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THE REAL EFFECTS OF CREDIT CRUNCH IN THE GREAT RECESSION: EVIDENCE FROM ITALIAN PROVINCES

by Guglielmo Barone,[♦] Guido de Blasio[♥] and Sauro Mocetti[♠]

Abstract

The paper estimates the effects on the real economy of the sharp reduction in the supply of credit following the 2008 financial crisis. We develop a measure of local credit supply that is based on the market shares of the banks that serve a local economy and the national change in each bank's lending that is attributable to supply factors (i.e. purged of local demand factors). The decrease in our credit supply indicator, which is strongly correlated to the growth of outstanding loans, accounts for 13 per cent of the contraction in real value added with respect to the pre-crisis period. The negative effects also concern employment, although to a lesser extent. The real effects of the credit crunch are concentrated on small firms and in the areas that are more dependent upon external finance. Finally, credit supply shocks affected lending but not real outcomes in the pre-crisis period.

JEL Classification: E51, G21, R11.
Keywords: credit crunch, economic crisis, local growth.

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[♦] Bank of Italy, Economic Research Unit, Bologna Branch, and RCEA.
[♥] Bank of Italy, Directorate General for Economics, Statistics and Research.
[♠] Bank of Italy, Economic Research Unit, Bologna Branch.

1. Introduction*

During the great recession the sharp reduction in GDP went hand in hand with a large decrease in the credit extended to the economy. Establishing to what extent credit supply depressed GDP growth or the latter led to a subdued credit growth has been a pressing concern for policy makers. Moreover, quantifying the impact of credit supply shocks on the real economy is important for better understanding the bank lending channel, in particular in those economies, like the Euro area, where the bank credit play a significant role.

This paper provides new evidence on the issue by, first, estimating a (data-driven) index for credit supply and, then, analyzing its relationship with the evolution of the economic activity. Namely, we develop a measure of local credit supply that is based on the market shares of the banks that serve a local economy and the national change in each bank's lending that is attributable to supply factors (i.e., purged of local demand factors). Such an index is then used to examine, by means of a panel data empirical strategy, the role of credit supply in the evolution of the value added for many local economies in the 2008-2011 period. The analysis is focused on the 110 Italian provinces. This geographic breakdown allows for both a meaningful estimation of the credit supply index (because the reliability of the index is weaker for larger geographical areas as it exploits the variability of bank lending practices across territories) and the analysis of its effects on the real economy (as the province is the smaller geographic unit for which data on the value added are available).

Our estimated measure of credit supply fairly mimics the tightening of credit standards applied by the Italian banks during the 2008-2009 financial crisis, as captured by the Bank Lending Survey (BLS) carried out by the European Central Bank (ECB). Our indicator is also higher for banks less exposed to the liquidity drought in interbank markets (i.e. small banks and those with higher capital, smaller funding gap and a lower incidence of bad loans). Moreover it works well in predicting the evolution of lending at the local level. As for the impact of credit supply on the local business cycle, according to our baseline findings, the supply-driven credit reduction explains roughly the 13% of the contraction in the real

* We thank Gilles Duranton, Eugenio Gaiotti, Francesco Manaresi, Paolo Sestito, Luigi Federico Signorini, participants at seminars at the Bank of Italy and the University of Siena, as well as two anonymous referees for comments and suggestions. The views expressed in this paper have to be referred to the authors alone and not to the Institutions they are affiliated with.

value added observed during the crisis. An extensive robustness analysis corroborates this result.

We also present a rich set of ancillary results. First, the effect of credit supply on value added is not found in the years before the great recession, suggesting that the effects of credit conditions differ between "normal times" and economic downturns. Second, the reduction in credit supply also contributed to the decline in labor units even if the estimated elasticity is relatively smaller. As a result, we can also detect a significant impact on labor productivity. Third, the role of credit supply is highly heterogeneous depending on firm's size, economic sector, degree of financial dependences and, consequently, geographical areas. Specifically, the impact of credit supply, as expected, is concentrated among small firms that heavily depend upon bank lending. Across sectors, manufacturing and services are those most affected by the supply-driven fund reductions. The impact is also stronger in the provinces that depend more heavily on external finance. Finally, the impact on the real economy is concentrated in the Centre-North and is negligible in the South, most likely reflecting the lower dependence on external finance of the southern economy.

