Out of sight, out of mind?
Global chains, export, and credit allocation in bad times

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Abstract

We investigate the allocation of credit between globally active and domestically oriented firms during a financial crisis. Using data on 15,000 businesses from seven European countries, we find that firms with a stable involvement in global value chains were 25% less likely to be rationed by banks during the 2009 financial crisis. This contrasts with the increase in the likelihood of credit rationing suffered by the average exporting firm. Matching the firm-level information with data on banks' branch and subsidiary networks in the countries, we obtain that banks insulated global chain participants from the credit crunch, not only accounting for the beneficial effects of global chain participation, but also to minimize negative spillovers on their own foreign activities.

Keywords: Banks; global value chains; firm export; financial crises.
JEL codes: F10; G20; D22.

1 Introduction

The link between finance and firms' internationalization has attracted growing interest in recent years. To internationalize their activities (e.g., export abroad and participate in global value chains), firms must invest resources to identify foreign partners, set up distribution networks, and tailor products to match foreign regulations (Baldwin and Krugman, 1989; Dixit, 1989). Most of these expenses have to be sustained up front so that firms need enough liquidity at hand and must often resort to external financing (Manova, 2013). Because of this reliance on external finance, one would be tempted to conclude that international activities

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are disproportionately exposed to credit crises. And yet, the effects of aggregate credit contractions on internationally active firms are far from being clear-cut. Levchenko et al. (2010), for example, examine the decline in U.S. international trade during the Great Financial Crisis and conclude that the decline was far larger than in previous downturns not caused by financial disruptions. By contrast, Alessandria et al. (2010) highlight that, while sizeable, the decline in trade was not unusual relative to the large drop in production. Figure 1 displays the patterns of credit aggregates, trade flows (total export and import content of export) and GDP during the Great Financial Crisis for seven major European countries (Austria, France, Germany, Hungary, Italy, Spain, and the United Kingdom). The figure clearly shows the significant drop of credit occurred in all the countries during the crisis. It also shows substantial cross-country differences in the decline of trade flows relative to that of the GDP. In France and Germany, trade flows dropped significantly more than the GDP, while the opposite can be observed for the United Kingdom and Hungary. Finally, there are also sizeable cross-country differences between the pattern of export and that of the import content of export: in the United Kingdom, for instance, the import content of export decreased less than total export while the opposite occurred in Spain.

This paper revisits the nexus between finance and firms' internationalization, possibly shedding new light on this unsettled debate. While the reliance of firms' international activities on external funding is well established, a fundamental aspect that the literature appears to neglect is that the main providers of credit, banks, are concentrated financial institutions which routinely make sophisticated lending decisions. For example, there is evidence that in bad times banks do not contract credit uniformly across the board but finely choose how to allocate their scarce liquidity across sectors, regions and segments of firms, possibly insulating some of their clients from the credit contraction at the expense of other customers (Giannetti and Laeven, 2012; De Haas and Van Horen, 2013; De Jonghe et al., 2020; Asea and Blomberg, 1998).

These observations lead to fundamental questions. How does firms' global status affect banks' credit allocation decisions during a credit crunch? Do banks treat internationally active

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clients differently from domestic-oriented ones? And does the mode of firms' internationalization, such as their participation in global value chains (GVCs), matter for bank lending decisions? Answering these questions can yield new insights into the dynamics of credit crises and help policy makers design interventions, possibly tailored to firms' international status.

To address these questions, we combine information from five databases: the EU-EFIGE Bruegel- UniCredit survey, the BvD-Amadeus database, the BvD-Orbis data set, Moody's Analytics BankFocus, and the BIS Consolidated Banking Statistics. Our main source of information consists of the EFIGE survey which targeted almost 15,000 manufacturing firms in seven European countries (Austria, France, Germany, Hungary, Italy, Spain, and the United Kingdom) at the peak of the Great Financial Crisis (2009). The EFIGE database provides rich information on firms' access to credit, as measured by a precise indicator of bank credit rationing. It also gives details on firms' modes of internationalization, including firms' export activities and whether a business participates in a global value chain, purchasing and/or selling intermediate products to other firms abroad. We complement the EFIGE data with balance-sheet information from the BvD-Amadeus database, the most comprehensive source of financial information for European firms. We further hand-match the EFIGE firm data with BankFocus data on the banks with which firms do business, particularly banks' international presence.[1]

Endogeneity issues plague any analysis of the linkages between credit and firms' internationalization. Credit rationing could affect internationalization decisions and, at the same time, firms' international status could influence banks' credit allocation and, hence, rationing (reverse causality). Moreover, unobservable firm characteristics could jointly determine credit provision and internationalization. Building on an established body of studies on the drivers of firms' supply chain participation and internationalization, we address these endogeneity issues by exploiting detailed information on firms' access to information technology. As shown, e.g., by Brynjofsson and Hitt (2000), firms with easier access to information technology infrastructures are facilitated in their ability to connect with other businesses and, hence, participate in supply chains. Moreover, Freund and Weinhold (2002) show that firms' ability to establish

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[1]To identify the lending banks of the sample firms, we exploit the Orbis database.

international trade linkages is strongly affected by their access to information technology. Our data provide details on whether firms have access to broadband connections and the purposes for which they view such connections as essential (namely, for e-commerce activity or for the management of purchases/sales firm networks). We can further interact this information with regional measures of the quality of local IT infrastructures (broadband access; Eurostat data). There is ample evidence that the quality of IT infrastructures differs greatly across European regions and this significantly affects firms' ability to establish supply chain links and international trade connections.

Our results reveal striking effects of firms' internationalization status on the probability that firms are credit rationed by banks during the 2009 credit crunch. We find that firms engaging in any type of export activities were more likely to suffer from bank credit rationing. This result aligns with the view that in bad times banks are inclined to retrench credit from risky activities. Export, in fact, entails operations in foreign markets and, hence, is exposed to significant volatility in sales and profits. However, we find that when the internationalization of a firm took the form of participation in a global supply chain, the firm was less likely to suffer from bank credit rationing. That is, banks ration credit less to firms that were involved in global supply chains than to those that were not. The magnitude of the effects is sizable. In 2009, the participation of a firm in a global supply chain reduced the probability that the firm suffered from credit rationing by 2.2 percentage points, which amounts to about 25% of the average probability of rationing in the sample.[2]

To dissect the scenarios in which the above effects are more pronounced, we then exploit a variety of characteristics of the firms and of their internationalization. The negative effect of global supply chain participation on bank credit rationing is more significant, statistically and economically, for firms with a more stable supply chain participation and for supply chains with a European span than for those that include far-away countries.[3] These results suggest that the effect of supply chain participation on rationing manifests itself when the

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[2]On the other hand, for an exporter of any type the probability of bank credit rationing rose by 1.7 percentage points, approximately 20% of the average probability of rationing in the sample.

[3]The findings do not appear to be driven by firms' position in supply chains, although we find some evidence that downstream firms are better protected from credit rationing.

participation is perceived to be more long-term and less uncertain by banks. The effect also appears to be stronger for businesses that are traditionally perceived to be vulnerable to bank credit constraints, such as relatively younger firms, and businesses that inherently rely more on external financing.

We surmise that our findings could reflect two complementary mechanisms. Banks could protect global supply chain participants because they attribute value to this participation, even accounting for a broad set of firm characteristics, including their productivity ("signal-extraction" mechanism). Supply chain participants could be more promising businesses with more stable prospects and more diversified markets. In the words of a major Italian banker, from banks' point of view "the weaknesses of small enterprises are attenuated in supply chains, thanks to the strengthening of their knowledge and of their professional, managerial, and organizational competencies" (Rotondi, 2013, p.VI). Anecdotal evidence suggests that banks attribute importance to supply chain participation in their lending decisions. For example, in a survey carried out by a major European banking group (UniCredit, 2012), no less than one third of the surveyed firms argue that their banks view supply chain participation as a pivotal dimension when making lending decisions. A second interpretation of our findings instead relates to the nature of banks as large institutions with a broad scope of operations. Banks could protect supply chain participants because they internalize the negative consequences that the denial of credit to their internationally active clients might have on other foreign entities with which the banks do business ("spillover" mechanism). For instance, consider a large German corporation operating in a global supply chain with Polish partners and suppose that its German lending bank has a broad network which also involves operations in Poland. If the bank anticipates that, if denied credit, its German customer could terminate its business with the Polish counterparts, the bank could fear negative repercussions on its own activities in Poland. It could then be reluctant to deny credit to the client and choose instead to penalize other borrowers with no international ramifications. Again in the words of an Italian banker, the expansion of global value chains "pushes to modify the bank lending activity towards a model that we could define as a value-chain bank (...), that is a bank with

interest and concerns in the firms connected along the supply chain" (Rotondi, 2013, p. VII).

