefficient of the BLS risk-perception indicators somewhat. This suggests that, at least during the sovereign debt crisis, the relationship between banks' funding difficulties and credit developments largely reflected the sovereign debt strains. Thus, the common shock to the banking system, captured by the changes in the sovereign debt spread, dominated the idiosyncratic components represented by the individual bank's marginal cost of funding and answers to the BLS.

In the above regression, lacking information on potential credit rationing, we treated the sovereign spread as a standard supply shifter. In fact, the Sargan-Hansen test accepts all the over-identifying restrictions used for identification, including the exclusion of the sovereign spread from the demand equation. Nonetheless, we further tested this restriction by including the sovereign spread in the loan demand equation: its coefficient is not statistically significant and the various diagnostics strongly reject this alternative specification, even when interacted with the sovereign-crisis dummy.

Next we checked whether the effects of changes in the sovereign spread differed depending on whether they are caused by yield changes on Italian or on German bonds. Actually, during the crisis the spread reflected both idiosyncratic factors related to economic and public finance developments in Italy and more general "flight-to-quality" phenomena connected with the investors' fears of euro reversibility ("redenomination risk"). The former effects are likely to increase the yield on BTPs for a given Bund yield, while the latter should lower Bund yield for a given BTP yield. In principle, one may expect that the idiosyncratic factors have a stronger impact on lending supply conditions.

[22] As in previous studies, here we focus on the effects of a temporary increase in the sovereign spread (i.e. a rise of the spread at time *t* which is reabsorbed in the following quarter). A more persistent shock would have stronger effects; e.g. a rise of the spread of the same magnitude at time *t* which persisted at time *t+1* would be associated to an increase of the loan spread by more than 50 basis points after one quarter. The quarter-on-quarter growth rate of lending would fall by about 1 percentage point.

To test this proposition empirically, we replaced the sovereign spread among the explanatory variables of the supply equation by including separately the BTP and the Bund yields. The results, reported in columns (b)-(b') of Table 3, show that a rise in the BTP yield does in fact have a stronger effect on the cost of loans to enterprises than a reduction in the Bund yield. The pass-through after one quarter is around 75 basis points in the former case and 50 in the latter.

The inclusion of the sovereign spread could raise problems of endogeneity, because the changes in this variable could themselves be determined by credit demand and supply conditions. But in Italy – unlike other countries –the causal link clearly runs from the sovereign debt tensions to the difficulties of the banking system, and not the other way round. Accordingly, it is reasonable to consider the spread as an exogenous variable in our regressions. In any case, to address the endogeneity concern, we ran additional estimates, first regressing the sovereign spread on the BLS demand and supply factors and then including the residual of this auxiliary equation in the main regression, so as to have an orthogonalized version of the sovereign spread as causal variable. The estimated coefficients for the auxiliary regression indicate that the behaviour of the sovereign spread mainly affects supply factors, lending support to our structural interpretation. Moreover, in the main regression all the structural coefficients remain virtually unchanged, confirming that the endogeneity of the spread is not a relevant concern.

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

In the previous sections we have shown that the BLS demand and supply indicators and the sovereign spread may help identify structural demand and supply curves for business lending. Now we use the empirical models to quantify the contribution of supply and demand to changes in the cost and the volume of loans during the two phases of the financial crisis. To this end we perform a counterfactual exercise setting the supply and demand indicators constant throughout the crisis at their pre-crisis (2007Q2) levels. Based on the estimated parameters we can calculate the values of the loan spread and growth rate in this counterfactual scenario and compare them with the fitted values based on actual demand and supply indicators, thus obtaining an estimate of each factor's contribution.

We perform the counterfactual analysis using the specification presented in columns (b)-(b') of Table 2. Figures 4a and 4b show the quarterly contribution of each factor to the change in the cost and the growth rate of loans to firms. Complementary information is

provided by Figures 5a and 5b, which show the corresponding cumulative effects over the entire crisis period. Finally, Table 4 provides a more compact illustration of the effects of demand and supply factors, in terms of their quantification and sources, by reporting the estimates of the cumulative effects in the two phases of the financial crisis.

The results indicate that supply factors – as measured by the BLS indicators – had a substantial effect on both the cost and the availability of credit throughout the crisis. The magnitude of the effects was stronger on average during the sovereign debt than during the global financial crisis.

As regards the cost of credit, the tightening of supply conditions is estimated to have determined a quarterly rise of around 70 basis points at the peak of the sovereign debt crisis (2011Q4), compared to about 30 basis points at the peak of the global crisis (2008Q4). The cumulative effect from the beginning of the crisis through 2012Q2 is estimated at around 220 basis points, of which about a third came during the global crisis and two thirds during the sovereign debt crisis.

