

CERBE

Center for Relationship Banking and Economics
Working Paper Series

Financial Constraints, Firms' Supply Chains and Internationalization

Raoul Minetti,
Pierluigi Murro
Zeno Rotondi and
Susan Chun Zhu

Working Paper No. 6 (rev.)

September 2017



Center for Relationship Banking and Economics
Department of Economic and Political Sciences
and of Modern Languages
LUMSA University
Via Pompeo Magno, 22, 00192 Rome – Italy
<https://sites.google.com/site/cerbelumsa/home>

Financial Constraints, Firms' Supply Chains and Internationalization

Abstract

Using a unique sample of small and medium-sized Italian firms, we investigate the effect of financial constraints on firms' participation in domestic and international supply chains. We find that firms more exposed to bank credit rationing and with weaker relationships with banks are more likely to participate in supply chains to overcome liquidity shortages. This benefit of supply chains is especially strong when firms establish long-term trading relationships and when they forge ties with large and international trading partners. To control for possible endogeneity of firms' access to credit, we construct instruments capturing exogenous shocks to the structure of the Italian local banking markets.

JEL Codes: F10, G20, L23

Keywords: Credit; Global Value Chains; Internationalization

1 Introduction

Financial frictions can have important effects on firms' production, investment and export decisions (see, e.g., Hubbard, 1998, Brunnermeier, Eisenbach and Sannikov, 2012, and Manova, 2015, for reviews of the literature). By contrast, perhaps because of a dearth of data, we still have limited understanding of whether financial factors can also shape the organization of firms' domestic and international activities. The goal of this paper is to help shed light on this issue, focusing on a key dimension of the organization of production: firms' participation in domestic and international supply chains.

Firms' production of goods and services is increasingly structured along domestic and global supply chains. A supply chain identifies the whole range of activities (design, production, distribution, and marketing) that different businesses carry out to bring a good or a service from its initial conception to the final use by consumers (Antràs and Chor, 2013). The division of labor along a supply chain can boost firm efficiency and competitiveness, allowing the various phases of design, production and marketing to be performed by the firms, and in the locations, with the strongest comparative advantage. It is estimated that about 60 percent of global trade consists of trade in intermediate products that are incorporated at various stages

in the process of production of final goods and services (UNCTAD, 2013).¹ And the average length of supply chains has increased from the mid-nineties (see, e.g., OECD, 2013a). Given this importance of supply chains, establishing whether financial factors play a role in their development can advance our understanding of the interaction between the financial sector and the real economy.

This paper investigates whether firms' access to the credit market is a determinant of their choice of participating in supply chains. If so, do financial constraints hinder or incentivize firms' participation in supply chains? The answer to these questions is far from being obvious a priori. On the one hand, the participation in a supply chain can allow a firm to unlock liquidity that would otherwise be tied up in assets and processes necessary for producing in-house all the components of a good or service (Manova, 2015). Moreover, in a supply chain firms can provide liquidity to each other by allowing the delayed payment of products (trade credit) or by paying for products before their delivery (prepayment). Indeed, it is often argued that trading partners can be willing to provide liquidity even when financial intermediaries such as banks are unwilling to do so (Biais and Gollier, 1997).² Thus, a firm can try to broaden its sources of liquidity by choosing to participate in a supply chain and establish trade linkages with other firms, rather than produce in-house all the various components of a good or service. On the other hand, the participation in a supply chain can entail up-front costs, including expenses for outsourcing production tasks and reorganizing production processes, as well as search, informational, and contractual costs for interacting with trading partners (Grossman and Helpman, 2002). Given the need to finance these up-front costs, financial constraints might hinder a firm's participation in a supply chain. Because of these conflicting mechanisms, the overall effect of financial constraints on firms' participation in domestic and international supply chains is ultimately an empirical question.

In this paper, we address this question using a unique, rich survey of over 7,000 Italian firms conducted by the banking group UniCredit for the year 2010. The survey data we use are an ideal testing ground for our purposes. The small and medium size of the firms in the sample, together with the characteristics of the Italian financial system, imply that the firms strongly rely on bank credit as a source of financing. The survey asks the firms several precise questions about their access to bank credit, including whether the firms are rationed by banks, and the strength (duration and number) of their relationships with banks. The data also provide rich information on firms' participation in supply chains, including whether the firms produce in-house all the components of final goods and services or instead specialize in some production tasks, purchasing or selling intermediate products to other firms. In addition,

¹The expansion of global value chains has been a salient aspect of the world economy in recent years (OECD, 2012). Businesses from developing countries, especially East Asia, have been a major player in this expansion.

²Thanks to their industry expertise, trading partners can have better information than banks about the prospects of a firm (Biais and Gollier, 1997) and an advantage over banks in liquidating collateral (Longhofer and Santos, 2003; Petersen and Rajan, 1997). This could ease the enforcement of repayment (Cunat, 2007).

the survey contains rich details on the supply chains, such as the characteristics of suppliers and customers and the nature of their linkages.

In the first part of the analysis, we study the impact of firms' access to bank credit on supply chain participation. We find that firms that are more exposed to bank credit rationing and have weaker (shorter and more fragmented) relationships with banks are more likely to participate in supply chains. For instance, our estimates imply that a firm rationed by banks is 4.7 percentage points more likely than a non-rationed firm to participate in a supply chain, a sizeable difference considering that 53% of the firms in our sample participate in supply chains.³ In addition, a firm rationed by banks is 10 percentage points more likely than a non-rationed firm to engage in organizational innovations aimed at outsourcing production tasks to supply chain partners. In the second part of the analysis, we try to disentangle the channels whereby access to bank credit can affect supply chain participation by investigating the nature of inter-firm linkages and trading partners in supply chains. We uncover evidence that firms with difficult access to bank credit are more inclined to establish long-term subcontracting relationships with large trading partners, that is, businesses that can have relatively easy access to financial markets and that are probably willing to provide credit to repeated customers.⁴ And the results also reveal that firms with difficult access to bank credit make more intense usage of trade credit in supply chains. Finally, when we differentiate supply chains based on the location of trading partners, we obtain that credit-constrained firms are more eager to participate in global supply chains with trading partners located in Western Europe than in domestic supply chains. This suggests that foreign trading partners located in countries with highly developed financial systems could especially be perceived as a potential source of liquidity. Altogether, these findings support the hypothesis that firms with limited access to bank credit view supply chain participation not only as a form of organization of production but also as a way of expanding their sources of liquidity.

The reader could be concerned that the estimated effects of bank credit rationing and credit relationships on firms' participation in supply chains suffer from endogeneity problems. That is, although we control for a battery of relevant characteristics of firms and their local environment, unobserved factors could drive both firms' access to bank credit and their participation in supply chains. And reverse causality could also be an issue: for instance, the participation in supply chains might send a signal to banks, influencing the extension of loans. To control for possible endogeneity of firms' exposure to bank credit rationing and firms' relationships with banks, we construct instruments capturing exogenous shocks to the structure of the Italian banking system. For this purpose, we exploit the merger between two

³As we shall see, the participation in supply chains of the firms in our sample is very similar to that reported by other analyses of small and medium-sized Italian firms.

⁴On the other hand, we find that firms with difficult access to bank credit are less inclined to participate in supply chains in which borrowing from trading partners entails a risk of hold up and rent extraction.

major Italian banking groups occurred in 2007, using measures of the relative presence of the merged banks in the local (provincial) credit markets as a proxy for the intensity of the merger shock on firms’ access to bank credit and on firm-bank relationships. A broad literature contends that a bank merger can significantly affect the availability of credit to firms (see, e.g., Sapienza, 2002; Walter, 2004; Berger, Demsetz and Strahan, 1999; Peek and Rosengren, 1998, and references therein). On the positive side, a merger allows local branches of the merged banks to share information on loan applicants, exploit economies of scale and scope in loan screening and monitoring, and attain improvements in loan origination technologies and in loan management (Shaffer, 1993; Berger and Hannan, 1998; Rhoades, 1998; Calomiris and Karceski, 2000). On the negative side, a merger could partially disrupt existing links between firms and banks (Cole, Goldberg and White, 2004).⁵ Based on the historical experience of the Italian banking system, we expect that the local branch presence of the banks at the moment of the merger was driven by previous bank regulation as well as historical ties of the banks with local communities. Thus, we expect that this relative presence was not correlated with economic conditions relevant for firms’ decision to participate in supply chains.

The remainder of the paper unfolds as follows. Section 2 discusses the relationship with prior literature. In Section 3, we provide details on the institutional background, including the participation of Italian firms in supply chains and characteristics of the Italian financial system. Section 4 discusses the testable hypotheses. In Section 5, we describe empirical methodology, data, and measurement of the variables. Section 6 presents the main results, while Sections 7 and 8 contain additional tests. Section 9 concludes.

2 Prior Literature

This paper is especially related to the literature on global value chains.⁶ A broad body of studies have investigated theoretically how global value chains influence the volume and pattern of international trade (see, e.g., Yi, 2003; Grossman and Rossi-Hansberg, 2008). Antràs and Chor (2013) study how the sequential structure of production affects the contractual relationships among final-good producers and suppliers. From an empirical viewpoint, we still have little hard evidence on the determinants of firms’ decision to participate in supply chains. Most papers are based on case studies or focus on specific industries (see, e.g., Gereffi, 1999; Sturgeon and Kawakami, 2010; Kannegiesser, 2008). An exception is Alfaro, Antràs, Chor and Conconi (2015) who examine the determinants of a firm’s propensity to integrate upstream versus downstream inputs and find that the elasticity of demand faced by parent firms

⁵The vulnerability to such disruptions may depend on the “lending technology” a firm relies on. We will exploit information in the survey about lending technologies to construct refinements of our instruments.

⁶With some abuse of terminology, we will refer to “supply chains” and “value chains” interchangeably.

influences the average upstreamness and downstreamness of its integrated inputs.⁷ Financial factors are frequently mentioned in case studies and policy analyses as a primary determinant of firms’ decision to participate in supply chains, but hard evidence about this argument remains scant (see Manova, 2015, for a detailed review). Manova and Yu (2015) find that Chinese firms adopt different export modes depending on their leverage and liquidity. In particular, Chinese firms with higher leverage and lower liquidity concentrate on less profitable stages of global supply chains, privileging “processing trade” (such as processing with imports) over “ordinary trade”. Our paper can contribute to fill this gap by exploiting survey data that provide direct, precise information on supply chain participation decisions, credit rationing, and bank-firm relationships.

The paper is also related to the literature on inter-firm credit in supply chains. Rajan and Zingales (1995) estimate that in a sample of U.S. nonfinancial firms, trade credit accounts for 15 percent of firms’ assets. Extant theories suggest that firms resort to trade credit when they are rationed in bank and bond markets, in spite of trade credit being an expensive form of funding (see, e.g., Biais and Gollier, 1997; Burkart and Ellingsen, 2004). For example, Cunat (2007) demonstrates that, by granting trade credit, suppliers can provide liquidity insurance to their customers. There is also an established empirical literature on trade credit (see, e.g., Petersen and Rajan, 1997, Burkart, Ellingsen and Giannetti, 2011, and Garcia-Appendini and Montoriol-Garriga, 2013). We can contribute to this literature by investigating how the interaction between bank credit and trade credit can orient the organization of production, by influencing firms’ decision to participate in domestic and global supply chains. Finally, it is worth recalling that a strand of literature emphasizes the role of trade credit as a commitment device rather than as a form of external finance. This view can yield interesting predictions in the context of supply chains, as shown by Kim and Shin (2012 and 2013) and Kalemli-Ozcan, Kim, Shin and Sorensen (2013). Later in the analysis, we will return to this point and how one can possibly separate such predictions from our hypotheses.

3 Institutional Background

Small and medium-sized firms account for a large share of economic activity in industrialized countries and are very important in the Italian business sector.⁸ In 2013, for example, firms with less than 20 employees accounted for 41 percent of the value added and 40 percent of the employment of all Italian businesses; firms with less than 50 employees accounted for 52 percent of the total value added and 53 percent of the total employment (Italian National

⁷Baldwin and Lopez-Gonzales (2015) offer a global view of the cross-border flows of intermediate products.

⁸In 2013, in the United Kingdom firms with less than 50 employees accounted for 48 percent of total employment. In manufacturing, in Spain firms with less than 50 employees accounted for 44 percent of total employment (Eurostat, 2014).

Statistics Office, ISTAT, 2013). Italian firms have engaged in an intense reorganization of production in the last two decades or so, increasing their participation in domestic and global value chains (De Nardis, 2010). Accetturo et al. (2013) document that in recent years the share of total turnover made up by sales of produced-to-order goods to foreign firms has been higher in Italy than in Germany and Spain. Considering the manufacturing sector only, Breda and Cappariello (2012) obtain that in 2007 in Italy and Germany the import content of production amounted to around 30%. Cappariello and Felettigh (2015) show that in 2011 in Italy, Germany, France and Spain almost 40% of gross exports involved the participation in global value chains (among these countries, Italy is the one for which the foreign content of exports has grown at the fastest pace since 1999).⁹ Netting out intra-euro area trade flows, Amador, Cappariello and Stehrer (2014) find that in 2011 the main contributors to the euro area's foreign content of exports were Germany (36.4%), France (14.4%) and Italy (12.7%).

Small and medium-sized Italian firms have exhibited a high speed of adjustment in the process of reorganization of production. In the 1990s, a large share of such firms integrated the whole process of production of goods and services within the firm boundary. In the last two decades, many small and medium-sized firms have faced the choice whether to keep the whole process of production within the firm boundary or instead participate in supply chains, specializing in one or more segments of the production process and purchasing or selling intermediate products to other firms. For businesses operating in foreign markets, this choice has also involved the decision whether to carry out greenfield foreign direct investment, in order to produce in-house all the components of the products, or offshore the production of some components to foreign trading partners, joining global value chains (Ferragina and Quintieri, 2002). In all sectors (from manufacturing to services and other industries), many firms have outsourced production tasks to other businesses located in the Italian territory (frequently, in distant areas of the country) or to businesses located abroad. In manufacturing industries, some small and medium-sized businesses have quickly switched from producing final goods to producing inputs and machineries for the production of the goods (Ferri and Ventura, 2007). Many firms have chosen to concentrate on the provision of design, marketing or distribution services. When joining supply chains, firms have faced the choice among different types of inter-firm agreements, ranging from informal links to contractual arrangements such as subcontracting and network contracts.

Turning to the characteristics of the Italian financial system, this can be described as a bank-based system. The stock market capitalization is low relative to other advanced economies: in 2010 the ratio between the stock market capitalization and the GDP was 15.4%, compared with 117.5% in the United States (World Bank, 2012). Specialized financial intermediaries, such as private equity and credit funds, have a limited presence, so that for small

⁹The foreign content of exports has risen in all sectors, from manufacturing to services and other industries (see, e.g., Taglioni and Winkler, 2016).

and medium-sized firms the sources of external finance alternative to banks are very scarce. The central role of banks makes the Italian financial system close to that of other countries in continental Europe, such as France and Germany, and to Japan. An important feature of the Italian banking system is its delimitation within local areas. These areas roughly coincide with Italian provinces (Sapienza, 2002; Guiso, Sapienza and Zingales, 2003), local entities defined by the Italian law that are similar in size to U.S. counties. There were tight regulatory restrictions on lending and branching in provinces until the nineties, so that firms' access to bank credit is still highly heterogeneous across provinces.¹⁰ In Italy, local bank branches are crucial for firms' access to bank credit because distance matters in the provision of loans (Petersen and Rajan, 2002; Guiso, Sapienza and Zingales, 2004) and it is particularly difficult for firms (especially small and medium-sized businesses) to borrow in a market other than the local (provincial) one. Indeed, distant lenders face pronounced informational disadvantages that can lead to a higher loan default rate for banks entering a new provincial market without having a branch in the province (Bofondi and Gobbi, 2006). Bonaccorsi Di Patti and Gobbi (2001) and Alessandrini et al. (2009) confirm that in Italy local bank branches play a critical role in credit provision.

4 Testable Hypotheses

The choice of a firm between participating in a supply chain and keeping the production process within the firm boundary is inherently complex. In this section, we discuss channels through which the access to bank credit can influence this choice. As we shall see, the different channels can work in opposite directions, so that the overall impact of the access to bank credit on supply chain participation is ultimately an empirical question. In discussing the channels, we also review some anecdotal evidence on their role in the supply chain participation of Italian firms.

Supply chain participation as a way to unlock liquidity. Through the disposal of assets and the reduction of production tasks, the participation in a supply chain can allow a firm to free liquidity that would otherwise be tied up in the various assets and processes necessary for producing all the product components (Manova, 2015). A firm with difficult access to bank credit could have limited ability to keep liquidity invested in the various assets and, hence, could especially benefit from this mechanism. We can label this an “unlocking liquidity” motive.¹¹ Various pieces of anecdotal evidence hint at the existence of such a motive for small and medium-sized Italian firms. For example, in a series of interviews conducted by

¹⁰Between 1936 (the year of introduction of the banking regulation) and 1985, in Italy the number of bank branches grew by 87% versus 1228% in the United States.

¹¹Different types of liquidity needs may have different influence on the link between access to bank credit and supply chain participation. In Section 7.3, we will test the role of working capital requirements.

ISFOL (2012), some firms argued that a significant benefit of their decision to outsource some production tasks and join a supply chain was the possibility of disposing of assets and unlocking liquidity that would have otherwise been tied up in assets and processes. Some respondents argued that relocating some employees also allowed to free liquidity and relax financial tensions. And other respondents also mentioned that the gap between the price at which they sold their assets to suppliers and the actual value of the assets represented a form of “hidden” credit from suppliers.