Several studies have focused upon the crisis episodes in order to identify the role of the credit supply shift. A first group of studies have examined across banks differences in the exposure to exogenous shocks (e.g. liquidity drought in interbank markets or exposure to sovereign debt risk) and the consequences in terms of credit supply.[1] A related research question, which is more relevant for our paper, is to what extent these credit supply shocks have affected the real economy. In a seminal paper, Peek and Rosengren (2000) showed that when Japanese banks became unhealthy in the 1990s, due largely to a collapse in the Japanese real estate market, they lent less in the United States, and this decline resulted in lower construction activity in states that were heavily dependent on Japanese banks. Needless to say, studies on the topic have boomed with the Great Recession. A handful of papers have tried to trace the effects of credit supply restrictions to the

[1] See, among others, Khwaja and Mian (2008), Ivashina and Scharfstein (2010) and Santos (2011). As regards the Italian experience, Albertazzi and Marchetti (2010) present evidence of a contraction of credit supply associated to low bank capitalization and scarce liquidity, over the 6-month period following the Lehman bankruptcy. Bonaccorsi di Patti and Sette (2012) document that the supply of loans drops more after the Lehman default, for the banks that were most exposed to the interbank market and for those that made the most use of securitization. Bofondi et al. (2013) exploit the differential exposure to the sovereign risk between domestic banks and foreign banks operating in Italy: they find that the lending of domestic banks grew less (and their interest rates were higher) than that of foreign banks, after the outbreak of the sovereign debt crisis).

firm level. Amiti and Weinstein (2011 and 2013) exploited bank shocks in the Japanese financial market in the 90s to examine the effects on firms' exports and investments. Chodorow-Reich (2014) found that firms that had pre-crisis relationships with less healthy lenders had a lower likelihood of obtaining a loan following the Lehman bankruptcy, paid a higher interest rate if they did borrow, and reduced employment by more compared to pre-crisis clients of healthier lenders. As for the Italian case, Cingano et al. (2013) exploit the exposure to the interbank markets as a source of variation in banks' credit supply and show that the negative credit shock lowered investments of Italian firms.[2]

An important study in this literature is Greenstone et al. (2015), which our paper is closely related to. They conduct the analysis at the aggregate level (US counties) and introduce an identification strategy that relies on the substantial heterogeneity of the degree to which banks cut lending over the financial crisis and to the variation of banks' market shares across counties. They find that counties, more exposed to banks that cut small business lending during the financial crisis, experienced a small decline in employment. We share with Greenstone et al. (2015) the choice of aggregate instead of firm-level data and borrow from them the empirical strategy aimed at capturing the credit supply at the local level.

Our paper makes the following contributions to the existing literature. With respect to firm-level studies, our paper has two main advantages. First, by using aggregate data, our findings do not suffer from selectivity (e.g. oversampling of larger firms) and attrition biases that characterize the studies with firm-level data, which usually focus on medium-large firms because of accounting data availability. Such biases might be even more severe during a financial crisis. Indeed, small firms are more likely to be affected by the worsening of supply conditions – in particular because they have no access to sources of finance other than bank loans (Gertler and Gilchrist, 1994) – and their exclusion from regression samples may lead to severe downward biases in the estimation of the true effects. Moreover, entry rates decline and exit rates increase during economic downturns (Clementi and Palazzo, 2015), thus emphasizing biases that arise from sample attrition. Second, using aggregate data and the value added as outcome, allows us to take into account spillover effects and interdependencies across firms (e.g. impact on suppliers and

[2] A similar result can be found in Gaiotti (2013), who shows that the elasticity of a firm's investment to the availability of bank credit is significant in periods of economic contraction. A different approach has been followed by Panetta and Signoretti (2010). They use the Bank of Italy's quarterly econometric model to estimate the effect of credit supply on the Italian output in the aftermath of the Lehman collapse and found a non-negligible effect.

customers of the same production chain). One typical drawback of aggregate analysis with respect to firm-level studies is that it is not possible to exploit individual heterogeneity. While we share this drawback with aggregate studies, we are still able to focus on several outcomes such as value added, employment, labor productivity, export and firm demographics and to examine heterogeneous effects by firms' characteristics, distinguishing the value added by firms' size and economic sectors.

In addition, while still using aggregate data, we differentiate from Greenstone et al. (2015) in the following main aspects. First, we focus on the impact on the value added, which is a more general and comprehensive outcome variable than employment. Second, we show significant heterogeneous effects between small and large firms and between areas more or less dependent upon external finance. This may explain why Greenstone et al. (2015) find economically small effects and cast doubts about the relevance of the business lending channel for economic activity. Indeed, in Italy the role of bank credit in firm financing is more relevant than in the US: according to the Bank of International Settlements, at the end of 2007 the bank share of total credit to the private non-financial sector was 70%, about double that of the US.[3] Moreover, the results of this paper are reasonably generalizable to the Euro area, where the same share is 64%. As a consequence, from a policy point of view assessing how the real economy reacts to changes in bank credit availability is a highly relevant issue for economic areas (like Italy) whose economy is heavily dependent on bank credit. Third, we consider bank credit to both households and firms, while almost all previous studies focus on business loans only. However, household loans may affect consumption (through credit consumption) and house purchase (through mortgages) and, by means of these, the GDP dynamics. Fourth, Italy is an interesting case of study to fully exploit the features of the identification strategy described above because the Italian banking system was hit by two large shocks (liquidity drought in interbank markets and sovereign debt crisis) and has a highly heterogeneous industrial structure: a large number of small local banks (e.g. credit cooperative banks) co-exist with a few large national players so that banks are differently exposed to exogenous international shocks; moreover the market shares of large banks are markedly different across local markets.