The two phases of the crisis were characterized by differing relative importance of the various supply factors. During the global crisis, risk perception played a predominant role in affecting the cost of lending while the impact of funding conditions was smaller. By contrast, during the sovereign debt crisis the factors relating to difficulties in access to funding became much more important, determining on average around two thirds of the rise in interest rates due to all supply factors. The effects on the growth rate of loans via the elasticity of demand to cost differed correspondingly. Credit rationing effects related to the banks' capital position were instead similar in the two phases of the crisis. The effect of funding factors peaked in the last quarter of 2011 and decreased rapidly thereafter, offering evidence of the effectiveness of the exceptional measures taken by the ECB at the end of 2011.[23],

As to the growth rate of loans, both weak demand and tight supply had substantial adverse effects in both phases of the crisis. The repercussions of demand were greater than those of supply in most of the quarters 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. The estimated supply effects were stronger during the sovereign debt crisis. The impact of supply factors was greatest in the

[23] See Casiraghi *et al.* (2013) for an analysis on the impact of the Eurosystem unconventional monetary policy on credit conditions and economic activity in Italy during the sovereign debt crisis.

last quarter of 2011, when it is estimated to have reduced the quarter-on-quarter growth rate of loans by about 2 percentage points, compared to around 1 point in 2008Q4.

At the end of the sample period (2012Q2), demand conditions are estimated to have determined a cumulative reduction of about 12 percent in the stock of loans. Supply factors are estimated to have had a cumulative impact of more than 8 percent. The part of this negative effect that can be ascribed to credit rationing is estimated to be about 4 percent, equally distributed in the two phases of the crisis.

We also carried out the counterfactual exercise using the specification of columns (a)-(a') of Table 3, which includes the sovereign spread. The estimates of the cumulative effects in the two phases of the financial crisis are reported in Table 5. In terms of the relative contribution of demand and supply, the results are very similar to the foregoing. The impact of risk perception is slightly smaller; that of the sovereign spread during the second phase of the crisis is somewhat greater compared to the impact of the BLS "pure" supply factors in the previous specification.

6. Concluding remarks

In this paper we use the indicators of supply and demand conditions based on Italian banks' responses in the euro-area Bank Lending Survey to estimate structural relationships that can assess the relative role of supply and demand in determining the dynamics of the cost and volume of lending to enterprises in Italy. Our framework allows us to test for the presence of credit rationing. The dataset combines the qualitative information obtained from the BLS with micro-data on loans granted by the participating Italian banks.

We found that in normal circumstances the functioning of the Italian credit market is consistent with the standard theoretical models of imperfect competition, in which banks set the interest rates based on borrower risk and their own funding constraints and fully accommodate changes in credit demand (i.e. the loan supply schedule is perfectly elastic to changes in interest rates). However, we also found that during the crisis periods, when banks reported having tightened their credit standards because of capital constraints, the supply schedule becomes price-inelastic and suggestive of credit rationing, in keeping with models in which lenders limit the supply of credit to borrowers even when they are willing to pay higher interest rates.

A counterfactual exercise suggests that both demand and supply factors played a relevant role throughout the crisis. The effects of the supply restriction on both the cost and the availability of credit were, on average, stronger during the sovereign debt crisis than the

global crisis. And whereas during the global crisis supply effects on the cost of credit were mostly related to the banks' risk perception, during the sovereign crisis funding conditions became predominant. The effects on the growth rate of loans via the elasticity of demand to cost differed correspondingly. Credit rationing effects related to the banks' capital position were instead similar in the two phases of the crisis.

To the extent that the Italian experience can be considered paradigmatic also for other euro-area countries, the differences we found in the origins of the credit restriction and in the magnitude of the various effects corroborate the ECB's mix of policy measures to counteract the effects of the crisis on lending, in order to sustain the financing of enterprises and break or at least attenuate the negative spiral between the financial tensions, the tightening of credit conditions and the deterioration of the real economy. In this respect, an interesting extension for future research would be to include bank-level information on the recourse to the Eurosystem's longer-term refinancing operations in our structural model. This would allow us to contribute to the growing empirical literature on the effects of unconventional monetary policy on credit conditions and on the real economy.