Supply chain participation as a way to broaden funding opportunities. The participation in a supply chain can also broaden a firm’s sources of liquidity. Suppliers can extend trade credit to customers by allowing the delayed payment of intermediate goods and services. The delayed payments appear as accounts receivable on the suppliers’ balance sheets and as accounts payable on the customers’ balance sheets, forming a chain of financial claims and obligations within the supply chain (Kim and Shin, 2012). Customers, for their part, can provide liquidity to suppliers by prepaying intermediate goods and services before their delivery.

Trading partners can be willing to supply liquidity even when banks are unwilling to grant loans because, thanks to their industry expertise, they can have better information than banks about a firm’s prospects (Biais and Gollier, 1997) and better ability to liquidate collateral (Longhofer and Santos, 2003; Petersen and Rajan, 1997). We can grasp a possible working of this “funding opportunities” motive in a setting with incomplete contracts (in which credit constraints arise naturally). In incomplete contracts models of trade credit, the provision of trade credit is often facilitated by specific investments of the supplier, such as customizing the input, gathering information on its resale market in the event of customer default, monitoring the customer’s decisions. These investments allow the supplier to better liquidate collateral and enforce repayments, thus easing the provision of trade credit (see, e.g., Cunat, 2007). In turn, a fundamental tenet of several incomplete contracts models of supply chains is that a firm that outsources production tasks can better incentivize suppliers to perform those kinds of investments. In fact, suppliers will have more bargaining power over inputs and expect to reap a larger surplus from customizing inputs and acquiring information about their resale markets, relative to a scenario in which the production tasks are integrated within the firm (see, e.g., Antràs and Chor, 2013).¹² Thus, the participation in a supply chain can allow a firm to enhance the pledgeability and collateral value of its assets.

There is anecdotal evidence that in recent decades many Italian firms have structured their relationships of vertical integration with other businesses by taking into account the liquidity that their trading partners can provide. For example, Marchi (1999) describes the organization of production of the ceramic firms in the area of Sassuolo (North of Italy). Based on interviews

¹²In Antràs and Chor (2013), the supplier-customer relation generates an extra surplus due to some specificity of the input. In Cunat (2007), if the supplier-customer relation is severed, there is a surplus loss because the firm needs to switch to a less productive technology (the firm is rationed by banks).

with these firms, he concludes that these firms often choose to purchase semi-finished products and tools because this allows them to interact with large producers that have ample financial capacity and, hence, are able to provide funding. Dei Ottati (1995) reviews the experience of small and medium-sized Italian firms through the lenses of case studies of textile firms in the Center of Italy. He concludes that such firms specialize in some production tasks and establish supply chain linkages with other businesses taking account of the provision of credit that trade linkages favor. Indeed, for such firms establishing a supply chain linkage and obtaining credit from the supply chain partner are part of the same “bundle”, so that the participation in a supply chain is naturally driven by the desire to expand the sources of liquidity.

Supply chain participation as a liquidity-demanding reorganization. The two channels above constitute mechanisms whereby the difficulty to access bank credit can encourage supply chain participation. Other mechanisms can work in an opposite direction, however. There can be up-front costs to be sustained for joining a supply chain. These include adjustment costs for outsourcing production tasks, such as retraining or reallocating some workers across production lines or hiring temporary workers specialized in the reorganization of production (Corbett, 2004).¹³ During the outsourcing process, a firm might also have to relocate some physical assets or pay fees for migrating IT and data. Finally, there can be costs for searching and interacting with trading partners, such as legal fees for interpretation of the contracts and expenses for new interfaces (Grossman and Helpman, 2002). Some of these costs may require liquidity up front and, hence, be harder to cover for firms with difficult access to bank credit.

Hypothesis 1. (Supply chain participation). Ex ante it is ambiguous whether firms with more difficult access to bank credit are more or less likely to participate in supply chains. Firms more exposed to bank credit rationing and with weaker (e.g., shorter and more fragmented) relationships with banks have more incentives to participate in supply chains. However, they might find it more difficult to cover up-front costs for joining supply chains.

The incentive of a firm to participate in a supply chain to broaden its sources of liquidity is likely to be especially strong when its trading partners have easier access to liquidity. Large businesses have allegedly easier access to financial markets than small firms because more public information is available about them (e.g., they are better covered by the financial press and by financial analysts; Petersen and Rajan, 1994). Indeed, the literature often stresses that large, established firms tend to be net providers of trade credit to small businesses with limited access to financial markets (Schwartz, 1974; Petersen and Rajan, 1997; Nilsen, 2002). The incentive to participate in a supply chain to broaden liquidity sources is also likely to be stronger when the firm has longer relationships with its trading partners. A trading partner with a long-term relationship with a firm has an interest in the long-term health of the firm and, hence, it may be more inclined to provide financing (Petersen and Rajan, 1997; Berlin,

¹³The firm could also have to hire an external agency to communicate the outsourcing process.

2003). In addition, a longer trading relationship allows a trading partner to acquire more accurate information about the firm, again facilitating the provision of financing (Mian and Smith, 1992). And a firm’s desire to participate in a supply chain to broaden liquidity sources may manifest itself in a more intense usage of trade credit. On the other hand, the appeal of a supply chain as a source of liquidity will be weaker when the firm is more exposed to hold up and rent extraction by its trading partners (Cunat, 2007; Biais and Gollier, 1997).

Hypothesis 2. (Trading partners; inter-firm linkages; trade credit usage). Firms with more difficult access to bank credit are more likely to forge ties with trading partners that have easier access to financial markets. Moreover, they are more likely to establish long-term relationships with their trading partners in supply chains and to make intense usage of trade credit. Firms with more difficult access to bank credit are instead less inclined to participate in supply chains in which borrowing from trading partners entails a hold-up risk.

Besides Hypothesis 2, we will be able to investigate other important aspects of the impact of credit access on the choice of trading partners and inter-firm linkages. The survey asks the firms whether their trading partners are strategic partners for innovative projects or represent sources of information for upgrading products and processes. Trading partners that collaborate in innovative projects and in product and process upgrading can be more inclined to provide financing because they would lose more if the firm’s business did not succeed (Cunat, 2007). The decision to forge trading relationships that are instrumental to product and process upgrading can also indicate that firms with difficult access to bank credit would find it difficult to upgrade products and processes if they did not participate in supply chains.

Finally, the data will allow us to differentiate across geographical origins of firms’ trading partners. Thus, we will be able to test whether financial constraints affect firms’ choice of joining a global network of trading partners. The location of trading partners can influence their access to financial markets, so a firm’s decision to establish links with partners from selected geographical areas could further reveal its desire to broaden the sources of liquidity.

5 Data and Empirical Strategy

In this section, we discuss the empirical methodology, the data used in the analysis, and the measurement of the variables.

5.1 Empirical model

We study how firms’ access to credit may influence firms’ decision to participate in a supply chain. The probability that firm i participates in a supply chain can be written as

$$P(\text{SupplyChain}_i = 1 | R_i, Z_i) = \Phi(\alpha_1 + R_i\beta_1 + Z_i\gamma_1), \quad (1)$$

where $\Phi(\cdot)$ is the standard normal cdf, R_i measures firm i 's access to bank credit (e.g., whether the firm is credit rationed by banks or not, and the strength of credit relationships as proxied by the number of banks from which the firm borrows and by the length of the relationship with the main bank); and Z_i is a vector of controls for firm characteristics that may affect firm i 's supply chain participation decision, as well as controls for differences across regions and industries.

One might be concerned that a firm's access to bank credit may be endogenous. Some omitted variable could be correlated with a firm's access to bank credit and also affect its decision to participate in supply chains. Our empirical specification controls for a rich set of factors that may affect supply chain participation decisions, including firm-level characteristics and industry and region fixed effects. This should minimize the risk of omitting factors correlated with both credit access and supply chain participation decisions. Furthermore, there is a possibility of reverse causality: for example, supply chain participation could send a signal to banks, thus affecting the probability that a firm is rationed by banks. To assuage concerns of endogeneity, we complement Probit estimates with an instrumental variable approach.

To construct the instruments, we aim at capturing exogenous shocks to the structure of the Italian local (provincial) credit markets which could have affected firms' access to bank credit. A broad literature finds that bank mergers can constitute important shocks to, and have profound effects on, firms' exposure to bank credit rationing and firms' incentives and ability to establish credit relationships with banks (see, e.g., Walter, 2004, Sapienza, 2002, Berger, Demsetz and Strahan, 1999, Peek and Rosengren, 1998, and references therein). On the one hand, bank mergers can generate informational and efficiency gains (e.g., information sharing among local bank branches, economies of scale and scope in loan screening and monitoring, and improvements in loan origination technologies and in loan management). On the other hand, they can partially dilute existing credit relationships and increase banks' market power, especially if the merging banks have significant market overlap.

Building on the banking literature, to construct the instruments we exploit the merger occurred in 2007 between two major Italian banking groups (UniCredit and Capitalia, which in turn comprised Banca di Roma, Banco di Sicilia and Bipop-Carire). While the banks involved in the merger operated in the whole Italian territory, their branch presence differed quite significantly across provinces at the time of the merger. We then expect that the impact of the merger on firms' access to bank credit depended on the importance of the merged banks relative to other banks in the local (provincial) credit market at the time of the merger. For instance, in a province with a large share of branches of the merged banks, firms should have benefited from increasing economies to scale and enhanced information sharing more than in a province with a scarce branch presence of the merged banks. In Section 5.3.3, we will discuss in detail our preferred instruments (the share of branches of the banks involved in the merger, relative to the total number of branches in the province, and the difference between the shares

of branches of the two banking groups involved in the merger).

For our instruments to be valid, they must be correlated with our proxies for credit rationing and for the strength of credit relationships, while they must not be correlated with unobservable variables (economic and institutional features of the provinces) which could also correlate with firms' decision to participate in supply chains. Regarding the first aspect, two elements are worth mentioning. First, Italian firms strongly rely on banks, as discussed above. This is even more true for the firms in our sample, which are small and medium-sized and, thus, have very limited alternative sources of external funds. In particular, the relevant credit market for Italian firms is the provincial one, also as a result of the historical evolution of the Italian local credit markets which remained segmented for several decades due to the banking regulation introduced in 1936 (Guiso, Sapienza and Zingales, 2003). Second, firms' small and medium size, and the resulting firms' informational opaqueness, imply that if, for instance, the bank merger resulted in informational gains for the banks (due to information sharing among local bank branches or the adoption of better information processing technologies), this could have profoundly affected the firms in our sample.

We have strong reasons to believe that at the time of the merger the relative branch presence of the two banking groups in the provinces was not correlated with economic features of the provinces. In fact, this presence was the result of the historical evolution of the Italian banking sector in the decades during which the 1936 banking regulation was in place, as well as the historical presence of the banks in the provinces, due to ties to the local communities and the strong geographical roots of the banks. For example, Banco di Sicilia (part of the Capitalia banking group) was particularly strong in the southern region of Sicily because of its traditional vocation to serve Sicilian provinces, due to its origins and its close ties to those geographical areas from its foundation in 1849. In the North, Bipop-Carire (part of Capitalia) had a strong presence in the province of Reggio Emilia, due to historical ties with local communities since the 1850s, and a very weak presence in the close-by provinces of Lucca and Pisa, characterized by similar GDP per capita and degree of banking development (in the provinces of Lucca and Pisa, the bank Monte dei Paschi di Siena has strong historical roots dating back to the Middle Ages). Figure 1 plots the relative branch presence of the merged banks in the provinces together with a measure of local banking development, the number of bank branches normalized by the provincial population: as the maps illustrate, there appears to be very little correlation between the two measures. Indeed, the correlation coefficient equals -0.17 and the rank correlation coefficient across provinces is -0.07.

5.2 Data

Our main data source is the VIII UniCredit Survey on small and medium-sized enterprises (SMEs), which was carried out by the Italian banking group UniCredit in 2011 on the previous year 2010. Every year this survey gathers data on a sample of Italian firms that are customers

of the bank. The 2011 wave targeted 7,433 firms. The sample is representative of the bank's portfolio, whose composition is well diversified by sector, given the large dimension of the bank in terms of loans, deposits and branches. The survey was designed according to a stratified selection procedure, so that findings are representative at company size level, individual sector level, as well as at the territorial level (province).

The main strength of this survey is its very detailed information on individual firms. In particular, the 2011 wave comprises information on firms': a) participation in domestic and international supply chains, as well as details on the supply chains; b) organizational innovations aimed at outsourcing production tasks; c) financial structure and relationships with the banking system; d) extent of internationalization and exports; e) organizational structure and number of employees; f) propensity to innovate. Thus, a unique feature of the 2011 survey wave is that it contains precise measures of both supply chains and access to credit (e.g., credit rationing) that are based directly on firms' responses to survey questions rather than being indirectly inferred from balance sheet statements.

Employing data on self-reporting firms might raise concerns about firms misreporting their participation in supply chains. We do not believe this to be the case. The survey is conducted by highly qualified personnel of a major Italian institute of statistics (Doxa, the Italian branch of the Gallup International Association) on behalf of UniCredit and firms' answers passed through several double checks by this qualified personnel. Over the various survey waves, this personnel has compiled exhaustive instructions to respondents about the interpretation of the questionnaire. Furthermore, the 2011 wave was specifically designed to study domestic and global supply chains, so particular attention was devoted to making the questions intelligible and to minimizing measurement errors. Second, the Italian law (675/1996) on the treatment of personal data forbids using them for objectives other than that mentioned in the survey. The interviewers made clear that the responses to the survey would only be used to compile statistical tables and to understand the point of view of businesses, so we do not expect the firms to misreport information with the objective of building better reputation in the credit market. Third, a pure measurement error in the dependent variable would bias the results only if it were systematically related to one or more of the explanatory variables.

Table 1 reports the summary statistics for the variables included in the regressions.¹⁴ The geographic distribution of the firms reveals a prominence of the North of Italy (57% of the total), while other firms are based in the Center (19%), and South and Islands (24%). By construction of the sample, the average size of the firms, measured by the number of employees, is relatively small (about 15). By comparison, the firms in the pooled 1998 and 1993 survey

¹⁴For each variable we show summary statistics for all the firms for which information on the variable is available. The summary statistics are very similar if we restrict attention to the firms that report all variables. The sample on which we can estimate most regressions includes about 4,200 firms; for the other firms in the original sample of 7,433 businesses, data are missing for one or more variables.

waves of the U.S. National Survey of Small Business Finances count about 30 employees on average. Only 26% of the firms in our sample are corporations. The sector composition is affected by the nature of the sample. In fact, small firms usually dominate sectors such as trade (28% of the firms in the sample) and services (30%) compared to large firms. Manufacturing firms account for 26% of the total, while Construction represents 10% of the sample. Finally, there are firms in tourism (2.7%) and agriculture (1.9%) sectors. In general, however, the composition is representative for both sample size and shares of the underlying population, so that sector peculiarities should not affect our analysis.

To complement the survey, we employ data from the Bank of Italy on the presence of banks in local markets. We also use data from the Italian National Statistics Office (ISTAT) on the population of provinces. Finally, for a subsample of firms, we could obtain additional firm-level data from the Centrale dei Bilanci database. This database collects yearly data on the balance sheets, income statements and other indicators of about 35,000 Italian firms. The information is assembled and standardized by a consortium of banks from sources such as the Italian Chambers of Commerce. The database is representative of the Italian business sector and has a very comprehensive coverage of small and medium-sized firms.

5.3 Measurement

5.3.1 Supply chains

The survey asks each firm to provide details on its participation in supply chains. In particular, the firms are requested to report if they produce in-house all the components of a final good or service or instead specialize in the production of some components, buying or selling intermediate products to other firms. The firms that participate in a supply chain are also asked to report their position in the supply chain (upstream, midstream, or downstream). In our sample, 52.8 percent of the firms participate in a supply chain. Among them, 16.2 percent are in an upstream position (that is, use raw materials and produce intermediate products), 10.2 percent are in the middle (use and produce semi-finished intermediate products), and 26.4 percent are at the end of the supply chain (use semi-finished intermediate products and produce final products). While national statistics are not available, these figures are in line with those found by various recent analyses of small and medium-sized Italian firms. Using data from an administrative source (“Studi di Settore”), Drudi and Pacci (2012) report that 61 percent of small clothing manufacturers in the region of Emilia-Romagna participate in supply chains, versus 39 percent who perform in-house all the production tasks. Considering a sample of small, medium and large businesses in the region of Piemonte, Calabrese (2007) reports that 65% of the businesses participate in supply chains.

The survey also asks the firms whether in the previous three years they engaged in organizational innovations aimed at outsourcing some production tasks (or establishing similar

forms of production agreements with other firms). This question provides additional insights because it may help capture changes in firms' participation in supply chains occurred immediately after the 2007 bank merger. While this does not constitute a natural experiment, it may help measure changes in firms' supply chain participation decisions triggered by the bank merger shock. To be clear, an affirmative answer does not necessarily indicate that a firm switched from in-house production to participating in a supply chain, as a firm already part of a supply chain might have outsourced additional production tasks. And, conversely, in some cases outsourcing may have occurred without significant organizational innovations.

In addition to investigating firms' participation in supply chains, the survey explores whether the firms have subcontracting relationships with their trading partners in supply chains. Based on the Italian civil and commercial law, subcontracting is defined as a contractual arrangement under which a firm commits to deliver a product following the technical procedures specified by the customer or buys a product under an analogous commitment of the supplier. Thus, subcontracting signals that the linkages among firms in the supply chain take a structured, contractual form.