We find that both mechanisms may play a role in our findings. Regarding the first channel, the effect of global supply chain participation on bank credit rationing is more pronaunced when firms engage in productivity-enhancing activities within the supply chain, such as projects aimed at expanding firms' distribution network and brand recognition abroad. Banks could view these activities as signals that the supply chain participation is value-enhancing for their client and thus be reluctant to penalize it. Regarding the second channel, we uncover that the effect of supply chain participation is more evident for banks with an international scope, as captured by a broad international branch network. We next merge our data with information from the Orbis database to construct proxies for banks' engagement in the geographical areas where client firms entertain supply chain linkages. Specifically, we hand-match data on the number of subsidiaries per country of each lending bank with information on the location of firms' supply chain partners. We find evidence that the effect of supply chain participation on bank rationing is stronger when banks conduct business (that is, have more subsidiaries) in the countries in which firms have chain links.[4]

The paper speaks to two strands of literature. The first investigates the implications of credit for international activities. We relate to the studies that use firm-level data to investigate these implications (Manova, 2013; Minetti and Zhu, 2011; Paravisini et al., 2015), but in our setting we reverse the research question. In fact, we are interested in the influence of firms' internationalization status and modes on bank credit decisions rather than the opposite effect. In this sense, our paper is close in spirit to Do and Levchenko (2007), who analyze the effect of international trade on a country's level of financial development in an aggregate perspective and show that financial development is affected by the external finance needs of exported goods.[5] The second related literature investigates the allocation of credit, especially during crises. As noted, there is growing evidence that banks make sophisticated decisions about credit extension (Giannetti and Saidi, 2019; De Jonghe et al., 2020). However, we still

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[4]In the paper, we also conduct tests to verify that this finding is not primarily driven by the knowledge of globally active banks about exported products.

[5]The paper also broadly relates to a growing literature on the higher or lower resilience of internationally active firms (e.g. multinationals) to financial crises (Manova et al., 2015).

have limited evidence about how firms' internationalization influences credit allocation. Our results suggest that banks engage in a careful credit allocation choice protecting firms that internationalize their activities through global chain participation. We will discuss the links to prior literature in greater detail when framing our hypotheses.

The remainder of the paper is organized as follows. Section 2 lays out testable hypotheses. Section 3 describes the data and the econometric approach. Section 4 discusses the main empirical results. In Section 5, we turn to dissect the mechanisms underlying our main findings. In Section 6, we draw some quantitative implications of our results for firms' foreign and domestic sales. To this end, we develop a simple background theoretical model. Section 7 concludes. Details on the data and additional results are in the online Appendix.

2 Testable hypotheses

Foreign activities are typically perceived by financiers as uncertain and risky (Manova, 2013). First, information on foreign markets is hard to obtain for creditors. Second, the enforceability of contracts in international transactions is limited: purchases and sales are made in foreign countries with different laws and regulations. Third, exporters and importers need substantial working capital because of the time lags associated with international transactions, thus increasing refinancing risk (Amiti and Weinstein, 2011). Due to the larger information asymmetries and risk associated with international activities, firms involved in global value chains and/or in exporting could be more likely to be credit rationed than their domestically oriented counterparts, especially during periods of credit crunch.

Yet, concentrated creditors, such as banks, make sophisticated decisions about the allocation of their credit capacity and could account for firms' participation in global value chains. Firms' internationalization has long been recognized as an important venue for firms to grow. Firms exporting their products and services are found to have better opportunities to enhance their productivity and efficiency than firms operating only on the domestic market (Bernard et al., 2007; Wagner, 2007; Blaum et al., 2018). Firms may decide to participate in international markets by joining a global value chain (Bernard et al., 2018b; 2019; Antrás and Chor,

2021).

Interviewing a large sample of Italian banks in the Veneto region, Degasperi et al. (2007) obtain that for about three quarters of the interviewed banks, the extension of credit to firms is conditioned on obtaining information about the supply chain participation of the firm and about its commercial partners, in particular. Further, the banks declare that firms' participation in supply chain networks is especially relevant for credit decisions in periods of crisis. And in a survey of loan officers in the Italian province of Vicenza, Bosi and Degasperi (2007) report that for roughly 63% of the loan officers the participation of customer firms in supply chain network is relevant for the loan extension decision. Further anecdotal evidence on this practice comes from the aforementioned survey conducted in 2010 by the major banking group UniCredit, which explicitly asked firms whether their bank attributes importance to firms' collaborations with other firms within networks. Approximately one third of the surveyed firms answered affirmatively to this question. Consistent with this, UniCredit has introduced a "supply chain rating" to better measure the growth potential of borrowers involved in global value chains (UniCredit, 2012).

The above evidence suggests that banks positively value the firm's network and could choose to partially insulate firms participating in global value chains in periods of tight credit. In other words, the participation in a global value chain can represent a good signal, as firms involved in this kind of network have higher chances to survive and grow (Biais and Gollier, 1997; McMillan and Woodruff 1999).

Hypothesis 1 (Banks value the firm's network). Although firms' internationalization activities are characterized by larger information asymmetries and risk, that get exacerbated during periods of credit crunch, banks may positively value firms' participation in global value chains and contract credit less to global value chain participants.

A second reason for which banks could insulate global chain participants from credit contractions, could be that banks internalize the negative spillovers associated with the denial of credit to internationalized firms. Banks with large exposures in foreign countries may be less likely to cut credit to firms operating in foreign markets (Favara and Giannetti, 2017). This

may be even more true when banks have customers positioned at different stages of the same global value chain and these customers account for non-trivial amount of activity within the chain. In this case, lenders could anticipate that, by maintaining liquidity provision to such customers, they will contain the effects of costly defaults on outstanding loans, preserving their own foreign business (Giannetti and Saidi, 2019). In 2010, major European banking groups held a significant share of their total assets abroad (Duijm and Schoenmaker, 2021): 87% for Standard Chartered, which is particularly exposed to the Asia-Pacific region (18% in Hong Kong, 7% in India, 11% in Korea, and 14% in Singapore); 86% for Raiffeisen Zentralbank Osterreich, whose main foreign assets are concentrated in developing European countries; 74% for BNP Paribas and 59% for UniCredit, which are mainly exposed to Central Europe; 69% for Banco Santander, that has a significant exposure in Latin America (15% in Brazil and 5% in Mexico); 60% for Deutsche Bank, whose foreign assets are mainly concentrated in Central Europe and the United States (22%).

Hypothesis 2 (Banks internalize the global spillovers of credit decisions). Banks with a high exposure in a foreign country may extend more credit to borrowers involved in GVCs operating in that country to preserve their own business in the country.

After presenting the main findings, we will further elaborate on these channels when analyzing the mechanisms (Section 5).

3 Data and empirical strategy

3.1 Data sources

To perform our empirical investigation, we draw information from five main sources: the EU-EFIGE Bruegel- UniCredit survey, the BvD-Amadeus database, the Bureau van Dijk Orbis data set, Moody's Analytics BankFocus, and the BIS Cross Border Banking Statistics. The EFIGE survey, coordinated by the Bruegel Institute and supported by the Directorate General Research of the European Commission, collects information on a representative sample of manufacturing firms with more than 10 employees in seven European countries (Austria,

France, Germany, Hungary, Italy, Spain, and the United Kingdom). The survey was conducted in early 2010 and spans the 2007-2009 period.[6] To ensure statistical representativeness, the data set was designed to fulfill two main criteria. First, the availability of an adequately large target sample of firms: 3,000 firms for each large country (France, Germany, Italy, Spain, and the United Kingdom) and 500 firms for each small country (Austria and Hungary), for a total of almost 15,000 firms. Second, the sample was stratified to ensure representativeness of the collected data for every country, especially focusing on the composition by sectors, regions and size classes. The survey questionnaire comprises the following broad areas: firm ownership and governance; workforce; exports, imports, and internationalization; financial conditions and bank-firm relationships; market structure and competition. Importantly, the survey also includes specific questions on firms' behavior during the crisis. To all the surveyed firms, we attach balance-sheet information for the years 2007-2009 provided by the BvD-Amadeus database, the most comprehensive and widely used source of financial information for public and private firms in Europe.