[3] http://www.bis.org/statistics/credtopriv.htm.

The rest of the paper is structured as follows: Section 2 describes the data; Section 3 discusses the empirical strategy; Section 4 presents the results; Section 5 concludes.

2. Data and descriptive evidence

Data are drawn from two main sources. The variables referring to the credit market have been drawn from the Bank of Italy Supervisory Report database. Specifically, we use confidential data on total (i.e. credit lines, credit receivable and fixed-term loans) outstanding loans extended by Italian banks to the private sector (firms and households) in the local credit markets (corresponding to provinces).[4] Through this database we describe the loan growth rate at the local level and we build a data-driven indicator of credit supply (see more on this in Section 3). We also use the Bank Lending Survey (BLS), which provides qualitative indicators of credit supply, to evaluate how well our indicator performs in reflecting the credit supply stance.[5]

Most of the variables referring to the real economy are taken from the National Institute of Statistics. They include nominal and real value added (the last available year for being 2011) with sectorial breakdown, labor units and exports (in current value). Data on firm demographics are provided by the Union of Chambers of Commerce. Finally, we have estimated province-year (nominal) value added referred to small and medium enterprises (firms with less than 50 employees) by subtracting from the total value added that referred to large firms (firms with more than 50 employees); the latter has been computed on the basis of microdata taken from the Company accounts database. The province-level indicators of financial dependence are based either on aggregate data or firm level data (computing sector-specific financial dependence and obtaining province level data through the sector composition of the local economy). Again, the latter has

[4] Italy is partitioned in 110 provinces that correspond to NUTS 3 Eurostat classification (counties in the UK and *départements* in France). According to the Italian Antitrust authority, provinces are the "relevant market" in banking.

[5] The BLS, started in 2003, is conducted by the national central banks of the euro area in collaboration with the ECB; it is a qualitative survey and, in Italy, 8 main credit groups are involved (see https://www.ecb.europa.eu/stats/money/surveys/lend/html/index.en.html). BLS indicators reflect subjective assessments of the lender on the relative importance of demand and supply factors in explaining the lending patterns. This information is collapsed in the so-called diffusion index. Technically, the diffusion index is the (weighted) difference between the share of banks reporting that credit standards have been tightened and the share of banks reporting that they have been eased (see http://www.ecb.europa.eu/stats/money/surveys/lend/html/index.en.html).

been computed on the basis of the Company accounts data system. For the manufacturing sector we also use the financial dependence index computed by Kroszner et al. (2007), which is widely used in the literature.

Main descriptive statistics are reported in Table 1.

The yearly growth rate (simple average across provinces) of the value added in the period 2008-2011 was –1.6%, markedly lower with respect to 2004-2007 (1.6%). The average loan growth rate was 4.8% (8.7% in the 2004-2007 period); on the other hand, our credit supply indicator declined by more than 3 percentage points, suggesting a worsening of credit availability after 2007.

Looking at the banking system, Italy has a comparatively high number of banks and a relatively low level of concentration; moreover, these features are also quite heterogeneous across provinces. The share of the five largest banks in 2007 was 43% in the median province as opposed to 27% and 57% in the provinces at the 10th and 90th percentile, respectively. The median bank was active (i.e. grant loans to households and firms) in 26 provinces; the largest banks, in contrast, were active in almost all provinces while only few mutual banks (with a negligible share of the loans market) were active in only one province. Finally, in each province there were more than one hundred active banks. All in all, these features confirm the higher heterogeneity, both at the local level and at a bank level, of the Italian banking system and this will be particularly useful for our identification strategy (see more on this below).

3. Empirical strategy

We adopt a two-step empirical approach. First, we estimate a province-year indicator of (supply-driven) credit growth according to the methodology recently proposed by Greenstone et al. (2015). Second, we estimate the effect of this loan supply indicator on the growth rate of the value added at the province level.

In the first step we isolate the contribution of supply factors to credit growth. Specifically, for each province $p = 1, \dots, 110$ we estimate the following equation that separates the contribution of demand and supply to the bank lending:

$$\Delta \ln(L_{bkt}) = \alpha + \delta_{bt} + \gamma_{kt} + \varepsilon_{bkt} \qquad (1)$$

where the outcome variable is the percentage change in outstanding loans by bank b in province $k \neq p$ between the years t and $t-1$; γ_{kt} is a set of province-year fixed effects that capture the variation in the change of lending due to local economic factors, which we can interpret as broadly measuring also local demand;

the (province-specific) bank-year fixed effects δ_{bt} represent our parameters of interest and capture nationwide bank lending policies that are purged of local loan demand (and of any other province-year level idiosyncratic shock). The identification of both γ_{kt} and δ_{bt} is guaranteed by the presence of multiple banks in each province (i.e. multiple banks exposed to the same local demand) and the presence of each bank in multiple provinces (i.e. multiple provinces exposed to the same bank supply conditions).