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Tables and Figures

Table 1

BLS supply and demand conditions for loans to enterprises, Italian banks' answers: 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
Structural equations for loans to enterprises

	(a)	(a')	(b)	(b')
	Supply curve	**Demand curve**	**Supply curve**	**Demand curve**
	Dependent variable:			
Endogenous variables:	**Δ(mark-up)(t)**	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**
Δ(loan) (t)	0.036		0.042	
Δ(mark-up) (t)		-2.163 ***		-1.978 ***
Predetermined variables:				
Δ(loan) (t-2)		0.224 ***		0.226 ***
Δ(mark-up) (t-1)	-0.345 ***		-0.347 ***	
Δ(mark-up) (t-2)	-0.196 ***		-0.197 ***	
Exogenous variables:				
BLS demand, increase (t)		1.007 **		1.030 **
BLS demand, decrease (t)		-0.995 **		-0.798 *
BLS supply, capital position, tightening (t)	-0.051			-1.894 ***
BLS supply, funding conditions, tightening (t)	0.377 ***		0.378 ***	
BLS supply, funding conditions, tightening (t-1)	0.277 **		0.273 **	
BLS supply, risk perception, tightening considerably (t)	0.466 ***		0.461 ***	
BLS supply, risk perception, tightening somewhat (t) * crisis dummy	0.167 **		0.166 **	
ΔMarginal cost of funding (t)	0.093 **		0.097 ***	
Crisis dummy	0.071		0.078	
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation technique	2S-GMM	2S-GMM	2S-GMM	2S-GMM
Number of observations (N)	245	245	245	245
Number of regressors (K)	13	7	12	8
Number of endogenous regressors (K1)	1	1	1	1
Number of instruments (L)	15	15	15	15
Number of excluded instruments (L1)	3	9	4	8
R-squared	0.279	0.142	0.263	0.189
Identification-diagnostics:				
Underidentification test				
Kleibergen-Paap rk LM statistic	20.55	63.56	27.32	63.28
p-value	0.00	0.00	0.00	0.00
Weak identification test				
F-statistic of excluded instruments	9.08	7.03	6.06	10.15
p-value	0.00	0.00	0.00	0.00
Overidentification test				
Hansen J statistic	4.25	20.27	7.83	11.26
p-value	0.12	0.01	0.17	0.13

Notes: The dependent variables *"Δ(mark-up)"* and *"Δloan"* are, respectively, the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate) and the quarterly change in loan quantity. *"BLS supply, capital position, tightening"*, "*BLS supply funding conditions, tightening"*, *"BLS supply, risk perception, tightening"* (also distinguishing whether the bank reported that this factor contributed considerably/somewhat to a tightening), are dummy variables taking the value of 1 if a bank reported that this factor contributed to a tightening in credit supply conditions. *"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%. The "*Underidentification test*" is a Lagrange-Multiplier test of the null hypothesis 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. The "*Overidentification test*" is based on the Sargan-Hansen statistics: under the null hypothesis that the exclusion restrictions are valid, the test statistic is distributed as chi-squared in the (*L-K*) number of tested over-identifying restrictions.

Table 3

Structural equations for loans to enterprises including the sovereign spread

	(a)	(a')	(b)	(b')
	Supply curve	**Demand curve**	**Supply curve**	**Demand curve**
	Dependent variable:			
	Δ(mark-up)(t)	**Δloan (t)**	**Δ(mark-up)(t)**	**Δloan (t)**
Endogenous variables:				
Δ(loan) (t)	0.019		0.008	
Δ(mark-up) (t)		-1.709 ***		-1.478 ***
Predetermined variables:				
Δ(loan) (t-2)		0.221 ***		0.216 ***
Δ(mark-up) (t-1)	-0.412 ***		-0.414 ***	
Δ(mark-up) (t-2)	-0.153 ***		-0.142 **	
Exogenous variables:				
BLS demand, increase (t)		1.012 **		0.990 **
BLS demand, decrease (t)		-0.827 ***		-0.852 *
BLS supply, capital position, tightening (t)		-1.911 ***		-1.926 ***
BLS supply, funding conditions, tightening (t)	0.053		-0.010	
BLS supply, funding conditions, tightening (t-1)	0.071		0.049	
BLS supply, risk perception, tightening considerably (t)	0.330 **		0.331 **	
BLS supply, risk perception, tightening somewhat (t) * crisis dummy	0.114 *		0.106 *	
ΔMarginal cost of funding (t)	0.039		0.034	
ΔSovereign spread (t)	0.235 ***			
ΔSovereign spread (t-1)	0.382 ***			
Δ10-y Italian BTP yield (t)			0.304 ***	
Δ10-y Italian BTP yield (t-1)			0.463 ***	
Δ10-y German Bund yield (t)			-0.232 ***	
Δ10-y German Bund yield (t-1)			-0.294 ***	
Lehman dummy	-0.007		-0.013	
Fixed-effects	yes	yes	yes	yes
Seasonal dummies	yes	yes	yes	yes
Estimation technique	2S-GMM	2S-GMM	2S-GMM	2S-GMM
Number of observations (N)	245	245	245	245
Number of regressors (K)	14	8	16	8
Number of endogenous regressors (K1)	1	1	1	1
Number of instruments (L)	17	17	19	19
Number of excluded instruments (L1)	4	10	4	12
R-squared	0.402	0.200	0.424	0.212
Identification-diagnostics:				
Underidentification test				
Kleibergen-Paap rk LM statistic	23.73	85.61	20.33	89.33
p-value	0.00	0.00	0.00	0.00
Weak identification test				
F-statistic of excluded instruments	6.12	12.52	5.12	11.06
p-value	0.00	0.00	0.00	0.00
Overidentification test				
Hansen J statistic	4.83	12.31	5.86	15.94
p-value	0.18	0.20	0.12	0.14