We complement the two firm-level databases with data from the BIS Cross Border Banking Statistics and, especially, detailed information from the BankFocus database on the lending banks of the firms in our sample. To hand-match the EFIGE data we recover the names of the firms' lending banks by exploiting the Orbis database.

Appendix Table A1 describes the variables employed in the empirical analysis. Table 1 displays summary statistics. At the mean, the surveyed firms have been in business for 34 years. More than 60% of them have fewer than 50 employees, while about 4% have more than 500 employees. The average (median) size of the firms, 72 (26) employees, suggests that the firms are small and medium-sized. 70% of the businesses are family owned and 22% are part of a group. The majority of firms (almost 80%) are located in Germany, France, Italy and Spain, while 14% are located in the United Kingdom, 3.3% in Hungary and 3% in Austria.

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[6]The data collection was carried out by a professional contractor (GFK, the fourth largest market research company in the world).

3.2 Measurement

3.2.1 Bank credit rationing

The large majority of the firms in our sample rely heavily on bank credit for external financing: for more than 50%, financial debt consists only of bank debt, and on average only 18% of financial debt consists of corporate bonds and other forms of non-bank debt. The EFIGE survey allows us to construct a precise measure of supply (bank) driven credit constraints, through the direct measurement of the bank credit rationing status of the surveyed firms. In particular, the survey asks: *During the last year (2009), did the firm apply for more credit? (i) yes, applied for it and it was successful; (ii) yes, applied for it and was not successful; (iii) no, did not apply for it.* Following a broad body of studies (e.g., Angelini and Generale, 2008; Minetti and Zhu, 2011; Jappelli, 1999; Ferri et al., 2019), our measure of bank credit rationing (*Rationing*) is a dummy variable taking the value of one if the firm responded (ii) to this question, that is, if it applied for more credit without success.[7] In subsequent tests, we will complement our analysis on credit rationing by exploiting less precise indicators of credit access constructed from balance sheet data. While significantly diluting the precision in the measurement of liquidity constraints, balance sheet data will allow us to capture time variation in firms' credit access.

As shown in Table 1, 8.7% of the surveyed firms were credit rationed during the crisis. Credit rationed firms are on average younger, more indebted, and have lower liquidity, profitability and productivity. Figure 2a draws the distribution of credit rationed firms across the regions, at the NUTS-2 level, of the seven European countries in our sample and reveals that rationed firms are not clustered in few regions.[8] The incidence of bank credit rationing ranges from 12.3% in Italy and 12.5% in Spain, to 3.8% in France and 6.3% in Germany. Although

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[7]Similar definitions of financially constrained firms have been also adopted by Angelini and Generale (2008), who employed the Survey on Italian Manufacturing Firms (SIMF), by Minetti et al. (2019), who relied on the UniCredit Survey on small and medium-sized enterprises, and by Jappelli (1990) and Duca and Rosenthal (1993), who employed the Survey on Consumer Finances.

[8]The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the European Union and the United Kingdom for the purpose of: the collection, development and harmonisation of European regional statistics; socio-economic analyses of the regions; framing of EU regional policies. In our sample, we have 103 regions.

Spanish and Italian firms are more likely to be rationed overall, we still find that some French and German regions have a relatively high share of credit rationed companies. Consistently across countries, a comparison of these figures with the analogous figures for non-crisis periods reveals an increase of the incidence of credit rationing during the crisis. For example, the average of credit rationing in Italy is higher than the average of the "strong credit rationing" measure (4.4%) observed by Minetti and Zhu (2011) for the Italian manufacturers covered by the Capitalia survey in 2000. For France, the average of credit rationing appears to be larger than that (1.3%) measured by Kremp and Sevestre (2013) for French manufacturers for the period 2004-2006.

The effects of the financial crisis on the credit sectors of our sample countries can also be inferred from Figure 1. In the figure, using World Bank data, we display the dynamics of credit growth in each country from 2008 to 2012. The figure clearly shows the significant drop of credit occurred in 2009: its average across countries was -2.7%. While the intensity of the credit crunch differed across countries, credit growth was depressed across the board (for example, equaling -4% in the United Kingdom, -3.9% in Germany, and -0.8% in Italy).

3.2.2 Global value chains and firm internationalization

At the beginning of the global financial crisis, the participation of European firms in global chains was relatively high compared with the world average and other economies, such as the United States and China (ECB, 2019). For the countries in our sample, in 2007, the import content of exports amounted to 25.49% on average, with the smallest countries, such as Hungary and Austria, sourcing a greater share of inputs from abroad (45.86% and 26.64%, respectively).

By relying on the information in the EFIGE survey, we define firms involved in a global value chain as firms that in 2008 imported intermediate goods and/or services and exported intermediate or final goods (Bernard et al., 2007; 2018a; Antrás and Chor, 2021). Our definition of global value chain participation is in line with the taxonomy used by World Bank (2016) and plausibly captures the most globalized businesses, that can simultaneously

deal with foreign firms on the buying and selling sides.[9] Our analysis may thus pick a "deep" form of globalization.

In our sample, 32.7% of firms participate in global value chains. These figures are in line with those found by Blaum et al. (2018) for French enterprises and Brancati et al. (2020) for Italian small and medium-sized enterprises.[10] Figure 2b reveals that the percentage of firms participating in global supply chains is particularly high in Austria (41.3%) and the United Kingdom (39.38%). The distribution of global chain participants by sector is in Figure 3. Pharmaceutical, chemical, and textiles are the industries most involved in global value chains while food products are those with the most domestic-oriented firms. Table 1 further suggests that firms participating in global value chains are on average larger and more productive, and more frequently belong to a business group. Pairwise correlations do not highlight differences in the incidence of credit rationing between global supply chains participants and non-participants.

In additional tests, we compare our findings for global chain participants with those for any exporting firm. In our sample, 58% of firms exported in 2008, with foreign sales accounting for 32% of their turnover on average. Figure 2c shows that the propensity to export is particularly high in Italy, Austria, and the United Kingdom, with a percentage of exporters as high as 69%, 63%, and 61.3%, respectively. These figures are in line with those of prior studies. For the United Kingdom, Greenaway and Kneller (2004) report that 66% of firms exported in 1995, while Greenaway et al. (2007) document that in a panel of 9,292 manufacturing firms observed over the period 1993-2003, almost 70% of the firms exported in at least one year. For Italy, the data from the Capitalia Survey on Italian Manufacturing Firms show that nearly 68.5% of Italian firms exported in 2000. Table 1 suggests that exporters are more likely to be credit rationed by banks than non-exporters.

Using World Bank aggregate data, Figure 1 shows a significant contraction of export and of the import content of export in each of the seven countries under study in the year 2009.

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[9]Observe that on the selling side (export) we cannot separate sales to firms and to final consumers. However, we will perform tests on this aspect later in the analysis.

[10]For example, Brancati et al. (2020) report an incidence of global value chain participation of 29%. In our sample, the percentage of Italian firms in global value chains is 32%.

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3.2.3 Control variables

To mitigate the risk that omitted variables drive both firms' internationalization and credit rationing, we control for a large set of possible confounding effects.

First, to account for the fact that young and small firms lack transparent information about their businesses and therefore are more likely to be credit restricted (Petersen and Rajan, 1994; Guiso and Minetti, 2010), we include firm size (*Size*, expressed as the logarithm of the number of employees) and age (*Age*, measured as the number of years from the firm inception). Second, as the firm's financial and economic position may significantly affect bank credit availability, we insert the firm's level of indebtedness (*Debt Ratio*, computed as total debt over total assets), profitability (*ROA*, return on assets), and productivity (*Labour Productivity*, computed as value added per employee). While a firm's indebtedness might increase its credit risk and the extent of financing constraints (Jensen and Meckling, 1976), a firm's profitability and productivity should be positively associated with the availability of bank credit. Another financial indicator we account for is the tangibility of the firm's assets (*Asset Tangibility*, defined as tangible fixed assets over total assets). This is plausibly a good proxy for the pledgeability of collateral guarantees by the borrowing firm, which we expect to reduce the probability of experiencing credit constraints (Almeida and Campello, 2007).[11] In robustness tests, we further include an overall measure of the perceived quality of a firm, as given by its ISO9000 certification status. In addition, we experiment with controlling for a proxy for the availability of investment opportunities to the firm, as captured by a dummy variable for whether the firms respond to face non-financial obstacles (e.g., scarce demand, lack of human capital, or tight regulatory standards).