We then construct a province-year credit supply index aggregating the bank-specific supply shocks using the pre-crisis bank market shares in the province as weights. Specifically, the credit supply for province p in the year t is:

$$S_{pt} = \sum_b w_{bp}\, \widehat{\delta_{bt}} \tag{2}$$

where $\widehat{\delta_{bt}}$ are the (province-specific) bank-fixed effects previously estimated and w_{bp} is the bank b market share in the province p in 2006 (before the great recession). By construction, S_{pt} captures the stance of the credit supply in a province after having purged any demand component; its source of variability is the substantial heterogeneity in changes in business lending across banks and the (pre-crisis) variation in bank market shares across provinces.

In the second step we estimate the effect of credit supply on the growth rate of the value added at the province level. Specifically, we run panel data regressions of the form:

$$y_{pt} = \alpha + \delta_p + \gamma_t + \beta S_{pt} + \varepsilon_{pt} \tag{3}$$

where y_{pt} is the growth rate of value added in real terms in the province p at time t; δ_p and γ_t are province- and year-fixed effects, respectively; S_{pt} is the credit supply indicator described above. We are interested in estimating β, which represents the elasticity of real value added to the credit supply stance.

4. Results

In the following we document the results of our two-step empirical approach.

4.1 The validity of credit supply indicator

In order for S_{pt} to serve as a valid instrument the two following requirements must be satisfied: exogeneity and relevance. Therefore, we need to convincingly rule out any direct effect of our credit supply indicator on the value added growth rate and we need to show that it is highly correlated with the observed loan growth rate.

The exogeneity of S_{pt} relies on the two terms w_{bp} and $\widehat{\delta_{bt}}$. As the first term, our assumption is that the lagged bank local market shares, once we have controlled for province-fixed effects, are not correlated with the value added *trend* at the province level. As far as the second term is concerned, bank-fixed effects $\widehat{\delta_{bt}}$ are very likely to be exogenous because they are purged of unobserved province-year factors. Moreover, to further reinforce their exogeneity we estimate (province p-specific) bank-fixed effects δ_{bt} using all provinces but p (i.e. $k \neq p$, as stated above). This choice is aimed at preventing unobservable shocks in province p from affecting (nationwide) lending policies of banks operating in that province. This may occur when a province market is sufficiently large with respect to the national credit market of a certain bank (e.g. small banks are typically geographically concentrated in few provinces) and, therefore, it may affect its lending policy; or, alternatively, when a bank systematically sorties into specific provinces anticipating local future prospects.

Another potential concern is that $\widehat{\delta_{bt}}$ might be correlated with certain bank characteristics and these characteristics, in turn, might be correlated with the outcome variable (value added growth in 2008-2011). In this case, we would identify a spurious correlation. An example helps clarifying the issue. Imagine that larger banks tend to show lower $\widehat{\delta_{bt}}$. It may happen, for instance, because they are more dependent on the interbank market that experienced a liquidity drought after Lehman. If larger banks are also localized in export-oriented provinces – for example because they are more able to offer export-related services to firms – and the same provinces also suffered more from the 2008-2011 recession (because of the collapse of the world trade in 2009), one would get a positive correlation between credit supply and value added growth, without any causal nexus between the two.

We address this concern as follows. First, we average S_{pt} over the 2008-2011 period and obtain a cross-section of 110 province-level average credit supply indexes S_p. Table 2 shows the mean of a rich set of province characteristics measured before the estimation period, which are supposed to be correlated with the subsequent growth, by quartile of S_p. This set includes: lagged value added growth, value added per capita, labor productivity, employment rate, share of graduates (as a proxy for human capital), an index of infrastructures (as a proxy for public physical capital), voter turnout (as a proxy for social capital), dummy for southern provinces, exports-to-GDP ratio, share of value added in manufacturing, construction, and services. In the last two columns we also report the estimated coefficients and standard errors of regressions of S_p on these variables. It turns out that they are well balanced with respect to the average credit supply index. Even when the regression coefficient is statistically different from zero (in the last two rows), differences by quartile seem not alarming at all.

As far as the relevance of S_p is concerned, we start by documenting some reassuring descriptive statistics on the credit supply indicator. At the nationwide level, our measure reasonably mirrors the diffusion index provided by the BLS, as shown in Figure 1.