Finally, the survey asks the firms further detailed information about inter-firm linkages and trading partners in the supply chains. We discuss this information in the next sections.

5.3.2 Access to credit

We consider three measures of access to credit using information in the survey: credit rationing, the number of relationships with banks, and the duration of the relationship with the main bank. Our measure of credit rationing is based on firms' response to the following question in the survey: "In 2010, would the firm have liked to obtain more credit at the interest rate requested by the bank(s)?" This measure is a dummy variable that treats as rationed the firms that responded "yes" to this question. As shown in Table 1, 37.7 percent of the firms in the sample are credit rationed. Using the Capitalia survey for Italian manufacturing firms, and based on the same type of question, Minetti and Zhu (2011) find for 2000 a share of credit rationed firms of approximately 20 percent. A likely explanation for our somewhat higher figure is that the firms in our sample are small (with an average of 15 employees versus an average of 80 employees in the Capitalia survey used by Minetti and Zhu, 2011). In fact, Albareto and Finaldi Russo (2012) estimate that the percentage of credit rationed firms in Italy is significantly higher for businesses with fewer than 50 employees.

The questionnaire also asks each firm to indicate the number of banks from which it borrowed. Nearly 41% of the firms have one bank, the mean number of banks is 2.4 and the median is 2. Multiple credit relationships can weaken the relationship with the main bank, exacerbating informational asymmetries and credit rationing (Petersen and Rajan, 1994). The fragmentation of credit relationships is often found to be an obstacle to credit access for Italian firms (see, e.g., Accetturo et al., 2013, and references therein).

As a proxy for the strength of credit relationships, we also use the length of the relationship with the firm’s main bank, measured by the number of years the firm has been operating with its current main bank. The literature finds that long-term credit relationships ease information acquisition and monitoring by banks, increasing firms’ access to bank credit (Petersen and Rajan, 1994, 1995; Berger and Udell, 1995). In our sample, the duration of the main credit relationship is 13.5 years on average. This figure is in the ballpark of what is found by other studies on Italian firms (e.g., Herrera and Minetti, 2007, report an average length of the main credit relationship of 17 years). Interestingly, while the measure of credit rationing is binary and hence does not contain information on the intensity of rationing, the number of credit relationships and the duration of the main credit relationship are (roughly) continuous and hence can help capture the intensity of credit constraints.¹⁵ As Table 1, Panel B, shows, credit rationing exhibits a slight positive correlation with the number of banks and a slight negative correlation with the duration of the main credit relationship.

5.3.3 Instruments

In May 2007, UniCredit bought Capitalia (which in turn comprised Banca di Roma, Banco di Sicilia and Bipop-Carire) for more than \$29 billions in shares. The merger strengthened UniCredit’s position as Italy’s largest bank by market value, with branches stretching from Sicily to Eastern Europe and with operations in four core markets (Italy, with 16% market share; Germany, with 5% market share; Austria, with 19% market share; and CEE, with a presence in 17 countries).¹⁶ The group resulting from the merger adopted a business model consistent with the previous divisional structure of UniCredit; in general, Capitalia’s activities were integrated within the existing UniCredit divisions.

A merger between two major banking groups such as UniCredit and Capitalia can have a profound impact on firms’ exposure to bank credit rationing and firms’ relationships with banks in local credit markets. On the positive side, bank mergers have been found to increase banks’ efficiency in loan origination and management through economies of scale and scope or technological and managerial improvements (Shaffer, 1993; Berger and Hannan, 1998; Rhoades, 1998; Calomiris and Karceski, 1999; Berger, Demsetz and Strahan, 1999; Peek and Rosengren, 1998).¹⁷ Mergers also allow banks to share information on loan applicants among local bank branches. And informational gains can also stem from the adoption of advanced technologies for loan screening and monitoring, which often feature increasing returns to scale

¹⁵Following prior literature in banking, and since there is substantial variation in these measures in our sample, we treat the number of banks and the length of the main credit relationship as continuous variables (see, e.g., Herrera and Minetti, 2007, and references therein).

¹⁶The merger enabled UniCredit to achieve a combined market capitalization of more than \$135 billions.

¹⁷Economies of scale and scope can arise in the adoption of risk models and of criteria for loan approvals. Moreover, merging banks can share management skills. A number of studies find that the efficiency gains induced by bank mergers boost banks’ liquidity creation (see, e.g., Berger and Bouwman, 2009).

(a customer database may entail large fixed costs or evaluation procedures may improve as the database grows larger). Given the pervasiveness of informational frictions in credit markets, especially for small and medium-sized firms, informational gains can significantly improve firms' access to bank credit. Bank mergers further create scope for diversification of loan portfolios, resulting into more efficient risk management, and allow merged banks to develop better internal capital markets (Houston and James, 1998).

The report prepared by UniCredit to explain the merger and the documents of the Italian regulatory agencies and of the Bank of Italy assessing the merger indicate that important benefits were expected from the merger of UniCredit and Capitalia in terms of information sharing, economies of scale and scope, and improvements in loan origination and management.¹⁸ Bank mergers may also have negative effects, however. They may increase market power, especially if the merging banks are both disproportionately present in the local credit market. They may also dilute existing credit relationships, by leading to some loss of soft information on firms (Peek and Rosengren, 1998; Sapienza, 2002). In particular, a bank merger can result in a more complex hierarchy, making it more difficult for bank managers to monitor local loan officers. Therefore, bank managers may increasingly rely on "hard", codified information (firms' financial statements and credit histories) rather than letting local loan officers rely on "soft" information about firms (private information accumulated through personal contacts between loan officers and firms; Berger, Demsetz and Strahan, 1999; McAfee and McMillan, 1995). As we elaborate below, firms' vulnerability to this issue may depend on the lending technology the firms rely on (Berger and Udell, 2002; Cole, Goldberg and White, 2004).

As instruments we use the share of branches of the banking groups involved in the 2007 merger, relative to the total number of branches in the province, and the difference between the provincial shares of branches of the two banking groups involved in the merger, UniCredit and Capitalia. The share of local branches of the merged banks is aimed at capturing the intensity of the merger shock in the local credit market. For small and medium-sized Italian firms the relevant credit market is inherently local (provincial), and in the banking literature the local presence of bank branches is widely used as a measure of the relevance of a bank as a source of credit. Studies on the Italian credit market confirm the critical importance of local bank branches (Alessandrini et al., 2009; Bonaccorsi Di Patti and Gobbi, 2001). The difference in the provincial shares of branches between UniCredit and Capitalia can reflect benefits or difficulties that can have occurred in the implementation of the merger in a province as a result of asymmetries in the local importance of the banks involved. For instance, in the report prepared by UniCredit to explain the merger, it is clearly indicated that the integration of Capitalia branches into the UniCredit branch network involved adjustment costs and organizational

¹⁸See, e.g., the documents of Consob on the merger of UniCredit and Capitalia drafted on the basis of Consob directive n.11971; the report on the merger presented by UniCredit in response to Consob; and the related documents of the Italian Competition Authority.

issues, with such costs being more sizeable where the number of Capitalia branches to be integrated was larger. And in studies on bank mergers, it is often found that there can be significant organizational problems in integrating two banks, especially when both banks have an important presence in the local territory. The difference in the provincial shares of branches of the merging banks can also capture possible anticompetitive effects of the merger: various studies stress that if two banks have symmetric local market shares there is a higher risk of increased banking market concentration following their merger.¹⁹ The two instruments we use to capture the effects of the merger shock not only follow a broad banking literature that measures the impact of bank mergers in local credit markets, but are also the key variables that were used by the Italian regulatory agencies and by the Bank of Italy to assess the impact of the merger between UniCredit and Capitalia. In the documentation assessing the merger, it was stressed that the combined shares of the local branch networks of the merging banks in the provincial credit markets and the degree of overlap of the two local bank networks (as measured by the difference in the shares of branches of the merging banks) were the key measures for evaluating the local impact of the merger in terms of economies of scale and scope, information sharing opportunities, as well as possible risks of anticompetitive effects.

A scatter plot of the share of credit rationed firms in the provinces against the provincial share of branches of the merged banks suggests a negative monotonic relationship between the two variables (see Supplementary Figure S1). As we shall see, consistent with this suggestive evidence, in the first stage regressions we obtain that the larger the share of branches of the merged banks in the province, the smaller the probability of credit rationing. This indicates that the merger favored borrowers when the banks involved accounted for a larger portion of the local credit market, for example because the merger allowed the banks to better exploit economies to scale or share among bank branches information which was previously segmented across the banks. In the first stage regressions, we will also obtain that a larger asymmetry between the shares of branches of the merged banks in the province implies a lower probability of credit rationing. This suggests that the merger had a stronger positive effect in provinces where it was easier to integrate the two local bank networks and there was a lower risk of anticompetitive effects due to overlapping local branch networks.

In addition to these two instruments that vary by province, we will also experiment with additional instruments that vary by firm. In particular, we will use information on the lending technologies on which the firms rely and, hence, on firms' vulnerability to possible losses of "soft" information caused by the merger. We will come back to this in Section 6.2.2.²⁰

¹⁹The studies on bank mergers in Italy suggest gains in banks' efficiency while finding little evidence of anticompetitive effects (see, e.g., Messori, 1997, for a review).

²⁰In unreported tests, we also experimented with instrumental variables such as the change in the provincial share of branches of the banks involved in the merger between 2007 and 2008.

5.3.4 Control variables

We include a comprehensive range of explanatory variables as controls in the regressions. To account for the fact that larger and older firms could have a different propensity to participate in a supply chain, we include firm size, measured as the log of total employees, and age (years from a firm’s inception). We also insert dummy variables indicating whether a firm is a corporation, and whether it belongs to a partnership, such as a consortium. For a subsample of firms we have further information drawn from balance sheets and income statements. We then conduct robustness checks by including other proxies for firm profitability (return on equity), growth opportunities (the sales growth rate and the share of intangible assets), as well as efficiency and access to technology (revenues per worker and an indicator for whether the firm perceives that its workforce is not sufficiently skilled for technological innovations).²¹

In the regressions, we include industry dummy variables to account for sectoral differences in the propensity to participate in supply chains. The survey asks the firms to report their sectoral classification based on the following categorization: Agriculture, Manufacturing, Services, Trade, Tourism, and Construction. The reader could wonder whether this classification is sufficiently fine to pick up technological factors that influence the propensity to participate in a supply chain. An important aspect to be considered is that, being representative of the Italian business sector, our data set also covers small and medium-sized firms in industries, such as services and trade, in which the degree of product detail and differentiation are relatively low and, hence, technological differences across subsectors are probably small. Nonetheless, to verify the robustness of the results, we also reestimate our regressions using a two-digit industry classification for manufacturing firms for which we could obtain a finer sectoral classification from Centrale dei Bilanci. In these robustness regressions, we continue to insert one-digit sector dummies for non-manufacturing firms. As is often the case, for the large majority of non-manufacturing businesses a finer sector classification is not available, reflecting the fact that for small and medium-sized non-manufacturing businesses the degree of product differentiation is relatively low compared to manufacturing firms. Due to missing data, we experience a loss of observations in these robustness regressions.

Further, we control for local socio-economic conditions by inserting area dummies indicating whether a firm is headquartered in the South or Center of Italy. (Firms in the North are the benchmark group). In fact, the main geographical areas of Italy differ in infrastructure and institutions. Finally, we control for the provincial bank branch density (total number of branches per 100,000 inhabitants) to capture the financial development of the province.

²¹Intangible assets (comprising, e.g., R&D capital, software, brands) are frequently used as a proxy for firms’ growth opportunities. See, for instance, OECD (2013b) for a discussion and review.

6 Supply Chain Participation

In this section, we investigate the relationship between a firm’s access to credit and its participation in supply chains (see Hypothesis 1 in the discussion of the testable hypotheses).

6.1 Baseline results

Table 2 lists the baseline results. In all the regressions, we report heteroskedasticity-robust standard errors clustered at the province level. In columns 1-2, a firm’s access to credit is captured by a dummy variable indicating whether the firm is credit rationed or not. Column 1 reports the marginal effects from the probit model in equation (1). The marginal effect of credit rationing is estimated to be 0.047, suggesting that a credit rationed firm is 4.7 percentage points more likely than non-rationed firms to participate in a supply chain. This magnitude is not small considering that 53% of the firms participate in supply chains.

In column 2, we treat credit rationing as endogenous and instrument for it using the provincial share of branches of the banks involved in the bank merger, and the difference between the shares of branches of the two bank groups involved in the merger. Since both the supply chain participation decision and credit rationing are binary variables, we estimate a bivariate probit model that comprises equation (1) and a probit equation of credit rationing as a function of the instruments, firm controls and region and industry dummies. We find an even larger positive effect of credit rationing on the probability of participating in a supply chain. As shown in column 2, the marginal effect of credit rationing is 0.187, implying that a credit rationed firm is 18.7 percentage points more likely than non-rationed firms to participate in a supply chain. Thus, the probit results in column 1 are confirmed by the IV estimates. One interpretation for the somewhat larger effect obtained after accounting for endogeneity relates to possible reverse causality mechanisms. If the reverse causality mechanism implies a negative effect (e.g., supply chain participation sends a good signal to banks, attenuating rationing), then using IV could correct this and generate a stronger effect of credit rationing on supply chain participation.

The bottom of column 2 reports the estimated coefficients on the instruments from the probit equation of credit rationing. To save space, the coefficients on firm controls and region and industry dummies are not reported. We find that the higher the share of branches of the merged banks in the province, the smaller is the probability of credit rationing. This indicates that the merger favored borrowers when the banks accounted for a larger portion of local branches, for example because the merger allowed to exploit economies to scale or share information among local bank branches. In turn, this would have outweighed potential negative effects of the merger. As for the second instrument, we find that the larger the difference in the shares of branches of the merged banks the smaller the probability of credit rationing. This may suggest that the merger had a stronger positive impact in provinces where it was not too

difficult to integrate the Capitalia branches into the UniCredit branch network (i.e., there was sufficient difference between the shares of branches of UniCredit and Capitalia). It may also suggest that possible anticompetitive effects, and any resulting tendency of increases in credit rationing, were less pronounced in provinces where there was less overlap of the local branch networks of the merging banks. To summarize, the first stage estimates point to a stronger positive impact of the merger on firms' access to bank credit in local (provincial) credit markets where the branch networks of the merging banks were more important, where it was easier to integrate the local branch networks of the merging banks, and where such integration entailed lower risk of anticompetitive effects. As noted, these findings are consistent with the expected outcomes of the merger illustrated in the report prepared by UniCredit to explain the merger.²²

The banking literature stresses that the strength of credit relationships can complement measures of credit rationing in capturing firms' access to bank credit. In columns 3-4, we measure the strength of firms' relationships with banks using the number of banks from which a firm borrows.²³ Firms with more banks are reputed to have a weaker relationship with the main one, which could imply a higher probability of credit constraints (Petersen and Rajan, 1994). The probit estimates in column 3 do not indicate a significant relationship between the number of banks and the probability of participating in a supply chain. In column 4 we treat the number of banks as endogenous and instrument for it using the share of branches of the merged banks and the difference between the shares of branches of UniCredit and Capitalia. The IV estimates reveal that firms that have relationships with more banks are more likely to participate in a supply chain. This finding is consistent with the results displayed in columns 1-2, suggesting that firms with weaker (more fragmented) credit relationships participate more in supply chains.²⁴ Further, the first stage result at the bottom of column 4 suggests that a higher share of branches of the merged banks and a larger difference in the shares of branches between UniCredit and Capitalia are negatively associated with the number of banks. This is consistent with the result for credit rationing shown in column 2 and also with the broadly

²²As noted in Section 5.3.3, a scatter plot of the average credit rationing in the provinces against the provincial share of branches of the merged banks suggests a monotonic relationship between the two variables. We also use Stata "acprplot" to make an augmented partial residual plot using estimates from the linear probability model of credit rationing on the instruments, firm controls and other controls in the first stage. A lowess smooth of the plotted points is added to assist in detecting nonlinearities. The lowess smooth line coincides with the downward sloping regression line (which has slope equal to the estimated effect of the provincial share of branches of the merged banks on the probability of credit rationing). Thus, we find clear evidence that the probability of credit rationing is monotonically decreasing in the share of branches of the merged banks.

²³UniCredit and Capitalia are counted as the same bank in firms' response about the number of banks.

²⁴The reader might wonder whether aspects of multiple borrowing not strictly related to credit access could drive this result. Multiple borrowing may favor information leakages from a firm (Bhattacharya and Chiesa, 1995). In turn, a process of outsourcing and the participation in a supply chain could induce some information leakages to suppliers and competitors (Baccara, 2003). If this channel were at play, we would expect multiple borrowing to discourage, not promote, supply chain participation. One might also wonder whether the risk of conflicts among banks during an outsourcing process could discourage supply chain participation. However, again this would imply a negative effect of multiple borrowing on supply chain participation.

held view in Italy that the effects of the bank merger in terms of economies of scale and scope, information sharing and better risk management can also have taken place through a reduction in the fragmentation of credit relationships.²⁵

In columns 5-6 firms' access to bank credit is captured by the length of the relationship with the main bank. A longer bank-firm relationship indicates a stronger relationship, which could imply a smaller probability of credit constraints (Ongena and Smith, 2001). Unlike the probit results in column 5, the IV estimates shown in column 6 suggest that firms with a longer relationship with their main bank are less likely to participate in a supply chain.²⁶ This result is thus in line with those obtained using credit rationing and number of banks to capture the access to credit. Overall, the consistency in the inferences drawn from using the three alternative measures of access to bank credit is reassuring.