We also account for the organizational and ownership structure of the firm. To account for the possibility that participation in business groups affects the probability of being rationed by banks, we control for the firm participation in a group (*Group*, a dummy variable equal to one if the firm belongs to a business group, and zero otherwise). Moreover, in line with the

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[11] As our dependent variables refer to 2009, all the balance-sheet indicators are computed as average values over the years 2007-2009. Estimation results are robust to the inclusion of balance-sheet information taken in 2007.

studies showing that family firms tend to be less credit rationed during a crisis (D'Aurizio et al., 2015), we include a measure of the firm's ownership structure (*Family Firm*, a dummy variable equal to one if the firm is family owned, and zero otherwise).

We finally saturate the empirical model with a comprehensive array of fixed effects: sector fixed effects according to the two-digit NACE classification and regional fixed effects (at the NUTS-2 level), based on the region where the firm is located. We also control for a measure of economic activity at the sector-region level, as given by the number of productive establishments in the sector-region in 2008. In robustness tests, we will drop the sector-region indicator of economic activity, and include sector × region fixed effects. At the cost of losing a subset of observations, in further tests we also experiment with including bank fixed effects and main destination country fixed effects.[12] [13]

3.3 Empirical model and instruments

The goal of this paper is to study whether firms' internationalization status affects bank credit rationing. The probability that firm i is credit rationed can be written as

$$P(Rationing_i = 1) = \Phi(\alpha_1 + INT_i\beta_1 + Z_i\gamma_1) \tag{1}$$

where $Rationing_i$ represents the binary bank credit rationing indicator described in section 3.2.1; INT_i denotes our measure of firms' internationalization status, as presented in section 3.2.2; and Z_i is a vector of covariates, listed in section 3.2.3, as well as detailed fixed effects at the region and industry levels.

The reader will be concerned that firms' decisions to participate in global value chains (or to export) are endogenous to their exposure to credit rationing. Although our specification controls for a rich set of factors that may affect credit rationing, including firm-level

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[12]For not all the firms we can recover the lending banks from Orbis and the information about the main destination countries.

[13]While our database is cross-sectional, and hence does not allow for the inclusion of firm fixed effects, it is worth recalling that the key internationalization variables of interest in our analysis, especially firms' participation in global value chains, are inherently very persistent variables. For example, Brancati et al. (2020) show for Italy that approximately 5% of firms switch from participating to not participating in supply chains across years.

characteristics as well as industry and region fixed effects, there could be concerns of reverse causality. Firms subject to more severe financing constraints may decide to participate in supply chains in order to obtain trade credit from their suppliers (Minetti et al., 2019). And, as documented by prior literature, firms' decision to export significantly depends on its access to credit (Manova, 2013). The information in the EFIGE survey partially helps us to deal with the reverse causality issue since we observe credit rationing in 2009, and import and export activities in 2008. Nonetheless, internationalization decisions may be both persistent and forward looking. Moreover, there can also be an issue of omitted variables that are correlated with firms' internationalization activities and also affect credit availability.

In light of these considerations, to address the endogeneity problems, throughout the analysis we rely on an instrumental variable approach (while reporting the non-instrumented estimates in the Appendix). In particular, we estimate a bivariate probit model that comprises equation (1) and the following probit equation for firms' internationalization status:

$$P(INT_i = 1) = \Phi(IV_i \delta_1 + Z_i \lambda_1) \tag{2}$$

where IV_i represents our set of instruments, and Z_i is a vector comprising all the exogenous covariates and controls for differences across regions and industries included in equation (1).[14]

To construct the instruments, we need exogenous factors that could affect firms' decisions to participate in a global value chain or to export. A growing literature has documented that firms' access to information technology is associated with a decrease in vertical integration and an increase in international trade. By using detailed data on 31 countries and 14 industries from 1995 to 1999, Freund and Weinhold (2002) find that internet development abroad facilitates service export to the United States. In a subsequent study, Freund and Weinhold (2004) confirm that internet stimulates international trade, by showing that a 10 percentage point increase in the growth of web hosts in a country leads to a 0.2 percentage point increase

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[14]Equations (1) and (2) constitute a recursive bivariate probit model. The effect of firms' internationalization on the probability of being credit restricted can be identified under the assumption that the set of instruments IV_i are excluded from equation (1). Although INT_i enters equation (1) as an endogenous variable, we can estimate equations (1) and (2) using a standard bivariate probit software (Greene, 2002).

in export growth. As internet reduces market-specific entry costs, suppliers can more easily gather information about new markets and advertise to numerous buyers at once. Regarding firms' participation in global value chains, Brynjofsson and Hitt (2000) document that access to IT is associated with a decrease in vertical integration because it lowers the costs of coordinating externally with buyers and suppliers. This result is supported by Fort (2017), who employs data on firms' decisions to contract for manufacturing services from domestic or foreign suppliers and documents that a firm's adoption of communication technology between 2002 and 2007 is associated with a 3.1 point increase in its probability of production fragmentation. In line with these studies, the critical role of access to IT in promoting firms' participation in global value chains and export is also confirmed by anecdotal evidence (see, e.g., AIP-Il Sole 24 ore, 2008, for a number of case studies referring to Italian firms).

Based on these studies, we construct our instruments for firms' export and global supply chain participation by considering firms' reliance on IT systems for conducting online purchasing and sales and for managing the purchasing and sales network, interacted with a regional indicator of broadband connection diffusion. The regional indicator (at the NUTS-2 level) of broadband access for the year 2008 is provided by the Eurostat database on households' broadband access, while the firm level IT variables are drawn from the EFIGE survey. The relevant survey questions ask whether the firm relies on a broadband connection and if so, whether it relies on it for: (i) internal information management; (ii) e-commerce (online purchasing/online sales); (iii) management of the sales/purchase network (suppliers' orders, customer service). Hence, in our baseline test, our firm-region varying instrument for the firm's participation in a global value chain is computed as the interaction between the firm's reliance on a broadband connection for the management of the sales/purchase network of suppliers and customers and the regional indicator of broadband access. Similarly, the firm-region varying instrument for firm export is computed as the interaction between the firm's reliance on a broadband connection for e-commerce and the regional indicator of broadband access. In further tests, we also experiment with using both instruments for each of the two internationalization variables.

For our instruments to be valid, they need to be correlated with our measures of firms' internationalization status, whereas they must not correlate with unobservable variables that could also explain firms' credit availability. We have no reason to be concerned about the fulfillment of the exclusion restrictions. We will nonetheless come back to this point later in the analysis (Sections 4.1-4.2).

4 Main results

This section presents the baseline findings and discusses preliminary insights on the underlying mechanisms (4.1). We then elaborate on the identification strategy (4.2), on measurement issues (4.3), and on the relevance of the effects (4.4). We further propose alternative tests to verify the robustness of our findings (4.5).

4.1 Baseline findings

Tables 2 and 3 report the baseline estimates for the impact of participation in a global value chain on bank credit rationing. We also compare the estimates with those for any exporter. As noted, we treat firms' internationalization status as endogenous and use as instruments the firm-level indicators of IT access detailed above. Since both credit rationing and firms' internationalization status (GVC participation or export) are binary variables, we estimate a bivariate probit model as detailed in equations (1) and (2).[15]

As shown in Table 2, column 1, we detect a negative and statistically significant effect of GVC participation on credit rationing.[16] The baseline estimate (marginal effect) for the variable *Global chain* participant is -0.023, implying that a firm involved in a GVC is 2.3 percentage points less likely to be credit rationed than a firm that does not participate in a global supply chain. This estimated impact is economically sizeable, amounting to about 25% of the average probability of credit rationing in the sample in the year 2009. As discussed in Section 2 when framing our hypotheses, we interpret this finding as suggesting that banks

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[15]In all the regressions, standard errors are heteroskedasticity robust, clustered at the region level.