Notes: The dependent variables *"Δ(mark-up)"* and *"Δloan"* are, respectively, the quarterly change in bank mark-up (computed as the difference between the average rate on new loans and the Eonia rate) and the quarterly change in loan quantity. *"BLS supply, capital position, tightening"*, "*BLS supply funding conditions, tightening", "BLS supply, risk perception, tightening"* (also distinguishing whether the bank reported that this factor contributed considerably/somewhat to a tightening), are dummy variables taking the value of 1 if a bank reported that this factor contributed to a tightening in credit supply conditions. *"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%. The "*Underidentification test*" is a Lagrange-Multiplier test of the null hypothesis 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. The "*Overidentification test*" is based on the Sargan-Hansen statistics: under the null hypothesis that the exclusion restrictions are valid, the test statistic is distributed as chi-squared in the (*L-K*) number of tested over-identifying restrictions.

Table 4

Counterfactual exercise: estimated cumulative contribution of supply and demand factors to the cost and growth rate of loans to enterprises
(based on columns (b)-(b') of Table 2)

	global crisis 2007q3-2010q1	sovereign debt crisis 2010q2-2012q2
	Effects on the cost of credit (basis points)	
BLS supply factors:		
- BLS funding conditions	*25*	*84*
- BLS perception of risk	*59*	*49*
Marginal cost of funding	*1*	*3*
Total supply indicators	**85**	**136**
	Effects on loan growth rate (percentage points)	
BLS supply factors:		
- BLS capital position	*-2.2*	*-2.0*
- BLS funding conditions	*-0.5*	*-1.7*
- BLS perception of risk	*-1.2*	*-1.0*
Marginal cost of funding	*0.0*	*-0.1*
Total supply indicators	**-3.9**	**-4.7**
BLS demand indicators	**-6.6**	**-5.7**

Table 5

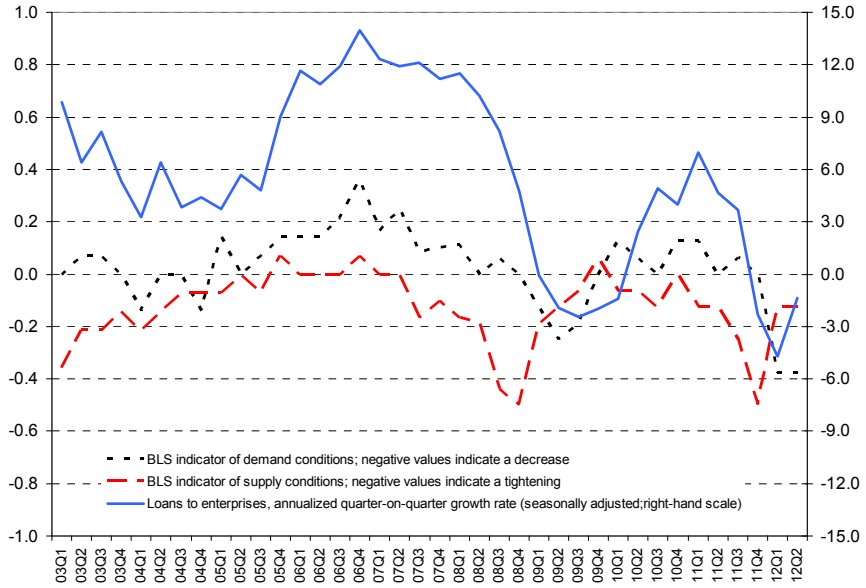
Counterfactual exercise: estimated cumulative contribution of supply and demand factors to the cost and growth rate of loans to enterprises including the sovereign spread
(based on columns (a)-(a') of Table 3)