In Table 3 we adopt a microeconomic perspective and describe bank characteristics that correlate with credit supply. Namely, we first average over the 2008-2011 period bank-fixed effects $\widehat{\delta_{bt}}$ and then regress them on a set of pre-crisis bank characteristics. The worsening in credit supply conditions was higher for larger banks, those with lower capital, larger funding gap (measured with the deposit-to-loan ratio) and a higher incidence of bad loans, consistently with the fact that those banks were likely more exposed to the liquidity drought in interbank markets.[6]

However, the more direct test for relevance of S_p in our empirical setting is that reported in Tables 4 and 5. We start by testing the predicting power of bank-year fixed effects in explaining the loan growth rate at the bank-year level (Table 4). The estimated coefficients are highly significant and stable across specification using various sets of fixed effects as controls. As far as the magnitude is concerned, a 1 percentage point increase in the supply index leads to an increase of about 0.6 points in the loan growth rate at the bank level; in terms of the standard deviation,

[6] Bonaccorsi di Patti and Sette (2012) show that the decline in lending after Lehman was very heterogeneous across banks and concentrated among the five largest banking groups, likely due to the fact that those banks have a higher share of assets that are funded by wholesale sources.

the variation in the credit supply index explains roughly 60% of the variation of bank loans.

Moving to the province-year level, our indicator, built using a transparent data-driven approach, predicts fairly well the loan growth rate at the province level over the period 2008-2011 (Table 5). According to the results in columns 4 the elasticity of loans to the credit supply is highly significant and is around 0.13; one standard deviation change of the supply indicator entails a variation equal to the 15% of the standard deviation of the loan growth rate at the province level.

All in all, Tables 4 and 5 indicate that a sharp reduction in credit supply (as proxied by the credit supply indicator) is associated with a decline in total lending – suggesting that households and firms cannot easily find, at least in the short term, a new lender if their banks limit access to credit; this is probably due to the existence of generalized credit restrictions or switching costs (Barone et al., 2011).

4.2 The real effects of credit supply

We now turn to our second set of results, which concern the real effects of the credit supply conditions. The baseline results, derived by using as outcome the (real) value added growth rate at the province-year level, are reported in Table 6. In column I we report the estimates without fixed effect. In columns II and III we add year- and province-fixed effects, respectively. The last column contains our preferred specification, jointly including all the fixed effects. Our baseline estimate is 0.13 and is significant at 1%. As far as the magnitude is concerned, according to this coefficient if banks cut the loan growth rate by 1 percentage point the real value added decreases by 0.13 points. One standard deviation change in the independent variable (that also corresponds to the credit supply reduction after 2008 with respect to the four-year period preceding the crisis) entails a change in the value added growth equal to 14% of its standard deviation.

Table 7 shows some robustness checks. The credit supply indicator is based on the dynamics of the stock of gross loans, which are measured in nominal terms while the dependent variable is in real terms. For the sake of consistency, we regress the nominal value added growth rate on crunch and we find that our results are not driven by the omission of the value added deflator (column I). Our crunch indicator is based on the dynamics of outstanding loans to the private sector (that includes households and firms). One may argue that the impact of bank lending on the real economy may be channeled mainly through the credit made available to businesses (this is the idea underlying a large part of the papers

in the reference literature that use microdata). In order to address this concern, we rely on a credit supply indicator built using only business loans in the first stage and results are unchanged (column II). Finally, we check the sensitivity of our results to outliers by trimming observations at the 1st and 99th percentiles of both the dependent variable and the credit supply indicator and our results are substantially confirmed (column III).

In Table 8 we replicate our baseline results for the 2004-2007 period, in order to examine how the credit supply affect the real economy in times characterized with better conditions in terms of access to credit. Market shares used to map bank-year fixed effects into the credit supply index are taken in 2002. Our findings in Panel A indicate that in normal times the supply side of the credit market was able to accommodate the demand side so that, on average, real outcomes did not depend on financial constraints.[7] This finding, therefore, suggests that policy measures aimed to ease supply side restrictions might be effective during an economic downturn and less effective under a more relaxed economic climate. Furthermore, Panel B, which parallel Table 5, shows that the credit supply indicator was strongly and significantly related to the loan growth rate also in the pre-crisis period. These combined results indicate that credit policies affected lending but not real outcomes in this period.

Table 9 examines the impact on other real outcomes. The point estimates for labor unit growth as a dependent variable is statistically significant and positive, thus indicating that the credit crunch also negatively affected employment (column I). The size of the parameter, however, is about one half of that related to the value added. This is probably due to the rigidities of the Italian labor market and the related costs to dismissals (on top of that some public schemes, such as the *Cassa Integrazione Guadagni*, that might have had a role in retarding the adjustment of the labor input). As a consequence, the credit crunch also negatively shaped the evolution of labor productivity (column II), measured with the value added per labor unit. With reference to export (column III), our results suggest that credit restrictions did not regard exporting firms, which are typically the most productive (and those that in case of funding problems from a bank, can easily turn somewhere else). Finally, the reduction of loan supply might have affected value

[7] Put differently, the elasticity of value added to credit supply is asymmetric depending on the phase of the financial cycle. Our results are broadly consistent also with stylized facts of credit over the business cycle (ECB, 2013): the growth rate of loans to households and non-financial corporations tend to move in line with the business cycle, though the relationship between GDP and loans to non-financial corporations is stronger during recessions.

added growth either through a decline in the value added of incumbent firms or through the entry and/or exit of some firms (with the value added of survivors being unaffected). According to our results, credit supply has no effect on the net entry rate (column IV), computed as the ratio between the entry-exit difference and the number of active firms at the end of the previous year. This result is therefore consistent with the former process.