[16]The non-instrumented probit estimates of Table 2 are reported in Table A2.

tend to protect firms in global value chains when curtailing credit in bad times. We will later perform tests on the mechanisms possibly motivating this attitude of banks.[17]

The instrument appears to be reassuringly strong. The bottom of column 1 reports the estimated coefficient on the instrument from the probit equation of GVC participation (to save space, the first-stage coefficients on firm controls and on region and industry dummies are not reported). We find that the higher the IT access of a firm, the higher the probability that the firm participates in global value chains. The Kleibergen-Paap Wald F-statistic from a linear first stage suggests that we do not face an issue of weak instrument (the value of the F-statistic is 10.85, above the conventional threshold for weak instruments indicated by Stock and Yogo, 2005).[18]

A relevant question is whether the estimated effect is confirmed when we restrict attention to stable global chain participants. Consistent with the observation that global supply chain participation is a stable characteristic of a firm, almost 90% of the global supply chain participants are regular participants. The findings in Table 2 column 2 suggest that participating in a global value chain significantly reduces the probability of experiencing credit rationing also when we focus on firms that were regularly involved in supply chains before 2008 (these businesses are 2 percentage points less likely to be credit restricted).

In column 3, we slightly alter our definition of global supply chain participants. As noted, given the nature of our data, we cannot precisely identify firms that export intermediate goods without being at the same time importers of intermediates. Since these businesses are part of global chains but end up being a portion (perhaps relatively small) of our control group, we suspect that, if anything, this could lead us to underestimate the effect of global supply chain participation. In column 3, we nonetheless conduct robustness tests by capturing such global chain participants using EFIGE survey information on subcontracting. In particular,

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[17]The estimated coefficients for the firm level controls are in line with expectations. More indebted firms turn out to be more likely to be rationed by banks. Conversely, more profitable businesses feature a lower probability of experiencing credit constraints. Somewhat more surprisingly, firm size appears to be positively associated with credit rationing.

[18]It is important to stress here that the literature on weak instruments is less developed with regard to diagnostics for nonlinear IV models (see, e.g., Mikusheva, 2013, for a survey). Thus, the often used cutoff values for the first-stage F-statistics are derived using a linear model. Moreover, the cutoff values for the Kleibergen-Paap Wald F-statistic are computed under the assumption that the error terms are homoskedastic (Stock and Yogo, 2005).

we redefine our global chain participant indicator by including also firms that do not import intermediates and declare to sell intermediate goods abroad through subcontracting. The results remain virtually unchanged.

Another possible concern about our measure of global supply chain participation is that a small subset of chain participants declare that they import intermediate goods and/or raw materials from abroad. In column 4, we attempt to exclude possible buyers of raw materials by dropping from our definition this small subset of firms. Thus, our definition should now include only importers of intermediate goods or services. The results obtained in column 1 carry through. Finally, in column 5, we perform the robustness tests in columns 3 and 4 jointly, by excluding possible buyers of raw materials and including non-importing sellers of intermediate goods through subcontracting. Again, the findings remain unaffected.

As we discuss below, the attenuating effect of GVC participation on the probability of being credit rationed contrasts with the opposite finding for the exporter status.

In Panels A-C in Table 3, we re-estimate the baseline regressions by inserting additional controls. In Panel A, we include a proxy for the level of economic activity in the region-sector, namely the number of productive establishments in 2008. The inclusion of this control can also help to assuage concerns that our instrument is picking up the level of the economic development in the region-sector. The results hold. In additional robustness check presented below, we will further verify that the results carry through when replacing the sector-region proxy for the economic activity with the more stringent sector-region fixed effects.

In Panel B, we insert an additional proxy for the quality of the firm, as given by the availability of an ISO9000 certification. This can help reduce the concern that our instrument is effectively capturing the degree of sophistication of the firm. The inclusion of this additional control leaves the results essentially unchanged. In Panel C, we also include an indicator for the availability of investment opportunities to the firms. The survey asks each firm whether they face obstacles to investments driven by scarcity of demand, lack of human capital, or tight regulatory constraints. While somewhat shrinking the sample size (due to the missing data for a subset of the firms), the inclusion of this control can reduce the concern that the

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availability of investment opportunities drives the propensity of a firm to be credit rationed and also correlates with the likelihood that the firm participates in a global chain. Again, the results are fully robust to the inclusion of this additional control.[19]

4.2 More on the identification strategy

4.2.1 Omitted variable issues

We run several robustness exercises to further address possible omitted variable issues. In column 1 of Table 4, to further control for region-sector explanatory factors, we experiment with including sector by region fixed effects, reaching conclusions very similar to the baseline.

Another concern with our identification strategy could be that firms that participate in global value chains tend to match with banks that have intrinsically lower propensity to ration credit, e.g. more efficient banks. To address this possible omitted variable issue, we rerun our baseline regression by also including bank fixed effects (see column 2 of Table 4). Therefore, the estimates now capture within-bank variation of the credit rationing status of firms with different internationalization profiles. The results remain virtually unchanged.

A further omitted variable concerns could be that conditions prevailing in the foreign destination country of a firm could impact on the credit rationing decisions of the firm's banks and also correlates with the firm participation in a global chain. For instance, if an Italian firm engages in chain linkages with French counterparts, and France experiences better prospects than Italy, then Italian lending banks could protect this firm. In turn, conditions in France could also correlate with the Italian firm's decision to participate in global chains. To assuage this concern, in column 3 of Table 4, we re-estimate our baseline regression by adding main destination country fixed effects. In doing so, we experience a loss of observations due to missing data. The results remain virtually unaffected after the addition of destination countries fixed effects.

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[19]We detect a slightly negative effect of the economic activity in the sector-region on the probability of firm rationing, while the effect of ISO9000 proxy for firm sophistication is estimated with low degree of precision. Finally, the effect for the proxy for the lack of investment opportunities suggests that the scarcity of investment opportunities correlates negatively with credit rationing.

4.2.2 Exclusion restrictions

We have no reason to expect that our instrumental variables influence the probability of credit rationing through channels alternative to firms' internationalization activities. Further, our variables are constructed based on a detailed question to the surveyed firms about the goals of IT usage, beyond standard e-mail systems. By construction, this excludes IT uses for financial purposes. Nonetheless, to further assuage concerns about the fulfillment of the exclusion restriction, we verified that firms' access to broadband connections is unlikely to drive credit availability. The results are displayed in Table 4.

In our sample, firms are asked whether one of the reasons why they rely on their main bank is that the bank is an efficient user of internet. Only little more than 15% of the survey respondents declare that this is one of the reasons. Further, when we re-estimate our baseline regressions of Table 2 after dropping this small portion of firms, the results (available upon request) carry through. Another element that validates this point is that the large majority of firms in our sample are small and medium-sized and tend to rely on personal lending relationships with loan officers instead of impersonal contacts with financial institutions. Based on this argument, we next study whether the effects estimated differ depending on features of the lending technology used by the main bank, that is, the length of the credit relationship with the firm and the type of information typically used by the bank in its lending relationship (Table 4). In Panel A, we consider the number of years that a firm has been operating with its current main bank. The marginal effects for the bivariate probit model indicate that our baseline results, that is an attenuating impact of GVC participation on credit rationing, are confirmed when focusing on global chain participants with a lending relationship longer than 5 years. These firms are 4 percentage points less likely to experience credit restrictions than firms not involved in global supply chains. It thus appears that banks' propensity to protect global supply chain participants from the credit crunch is confirmed for firms more likely to engage in personal relationships with their loan officers.[20] Importantly, these are the businesses for which the type of lending technology of the bank (personal,

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[20]Similarly, for export, the baseline results are confirmed for the subsample of firms with long lending relationships.

repeated interactions with the borrowing firm over the course of several years) likely makes firms' access to internet entirely irrelevant for the availability of credit. As shown in Table A3, the results of Panel A are fully robust to interacting the global chain indicator with the dummy for relationship lending (instead of partitioning the sample) and instrumenting both the global chain indicator and the relationship lending dummy. In particular, to instrument the relationship lending dummy, we restrict attention to the subsample of Italian businesses and employ as instruments the indicators of the 1936 Italian banking regulation (see, e.g., Guiso et al., 2004, and the Appendix for more details on these instruments).

To further probe the above point, in columns 3 and 4 of Table 4 we next restrict attention to the firms that declare that typically most of the information acquisition of loan officers occurs through personal interviews and meetings with the firm's management. Again, the estimates show that personally interviewed firms that participate in a global value chain are characterized by a smaller probability of experiencing credit restrictions (see column 3).