	global crisis 2007q3-2010q1	sovereign debt crisis 2010q2-2012q2
	Effects on the cost of credit (basis points)	
BLS supply factors:		
- BLS perception of risk	*41*	*33*
Sovereign spread	*31*	*128*
Total supply indicators	**71**	**161**
	Effects on loan growth rate (percentage points)	
BLS supply factors:		
- BLS capital position	*-2.2*	*-2.0*
- BLS perception of risk	*-0.7*	*-0.6*
Sovereign spread	*-0.5*	*-2.2*
Total supply indicators	**-3.4**	**-4.7**
BLS demand indicators	**-6.5**	**-5.7**

Figure 1

BLS supply and demand indicators and lending dynamics to enterprises in Italy

(quarterly data; percentage points; diffusion indexes)



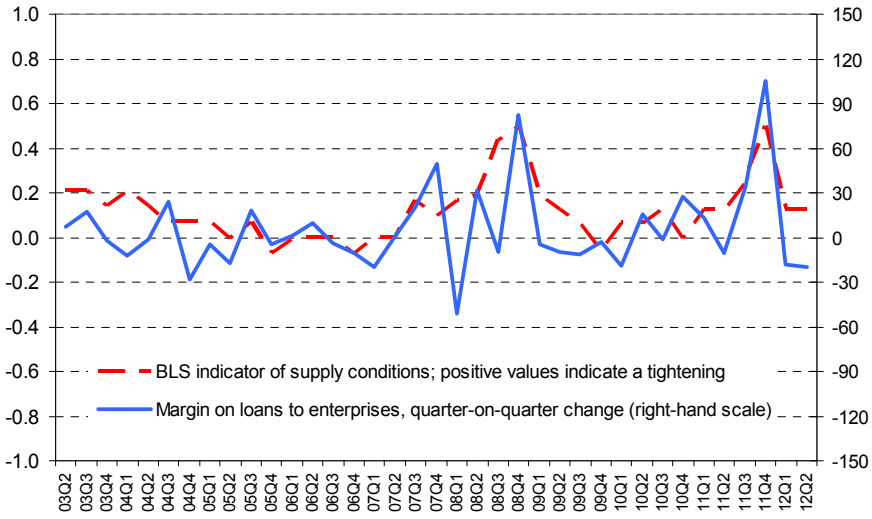
Source: Bank of Italy; euro-area Bank Lending Survey.

Notes: Positive (negative) values of the BLS indexes indicate supply easing (tightening) / demand expansion (contraction) compared with the previous quarter. Diffusion indices are constructed on the basis of the following weighting scheme. For supply conditions: -1 = tightened considerably, -0.5 = tightened somewhat, 0 = basically unchanged, 0.5 = eased somewhat, 1 = eased considerably (signs have been inverted with respect to the usual weighting scheme to make the reading of the figure more intuitive); for demand: 1 = increased considerably, 0.5 = increased somewhat, 0 = basically unchanged, -0.5 = decreased somewhat, -1 = decreased considerably. The range of variation of the index is from -1 to 1.

Figure 2

BLS supply indicator and margins on new loans to enterprises in Italy

(quarterly data; basis points; diffusion index)