In the estimation, we also control for various firm characteristics. We find that younger firms are more likely to participate in a supply chain.²⁷ Being part of a supply chain could help a firm to grow. We obtain more mixed evidence on the impact of firm size. Firms with partnership are less likely to participate in a supply chain. There is also a significant difference across regions. Firms located in the Center or South are significantly less likely to participate in supply chains compared to firms located in the North.

In columns 7-12, we reestimate the regressions of columns 1-6 by including two-digit industry dummies for manufacturing firms, while retaining the broader industry dummies for non-manufacturing firms (as noted, in these regressions we experience a loss of observations due to missing data). The baseline results remain virtually unchanged.

At the bottom of the table, we report the p-value of overidentification tests. Across all specifications, the overidentifying restrictions cannot be rejected at any reasonable level. In Supplementary Table S1 we also report the test statistics of joint significance of the instruments from the first stage, which indicate that overall the instruments are jointly relevant. We note that the literature on weak instruments is much less developed with regard to diagnostics for non-linear IV models (see Mikusheva, 2013, for a recent survey), and the often used cutoff values for the first-stage F -statistics are derived using a linear model under the assumption that the model is homoskedastic (Stock and Yogo, 2005).

²⁵For example, after the merger the opportunity to exploit scale and scope economies in loan provision and the enhanced bank loan portfolio diversification and risk management have allegedly reduced the need and incentive to disperse lending and engage in multiple credit relationships (see, e.g., Parrillo, 1999, for a discussion of these effects of bank mergers in Italy).

²⁶Consistent with the findings for the number of banks, the first stage results suggest that the merger had a positive effect on the length of the main credit relationship.

²⁷The sign of the coefficient for firm age switches to positive in the regressions in which access to credit is measured by the length of the main credit relationship. This could be due to the fact that in other regressions firm age also picks up the negative effect of the relationship length on supply chain participation.

6.2 Robustness tests

Tables 3a, 3b, and 4 report robustness checks on the baseline results.

6.2.1 Robustness to further control variables

In Table 3a, we perform robustness tests with alternative sets of control variables (to conserve space, we only report the IV estimates). In columns 1-3, we insert two additional controls, the share of branches of the two main local banks in 2007 and the GDP per capita in the province in the year 2009, to control for the degree of concentration of the local banking market and for local economic conditions, respectively. To capture the competition faced by the firm, we also insert a dummy (“high competition”) that takes the value of one if the firm declares to have a number of competitors higher than the median number in the sample. The results suggest that these additional controls have no significant effect on the supply chain participation decision and the estimated coefficients on credit rationing and on the measures of the strength of credit relationships remain unaltered. In columns 4-6, we experiment with inserting additional firm-level control variables that capture firms’ profitability, growth opportunities, capital intensity, and access to technology. Adding these further controls leads to a substantial loss of observations because of missing data for the newly added control variables. We include the firm’s return on equity (ROE) to capture profitability and, as measures of growth opportunities, the (lagged) sales growth and the share of intangible assets of the firm. We also insert capital intensity (as measured by fixed assets per worker) and current assets for the year 2009. Finally, as an additional proxy for access to technology and productivity, we include a dummy for whether the firm perceives that its workforce is not sufficiently skilled for the introduction of new technologies. The baseline results carry through.²⁸

6.2.2 Robustness to instrumental variables

In the robustness tests of Table 3b, we focus on the instrumental variables. By exploiting firm-level information about lending technologies, we refine the set of our instruments and experiment with additional instruments that vary by firm. The banking literature distinguishes between two types of lending technologies: “soft” lending technologies, such that loan officers gather information on a firm through personal contacts, provide advice and suggestions to the firm, etc.; and “hard” lending technologies, such that the bank especially relies on information codified in documents (firms’ balance sheets and credit histories), maintaining a more arm’s length relationship with the firm. The survey asks each firm to indicate the most important elements in the relationship with a bank. This allows us to construct a dummy variable for whether the firm strongly relies on a soft lending technology (a stable loan officer, the close

²⁸ Adding revenues per worker also left the results unaltered.

presence of loan officers, the tendency of loan officers to offer advice and suggestions). This is useful because, as noted in Section 5.3.3, some studies find that bank mergers can benefit relatively less the firms that rely on a soft lending technology. In fact, merging banks may centralize competencies, by transferring power from loan officers to the upper management, and increase their reliance on hard, codified information in evaluating loan applicants, so that credit relationships based on soft information (private information collected through direct interactions between loan officers and firms) may partially lose relevance. Further, any loss of soft information due to the reshuffling of loan officers can be more harmful for firms that rely on a soft lending technology (Berger and Udell, 2002). At the same time, based on the banking literature, the lending technology largely depends on the firm-bank distance and on characteristics of the bank. The only channel through which we expect the lending technology to affect firms' participation in supply chains is its impact on firms' access to bank credit. And we also note that the lending technology can be considered to be predetermined prior to the bank merger shock.

In the first stage, we then insert the indicator for whether the firm strongly relies on a soft lending technology and its interaction with our proxy for the intensity of the bank merger shock in the province (the share of provincial branches of the merging banks). We obtain that, for a given intensity of the merger shock, firms relying on a soft lending technology experience a smaller drop in the probability of being rationed by banks (the coefficient on the interaction term is significantly positive; see column 3). This is consistent with the prediction that such firms are more vulnerable to losses of soft information and thus can benefit less from the reduction in bank credit rationing induced by the merger. And, as predicted by the literature on bank mergers, we also find evidence that in provinces where the merger shock was more intense, the firms relying on a soft lending technology engaged in relatively shorter credit relationships (see column 9). Further, in line with prior literature, when we look at the coefficient on the indicator for soft lending technology, we obtain that firms relying on a soft lending technology tend to be less subject to bank credit rationing.²⁹

The second stage results carry through when we augment our set of instruments with the newly constructed instrumental variables. However, the results of the test for over-identifying restrictions and the F -test suggest that the augmented set of instruments performs relatively worse than the instrumental variables used in Table 2. In what follows, we then treat the instruments in Table 2 as our preferred set of instruments.³⁰

²⁹The literature often finds that for relatively opaque borrowers (e.g., small and medium-sized firms), because of banks' comparative advantage in monitoring and screening, interactions between local loan officers and firms tend to be superior to a hard lending technology based on codified information.

³⁰In Table 3b, we also present estimates obtained by using only the share of provincial branches of the merging banks as an instrument. As shown in Supplementary Table S1, this single instrument has a strong partial correlation with the number of banks and the main relationship length, but a weaker partial correlation with credit rationing.

In untabulated regressions, we also performed placebo tests. Instead of using the instrumental variables in Table 2, as instruments for firms' credit conditions we employed the shares of provincial branches of two other major Italian banks (including the above-mentioned Monte dei Paschi di Siena). These two variables are unrelated to the 2007 bank merger. These two measures turned out to be insignificantly correlated with credit rationing or with the measures of the strength of credit relationships. This result provides additional evidence that the cross-firm variation in credit conditions captured by our preferred instruments is likely a result of the 2007 bank merger.

6.2.3 Alternative definitions of the dependent variable

The survey provides information about recent organizational innovations aimed at outsourcing production tasks. This can help capture recent changes in firms' participation in supply chains. In Table 4, the dependent variable is a dummy that equals one if the firm declares that in the last three years it engaged in organizational innovations aimed at outsourcing production tasks (or analogous objectives). In columns 1-6 of the table, we use industry dummies based on firms' categorization in Agriculture, Manufacturing, Services, Trade, Tourism, and Construction; in columns 7-12 we reestimate the regressions inserting two-digit industry dummies for manufacturing firms. Across the three indicators of access to bank credit, the results are consistent with those obtained in the baseline regressions of Table 2. In particular, firms with more difficult access to bank credit are more likely to reorganize their activities so as to reduce the production tasks they carry out and participate in supply chains.

7 Disentangling the Channels

The results reported in Tables 2-4 suggest that firms with more difficult access to bank credit are significantly more likely to participate in a supply chain. In Sections 7.1-7.3 we aim at disentangling the channels whereby firms' access to bank credit can affect their participation in supply chains. In Section 7.4, we explore possible reverse signalling mechanisms in the relation between supply chain participation and access to bank credit.

7.1 Trading partners and inter-firm linkages

In the discussion of the testable hypotheses, we noted that two forces could especially push firms with difficult access to bank credit to participate in a supply chain. First, the participation in a supply chain could free liquidity that would otherwise be tied up in assets and processes needed for producing all the various product components ("unlocking liquidity" motive). Second, the participation in a supply chain could broaden the sources of liquidity ("funding opportunities" motive). In Tables 5a, 5b, and 6, we investigate whether these two

forces are at play in the data. It is worth stressing that finding that one motive is at play does not imply that the other is not: the two motives can coexist and work in a complementary way in driving the supply chain participation of credit-constrained firms.

In Table 5a we especially test the presence of a “funding opportunities” motive by refining the definition of our dependent variable. If the propensity to participate in a supply chain reflects the firm’s desire to gain access to an alternative source of liquidity, the characteristics of the trading partners and of the inter-firm linkages should matter in the relationship between access to bank credit and the supply chain participation decision (see Hypothesis 2 in the discussion of the testable hypotheses). As noted, large businesses have allegedly easier access to financial markets than small firms (Petersen and Rajan, 1994; Berlin, 2003). For example, an examination of trade credit positions in Compustat reveals that large U.S. firms are generally net creditors. Besides the size of the trading partner, the length of the trading relationship can also matter in credit provision. A long-term trading partner will be able to acquire better information on the firm (Mian and Smith, 1992; Cunat, 2007) and will be more interested in its long-term health (Berlin, 2003). This will encourage credit provision.

Based on the arguments above, we expect that a firm can especially resort to a supply chain as a source of liquidity if it establishes contractual links with large trading partners or if it engages in long-term relationships with its trading partners. We then exploit the information in the survey on the size of subcontractors and on the length of the relationships with subcontractors in the supply chain.³¹ In Panel A of Table 5a, the dependent variable is a dummy that equals one if the firm engages in a subcontracting relationship with a large supplier or with a large customer. The results suggest that indeed credit rationed firms are more likely to engage in subcontracting relationships with large trading partners than non-rationed firms. In Panel B, the dependent variable is a dummy that equals one if the firm engages in a long-term subcontracting relationship with a supplier or with a customer. The estimates suggest that a credit rationed firm is significantly more likely to have a long-term relationship with subcontractors than non-rationed firms. The results in Panels A and B thus tend to confirm the hypothesis that gaining access to an alternative source of liquidity is an objective that firms pursue when they choose to participate in supply chains.

In Panel C, we refine our dependent variable by focusing on other measures of the tightness of inter-firm linkages in supply chains. The survey provides information on whether a firm’s trading partner is also its principal partner in innovative projects. Further, it asks the firms whether trading partners were an important source of information in recent product or process innovations. Columns 1-2 of Panel C show that credit rationed firms are more

³¹The survey asks the firms whether they have an established, long-term relationship with their subcontractor, or the relationship is recent and occasional. It further asks whether the subcontractor is a small (full liability) firm; a medium-sized firm (up to 50 employees); or a large firm. Observe that while the survey targets small and medium-sized firms, the subcontractors of the surveyed firms can be large businesses.

likely to collaborate with trading partners in innovative projects. And columns 3-4 show that credit rationed firms are more likely to exchange information with trading partners in product or process innovations. These results may suggest that credit rationed firms establish tight, innovation-intensive linkages in supply chains with the goal of gaining better access to liquidity (for example, a trading partner collaborating in an innovative project could gather better information on its customer or easily enforce the fulfillment of debt obligations). These results may also suggest that firms rationed by banks would find it difficult to upgrade products and processes if they did not establish trade linkages in supply chains.

Panel D of Table 5a considers a darker side of the inter-firm linkages in supply chains. The hold-up literature (see, e.g., Rajan, 1992) suggests that firms that are more dependent on their trading partners could be more exposed to hold up and rent extraction when borrowing from trading partners (e.g., in the form of more expensive funding). This hold-up risk could partially dilute the appeal of supply chains as an alternative source of liquidity (Cumming, 2012). Consistent with this argument, in the IV estimates in Panel D the coefficient on credit rationing tends to lose significance when we focus on the participation in supply chains in which firms lack autonomy from trading partners. And, in untabulated tests, we further obtain some evidence that credit access has a weaker impact on supply chain participation when firms declare to be less able to switch away from their trading partners.

7.2 Trade credit usage

In the tests of Table 5a, we have investigated the presence of a “funding opportunities” motive by focusing on characteristics of trading partners and relationships. A further way to disentangle whether firms rationed by banks participate in supply chains with the goal of broadening their liquidity sources is to test whether they tend to substitute bank credit with trade credit. By employing data from Centrale dei Bilanci on a subset of firms, we then construct measures of trade credit usage typically considered by the trade credit literature and by financial analysts (see, e.g., Demigurk Kunt and Maksimovich, 2001; Petersen and Rajan, 1997).

In Table 5b, Panel A, we study the pattern of trade credit in our sample of firms; in Panels B and C, we investigate the impact of access to bank credit on trade credit usage. Panel A gathers summary statistics for net trade credit borrowing days, defined as days payable outstanding minus days sales outstanding. Days payable outstanding (the payment delay granted by suppliers) is a measure of the debt position of a firm vis-à-vis its suppliers and is computed as the firm’s accounts payable over the average cost of goods sold per day; days sales outstanding is a measure of the credit position of a firm vis-à-vis its customers and is computed as the firm’s accounts receivable over the average sales per day. In the U.S.-based literature on trade credit, some studies find that, with the exception of downstream firms, U.S. manufacturers tend to be net providers of trade credit. The reader might wonder to what extent this pattern is present in our data and whether this could entail financial

pressure on firms in midstream and upstream positions in supply chains. Panel A shows that on average small and medium-sized Italian businesses positioned midstream and upstream in supply chains tend slightly to be net recipients of trade credit. Expectedly, among these firms, larger and older businesses turn out to be net trade creditors on average, while smaller and younger businesses are net recipients of trade credit.

In Panel B, we test the impact of bank credit rationing on measures of trade credit usage. In column 1, as an (inverse) measure of net trade credit, we again consider net trade credit borrowing days. In columns 2-4, we consider measures of firms' trade debt, including days payable outstanding (column 2) and the ratio of the average of accounts payable at the beginning and at the end of 2010 over the firm's assets at the end of 2010 (columns 3-4).³² The controls in the regressions of Tables 2-5a for firm size, age, performance, industry and region are often used in the literature to explain trade credit usage. We then retain this set of controls in the regressions for trade credit. In line with expectations, consistently across the measures of trade credit, we find that firms rationed by banks engage in more intense usage of trade credit. For example, the estimates in column 3 suggest that a firm rationed by banks has a ratio of accounts payable over assets 2.5 percentage points higher than non-rationed firms.

In Panel C of Table 5b, we explore whether establishing long-term trading relationships inside supply chains is instrumental to gaining access to trade credit. In columns 5-6, we estimate the impact on trade credit usage of the indicator for long-term subcontracting relationships with suppliers (a dummy that equals one if the firm has a long-term subcontracting relationship with a supplier, zero otherwise). In columns 7-8, we include both the indicator for bank credit rationing and the indicator for long-term subcontracting relationships to have a sense how much subcontracting relationships would pick up the effect of credit rationing on trade credit usage. We uncover some evidence that long-term subcontracting relationships facilitate firms' access to trade credit (in column 6, the estimated effect on days payable outstanding is positive and marginally significant). Further, as shown in columns 7-8, the effect of bank credit rationing on trade credit usage remains statistically significant after controlling for long-term subcontracting relationships.

Overall, the tests in Table 5b confirm the baseline results and support the hypothesis that broadening the sources of liquidity is a motive that induces firms with difficult access to bank credit to participate in supply chains.

7.3 Working capital stress

In the tests in Tables 5a and 5b, we have focused on the funding opportunities that firms could access by participating in supply chains. It is harder to extract information from our data

³²The regressions in columns 3-4 allow us to verify that the results remain unchanged if one normalizes accounts payable by assets rather than by the cost of goods sold. The specification in logs in column 4 can also help take account of the fact that the measures of trade credit tend to be skewed.

about what we labelled the “unlocking liquidity” motive, that is the pressure to outsource production tasks and participate in supply chains to unlock liquidity from existing assets and processes. However, our survey provides interesting information on whether the firms recently experienced changes in liquidity needs due to difficulty in meeting working capital requirements. Precisely, the survey asks each firm if in the last year it experienced an increase in the need for credit and, if so, whether this increase was driven by changes in funding needs for working capital and inventories.

We identify two opposite mechanisms through which difficulties in meeting working capital requirements could have affected firms’ choice of participating in supply chains. Such difficulties could have reinforced the incentive of credit-constrained firms to seek liquidity inside a supply chain. However, a recent strand of theories on working capital as a commitment device in supply chains yield an opposite prediction. According to Kalemli-Ozcan, Kim, Shin and Sorensen (2013) and Kim and Shin (2012 and 2013), in supply chains firms could have to hold sizeable amounts of working capital to commit to making effort for the success of the final products. These theories specifically predict that a firm facing working capital stress could be less inclined to participate in a supply chain, even if overall this participation would help the firm to better face liquidity shortages. In Panel A of Table 6, columns 1-4, we study how working capital stress influences the relationship between access to bank credit and the participation in supply chains. To this end, we construct a dummy (“working capital stress”) that takes the value of one if the firm recently experienced changes in liquidity needs due to difficulty in meeting working capital requirements, and zero otherwise. We then insert in the regressions this dummy as well as its interaction with the variable for credit rationing. Based on the opposite mechanisms described above, *ex ante* the expected sign of the effect of working capital stress is ambiguous. Across specifications, we find no significant effect of the indicator or of its interaction with credit rationing. A possible interpretation is that the opposite mechanisms detailed above essentially offset each other in determining the impact of working capital stress on supply chain participation.