To conclude this robustness analysis, we resorted to information provided by the afore-mentioned Capitalia survey, which roughly covers the Italian subsample of the EFIGE survey. In the Capitalia survey, firms declare that they visit their loan officer every 15 days and more than 50% of the firms visit loan officers every 5 days. In addition, the average firm is located only 4 kilometers away from the bank branch. All these pieces of evidence point to the significant relevance of personal interactions, and a negligible relevance of internet access, for banks' material decisions regarding credit extension.

4.3   Alternative measurement

We refine the measurement of our key variables in order to gain additional insights into the impact of GVC participation on credit rationing. In panel A of Table 5, we distinguish between global chain participants importing services and global chain participants importing intermediate goods (column 1 carries over the marginal effects of the baseline regression of Table 2 column 1). The estimations suggest that both the firms importing services and those importing intermediate goods have a lower probability of experiencing credit restrictions. The

marginal effects imply that firms involved in global supply chains are 4.1 and 3.7 percentage points less likely to experience credit restrictions when they import services and intermediate goods, respectively.

In Panels B and C of Table 5, we distinguish global supply chain participants according to the firm's position in the chain and the intensity of the inter-firm linkages along the chain. In Panel B, we separate relatively upstream from relatively downstream firms.[21] The estimates in columns 4-5 suggest that firms participating in global value chains are less likely to experience credit restrictions, regardless of their position in the chain. The marginal effects of both upstream and downstream participation are negative.

In Panel C, we investigate whether the baseline effects depend on the intensity of inter-firm linkages along the chain. The survey does not ask firms information on this aspect. To gain insights, we then consider sector-country information from Eurostat on the relevance of intermediates purchases by two-digit sectors and countries (a frequently used proxy for the density of supply chain networks in sectoral studies on value chains). We normalize this measure by the total output of the industry of the firm.[22] The estimates in Panel C of Table 5 suggest that the effect of global value chain participation is larger in sectors characterized by stronger production fragmentation (relative value of the intermediates above the median). This complements the finding in column 2 of Table 2 for the stability of global chains, pointing to a stronger effect when supply chain links are intense and stable.

4.4 Do the effects matter?

The impact on credit rationing on a firm's internationalization may vary depending on characteristics of the firm. Investigating for what segments of firms our results are stronger can also help understand whether the effects bite especially for the businesses more vulnerable to bank credit rationing and, hence, are indeed relevant. We investigate this point in Table 6.

Columns 1-2 re-estimate the baseline regressions of Table 2 for the subsample of firms with

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[21]Observe that in our setting we define relatively upstream firms as those that both import and export intermediate goods, where the export of intermediate goods is captured by the aforementioned subcontracting variables.

[22]As a robustness, we also experimented with scaling by the total import content of export of the country.

less or more than 25 years, the median firm age. Age is generally considered as a proxy for the vulnerability of credit constraints, as young firms typically have fewer source of financing and are informational opaque in financial markets. The marginal effects in columns 1-2 suggest that the participation in global value chains mitigates the probability of experiencing credit rationing only for younger firms. Among young businesses, those involved in global supply chains are 2.9 percentage points less likely to be credit rationed. Conversely, older firms that are involved in GVCs are not significantly different from businesses not participating in GVCs, in terms of credit availability.[23]

While firm age is often viewed as an indicator of firm vulnerability to credit constraints, it represents an indirect proxy. The EFIGE survey provides however direct, self-reported measures of firms' reliance on external financing. In columns 3-4, we re-estimate our baseline regressions subdividing the sample according to whether a firm declares to rely highly on external financing or not. The estimates suggest that the effects are more significant for firms more reliant on external funding (column 3). The survey also provides information on firms' typical usage of bank financing. In columns 5-6, we then also verify whether the effects are stronger for firms whose external debt consists entirely of bank debt. The estimates show that such firms are indeed those for which our baseline effects are more pronounced. Overall, consistent with the estimates of columns 1-2, the findings in columns 3-6 point to a relevance of the effects for the businesses more likely to be vulnerable to a bank credit denial (i.e., more reliant on external finance and, among source of external financing, more reliant on bank funding).[24]

4.5 Internationalization and debt dynamics pre and post crisis

The baseline specification does not exploit information about firms' access to credit in the years prior to the crisis. To further probe our argument, we carry out an alternative test using balance sheet information on firms' use of debt from 2005 to 2009. An advantage of this

[23]Different results are obtained for firm export. In this case, firms with more than 25 years are more likely to experience credit restrictions when they sell their products or services abroad.

[24]By construction, the binary measure of credit rationing does not capture the intensity of constraints. By splitting the sample according to financial dependence, we can also capture the possible intensity of the effects of rationing.

approach is that we can exploit intertemporal variation in firms' access to credit and include firm and time fixed effects.[25] The cost is that we lose the precision of our supply-driven measure of bank credit rationing.[26] We collected balance sheet data from BvD-Amadeus on the ratio between firms' non-current liabilities and total assets for the five years from 2005 to 2009. Non-current liabilities exclude trade credit and given the size of firms in our sample, they are likely to capture predominantly debt exposure to banks.

Consistent with the baseline analysis, we treat 2009 as the crisis year and 2005-2008 as the pre-crisis period. We then estimate the following empirical model:

$$Debt_{it} = \beta_1 INT_i \times Crisis_t + Z_{it}\gamma_1 + \zeta_i + \theta_t + \epsilon_{it} \tag{3}$$

where $Debt_{it}$ is the ratio of non-current liabilities over total assets of firm i in year t; $INT_i \times Crisis_t$ is the key variable of interest, the interaction between the crisis (2009) dummy and the indicator for global chain participation; θ_t denotes the time fixed effects (dummies for each year from 2005 to 2009); ζ_i captures firm fixed effects; Z_{it} represent the vector of time-varying firm variables already included in the baseline regression; and ϵ_{it} is the error term. In measuring INT, we consider the various global chain participation indicators listed in Table 2. In a first specification (columns 1-2 and 5-10 of Panel B in Table 7), we treat the global chain participation indicator as a time-invariant characteristic of the firm over the 2005-2009 period. In a second specification (columns 3 and 4 of Panel B in Table 7), we instead use a time varying global chain participation indicator inferred from the information on the regularity firms' participation in global chains. In particular, for the firms that in 2009 declared to be non-regular participants before 2008, we construct INT as equal to zero from 2005 to 2007, and one in 2008-2009. We perform the estimation of the model in 3 both by OLS and using an IV approach. In the IV approach, in line with the baseline model, we instrument the interaction term between the dummy crisis and the global chain participation indicator with the interaction between the crisis dummy and the IT access variable.

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[25]As discussed below, we have some although limited information about intertemporal variation in global chain participation.

[26]Our measure of credit rationing is taken directly from firms' responses to the survey rather than indirectly inferred from firms' financial statements (Minetti and Zhu, 2011).

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Panel A of Table 7, displays the growth rates of the ratio between non-current liabilities and total assets before the crisis and during the crisis. The growth rates clearly reveal a reduction of credit extended to firms during the crisis. Observe that, on average, during the crisis, firms' assets also shrank, implying that the ratio actually grew during the crisis, although less than before the crisis.Panel B displays the regression coefficients, consistently showing a significantly positive effect of the interaction term $INT_i \times Crisis_t$, suggesting that during the crisis firms in global chains had better access to credit than their counterparts not in global chains. Similar to what found in Table 2, for the baseline model, the results are consistent across the various measures of global chain participation. While the inclusion of time and firm fixed effects helps assuage concerns about omitted variable bias, it is reassuring that the IV estimation in column 2 confirms those obtained through OLS.[27]

In the Appendix, we conduct several robustness tests and additional tests. Using survey information, we further refine the measurement of the non-current liabilities ratio, by taking its product with the self-reported share of long-term bank debt over total non-current liabilities. Alternatively, we drop the firms with positive or non-negligible medium-long term bonds. Finally, we repeat the refinement tests of Table 5 using this alternative approach, obtaining similar insights as for the baseline model with credit rationing.

4.6 Any exporter

As anticipated above, we contrast our findings for global chain participation with those for any exporter. In Table 8, we re-estimate the empirical model in Eq. (1) and (2) after replacing the global chain participation variable with the any exporter variable. The marginal effect of export is estimated to be positive and equal to 0.017, suggesting that any exporter is 1.7 percentage points more likely than a non-exporter to be rationed by banks (approximately 20% of the average probability of rationing). As noted, we can interpret this result for any exporter as reflecting the higher riskiness associated with export activities.