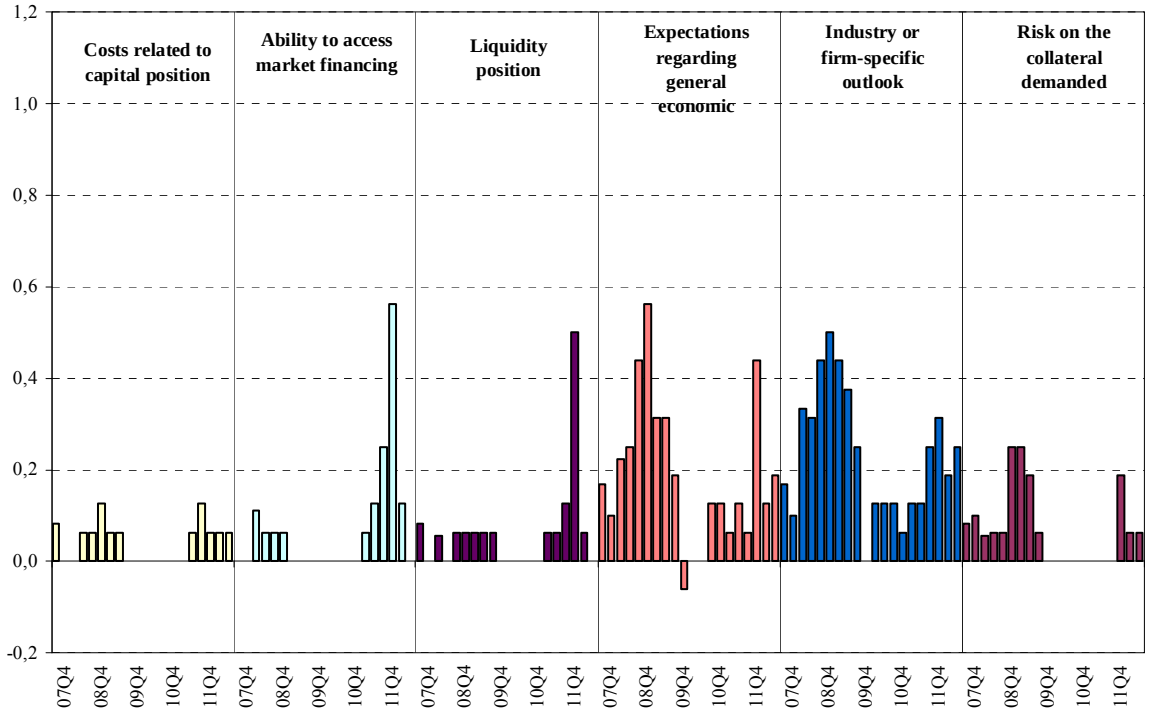
Source: Bank of Italy; euro-area Bank Lending Survey.

Notes: Positive (negative) values of the BLS supply index indicate supply tightening (easing) compared with the previous quarter. The diffusion index is constructed on the basis of the following weighting scheme: 1 = tightened considerably, 0.5 = tightened somewhat, 0 = basically unchanged, -0.5 = eased somewhat, -1 = eased considerably. The range of variation of the index is from -1 to 1.

Figure 3

Factors behind changes in credit supply conditions for enterprises in Italy

(diffusion indexes)



Source: 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 credit standards, -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.

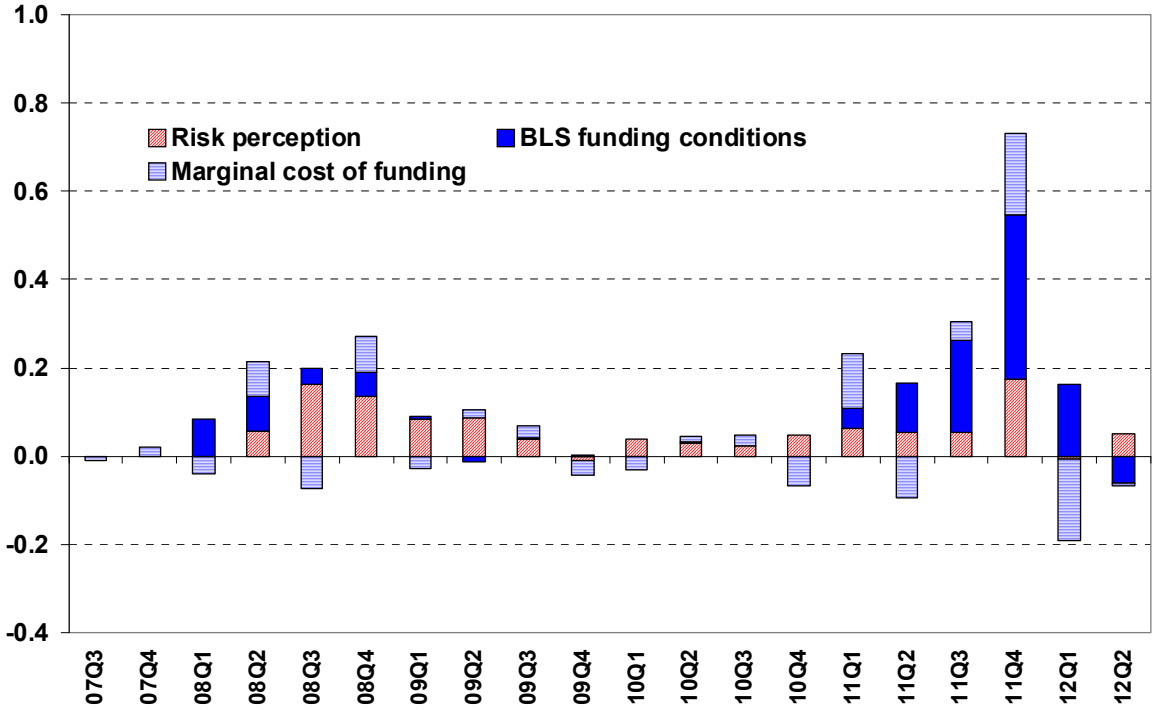
Figure 4

Counterfactual exercise: estimated contribution of supply and demand factors to the cost and growth rate of loans to enterprises