In Panel B of Table 6, columns 5-8, we try to separate the two competing theoretical explanations for the effect of working capital stress. The theories in Kalemli-Ozcan, Kim, Shin and Sorensen (2013) and Kim and Shin (2012 and 2013) emphasize that the need to hold sizeable amounts of working capital for commitment purposes is more pronounced for firms more upstream in a supply chain. In fact, such firms are farther away from the final products so they need to have more “skin in the game” to be induced to exert effort in the production of their product components. By contrast, our hypothesis applies more to firms that are more downstream in a supply chain, because such firms could especially benefit from gaining access to suppliers’ liquidity. In Panel B of Table 6, we then rerun the regressions of Panel

A by exploiting information on the position of the firm in the supply chain.³³ Specifically, the dependent variable is a dummy that equals one if the firm participates in a supply chain in an upstream or midstream position, and zero if the firm is downstream or if the firm does not participate in a supply chain. The estimated coefficient on the interaction between credit rationing and the indicator for working capital stress clearly suggests that credit rationed firms facing working capital stress have a lower incentive to participate in the upstream segment of a supply chain. This finding thus suggests that both the mechanism put forward by Kalemlı-Ozcan, Kim, Shin and Sorensen (2013) and Kim and Shin (2012 and 2013) and the explanation we emphasize in this paper can be at work in our data.³⁴

7.4 Signalling mechanisms

Our instrumental variable approach should assuage concerns about possible reverse causality mechanisms that could bias our estimates. However, the reader might still wonder whether credit-constrained firms have an incentive to participate in a supply chain to send a signal to banks and improve their access to bank credit, rather than to gain access to alternative sources of funding or unlock liquidity from assets and processes. Exploiting additional information in the survey, we can carry out a test to further rule out a reverse signalling mechanism. The test builds on the observation that, if banks do not pay attention and attribute importance to collaborations among firms in supply chains, the firms should have no interest in participating in a supply chain merely to send a good signal to banks (in fact, the banks would not value this signal). The survey asks the firms whether, based on their experience, their main bank attributes importance to inter-firm collaborations. In Table 7, columns 1-6, we then reestimate the baseline regressions of Table 2 after redefining the dependent variable: this is now a dummy that equals one if the firm participates in a supply chain and its main bank does not consider inter-firm collaborations to be important. The baseline results carry through: firms with more difficult access to bank credit are more likely to participate in a supply chain. Thus, there is no evidence that credit-constrained firms participate in a supply chain merely to send a good signal to banks.

In some scenarios the participation in a supply chain might instead send a worrisome

³³When joining a supply chain, a firm may choose strategically its position in the supply chain; in other cases, a firm can “upgrade” its position along the supply chain by reorganizing its production. In the last twenty years or so the reorganization of production in the Italian business sector has regarded not only firms’ participation in supply chains but also their positioning in the supply chains (Accetturo, Giunta and Rossi, 2011).

³⁴We also experimented with instrumenting working capital stress in the first stage. As an instrument, we used a binary variable equal to one if the firm declares to be on average highly dependent on internal cash for activities such as working capital management (usage of cash above the median). A high reliance on internal cash is likely to reflect technological aspects of the firm such as the lumpiness of its investments and the size of its fixed costs. At the same time, this reliance is likely to affect the firm’s ability to tackle shocks that trigger working capital stress. In the first stage, the instrument turned out to significantly affect working capital stress; in the second stage, the results remained virtually unchanged (see Supplementary Table S3).

signal to banks. According to the theory in Kalemli-Ozcan, Kim, Shin and Sorensen (2013) and Kim and Shin (2012 and 2013), a firm entering in an upstream position in a supply chain may need to accumulate accounts receivable to commit to exerting production effort vis-à-vis downstream firms. The firm would now experience a larger need of financial resources, stronger financial pressure, and, potentially, a lower ability to repay bank loans. This might send a worrisome signal to banks. To verify whether this reverse mechanism could be present in our data, we again exploit information about the attention paid by the main bank to the firm’s collaborations with other businesses. We expect that if the bank pays attention to such collaborations, a firm facing working capital stress should be even more hesitant to participate in a supply chain in an upstream position. In fact, the firm would expect not only to be unable to sustain the working capital commitment vis-à-vis other firms but also to send an alarming signal to its bank, possibly worsening the access to bank credit. We then reestimate the regressions of Panel B of Table 6 for the impact of working capital stress after redefining the dependent variable as a dummy that equals one if the firm participates in a supply chain in an upstream or midstream position and also declares that the bank pays attention to inter-firm collaborations. If the reverse signalling mechanism were present in our data, we would expect a stronger negative coefficient on the interaction term. As columns 9-10 of Table 7, Panel B, show, we find no such evidence. The estimated coefficient on the interaction term between working capital stress and credit rationing is no stronger, and actually loses significance relative to the regressions in which we do not account for the attention paid by the bank (columns 7-8, carried over from Panel B of Table 6).³⁵

8 Domestic and International Supply Chains

In this section, we study the relative importance of access to credit in the participation in domestic and international supply chains. The trading partners of a firm can be located throughout the Italian territory or in foreign countries. If a supply chain stretches from Italy to foreign countries, a firm can have the opportunity to interact with more sophisticated trading partners with easier access to financial markets abroad and, hence, better capacity to provide financing. One could then expect financial constraints to have a larger positive impact on firms’ decision to participate in an international supply chain. The survey does not ask the firms whether there are segments of the supply chain abroad. In fact, this would probably be

³⁵One could also wonder whether supply chain participation can feedback on the number of banks. If banks are specialized in financing some production segments, a unique bank might find it difficult to monitor the entire production process, and a firm might have to rely on multiple banks when keeping in-house the whole production. A firm in a supply chain could more easily resort to a unique bank, so there could be a negative effect of supply chain participation on the number of banks. However, this mechanism would induce a negative correlation between the number of banks and supply chain participation, which is the opposite of what we find in the data. In addition, it is unlikely that in our context banks are specialized in financing particular production phases, as Italian banks are typically generalist banks.

beyond the knowledge of the respondents. However, the firms are asked whether they have suppliers or customers abroad. For our purposes, this is the key piece of information because a firm's trading partners are those relevant for the provision of liquidity to the firm.

In Table 8, columns 1-4, we first look at the effect of access to credit on a firm's decision to participate in a domestic or in an international supply chain.³⁶ A domestic supply chain indicates that the firm has only domestic suppliers or customers; an international supply chain indicates that the firm has suppliers or customers abroad. The baseline choice is to produce in-house all the components of a good or service. We estimate this supply chain participation decision using a multinomial logit model. To facilitate interpretation of the estimates, we report the marginal effect of credit rationing in Table 8.³⁷ We find weak evidence that firms rationed by banks are more likely to participate in a domestic supply chain while we find compelling evidence that they are more likely to participate in an international supply chain. Thus, the effect of credit access is stronger in the case of international supply chains.

To further investigate, in columns 5-8 we use the information on the markets where the suppliers or customers are located and compare the effect of credit rationing on the participation in supply chains with trading partners in Western Europe with its effect on the participation in supply chains with trading partners in the Rest of the World. Again, the baseline choice is to produce in-house all the components of a good or service. We find that credit rationed firms are significantly more likely to participate in a supply chain with partners in Western Europe. By contrast, we do not find equally compelling evidence for the participation in supply chains with partners from the Rest of the World. From columns 5-8, we may infer that the strong results for international supply chains as revealed in columns 1-4 are likely driven by the firms that participate in supply chains with trading partners in Western Europe. Taken together, the results suggest that for an Italian firm seeking liquidity from sophisticated trading partners from Germany, France or the United Kingdom (countries with highly developed financial systems) could be easier than seeking liquidity from domestic trading partners or from trading partners from far-away markets.³⁸

Finally, it is worth stressing that the results in Table 8 are unlikely to reflect a credit crunch hitting the Italian credit market disproportionately more than other countries. As shown in supplementary Figure S2 and as discussed in various Supplements to the Statistical Bulletin

³⁶To conserve space, we omit the results for the number of banks and the length of the main credit relationship. The results (available from the authors) yield insights similar as those for credit rationing.

³⁷In column 2 of Table 8, we use the control function method to estimate the multinomial logit model where credit rationing is treated as endogenous. In the first stage, we run a probit of credit rationing on instruments, firm controls and industry and area dummies and obtain the generalized residuals. In the second stage, we estimate the multinomial logit model of supply chain participation decision on credit rationing, firm controls, industry and area dummies, and the generalized residuals. The bootstrap is used to adjust the standard errors for the two-step estimation. See Wooldridge (2015) for more details.

³⁸A complementary interpretation is that the up-front costs for interacting with trading partners in Western Europe may be lower than those for interacting with trading partners in the rest of the world. Thus, for a credit-constrained firm it could be easier to sustain up-front costs.

of the Bank of Italy, a prolonged credit crunch occurred in Italy later than the period covered by the survey, starting especially from the second part of 2011. And in 2010 the pattern of bank credit was similar to that of other countries of the European Union.

9 Conclusion

This paper has examined the impact of credit access on the participation of small and medium-sized firms in domestic and global supply chains. The results reveal that firms with difficult access to bank credit are more inclined to participate in supply chains and especially to forge ties with international trading partners. We have also found evidence that, in structuring their relationships with trading partners in supply chains, credit-constrained firms mimic the kind of relationships that generally facilitate their borrowing from banks. For example, they engage in long-term relationships with large trading partners more than unconstrained firms. Furthermore, they are especially eager to participate in supply chains in which they have little risk of being held up in trade credit transactions. Overall, the results suggest that for credit-constrained small and medium-sized firms the participation in supply chains is a way of broadening the sources of liquidity and unlocking liquidity from assets and processes. These positive effects may outweigh possible difficulties that credit-constrained firms could face in covering up-front costs of outsourcing and supply chain participation.

Prior literature has found that financial factors play an important role in firms' production and investment decisions. Our results reveal that financial factors can also shape the organization of production activities, by influencing firms' decision to participate in supply chains. In an aggregate perspective, several studies show that, while supply chains are a defining feature of many economies, their relative importance differs quite significantly across countries (see, e.g., OECD, WTO and World Bank, 2014). Our findings suggest that the observed cross-country variation in the importance of supply chains could at least partially stem from the different severity of financial market frictions across countries. From a policy perspective, our results suggest that interventions aimed at favoring firms' participation in supply chains could also have a beneficial impact on firms' access to liquidity. Such benefits could arise both in normal times and, perhaps even more significantly, during financial crises (such as the recent Great Recession). We leave these and other issues to future research.

References

Accetturo A., Bassanetti A., Bugamelli M., Faiella I., Finaldi Russo P., Franco D., Giacomelli S. and M. Omiccioli (2013) "Il sistema industriale italiano tra globalizzazione e crisi." In: Rotondi, Zeno (ed.), *Filiere produttive e nuova globalizzazione*, Laterza Editore.

Accetturo, A., Giunta, A. and S. Rossi (2011) “The Italian firms between crisis and the new globalization,” Occasional Papers No. 86, Bank of Italy.

Albaretto, G. and P. Finaldi Russo (2012) “Fragilità finanziaria e prospettive di crescita: il razionamento del credito alle imprese durante la crisi,” Occasional Papers No. 127, Bank of Italy.

Alessandrini, P., Presbitero A. F. and A. Zazzaro (2009) “Banks, distances and firms’ financing constraints,” *Review of Finance* 13, 261–307.

Alfaro, L., P. Antràs, D. Chor and P. Conconi (2015) “Internalizing global value chains: A firm-level analysis,” working paper, Harvard University.

Amador, J., Cappariello R. and R. Stehrer (2014) “Global value chains: A view from the Euro Area,” Working Paper No. 12, Banco de Portugal.

Antràs, P. and D. Chor (2013) “Organizing the global value chain”, *Econometrica* 81, 2127–2204.

Baldwin, R. and J. Lopez-Gonzalez (2015) “Supply-chain trade: A portrait of global patterns and several testable hypotheses,” *The World Economy* 38, 1682–1721.

Berger, A. N. and C. H. S. Bouwman (2009) “Bank liquidity creation,” *Review of Financial Studies* 22, 3779–3837.

Berger, A. N., Demsetz R. S. and P. E. Strahan (1999) “The consolidation of the financial services industry: causes, consequences, and implications for the future,” *Journal of Banking and Finance* 23, 135–94.

Berger, A. N. and T. H. Hannan (1998) “The efficiency cost of market power in the banking industry: A test of the “Quiet Life” and related hypotheses,” *Review of Economics and Statistics* 80, 454–465.

Berger, A. N. and G. F. Udell (1995) “Relationship lending and lines of credit in small firm finance,” *Journal of Business* 68, 351–381.

Berger, A. N. and G. F. Udell (2002) “Small business credit availability and relationship lending: The importance of bank organisational structure,” *Economic Journal* 112, F32–F53.

Berlin, M. (2003) “Trade credit: why do production firms act as financial intermediaries?” *Federal Reserve Bank of Philadelphia Business Review* Q3, 21–28.

Bhattacharya, S. and G. Chiesa (1995) “Proprietary information, financial intermediation, and research incentives,” *Journal of Financial Intermediation* 4, 328–357.

- Biais, B. and C. Gollier (1997) “Trade credit and credit rationing,” *Review of Financial Studies* 10, 903–937.
- Bofondi, M. and G. Gobbi (2006) “Informational barriers to entry into credit markets,” *Review of Finance* 10, 39–67.
- Bonaccorsi di Patti, E. and G. Gobbi (2001) “The changing structure of local credit markets: Are small businesses special?,” *Journal of Banking & Finance* 25, 2209–2237.
- Breda E. and R. Cappariello (2012) “A tale of two bazaar economies: An input-output analysis for Germany and Italy,” *Economia e Politica Industriale* 39, 43–69.
- Brunnermeier, M. K., Eisenbach, T. M. and Y. Sannikov (2012) “Macroeconomics with financial frictions: A survey,” Working Paper No. 18102, National Bureau of Economic Research.
- Burkart, M. and T. Ellingsen (2004) “In-kind finance: a theory of trade credit,” *American Economic Review* 94, 569–590.
- Burkart, M., Ellingsen, T. and M. Giannetti (2011) “What you sell is what you lend? Explaining trade credit contracts,” *Review of Financial Studies* 24, 1261–1298.
- Calabrese, G. (2007) “Aspetti caratteristici delle imprese best performance piemontesi,” in: *Dalle best performance alle best practice nelle imprese manifatturiere piemontesi. Rapporto Ceris-Cnr, Regione Piemonte.*
- Calomiris, C. W. and J. Karceski (2000) “Is the bank merger wave of the 1990s efficient?: Lessons from nine case studies,” in *Mergers and Productivity*, S. N. Kaplan (ed.) Chicago: University of Chicago Press.
- Cappariello R. and A. Felettigh (2015) “How does foreign demand activate domestic value added? A comparison among the largest euro-area economies,” Working Paper No. 1001, Bank of Italy.
- Cole, R. A., Goldberg L. G. and L. J. White (2004) “Cookie-cutter versus character: the micro structure of small-business lending by large and small banks,” *Journal of Financial and Quantitative Analysis* 39, 227–251.
- Corbett, M. F. (2004) *The outsourcing revolution – Why It makes sense and how to do it.* Dearborn Trade Publishing.
- Cumming, D. (2012) *Oxford handbook of entrepreneurial finance.* Oxford University Press, Oxford.
- Cunat, V. (2007) “Trade credit: suppliers as debt collectors and insurance providers,” *Review of Financial Studies* 20, 491–527.

De Nardis, S. (2010) *Imprese italiane nella competizione internazionale*. FrancoAngeli edizioni, Milano.

Dei Ottati G. (1995) *Tra mercato e comunità*. Franco Angeli edizioni, Milano.

Demirguc-Kunt, A. and V. Maksimovic (2001) "Firms as financial intermediaries - evidence from trade credit data," World Bank Policy Research Working Paper 2696.

Drudi, I. and S. Pacei (2012) "Who benefits from outsourcing? A study of one Italian region's small firms," *Statistica* 72, 337–356.

EUROSTAT (2014) "Structural business statistics," Luxembourg.

Ferragina, A.M. and B. Quintieri (2002) *I processi di frammentazione produttiva dell'Italia verso l'area Mediterranea e l'Est Europeo. Rapporto sulla competitività dell'Italia: le imprese*.

Ferri, G. and M. Ventura (2007) "Macchinari del made in Italy e dinamiche dei distretti industriali," ISAE Working Paper No. 74, Italian National Institute of Statistics.

Garcia-Appendini, E. and J. Montoriol-Garriga (2013) "Firms as liquidity providers: Evidence from the 2007–2008 financial crisis," *Journal of Financial Economics* 109, 272–291.

Gereffi, G. (1999) "International trade and industrial upgrading in the apparel commodity chain," *Journal of International Economics* 48, 37–70.

Grossman, G.M. and H. Helpman (2002) "Integration versus outsourcing in industry equilibrium," *Quarterly Journal of Economics* 117, 1, 85–120.

Grossman, G.M. and E. Rossi-Hansberg (2008) "Trading tasks: A simple theory of offshoring," *American Economic Review* 98, 1978–1997.