In columns 2-4, we rerun the regression for any exporter by adding the additional controls for sector-region economic activity, firm quality and firm investment opportunities, already

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[27]The values of the F-statistics confirm the validity of our instruments.

used in Table 3. The results carry through. Finally, in columns 5-6, we repeat the analysis by restricting the attention to firms with more intense lending relationships and use of soft information in their credit relationships. The results are essentially unaffected.

5 Mechanisms

As discussed in Section 2, we envisage two main mechanisms that could drive the effect of firms' global engagement on bank credit rationing. First, banks could view global supply chain participation as a signal of the prospects of their clients ("signal-extraction" mechanism). Second, banks could internalize the negative consequences of their credit denial on other activities they conduct abroad ("spillover" mechanism). In Tables 6-8, we investigate these two mechanisms. It is important to highlight up front that we do not view these mechanisms as alternative to each other but as possible complementary forces behind our main results. Whenever relevant, we compare the findings for global value chains with those for export.

5.1 Supply chain participation as a signal

5.1.1 Background motivation

Firms' participation in global value chains increasingly affects banks' assessment of borrowers' prospects. First, in evaluating borrowers, banks have started to shift their focus from the single borrower to its whole supply chain (Rotondi, 2013). Supply-chain ratings are built on information about the amount and frequency of transactions, payment terms, and financial instruments employed along the value chain. Most importantly, they may improve the assessment of borrowers, when some conditions about the governance and organizational design of the supply chain are satisfied (Proto and Cabigiosu, 2015). Second, firms' involvement in global value chains has improved the consultancy services offered by banks to internationalized firms. The French banking group BNP Paribas, for instance, has opened new branches in China and India to assist companies that want to expand their activities in those regions. Deutsche Bank and Credit Agricole, in turn, have developed innovative technologies to im-

prove the economics of their borrowers' supply chains (Rotondi, 2013).[28]

5.1.2   Testing the "signal-extraction" channel

In Table 6, we study the "signal-extraction" mechanism by exploiting information on the types of activities conducted by firms within global chains as well as on the characteristics of the sectors to which the firms belong.

To the extent that global chain participation is a signal of potential borrowers' prospects, we would expect our main results to be stronger when this participation is associated with productivity-enhancing activities. In Panel A, as a proxy for such activities, we consider the implementation of investments aimed at expanding the firm's global network. Our results are confirmed for the subsample of businesses engaging in such activities while they lose significance for less sophisticated participations. These findings are in line with the view that banks especially insulate from a credit crunch the firms that are more dynamic in their global chain participation. This conclusion is confirmed when we measure the quality of global chain participation by looking at whether an internationalized firm invests in brand recognition and quality. As shown in Panel B, the results are significantly stronger for such firms than for firms that do not make these investments. In Panel C, we instead turn our attention to the industries to which the firms belong. Global value chain participation may be perceived as more appealing by banks if the riskiness of the chain linkages of the industry is lower. To proxy for such riskiness, using data from Eurostat, we compute the standard deviation of the total value of the intermediates for each industry and country in our sample (scaled by the total output of the industry-country). We then re-estimate the baseline regression by separating low- from high-volatility industries. The results appear to be especially driven by industries-countries for which supply chain participation is less risky.

Another way to disentangle banks' view of global chain participation as a positive signal is to consider the nature of the information acquired by banks during the lending process.

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[28]Raz and Gloor (2007), for a sample of software start-ups, find that firms with larger informal business networks have higher chances to survive external shocks. Similarly, by using a data set of new ventures in the open source software industry, Stam and Elfring (2008) demonstrate that firms' networks positively affect firms' performance. These studies provide evidence on the positive effects of firms' business networks on firms' survival and performance, which in turn could influence bank lending decisions.

We focus here on the request of collateral guarantees. We expect the signaling role of GVC participation to be more pronounced when a bank does not rely mechanically on the posting of collateral for its decision to provide credit. The estimates in Panel D suggest that being involved in a global chain mitigates the probability of experiencing credit limits only for firms that do not pledge collateral guarantees to their lenders. The marginal effects reported in columns 7 and 8 of Panel D are both negative, although only the latter is statistically significant. This is in line with the hypothesis that, for borrowers that do not pledge collateral, the signal conveyed by global supply chain participation is probably more relevant.[29] To further probe this point, in columns 9-10 of Panel D we rerun the regression in column 8 on the role of collateral splitting between small and large businesses. We expect the signaling effect to be sharper for small businesses, which are plausibly more informationally opaque. The results confirm this expectation: the effect is statistically significant only for the smaller firms.

5.2 Internalizing the spillover effects of credit decisions

5.2.1 Background motivation

Since the approval of the Second Banking Directive and the Single Banking License in 1989, cross-border financial flows have grown considerably in Europe, and the banking sector has consolidated through a wave of cross-border mergers and acquisitions (Allen, 2011). Banks with high exposure in a foreign country may anticipate that, by providing liquidity to domestic borrowers operating, directly or indirectly, in that country they can limit costly defaults on outstanding loans and preserve foreign business in that country.[30] The literature has shown that banks take spillover effects in their lending decisions into account. Using differences in US local housing markets during the 2007-2010 housing crisis, Favara and Giannetti (2017) find

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[29]Opposite results are found for firm export (see Table A4). In this case, our baseline findings seem to be driven by the subsample of firms that typically pledge collateral to their main bank: the marginal effects indicate that exporters are 2.1 percentage points more likely to be credit rationed than non-exporters when they are requested to provide collateral. This is consistent with the view that for borrowers that are requested to pledge collateral, export is probably a stronger signal of riskiness.

[30]Banks operating in foreign markets may also have an information advantage and be better positioned to overcome information asymmetries. In the analysis, we will try to disentangle the role of banks' knowledge.

that lenders with a high share of collateralized debt in their portfolios internalize the negative effects of liquidation decisions on collateral values and renegotiate their debt to avoid price-default spirals. Giannetti and Saidi (2019) indicate that lenders with a high market share in an industry grant disproportionately more credit than other banks to firms in that industry during periods of distress in comparison to normal times.

Figure 5 illustrates the international diffusion (allocation of foreign asset portfolios) of the banks of six of our sample countries. Spanish and Italian banks have the largest involvement in EU 15 countries, while Austrian banks are especially exposed to non-EU 15 European countries. UK banks are particularly active across the Atlantic, e.g., in the United States.

In Tables 7 and 8, we test the "spillover" mechanism, that is, the hypothesis that banks protect supply chain participants because they internalize the consequences that a denial of credit could have on their own foreign business.

5.2.2 Preliminary analysis

To gain preliminary insights on the "spillover" mechanism, in Panel A of Table 7 we distinguish between firms borrowing from banks with a local scope (domestic local banks or domestic national banks without an international network) and firms borrowing from banks with a global scope (domestic national banks with an international network or foreign banks).[31] The estimates suggest that the participation in global value chains mitigates the probability of experiencing credit constraints for both subgroups. However, the effects appear to be significantly more pronounced in the case of banks with an international scope, consistent with the hypothesis that these banks are more concerned about international spillovers of their credit denial to global chain participants.[32]

A second piece of preliminary evidence comes from investigating the geographic location of the firm's supply chain customers and suppliers. In Panel B of Table 7 we classify firms based

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[31]To classify our sample firms, we rely on two questions of the EFIGE survey: *What type of bank/credit institution does the firm use? (i) domestic local banks; (ii) domestic national banks; (iii) foreign banks.*; *Which factors are key in the choice of a main bank? ...; (v) the bank has an extensive international network; ... .*

[32]When looking at the results for firm export, the positive impact of export on credit rationing is confirmed only for the subsample of firms borrowing from domestic local banks or from domestic national banks without an international network. Results available from the authors.

on whether they import or export their products and services in three main geographical areas: Europe, Asia and the Americas. In column (3) we rerun the baseline regression of column 1 of Table 2.[33] The estimates indicate that global chain participants with partners located in Europe are less likely to experience credit restrictions, while global chain participants doing business with customers and suppliers located in Asia (mainly India and China) are more exposed to bank credit rationing. As explained below, this can point to a tendency of banks to especially protect firms whose global chains span European markets, in which banks themselves have larger ramifications. Interestingly, this contrasts with the findings for the destination of firm export, displayed in Appendix Table A4. Our baseline findings for export are especially driven by firms exporting their products and services to Asia.[34] This may reflect the fact that exporting to far-away markets may be perceived by banks to be particularly risky, and hence be more exposed to credit rationing in difficult times.