In the next four tables we investigate the heterogeneity of the effect of the credit supply on value added according to the following dimensions: firm size, economic sector, financial dependence and the geographical area.

Table 10 shows that the impact of credit supply on the (nominal) value added growth rate is concentrated among small and medium firms while it is not significantly different from zero among larger firms. This evidence is in line with the fact that small firms are usually more dependent on bank finance than large firms since it is harder for them to get access to other external financial sources.

Tables 11 examine the heterogeneous effects of the credit supply on value added by economic sectors: the impact is concentrated on the manufacturing sector and on services. These findings are quite reasonable, as the construction-sector continued to benefit, during the economic downturn, of the financial support of the banks.[8]

Table 12 examines whether the impact of credit supply varies depending on the financial dependence of the local economy. This exercise should also be taken as providing additional robustness, as the estimated impact of the supply-driven credit reductions should be more evident in territories that are more dependent on bank credit. We consider three different measures for financial dependence. The first is the more general one and is based on aggregate data: the ratio between outstanding loans and the value added (it also proxies for financial development); the second has been built using microdata (balance-sheets variables at the firm level) and is given by the ratio between bank outstanding loans and total assets[9]; the third, following Rajan and Zingales (1998), is the fraction of capital expenditures not financed with cash flow in the manufacturing sector and has been taken from Kroszner et al. (2007). For the second and the third indicator, province level external dependence is computed by weighting sectors' financial dependence

[8] At the nationwide level, loans to the building sector increased by 15% between 2007 and 2013, against stagnation for private services and a decrease by 7% in the manufacturing sector.
[9] Data are drawn from the Company Accounts data system and refer to the pre-crisis period.

with employment shares. Not surprisingly, we find that the impact is stronger in the provinces that depend more heavily on bank lending.

Finally, in Table 13 we examine whether the impact of credit supply varies by geographical areas. In column I we split the coefficient for the two areas while in columns II and III we split the sample and estimate the model for the two groups of provinces, separately. In all the cases, the impact of the credit supply conditions was stronger (and significant) in the Centre-North while we fail to find an impact for the southern provinces.

According to our findings, this asymmetry does not depend on firm size (in the South firm's size is lower) or sectorial composition of the local economy (combining, trough little algebra, coefficients in Table 11 and sectorial shares at the local level we do not find significant differences in the predicted impact in the two areas). On the contrary, our results strongly support the role of financial dependence. Indeed, the ratio between outstanding loans and value added is much larger in the Centre-North (63% against 38% in the South).

5. Conclusions

The paper estimates the effect of the sharp reduction in credit supply, following the 2008 financial crisis, on the real economy. First, we apply a method that allows us to isolate the contribution of supply factors to credit growth. Second, we estimate the impact of the credit supply on the real economy, using a more comprehensive outcome (the value added) with respect to previous studies.

Our findings indicate that the supply-driven credit reduction explains about 13% of the contraction in the real value added observed during the crisis. A number of ancillary findings complete the overall picture. First, the effect of credit supply on value added is not detectable in the years before the great recession, indicating that credit supply is more relevant during an economic downturn. Second, the reduction in credit supply also explains the decline in employment even if the estimated effect is lower than that on value added. As a result, we can also detect a significant impact on labor productivity, while there is no effect on exports and on firm demographics. Third, the role of credit supply does vary across firms' size, economic sectors, degree of financial dependence and, consequently, across geographical areas. Specifically, the impact is concentrated among small firms and among those operating in the manufacturing and service sectors. The impact is also stronger in the provinces that depend more heavily on external finance. Finally, the effects are heterogeneous across geographical areas and, in

particular, are concentrated in the Centre-North. This finding most likely reflects the lower dependence on external finance of the Italian southern economy.

This last result suggest that the role of credit supply shock on the real economy may vary across territories (and, more generally, across countries) depending on the industrial and financial characteristics of the local economy.

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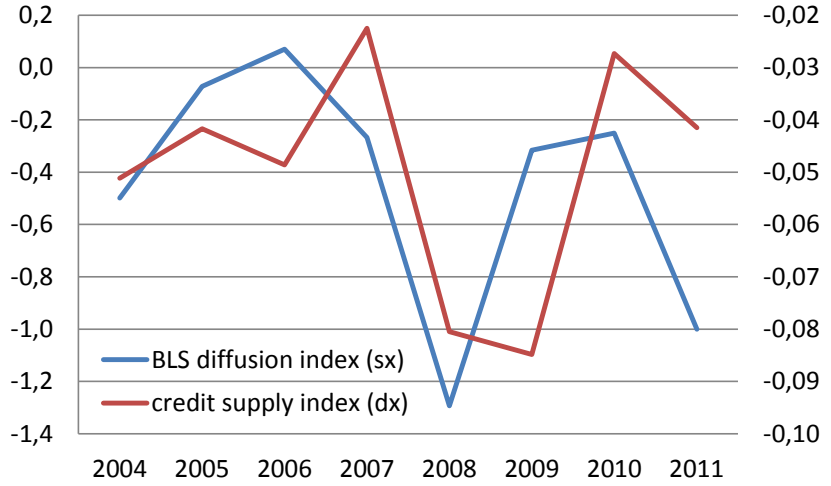
Figures