Guiso, L., Sapienza, P. and L. Zingales (2003) "The cost of banking regulation," working paper, Chicago Graduate School of Business.

Guiso, L., Sapienza, P. and L. Zingales (2004) "Does local financial development matter?," *Quarterly Journal of Economics* 119, 929–969.

Herrera, A. M. and R. Minetti (2007) "Informed finance and technological change: Evidence from credit relationships," *Journal of Financial Economics* 83, 223–269.

Houston, Joel F. and C. James (1998) "Do bank internal capital markets promote lending?" *Journal of Banking & Finance* 22, 899–918.

Hubbard, R. G. (1998) "Capital-market imperfections and investment," *Journal of Economic Literature* 36, 193–225.

ISFOL (2012) Il fenomeno delle esternalizzazioni in Italia: indagine sull’impatto dell’outsourcing sull’organizzazione aziendale, sulle relazioni industriali e sulle condizioni di tutela dei lavoratori. A cura di Mario Emanuele - Roma. I libri del Fondo sociale europeo.

ISTAT (2013) “Statistiche nazionali sulla struttura delle imprese,” Rome.

Kalemli-Ozcan, S., Kim, S.J., Shin, H.S., Sorensen, B. and S. Yesiltas (2013) “Financial shocks in production chains”, working paper, University of Maryland.

Kannegiesser, M. (2008) Value chain management in the chemical industry: Global value chain planning of commodities. Springer, Berlin.

Kim, Se-J. and H. S. Shin (2012) “Sustaining production chains through financial linkages,” *American Economic Review* 102, 402–406.

Kim, Se-J. and H. S. Shin (2013) “Working capital, trade and macro fluctuations,” working paper, Princeton University.

Longhofer, S. D. and J. Santos (2003) “The paradox of priority,” *Financial Management* 32, 69–81.

Manova, K. (2015) “Global value chains and multinational activity with financial frictions,” in: *The age of global value chains: Maps and policy issues*, J. Amador and F. di Mauro, eds., CEPR E-book.

Manova, K. and Z. Yu (2015) “How firms export: Processing vs. ordinary trade with financial frictions, working paper, Oxford University.

Marchi, G. (1999) *Reti e sistemi di piccole imprese*. Franco Angeli edizioni, Milano.

McAfee, P. R. and J. McMillan (1995) “Organizational diseconomies of scale,” *Journal of Economics & Management Strategy* 4, 399–528.

Messori, M. (1997) “Relazione al convegno: Banche e finanza per lo sviluppo del Mezzogiorno,” *Fondazione CESPE-PDS*, Bari, Fiera del Levante, 15 settembre 1997.

Mian, S. and C. W. Smith (1992) “Accounts receivable management policy: Theory and evidence,” *Journal of Finance* 47, 169–200.

Mikusheva, A. (2013) “Survey on statistical inferences in weakly-identified instrumental variable models,” *Applied Econometrics* 29, 116–131.

Minetti, R. and S. Zhu (2011) “Credit constraints and firm export: Microeconomic evidence from Italy,” *Journal of International Economics* 83, 109–125.

Nilsen, J. H. (2002) “Trade credit and the bank lending channel,” *Journal of Money, Credit and Banking* 34, pages 226–53.

Ongena, S. and D. C. Smith (2001) “The duration of bank relationships,” *Journal of Financial Economics* 61, 449–475

OECD (2013a) “Mapping global value chains,” working paper of the Trade Committee, Paris.

OECD (2013b) “Supporting investment in knowledge capital, growth and innovation,” OECD Publishing, Paris.

OECD, WTO and World Bank (2014) “Global value chains: Challenges, opportunities, and implications for policy,” Report prepared for the G20 Trade Ministers Meeting, Sydney.

Parrillo, F. (1999) “Ulteriori sviluppi delle aggregazioni bancarie. La Banca d’Italia custode delle regole,” *Rivista Bancaria* 1, 5–23.

Peek, J. and E. S. Rosengren (1998) “Bank consolidation and small business lending: It’s not just size that matters,” *Journal of Banking and Finance* 22, 799–819.

Petersen, M. and R. Rajan (1994) “The benefits of firm-creditor relationships: evidence from small business data,” *Journal of Finance* 49, 3–37.

Petersen, M. and R. Rajan (1995) “The effect of credit market competition on lending relationships,” *Quarterly Journal of Economics* 110, 407–442.

Petersen, M. and R. Rajan (1997) “Trade credit: theories and evidence,” *Review of Financial Studies* 10, 661–691.

Petersen, M. and R. Rajan (2002) “Does distance still matter? The information revolution in small business lending,” *Journal of Finance* 57, 2533–2570.

Rajan, R. (1992) “Insiders and outsiders: The choice between informed and arm’s-length debt,” *Journal of Finance* 47, 1367–400.

Rajan R. and L. Zingales (1995) “What do we know about capital structure? Some evidence from international data,” *Journal of Finance* 50, 1421–1460.

Rhoades, (1998) “The efficiency effects of bank mergers: An overview of case studies of nine mergers,” *Journal of Banking & Finance* 22, 273–291.

Sapienza, P. (2002) “The effects of banking mergers on loan contracts,” *Journal of Finance* 57, 329–367.

Schwartz, R.A. (1974) “An economic model of trade credit”, *Journal of Financial Quantitative Analysis*, 9:643–657.

Shaffer, S. (1993) “Can megamergers improve bank efficiency?,” *Journal of Banking and Finance* 17, 423–436.

Stock, J. H. and M. Yogo (2005) “Testing for weak instruments in linear IV regression,” in: *Identification and inference for econometric models: A festschrift in honor of Thomas J. Rothenberg*, D. W. K. Andrews and J. H. Stock (eds.). Cambridge, UK: Cambridge University Press.

Sturgeon, T. and M. Kawakami (2010) “Global value chains in the electronics industry: Was the crisis a window of opportunity for developing countries?,” working paper, The World Bank.

Taglioni, D. and D. Winkler (2016) *Making global value chains work for development*. World Bank Group, Washington, D.C.

UNCTAD (2013) “World investment report. Global value chains: Investment and trade for development,” United Nations, New York and Geneva.

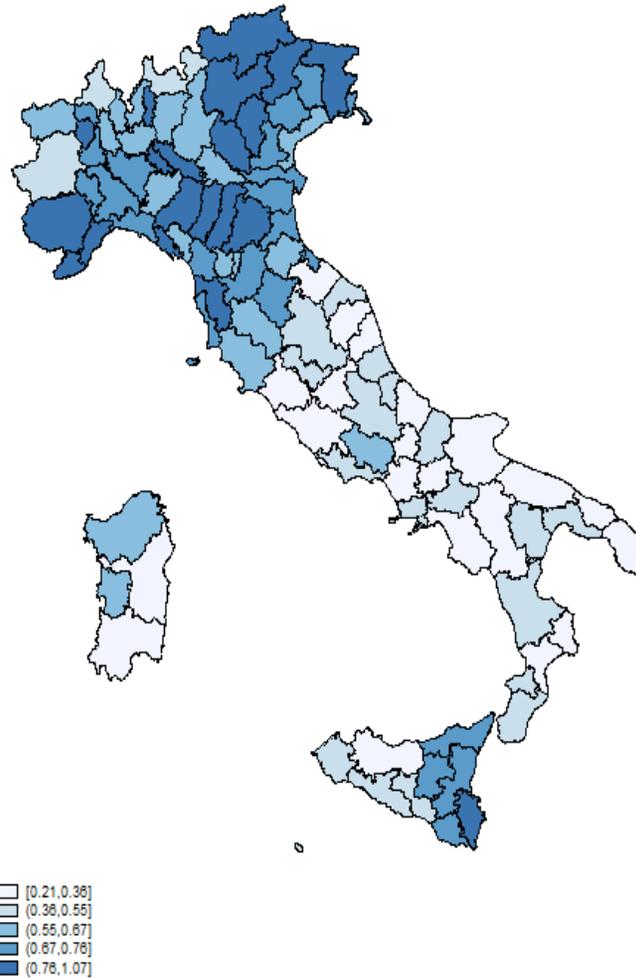
Walter, I. (2004) *Mergers and acquisitions in banking and finance: What works, what fails, and why*. Oxford University Press, Oxford.

Wooldridge, J. M. (2015) “Control function methods in applied econometrics,” *Journal of Human Resources* 50, 420–445.

World Bank (2012) “World development indicators,” World Bank, Washington, D.C.

Yi, K.M. (2003) “Can vertical specialization explain the growth of world trade?,” *Journal of Political Economy* 111, 52–102.

Banking development 2010



Share UniCredit group 2007

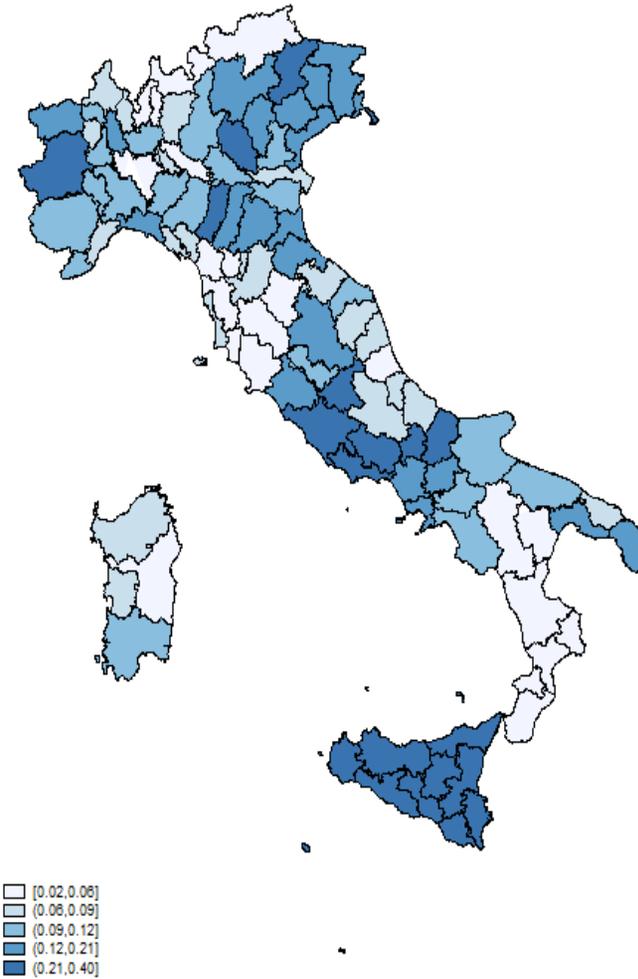


Figure 1. Banking development and Share UniCredit group

Note: This figure plots bank branches per 100,000 inhabitants in the provinces for 2010 (left) and the share of provincial branches of UniCredit and Capitalia for 2007 (right).

Table 1. Summary statistics, description, and correlation matrix

<i>Panel (A) Summary statistics and description</i>				
	Num.	Mean	Std. Dev.	Description
<i>Main dependent variables</i>				
Supply chain	4497	0.528	0.499	Dummy that equals one if the firm is in a supply chain, zero otherwise
Upstream in supply chain	4497	0.162	0.369	Position in the supply chain: the firm uses raw materials and produces an intermediate product
Midstream in supply chain	4497	0.102	0.303	Position in the supply chain: the firm uses and produces semi-finished intermediate products
Downstream in supply chain	4497	0.264	0.441	Position in the supply chain: the firm uses semi-finished intermediate products and produces final products
Subcontractor	4497	0.108	0.310	Dummy that equals one if the firm has a subcontracting relationship with a trading partner, zero otherwise
<i>Credit conditions</i>				
Credit rationing	7247	0.377	0.485	Dummy that equals one if the firm is credit rationed, zero otherwise
Number of banks	7433	2.422	2.094	Number of banks from which the firm borrowed in the year of the survey
Relationship length	7433	13.529	11.202	Length of the relationship with the main bank (in years)
<i>Control variables</i>				
Age	7121	18.959	17.818	Number of years since inception
Number of employees	7153	15.380	42.401	Total number of employees in the year of the survey
Corporation	7433	0.259	0.438	Dummy on whether the firm is a private limited company (LTD) or a public limited company (PLCs)
Partnership	7433	0.169	0.374	Dummy that equals one if the firm is part of a partnership, zero otherwise
Banking development	7294	0.627	0.198	Number of bank branches in the province in the year 2009, per 100,000 inhabitants
Very high or high working capital stress	7436	0.086	0.280	Dummy that equals one if the firm considers working capital as one of the two most important reasons for increasing financial needs, zero otherwise
North	7433	0.577	0.463	Dummy that equals one if the firm is located in the North of Italy, zero otherwise
Center	7433	0.186	0.389	Dummy that equals one if the firm is located in the Center of Italy, zero otherwise
South	7433	0.237	0.237	Dummy that equals one if the firm is located in the South of Italy, zero otherwise
Agriculture	7436	0.019	0.135	Sector of activity
Construction	7436	0.108	0.300	Sector of activity
Trade	7436	0.284	0.451	Sector of activity
Tourism	7436	0.027	0.161	Sector of activity
Services	7436	0.301	0.459	Sector of activity
Manufacturing	7436	0.262	0.440	Sector of activity
<i>Panel (B) Correlation matrix</i>				
	Credit rationing	Number of banks	Relation. length	
Number of banks	0.022 (0.066)			
Relationship length	-0.005 (0.654)	0.227 (0.000)		
Age	-0.063 (0.000)	0.286 (0.000)	0.483 (0.000)	
Number of employees	-0.052 (0.000)	0.613 (0.000)	0.261 (0.000)	

Note: This table reports summary statistics, description and correlation for the main variables used in the analysis. In parentheses are standard deviations.

Table 2. Supply chain participation and credit access

	Full sample with broad industry info.						Manuf. with detailed industry info. + nonmanuf.					
	bivariate		IV		IV		bivariate		IV		IV	
	probit	probit	probit	probit	probit	probit	probit	probit	probit	probit	probit	probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Credit rationing	0.047*** (0.017)	0.187** (0.079)					0.047** (0.019)	0.167** (0.071)				
Number of banks			-0.004 (0.005)	0.135*** (0.048)					-0.005 (0.005)	0.129** (0.054)		
Relationship length					-0.001 (0.008)	-0.239*** (0.081)					-0.003 (0.010)	-0.256** (0.106)
Age	-0.001** (0.000)	-0.001* (0.000)	-0.001** (0.000)	-0.002*** (0.001)	-0.001** (0.000)	0.004** (0.002)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001** (0.001)	-0.001** (0.000)	0.004* (0.002)
Size (employees)	-0.017** (0.009)	-0.001 (0.004)	-0.013 (0.009)	-0.108*** (0.033)	-0.016* (0.009)	-0.004 (0.010)	-0.017* (0.009)	-0.006 (0.005)	-0.012 (0.009)	-0.111*** (0.039)	-0.017* (0.009)	-0.006 (0.011)
Corporation	-0.019 (0.027)	-0.019 (0.014)	-0.023 (0.026)	-0.088*** (0.029)	-0.021 (0.027)	0.006 (0.028)	-0.008 (0.035)	-0.026* (0.015)	-0.011 (0.033)	-0.063* (0.033)	-0.010 (0.034)	0.009 (0.033)
Partnership	-0.061*** (0.023)	-0.019* (0.012)	-0.062*** (0.023)	-0.043* (0.023)	-0.065*** (0.024)	-0.007 (0.034)	-0.058** (0.028)	-0.019 (0.012)	-0.059** (0.027)	-0.026 (0.030)	-0.062** (0.028)	-0.010 (0.039)
Banking development	-0.067 (0.112)	-0.039 (0.040)	-0.069 (0.068)	-0.248*** (0.078)	-0.063 (0.067)	0.021 (0.087)	-0.079 (0.079)	-0.041 (0.045)	-0.083 (0.076)	-0.240*** (0.080)	-0.078 (0.075)	0.003 (0.097)
Center	-0.065** (0.029)	-0.019* (0.010)	-0.061** (0.029)	-0.065** (0.029)	-0.061** (0.029)	-0.059** (0.025)	-0.059* (0.032)	-0.021* (0.012)	-0.056* (0.031)	-0.052* (0.030)	-0.055* (0.031)	-0.051* (0.029)
South	-0.066* (0.034)	-0.005 (0.015)	-0.058* (0.034)	-0.083** (0.034)	-0.051 (0.034)	-0.044 (0.037)	-0.057 (0.037)	-0.001 (0.015)	-0.049 (0.037)	-0.072** (0.037)	-0.042 (0.037)	-0.038 (0.041)
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Instruments												
Share UniCredit Group		-0.504** (0.199)		-1.367*** (0.378)		0.913*** (0.189)		-0.417** (0.212)		-1.195*** (0.418)		0.774*** (0.215)
UniCredit – Capitalia		-0.474*** (0.150)		-0.743*** (0.243)		0.517*** (0.151)		-0.568*** (0.185)		-0.943*** (0.285)		0.455*** (0.151)
Overid test (p-value)		0.511		0.744		0.878		0.869		0.570		0.394
Observations	4,176	4,176	4,239	4,239	4,163	4,163	3,585	3,585	3,638	3,638	3,568	3,568