(based on columns (b)-(b') of Table 2)

a) Cost of loans: quarter-on-quarter change in bank margin on new loans

(quarterly data; basis points)



b) Loan quantity: quarter-on-quarter growth rate

(quarterly data; percentage points)

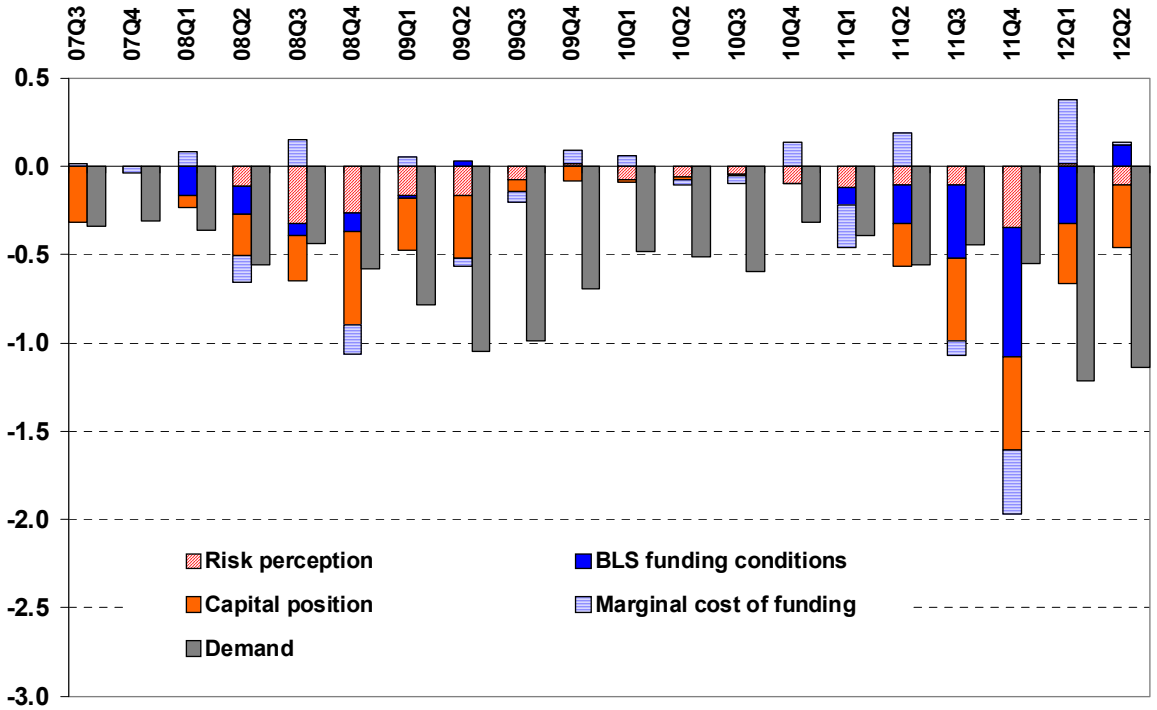


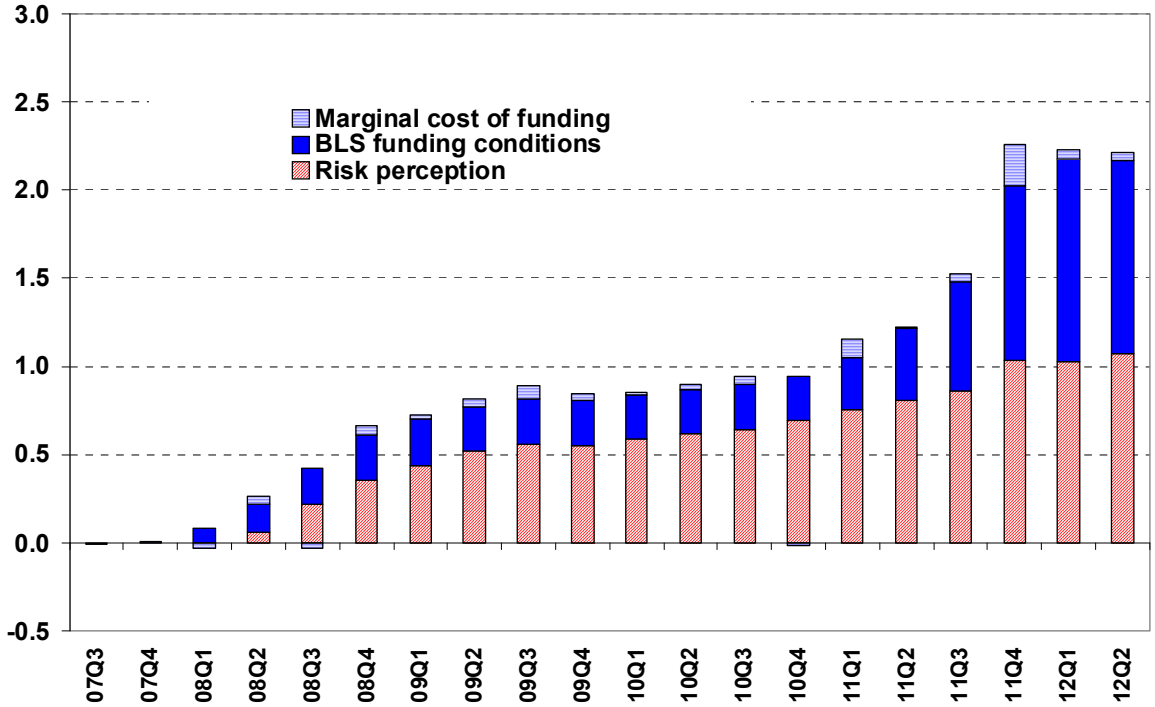
Figure 5

Counterfactual exercise: estimated cumulative contribution of supply and