Figure 1. BLS diffusion index and our credit supply index



The line plots the BLS diffusion index with the inverted sign – so that positive (negative) values indicate easing (tightening) in bank lending standards (see text for details) – and the credit supply index estimated using the approach by Greenstone et al. (2015); the BLS diffusion index is computed as (weighted) mean of the indexes for business loans, household mortgages and credit consumption; the credit supply indicator is obtained as (weighted by national market share) mean of bank fixed effects. Source: authors' elaboration on data drawn from the BLS and Bank of Italy.

Tables

Table 1: Main descriptive statistics

	Mean	St. dev.	Min.	Max
		2004-2007		
Value added growth rate	0.016	0.023	-0.067	0.100
Labor unit growth rate	0.006	0.023	-0.088	0.084
Labor productivity growth rate	0.010	0.013	-0.031	0.064
Export growth rate	0.070	0.138	-0.712	0.782
Net entry rate	0.009	0.013	-0.050	0.051
Loan growth rate	0.087	0.038	-0.151	0.304
Credit supply index	-0.031	0.029	-0.100	0.141
		2008-2011		
Value added growth rate	-0.016	0.045	-0.191	0.113
Labor unit growth rate	-0.012	0.033	-0.123	0.129
Labor productivity growth rate	-0.004	0.027	-0.075	0.068
Export growth rate	-0.002	0.221	-0.778	0.808
Net entry rate	-0.003	0.014	-0.087	0.027
Loan growth rate	0.048	0.043	-0.089	0.229
Credit supply index	-0.063	0.048	-0.218	0.147

Table 2. Balancing of baseline province characteristics

Baseline province characteristics	Quartile of credit supply index				Regression estimate	
	1	2	3	4	coefficient	st. dev.
Lagged value added growth	0.015	0.015	0.015	0.017	0.036	(0.032)
Value added per capita (000 euros)	21.9	23.4	22.6	23.8	31.9	(25.0)
Labor pr. (000 euros per labor unit)	51.5	52.6	50.1	50.1	-8.96	(23.15)
Employment rate	0.570	0.598	0.587	0.604	0.462	(0.300)
Share of graduates	0.067	0.066	0.071	0.067	0.002	(0.052)
Index of infrastructures (Italy=100)	98.9	96.1	95.3	80.7	-219.5	(142.6)
Voter turnout	0.517	0.553	0.548	0.542	0.132	(0.352)
Dummy for southern provinces	0.500	0.259	0.429	0.296	-2.496	(1.571)
Exports / GDP ratio	0.245	0.227	0.206	0.268	0.006	(0.650)
Share of v. a. in manufacturing	0.162	0.184	0.166	0.202	0.362	(0.290)
Share of v. a. in construction	0.066	0.068	0.070	0.072	0.097**	(0.044)
Share of v. a. in services	0.716	0.694	0.708	0.671	-0.465*	(0.248)

Value added per capita, labor productivity, employment rate, index of infrastructures, export / GDP ratio, shares of value added are measured in 2007; lagged value added growth refers to the 2004-2007 period; share of graduates is measured in 2001; voter turnout is measured in 2006. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Bank characteristics and credit supply index

	I	II	III	IV	V
Bank size	-0.019***				-0.010***
	(0.005)				(0.003)
Tier 1 capital		0.207***			0.124*
		(0.064)			(0.065)
Funding gap			-0.003***		-0.004**
			(0.001)		(0.002)
Share of bad loans				-0.001***	-0.353***
				(0.000)	(0.102)
Observations	634	568	592	634	554
R-squared	0.054	0.052	0.030	0.000	0.112

The dependent variable is the credit supply at the bank level (average over the period 2008-2011). The control variables (observed in 2007) are bank size (log of total assets), Tier 1 capital (ratio of 'tier one' capital to risk weighted assets), funding gap (ratio between outstanding loans and deposits) and share of bad loans (ratio between bad loans and outstanding loans).