Note: This table reports the effects of firms' access to credit on their participation in supply chains. Access to credit is measured by a binary variable for credit rationing (columns 1-2 and 7-8), number of banks (columns 3-4 and 9-10), or length of the relationship with the main bank (columns 5-6 and 11-12). All the columns report the marginal effects and all the regressions include industry fixed effects. In columns 1-6, industry fixed effects refer to the broad industry classification. In columns 7-12, industry fixed effects refer to the two-digit industry classification for manufacturing firms and to the broad classification for non-manufacturing firms. In columns 2, 4, 6, 8, 10, and 12 the measure for access to credit is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). In columns 2 and 8, the coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. In columns 4, 6, 10, and 12 the coefficients on the instruments are from the first stage regression of the number of banks and relationship length, respectively, on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 3a. Supply chain participation and credit access; robustness to further controls

	bivariate probit (1)	IV probit (2)	IV probit (3)	bivariate probit (4)	IV probit (5)	IV probit (6)
Credit rationing	0.187** (0.075)			0.162** (0.064)		
Number of banks		0.137*** (0.045)			0.078*** (0.018)	
Relationship length			-0.242*** (0.074)			-0.306*** (0.043)
<i>Local economic development</i>						
Province GDP per capita	0.001 (0.001)	0.002 (0.003)	0.001 (0.002)	0.003 (0.002)	0.001 (0.000)	0.004** (0.001)
<i>Firm and bank competition</i>						
High competition	-0.000 (0.008)	0.040** (0.016)	-0.005 (0.019)	0.004 (0.012)	0.023 (0.016)	-0.039** (0.018)
Share of two main banks	0.048 (0.056)	0.123 (0.104)	0.146 (0.101)	0.100 (0.082)	0.190** (0.093)	0.250*** (0.079)
<i>Firm profitability</i>						
Return on equity				-0.006 (0.007)	0.002 (0.005)	-0.004 (0.002)
<i>Firm growth opportunities</i>						
Change of sales				0.000 (0.001)	0.000 (0.004)	0.000 (0.001)
Intangible assets 2009				0.027 (0.047)	-0.069 (0.090)	-0.200*** (0.077)
<i>Firm liquidity and capital intensity</i>						
Capital intensity 2009				0.004 (0.003)	-0.001 (0.000)	0.005* (0.003)
Current assets 2009				-0.016 (0.025)	-0.028 (0.021)	-0.048 (0.033)
<i>Firm technological sophistication</i>						
Workforce unskilled for innovation				0.013 (0.012)	-0.014 (0.013)	-0.013 (0.057)
Firm controls	Y	Y	Y	Y	Y	Y
Industry & area dummies	Y	Y	Y	Y	Y	Y
Instruments						
Share UniCredit Group	-0.495** (0.197)	-1.351 (1.154)	0.916*** (0.190)	-0.096* (0.052)	-1.933*** (0.697)	0.385** (0.187)
UniCredit – Capitalia	-0.488*** (0.146)	-0.913** (0.464)	0.512*** (0.156)	-0.075* (0.045)	-0.705* (0.361)	0.194 (0.124)
Overid test (p-value)	0.559	0.629	0.639	0.550	0.619	0.570
Observations	4,176	4,239	4,163	1,942	1,978	1,939

Note: This table reports robustness tests for the effects of firms' access to credit on their participation in supply chains. In particular, the regressions consider additional control variables. Access to credit is measured by a binary variable for credit rationing (columns 1 and 4), number of banks (columns 2 and 5), or length of the relationship with the main bank (columns 3 and 6). All the columns report the marginal effects and all the regressions include firm controls, industry and area fixed effects. In all columns the measure for access to credit is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). In columns 1 and 4, the coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. In columns 2 and 5, the coefficients on the instruments are from the first stage regression of the number of banks on the instruments, firm controls, and industry and area dummies. In columns 3 and 6, the coefficients on the instruments are from the first stage regression of the relationship length on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 3b. Supply chain participation and credit access; robustness to alternative instruments

	bivariate probit	bivariate probit	bivariate probit	IV probit	IV probit	IV probit	IV probit	IV probit	IV probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Credit rationing	0.187** (0.079)	0.146 (0.234)	0.213*** (0.026)						
Number of banks				0.135*** (0.048)	0.125*** (0.046)	0.073 (0.065)			
Relationship length							-0.239*** (0.081)	-0.233*** (0.079)	-0.174*** (0.049)
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry & area dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Instruments									
Share UniCredit Group	-0.504** (0.199)	-0.442** (0.199)	-0.338** (0.160)	-1.367*** (0.378)	-1.356*** (0.422)	-1.202 (1.033)	0.913*** (0.189)	0.882*** (0.240)	1.830*** (0.592)
UniCredit – Capitalia	-0.474*** (0.150)		-0.065*** (0.025)	-0.743*** (0.243)		-0.679** (0.319)	0.517*** (0.151)		0.499*** (0.148)
Lending technology			-0.048** (0.023)			0.291 (0.194)			0.104 (0.104)
Share UniCredit*lending technology			0.287* (0.168)			-0.204 (1.134)			-0.994* (0.521)
Overid test (p-value)	0.511		0.232	0.744		0.004	0.878		0.078
Observations	4,176	4,176	4,176	4,239	4,239	4,239	4,163	4,163	4,163

Note: This table reports robustness tests for the effects of firms' access to credit on their participation in supply chains. In particular, the regressions report results using alternative sets of instrumental variables. Access to credit is measured by a binary variable for credit rationing (columns 1-3), number of banks (columns 4-6), or length of the relationship with the main bank (columns 7-9). All the columns report the marginal effects and all the regressions include area and industry fixed effects. In columns 1, 4, and 7, the measure for access to credit is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). In columns 2, 5, and 8, it is instrumented using the share of provincial bank branches of the merged banks. In columns 3, 6, and 9, it is instrumented using the share of provincial bank branches of the merged banks, an indicator for reliance on a soft lending technology, the interaction between the two, and the difference between the shares of provincial bank branches of the two banking groups involved in the merger. In columns 1-3, the coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and region dummies. In columns 4-9, the coefficients on the instruments are from the first stage regression of the number of banks and relationship length, respectively, on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 4. Credit access and organizational innovations aimed at outsourcing

	Full sample with broad industry info.						Manuf. with detailed industry info. + nonmanuf.					
	bivariate		bivariate		bivariate		bivariate		bivariate		bivariate	
	probit	probit	probit	probit	probit	probit	probit	probit	probit	probit	probit	probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Credit rationing	0.103*** (0.013)	0.115*** (0.009)					0.109*** (0.015)	0.115*** (0.009)				
Number of banks			0.014*** (0.004)	0.045** (0.021)					0.016*** (0.004)	0.058*** (0.018)		
Relationship length					0.005 (0.009)	-0.071* (0.037)					0.003 (0.010)	-0.108*** (0.031)
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry & area dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Instruments												
Share UniCredit Group		-0.415** (0.196)		-1.402*** (0.357)		0.916*** (0.187)		-0.462** (0.206)		-1.282*** (0.377)		0.803*** (0.201)
UniCredit – Capitalia		-0.434*** (0.141)		-0.692** (0.322)		0.512*** (0.146)		-0.479*** (0.166)		-0.859** (0.363)		0.416*** (0.150)
Overid test (p-value)		0.571		0.968		0.987		0.196		0.434		0.702
Observations	4,176	4,176	4,239	4,239	4,163	4,163	3,585	3,585	3,638	3,638	3,568	3,568

Note: This table reports the effects of firms' access to credit on organizational innovations aimed at facilitating outsourcing. Access to credit is measured by a binary variable for credit rationing (columns 1-2 and 7-8), number of banks (columns 3-4 and 9-10), or length of the relationship with the main bank (columns 5-6 and 11-12). All the columns report the marginal effects and all the regressions include area and industry fixed effects. In columns 1-6, industry fixed effects refer to the broad industry classification. In columns 7-12, industry fixed effects refer to the two-digit industry classification for manufacturing firms and to the broad classification for non-manufacturing firms. In columns 2, 4, 6, 8, 10, and 12 the measure for access to credit is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). In columns 2 and 8, the coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and region dummies. In columns 4, 6, 10, and 12 the coefficients on the instruments are from the first stage regression of the number of banks and relationship length, respectively, on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 5a. Credit access, trading partners and inter-firm linkages

	bivariate		bivariate		bivariate		bivariate		
	probit	probit	probit	probit	probit	probit	probit	probit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
<i>Panel (A) Large subcontractor</i>				<i>Panel (B) Long subcontracting relationship</i>					
	Supplier		Acquirer		Supplier		Acquirer		
Credit rationing	0.012** (0.005)	0.011** (0.006)	0.006*** (0.002)	-0.017 (0.045)	0.023*** (0.005)	0.017*** (0.002)	0.023*** (0.005)	-0.046 (0.044)	
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	
Industry & Area dummies	Y	Y	Y	Y	Y	Y	Y	Y	
Instruments									
Share UniCredit Group		-0.371* (0.212)		-0.390* (0.207)		-0.396** (0.193)		-0.329* (0.192)	
UniCredit – Capitalia		-0.448*** (0.172)		-0.455*** (0.149)		-0.489*** (0.127)		-0.483*** (0.163)	
Overid test (p-value)		0.675		0.913		0.755		0.223	
Observations	4,176	4,176	4,176	4,176	4,176	4,176	4,176	4,176	
<i>Panel (C) Trading partner and innovation</i>				<i>Panel (D) Autonomy in supply chain</i>					
	Partner in innovation		Info. source for innovation		No autonomy		Partial autonomy		
Credit rationing	0.051*** (0.014)	0.083*** (0.016)	0.070*** (0.012)	0.115*** (0.017)	0.026** (0.011)	0.019 (0.020)	0.028*** (0.008)	0.009 (0.022)	
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	
Industry & Area dummies	Y	Y	Y	Y	Y	Y	Y	Y	
Instruments									
Share UniCredit Group		-0.393** (0.196)		-0.399** (0.183)		-0.372* (0.207)		-0.369* (0.208)	
UniCredit – Capitalia		-0.440*** (0.154)		-0.359** (0.155)		-0.451*** (0.163)		-0.436*** (0.158)	
Overid test (p-value)		0.811		0.317		0.703		0.997	
Observations	4,176	4,176	4,176	4,176	4,176	4,176	4,176	4,176	

Note: This table reports tests for the effects of characteristics of trading partners and inter-firm linkages on the relationship between access to credit and participation in supply chains. In panel A, the dependent variable equals 1 if the firm has a subcontracting relationship with a large trading partner in the supply chain, and 0 otherwise (columns 1-2 refer to the case of a supplier; columns 3-4 refer to the case of an acquirer). In panel B, the dependent variable equals 1 if the firm has a long-term subcontracting relationship with a trading partner in the supply chain, and 0 otherwise (columns 5-6 refer to the case of a supplier; columns 7-8 refer to the case of an acquirer). In panel C, columns 1-2, the dependent variable equals 1 if the subcontractor (supplier or customer) is the firm's principal partner in innovative projects, and 0 otherwise. In panel C, columns 3-4, the dependent variable equals 1 if the firm declares that suppliers or customers were a relevant source of information in product or process innovations, and 0 otherwise. In Panel D, columns 5-6, the dependent variable equals 1 if the firm has no autonomy from its trading partners in the supply chain, and 0 otherwise; in columns 7-8, the dependent variable equals 1 if the firm has partial autonomy from its trading partners in the supply chain, and 0 otherwise. All the columns report the marginal effects and all the regressions include firm-level controls, industry and area fixed effects. In columns 2, 4, 6 and 8, the measure for access to credit (credit rationing) is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). The coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 5b. Credit access and trade credit usage

<i>Panel (A) Summary statistics for trade credit usage: Net days payable = days payable outstanding – days receivable outstanding</i>							
	Mean	Older firms	Younger firms	<i>t</i>	Bigger firms	Smaller firms	<i>t</i>
Upstream/midstream	6.079	-1.501	23.770	-2.766	5.593	19.306	-1.065

	<i>Panel (B)</i>				<i>Panel (C)</i>			
	Net days payable	Days payable	Accounts payable over assets	Log accounts payable over assets	Net days payable	Days payable	Net days payable	Days payable
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit rationing	12.211*** (4.022)	14.359*** (3.735)	0.025*** (0.009)	0.071* (0.038)			12.238*** (4.020)	14.105*** (3.784)
Long subcontracting relation. with supplier					-0.003 (6.610)	11.436* (6.500)	-1.056 (6.614)	10.060 (6.495)
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Industry & area dummies	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,988	2,988	2,976	2,800	3,052	3,052	2,988	2,988

Note: This table reports patterns of trade credit and tests for the effects of access to credit and strength of trading relationships in supply chains on trade credit usage. In Panel A, we report summary statistics for the net days payable (days payable outstanding–days receivable outstanding). "Older firms" are firms with age above the median and "younger firms" are those with age below the median. "Bigger firms" are firms with number of employees above the median, and "smaller firms" are those with number of employees below the median. Panel B, columns 1-4, report the effects of credit rationing on net days payable, days payable outstanding, the ratio of accounts payable over the firm's assets, and the log of the ratio of accounts payable over the firm's assets. Panel C, columns 5-8, report the effects of the length of the subcontracting relationship with the firm's supplier on net days payable and on days payable outstanding. The length of the subcontracting relationship with a supplier is a variable that equals 1 if the firm has a long-term subcontracting relationship with a supplier in the supply chain, and 0 otherwise. All the columns in Panels B and C report the OLS estimates from regressions that include firm-level controls, industry and area fixed effects. See Table 1 and Section 5 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 6. Supply chain participation, credit access, and working capital stress

	<i>Panel (A) Supply chain or not</i>				<i>Panel (B) Upstream/Midstream or not</i>			
	Very high working capital stress		Very high or high working capital stress		Very high working capital stress		Very high or high working capital stress	
	probit	bivariate probit	probit	bivariate probit	probit	bivariate probit	probit	bivariate probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit rationing	0.049*** (0.018)	0.188** (0.079)	0.050*** (0.018)	0.188** (0.081)	0.047*** (0.015)	0.055 (0.059)	0.047*** (0.015)	0.056 (0.059)
Working capital stress	0.029 (0.053)	0.010 (0.019)	0.067 (0.044)	0.023 (0.018)	0.072 (0.050)	0.025 (0.018)	0.065* (0.037)	0.022 (0.014)
Rationing*working capital stress	-0.052 (0.076)	-0.016 (0.023)	-0.074 (0.053)	-0.022 (0.018)	-0.110** (0.047)	-0.036* (0.020)	-0.080** (0.036)	-0.026* (0.014)
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Industry & Area dummies	Y	Y	Y	Y	Y	Y	Y	Y
Instruments								
Share UniCredit Group		-0.503** (0.199)		-0.503** (0.200)		-0.416* (0.250)		-0.415* (0.251)
UniCredit – Capitalia		-0.474*** (0.150)		-0.475*** (0.150)		-0.436*** (0.150)		-0.436*** (0.150)
Overid test (p-value)		0.629		0.782		0.165		0.215
Observations	4,176	4,176	4,176	4,176	4,176	4,176	4,176	4,176

Note: This table examines the link between working capital stress and participation in supply chains. In columns 1-4 the dependent variable is a dummy that equals one if the firm participates in a supply chain, and zero otherwise. In columns 5-8 the dependent variable is a dummy that equals one if the firm is upstream or midstream in a supply chain, and zero if the firm is downstream or not part of a supply chain. "Working capital stress" in columns 1-2 and 5-6 is defined as a dummy that equals one if the firm has increased liquidity needs and views working capital as the most important factor; and in columns 3-4 and 7-8 it is defined as a dummy that equals one if the firm has increased liquidity needs and views working capital as the most or second most important factor. All the columns report the marginal effects, and all the regressions include firm controls, industry and area fixed effects. In columns 2,4, 6 and 8, the measure for access to credit (credit rationing) is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). The coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 7. Signalling to the main bank and supply chain participation

	Panel (A)						Panel (B)				
	Supply Chain * Low Signalling Probability						Upstream/Midstream		Upstream/Midstream * High Signalling Probability		
	bivariate		probit	IV		probit	probit	bivariate		bivariate	
	probit	probit		probit	probit			probit	probit	probit	probit
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		
Credit rationing	0.032*** (0.012)	0.076*** (0.022)					0.047*** (0.015)	0.055 (0.059)	0.026*** (0.010)	0.042*** (0.004)	
Number of banks			-0.003 (0.004)	0.231* (0.139)							
Relationship length					0.006 (0.008)	-0.422** (0.215)					
Working capital stress							0.072 (0.050)	0.025 (0.018)	0.045 (0.037)	0.004 (0.007)	
Rationing*working capital stress							-0.110** (0.047)	-0.036* (0.020)	-0.054** (0.022)	-0.003 (0.007)	
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Industry & Area dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Instruments											
Share UniCredit Group		-0.413* (0.218)		-1.381*** (0.356)		0.914*** (0.179)		-0.416* (0.250)		-0.393** (0.199)	
UniCredit – Capitalia		-0.482*** (0.170)		-0.724*** (0.260)		0.515*** (0.138)		-0.436*** (0.150)		-0.495*** (0.155)	
Overid test (p-value)		0.955		0.778		0.925		0.165		0.786	
Observations	4,176	4,176	4,239	4,239	4,163	4,163	4,176	4,176	4,176	4,176	

Note: This table reports tests for the effects of banks' characteristics on the link between access to credit and participation in supply chains. In Panel A, the dependent variable is a dummy variable that equals one if the firm participates in a supply chain and its main bank does not consider inter-firm collaborations to be important (i.e., Low Signalling Probability), and zero otherwise. In Panel B, columns 7-8, the dependent variable is a dummy variable that equals one if the firm participates in a supply chain in an upstream/midstream position, and zero otherwise (these results are carried over from columns 5-6 of Table 6). In Panel B, columns 9-10, the dependent variable is a dummy variable that equals one if the firm participates in a supply chain in an upstream/midstream position and its main bank considers inter-firm collaborations to be important (i.e., High Signalling Probability), and zero otherwise. All the columns report the marginal effects, and all the regressions include firm-level controls and industry and area fixed effects. In columns 2, 4, 6, 8, and 10, the measure for access to credit is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). In columns 2, 8, and 10 the coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. In columns 4 and 6, the coefficients on the instruments are from the first stage regression of the number of banks and relationship length, respectively, on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 8. The effect of credit rationing on domestic and international supply chain participation