demand factors to the cost and growth rate of loans to enterprises

(based on columns (b)-(b') of Table 2)

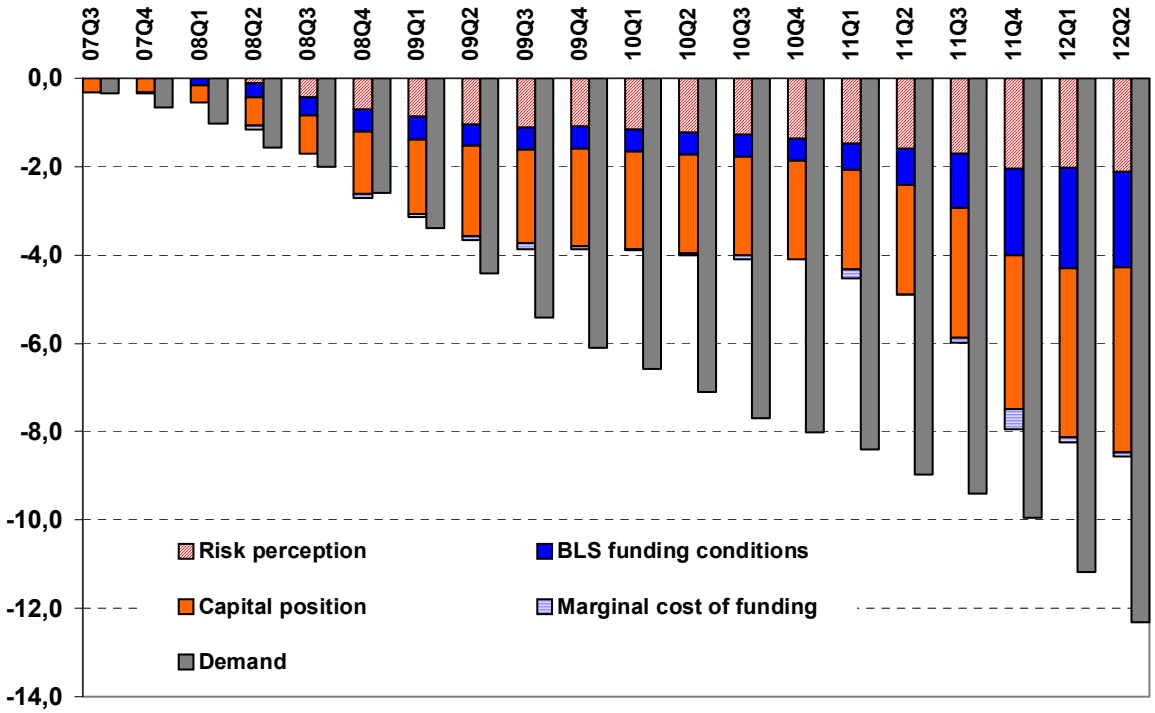
a) Cost of loans: cumulative change in bank margin on new loans

(quarterly data; basis points)



b) Loan quantity: cumulative change in outstanding loans

(quarterly data; percentage points)



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