Table 4: Loan growth rate and credit supply: bank-level evidence

	I	II	III	IV
Credit supply index	0.745***	0.746***	0.640***	0.635***
	(0.067)	(0.067)	(0.060)	(0.059)
Year FE	NO	YES	NO	YES
Bank FE	NO	NO	YES	YES
Period	2008-2011	2008-2011	2008-2011	2008-2011
Observations	2,567	2,567	2,567	2,567
R-squared	0.441	0.451	0.674	0.687

The dependent variable is the loan growth rate at the bank-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Loan growth rate and credit supply: province-level evidence

	I	II	III	IV
Credit supply index	0.281***	0.092**	0.391***	0.130**
	(0.051)	(0.043)	(0.058)	(0.059)
Province FE	NO	YES	NO	YES
Year FE	NO	NO	YES	YES
Period	2008-2011	2008-2011	2008-2011	2008-2011
Observations	440	440	440	440
R-squared	0.150	0.432	0.150	0.432

The dependent variable is the loan growth rate at the province-year level. Robust standard errors in round brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Credit supply and value added growth rate: baseline results

	I	II	III	IV
Credit supply index	0.351***	0.098**	0.486***	0.131***
	(0.049)	(0.039)	(0.056)	(0.050)
Province FE	NO	NO	YES	YES
Year FE	NO	YES	NO	YES
Period	2008-2011	2008-2011	2008-2011	2008-2011
Observations	440	440	440	440
R-squared	0.205	0.486	0.205	0.486

The dependent variable is the real value added growth rate at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Credit supply and value added growth rate: robustness

	I	II	III
Change with respect to the baseline:	Nominal value added growth rate	Credit supply using business loans	Trimming
Credit supply index	0.112**	0.137***	0.118**
	(0.050)	(0.046)	(0.054)
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Period	2008-2011	2008-2011	2008-2011
Observations	440	440	423
R-squared	0.341	0.487	0.488

The dependent variable is the nominal value added growth rate (Column I) or the real value added growth rate (columns II and III) at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8. Credit supply, loan and value added growth rate: pre-crisis evidence

	I	II	III	IV
Panel A – Dependent variable: value added growth rate				
Credit supply index	-0.004	-0.000	-0.019	-0.031
	(0.032)	(0.034)	(0.051)	(0.058)
Province FE	NO	NO	YES	YES
Year FE	NO	YES	NO	YES
Period	2004-2007	2004-2007	2004-2007	2004-2007
Observations	440	440	440	440
R-squared	0.000	0.051	0.000	0.052
Panel B – Dependent variable: loan growth rate				
Credit supply index	0.117**	0.134**	0.203***	0.232***
	(0.056)	(0.060)	(0.071)	(0.080)
Province FE	NO	NO	YES	YES
Year FE	NO	YES	NO	YES
Period	2004-2007	2004-2007	2004-2007	2004-2007
Observations	440	440	440	440
R-squared	0.019	0.169	0.019	0.172

The dependent variable is the real value added growth rate (Panel A) or the loan growth rate (Panel B) at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9. Credit supply and other real outcomes

	I	II	III	IV
Dependent variable:	Labor units	Labor productivity	Export	Net entry rate
Credit Supply index	0.077**	0.054**	-0.346	-0.016
	(0.039)	(0.027)	(0.436)	(0.014)
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Period	2008-2011	2008-2011	2008-2011	2008-2011
Observations	440	440	440	412
R-squared	0.143	0.613	0.151	0.154

The dependent variable is the labor unit growth rate (Column I), the labor productivity growth rate (columns II), the export growth rate (column III), or the net entry rate (column IV) at the province-year level. *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Credit supply and value added growth rate by firm size

	I	II
Firm size:	Small-medium	Large
Credit Supply index	0.125**	-0.068
	(0.0567)	(1.030)
Province FE	YES	YES
Year FE	YES	YES
Period	2008-2011	2008-2011
Observations	440	440
R-squared	0.281	0.004

The dependent variable is the nominal value added growth rate at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11. Credit supply and value added growth rate by economic sector

	I	II	III
Economic sector:	Manufacturing	Construction	Services
Credit Supply index	0.179*	-0.005	0.137**
	(0.097)	(0.101)	(0.055)
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Period	2008-2011	2008-2011	2008-2011
Observations	440	440	440
R-squared	0.634	0.129	0.233

The dependent variable is the real value added growth rate at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 12. Credit supply and value added growth rate by financial dependence

	I	II	III
Indicator of financial dependence:	Loans over value added	Debt over asset	Kroszner et al. (2007) only Manufacturing
Credit Supply index × High external dependence	0.149**	0.222***	0.441***
	(0.0577)	(0.064)	(0.099)
Credit Supply index × Low external dependence	0.112	0.025	-0.231
	(0.0776)	(0.072)	(0.166)
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Period	2008-2011	2008-2011	2008-2011
Observations	440	440	440
R-squared	0.489	0.495	0.650

The dependent variable is the real value added growth rate at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 13. Credit supply and value added growth rate by geographical areas

	I	II	III
Geographical area:	Italy	Centre-North	South
Credit Supply index × Centre-North	0.170***		
	(0.052)		
Credit Supply index × South	-0.042		
	(0.116)		
Credit Supply index		0.120**	0.137
		(0.053)	(0.115)
Province FE		YES	YES
Year FE		YES	YES
Period		2008-2011	2008-2011
Observations	440	276	164
R-squared	0.490	0.575	0.336

The dependent variable is the real value added growth rate at the province-year level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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