	Multinomial Logit		IV Multinomial Logit		Multinomial Logit		IV Multinomial Logit	
	<i>Domestic supply chains</i>	<i>Int'l supply chains</i>	<i>Domestic supply chains</i>	<i>Int'l supply chains</i>	<i>Supply chains in Western Europe</i>	<i>Supply chains in Rest of the World</i>	<i>Supply chains in Western Europe</i>	<i>Supply chains in Rest of the World</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit rationing	0.010 (0.016)	0.041*** (0.010)	0.010 (0.013)	0.040*** (0.007)	0.021** (0.009)	0.012 (0.012)	0.020** (0.009)	0.012 (0.011)
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Industry & Area dummies	Y	Y	Y	Y	Y	Y	Y	Y
Instruments								
Share UniCredit Group				-0.369* (0.206)				-0.146 (0.327)
UniCredit – Capitalia				-0.437*** (0.153)				-0.601** (0.274)
Observations	4,176		4,176		2,223		2,223	

Note: This table reports the effects of firms' access to credit on their participation in domestic and international supply chains. All regressions are estimated by multinomial logit. "Domestic supply chains" is a dummy that equals one if the firm participates in a supply chain and has only domestic customers or suppliers, and zero otherwise; "foreign supply chains" is a dummy that equals one if the firm participates in a supply chain and has foreign customers or suppliers, and zero otherwise. "Supply chains in Western Europe" is a dummy that equals one if the firm participates in a supply chain and has customers or suppliers in Western Europe, and zero otherwise; "supply chains in rest of the world" is a dummy that equals one if the firm participates in a supply chain and has customers or suppliers in the rest of the world, and zero otherwise. Access to credit is measured by a binary variable for credit rationing. In columns 1-2, and 3-4, firms decide whether to participate in a domestic supply chain, or in an international supply chain, or to produce in-house all the components of a good or service (the baseline choice). In columns 5-6, and 7-8, firms decide whether to participate in a supply chain with trading partners in Western Europe, or in a supply chain with trading partners in the Rest of the World, or to produce in-house all the components of a good or service (the baseline choice). All the columns report the marginal effects, and all regressions include firm-level controls, industry and area fixed effects. In columns 3-4 and 7-8, credit rationing is instrumented using the share of provincial bank branches of the merged banks (Share UniCredit Group) and the difference between the shares of provincial bank branches of the two banking groups involved in the merger (UniCredit – Capitalia). The coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Online Supplementary Appendix (not for publication)

This online Supplementary Appendix contains:

- i) additional details on the survey questions;
- ii) two supplementary figures (Supplementary Figures S1-S2);
- iii) three supplementary tables (Supplementary Tables S1-S3).

Additional Details on Survey Questions

Below, we report the survey questions for firms' access to bank credit; supply chain participation and position; characteristics of trading partners and relationships; as well as other selected questions for variables used in the analysis.

Access to bank credit (credit rationing; length of main credit relationship; number of banks)

Q. During 2010 would the firm have desired to obtain more bank credit at the interest rate charged by banks?

Yes

No

Does not know, does not answer

Q. For how many years have you had a relationship with your main bank?

Q. With how many banks do you have credit relationships?

Supply chain participation, position; trading partners and relationships

Q. Your firm:

Uses raw materials and produces intermediate products

Uses raw materials and produces in-house final products

Uses semi-finished products purchased from suppliers and produces intermediate products

Uses semi-finished products purchased from suppliers and produces final products

Does not know, does not answer

Answers 1, 3, 4, imply participation in a supply chain, respectively, in an upstream position, in the middle, and downstream.

Q. In the last three years has the firm introduced the following organizational innovations?

.....

Innovations aimed at modifying the relationships with other firms (outsourcing, subcontracting agreements, other production partnerships) Yes No

.....

Q. What is the size of your main supplier?

It's a small firm

It's a medium-sized firm (up to 50 employees)

It's a big firm

Does not know, does not answer

Q. What is the size of your main customer?

It's a small firm

It's a medium-sized firm (up to 50 employees)

It's a big firm

Does not know, does not answer

Q. The relationship with your main supplier. . .
Is a long-term and established relationship
Is relatively frequent but only recent
Is occasional, our supplier changes often

Q. The relationship with your main customer. . .
Is a long-term and established relationship
Is relatively frequent but only recent
Is occasional, our customer changes often

Q. What is the main partner with which the firm has established cooperation agreements in the activity of (product or process) innovation?

.....

Customer or supplier firms

.....

Q. Indicate whether in the activity of (product or process) innovation, customer or supplier firms been an important source of information.

Other selected questions

Working capital needs

Q. In the last year what has been the evolution of your credit and financing needs?
Large or moderate contraction
No substantial change
Large or moderate increase
Does not know, does not answer

Q. Which have been the most important factors in determining the change in your credit and financing needs? (indicate the most and the second most important factor, if answered large or moderate increase in the above question)

.....

Changes in needs for working capital and inventories

.....

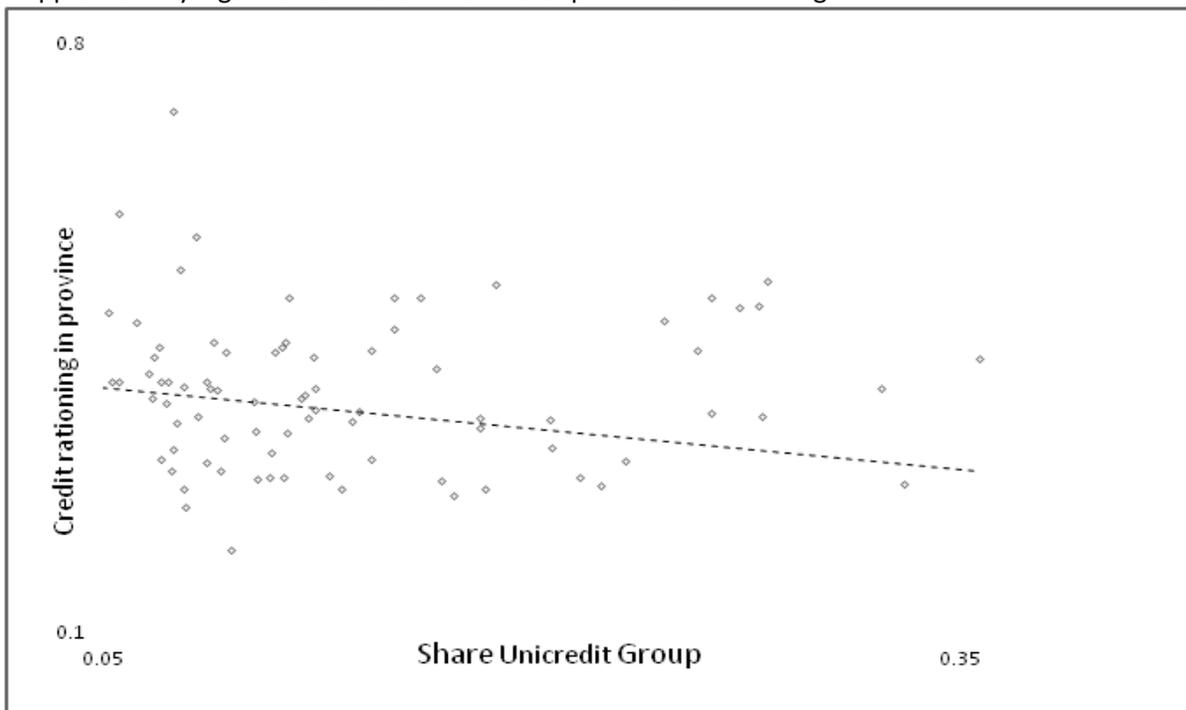
The indicator for very high or high working capital stress equals one if the firm declares it experienced a large or moderate increase in credit needs and then declares that “changes in needs for working capital and inventories” were the most or second most important factor in this change. The indicator for very high working capital stress equals one if the firm declares it experienced a large or moderate increase in credit needs and then declares that “changes in needs for working capital and inventories” were the most important factor in this change.

Bank's attention to inter-firm collaborations (reverse signaling effects)

Q. Does the bank attribute relevance to your participation in productive collaborations with other businesses? Yes No

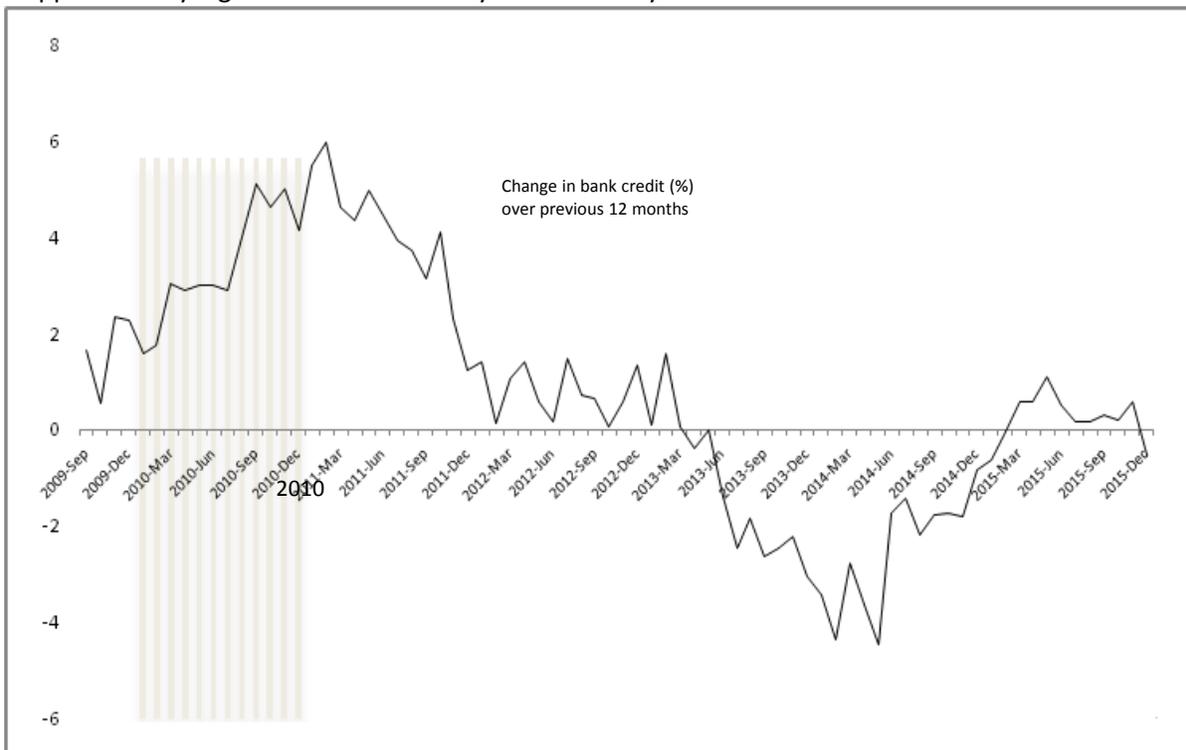
Supplementary Figures for "Financial Constraints, Firms' Supply Chains and Internationalization" (Not for Publication)

Supplementary Figure S1. Share Unicredit Group and credit rationing



Note: This figure plots the share of credit rationed firms in Italian provinces against the provincial share of branches of Unicredit Group.

Supplementary Figure S2. Bank credit dynamics in Italy



Note: This figure plots the percentage change in bank credit extended to domestic residents in Italy (relative to the previous 12 months) between September 2009 and December 2015.

Supplementary Table S1. Additional diagnostic tests (Not for Publication)

	Baseline regressions of Table 2 (preferred instruments)			Regressions of Table 3b with alternative sets of instruments					
	bivariate probit	IV probit	IV probit	bivariate probit	IV probit	IV probit	bivariate probit	IV probit	IV probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Credit rationing	0.187** (0.079)			0.146 (0.234)			0.213*** (0.026)		
Number of banks		0.135*** (0.048)			0.125*** (0.046)			0.073 (0.065)	
Relationship length			-0.239*** (0.081)			-0.233*** (0.079)			-0.174*** (0.049)
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry & area dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Instruments									
Share UniCredit Group	-0.504** (0.199)	-1.367*** (0.378)	0.913*** (0.189)	-0.442** (0.199)	-1.356*** (0.422)	0.882*** (0.240)	-0.338** (0.160)	-1.202 (1.033)	1.830*** (0.592)
UniCredit – Capitalia	-0.474*** (0.150)	-0.743*** (0.243)	0.517*** (0.151)				-0.065*** (0.025)	-0.679** (0.319)	0.499*** (0.148)
Lending technology							-0.048** (0.023)	0.291 (0.194)	0.104 (0.104)
Share UniCredit*lending technology							0.287* (0.168)	-0.204 (1.134)	-0.994* (0.521)
Overid test (p-value)	0.511	0.744	0.878				0.232	0.004	0.078
Joint significance of instruments	9.600	8.608	22.392	2.360	10.279	13.463	12.543	5.970	13.432
Observations	4,176	4,239	4,163	4,176	4,239	4,163	4,176	4,239	4,163

Note: Columns 1-3 of this table report the baseline results of columns 2,4, and 6 of Table 2 augmented with tests of joint significance of the instruments (F test from linear model in columns 2-3; Chi-squared test for a first-stage probit in column 1). Columns 4-9 of this table report the results of Table 3b for alternative sets of instruments augmented with tests of joint significance of the instruments (F test from linear model in columns 5-6 and 8-9; Chi-squared test for a first-stage probit in columns 4 and 7). See Table 1 and Section 5 for details on the control variables. The table also reports p-values for overidentification tests. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Supplementary Table S2. Supply chain participation and credit access; placebo tests (Not for Publication)

	bivariate probit (1)	bivariate probit (2)	IV probit (3)	IV probit (4)	IV probit (5)	IV probit (6)
Credit rationing	0.726 (1.426)	-0.189 (0.989)				
Number of banks			-0.169 (0.190)	-0.142 (0.251)		
Relationship length					-0.252 (0.306)	-0.173 (0.395)
Firm controls	Y	Y	Y	Y	Y	Y
Industry & area dummies	Y	Y	Y	Y	Y	Y
Instruments						
Share Intesa SanPaolo	0.102 (0.103)		-0.328 (0.465)		-0.334 (0.316)	
Share Monte dei Paschi		-0.243 (0.251)		-0.606 (1.030)		-0.492 (0.449)
Observations	4,176	4,174	4,239	4,237	4,163	4,161

Note: This table reports placebo tests. Access to credit is measured by a binary variable for credit rationing (columns 1-2), number of banks (columns 3-4), or length of the relationship with the main bank (columns 5-6). All the columns report the marginal effects and all the regressions include area and industry fixed effects. The columns report results of placebo tests using the share of provincial bank branches of two banks not involved in the merger (Share Intesa SanPaolo and Share Monte dei Paschi). See Table 1 and Section 5 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Supplementary Table S3. Instrumenting working capital stress (Not for Publication)

	<i>Supply chain</i>		<i>Upstream/Midstream</i>	
	No IV for Working capital	IV for Working capital	No IV for Working capital	IV for Working capital
	bivariate probit	bivariate probit	bivariate probit	bivariate probit
	(1)	(2)	(3)	(4)
Credit rationing	0.188** (0.079)	0.199*** (0.073)	0.055 (0.059)	0.062 (0.050)
Working capital stress	0.010 (0.019)	0.201 (0.210)	0.025 (0.018)	0.123 (0.188)
Credit rationing*working capital stress	-0.016 (0.023)	-0.009 (0.014)	-0.036* (0.020)	-0.023* (0.015)
Firm controls	Y	Y	Y	Y
Industry & Area dummies	Y	Y	Y	Y
Baseline instruments				
Share UniCredit Group	-0.503** (0.199)	-0.529*** (0.196)	-0.416* (0.250)	-0.415* (0.242)
UniCredit – Capitalia	-0.474*** (0.150)	-0.413*** (0.149)	-0.436*** (0.150)	-0.410*** (0.156)
Observations	4,176	4,023	4,176	4,023

Note: This table reports results for the effect of working capital stress on supply chain participation after instrumenting the measure of working capital stress. In the first stage of columns 2 and 4, working capital is instrumented using a binary indicator that equals one if in an average year the firm has a higher than median reliance on internal cash for activities such as working capital management. Columns 1 and 3 carry over the results of columns 2 and 6 of Table 6. In columns 1-2 the dependent variable is a dummy that equals one if the firm participates in a supply chain, and zero otherwise. In columns 3-4 the dependent variable is a dummy that equals one if the firm is upstream or midstream in a supply chain, and zero if the firm is downstream or not part of a supply chain. "Working capital stress" is defined as a dummy that equals one if the firm has increased liquidity needs and views working capital as the most important factor. All the columns report the marginal effects, and all the regressions include firm controls, industry and area fixed effects. In all columns, the measure for access to credit (credit rationing) is instrumented using the share of provincial bank branches of the merged banks and the difference between the shares of provincial bank branches of the two banking groups involved in the merger. The coefficients on the instruments are from the probit equation of credit rationing on the instruments, firm controls, and industry and area dummies. See Table 1 and Section 5 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the province level. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.