5.2.3   Testing the "spillover" channel

To perform finer tests on the "spillover" mechanism, we combine the firm-level information on the regions of origin and destination of firms' products with data on the areas of operation of internationally active banks.

In Panels C and D of Table 7, relying on BIS country-level data on the locational activities of internationally active banks, we split our sample according to whether the banks of a firm's country hold a material participation in the region where the firm's global chain partners are located. Recall that the results in Panel B suggest that our findings are especially driven by global chains with a European span. Therefore, in Panels C and D of Table 7, we focus on EU-based supply chains.[35] We choose a threshold of 60% for the relevance of the countries in the bank lending portfolio, but perform sensitivity analysis with thresholds in the 50%-70% range. Observe that this threshold effectively partitions our sample into two subgroups of

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[33]In the first stage we insert the instrument interacted with the destination market.

[34]In particular, the estimates suggest that firms exporting in Asia are 5.1 percentage points more likely to experience credit constraints than other firms. Conversely, firms exporting in Europe are not significantly different from non-exporters in terms of credit availability.

[35]Specifically, we interact our measure of supply chain participation with the dummy for EU based participation.

countries of approximately equal number. For other non-15 EU countries, with the same logic, we choose 10% as a threshold. The estimates in columns 1-4 show that our results for EU-based supply chains are especially strong for the subsample of countries whose banks are more exposed to the area where the firms have global chain links. While suggestive, this supports the hypothesis that, by protecting global supply chain participants, banks also protect their own interests in the countries where their clients operate.

In Table 8, we turn to a more precise test using matched bank-firm data. First of all, we identify the lending banks of a firm by exploiting information from the BvD-Orbis database regarding the name of the banks with which our sample firms do business.[36] We then use the Moody's Analytics BankFocus database to extract details on banks' international presence (subsidiaries per country). For each bank, in order to measure the relative importance of a country for the bank's operations, we normalize its subsidiaries in the country by the total number of subsidiaries of the bank. Finally, as noted, we have information from EFIGE on the countries in which firms' supply chain partners are located.[37]

Figure 6 displays the distribution of bank subsidiaries by country as well as the same distribution weighted by the share of the sample exporters to that country that are clients of the bank. In Table 8, we next re-estimate the baseline regression of Table 2 after partitioning our sample based on how much the country with which a firm has supply chain linkages matters for the firm's lending banks. The results provide strong evidence that the attenuating effect of global chain participation on bank credit rationing occurs when banks have a relative strong presence in the countries where firms have supply chain links.[38] Conversely, no such effect emerges when banks do not have a relevant presence in the countries.

Finally, to capture the possible spillovers associated with bank lending decisions, we also consider the size of firms. The larger the size of a firm, the greater repercussions credit denial could have in the foreign market. When we rerun the regression in column 4 splitting by firm size, we observe that our findings are indeed driven by larger firms. Interestingly, these findings contrast with that obtained for the "signal-extraction" mechanism, which appear to

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[36]In conducting this test, we suffer a loss of observations due to data availability.

[37]EFIGE reports the three main countries where the firm does business abroad.

[38]As noted, the bank presence is computed as the share of bank branches located in that country.

be more relevant for smaller firms.

5.2.4 Is it knowledge?

The reader could wonder whether the findings in Tables 7 and 8 mostly reflect banks' superior knowledge about internationally traded products rather than banks' interest in preserving their own activities abroad. Clearly, we do not view the two mechanisms as alternative but possibly as reinforcing each other. Nonetheless, it is useful to try and tease out the possible contribution of banks' knowledge. A first observation is that our results show that internationally active firms are significantly less exposed to bank rationing than domestically oriented ones. For this finding to be driven by banks' knowledge, one should probably conjecture that such knowledge is stronger for international activities than for domestically oriented activities. We view this possibility as unlikely, at least for a substantial portion of the banks in our sample. To further rule out this possibility, in Table 9 we perform three types of tests. First, we look at the nature of banks. We would expect foreign banks to be potentially more knowledgeable about internationally traded products than about domestically sold ones. When we rerun the regressions of Table 8 by dropping firms whose main bank is foreign (e.g., French firms whose main bank is Italian), we obtain virtually unchanged results (Panel A). We interpret this as suggesting that our estimates are not purely knowledge-driven.[39]

In Panel B, we consider instead the nature of internationally traded products. Bank knowledge could be more relevant for goods that are not well-known either because they are not sold in the domestic market or because they are inherently informationally opaque. In columns 5-6, we use the indicators of product information complexity constructed by Nunn (2007) (the conservative and non-conservative sectoral fraction of inputs not sold on exchange). When we restrict attention to products that are informationally transparent, the baseline results carry through. This again suggests that banks' knowledge is not the primary driver of our findings. The test in column 7 of Panel B further confirms this conclusion. In

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[39]Interestingly, the negative impact of global chain participation on rationing appears to be confirmed for the uppest quartile of the joint exposure of firms and banks to the country, while the sign for the third quartile switches from negative to positive.

that column, we restrict attention to export products that are also sold domestically.[40] Again, we continue to estimate an attenuating effect of GVC participation on bank rationing.

Finally, Panel C exploits an alternative proxy for bank knowledge of products. We compute the number of a firm's sectoral peers with which the lending bank does business and normalize it by the total number of clients of the bank (De Jonghe et al., 2020). We then rerun our baseline regression by separating between banks with strong and low specialization in the sector of the firm (columns 1-2). In contrast with the knowledge hypothesis, the result remains significant only for the subsample of banks with low specialization in the firm's sector. This result is even more striking when compared with that shown in columns 3-4 of Panel C. In those columns, we observe that the negative effect of global chain participation is stronger when banks have high specialization in the sector contiguous to that of the firm (according to the Eurostat input-output tables). The latter result may suggest that banks are especially concerned about the business of the potential customers of its client firms ("spillover" mechanism).

In conclusion, the results in Table 9 suggest that banks' protection of globally connected firms can reflect banks' interest in preserving their business abroad rather than mostly banks' knowledge of internationally traded products.

6   Some implications for lending contractions

We conclude the analysis by examining the implications of our results for the effects of bank lending contractions (such as that occurred during the Great Financial Crisis). We first present a stylized, illustrative model of a capital constrained bank that grants loans to two categories of firms: globally active and domestically oriented. We then use this simple model to quantify the effects on foreign and domestic sales of lending contractions.

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[40]The EFIGE survey specifically asks: *The main product line you sell to foreign markets... (i) is also the main product line in your domestic market; (ii) is also sold in your domestic market but it is not the main product line; (iii) is not sold in your domestic market.*

6.1 A stylized illustrative model

There are three key ingredients of the illustrative framework. First, banks choose how to allocate their scarce lending capacity between two segments of firms, globally active (G) and domestically oriented (D). Second, banks derive (unmodelled) higher returns from extending loans to globally active firms (L_G) than to domestically oriented ones (L_D), due, for example, to the mechanisms studied in Section 5. Third, globally active firms rely more than domestically oriented ones on external (bank) financing in covering the expenses of their production input (Manova, 2013).

The lending capacity of the bank is determined by its net worth (NW) through a standard capital constraint, which states that the total lending of the bank cannot exceed a multiple $1/\psi$ of the bank's net worth (where ψ denotes the capital adequacy ratio). We take the initial net worth of the bank (NW) as given. The bank's objective is to maximize its future net worth NW', given by the gross returns on loans to the two firm categories, $\mathcal{R}(L_D)$ and $\mathcal{R}(L_G)$, net of the cost of deposits, $(1+r)D$ (where r denotes the net deposit rate and D is the deposit stock). The bank's constraints are given by a standard budget constraint and by the capital constraint:

$$\max_{L_D,L_G,D} NW' \ = \ \mathcal{R}(L_D) + \mathcal{R}(L_G) - (1+r)D \tag{4}$$

$$s.t. \quad L_D + L_G \ = \ D + NW \tag{5}$$

$$NW \ \geq \ \psi\left(L_D + L_G\right). \tag{6}$$

As noted, we posit that the bank derives higher returns from lending to globally active firms, e.g., $\mathcal{R}(L_G) = \omega\mathcal{R}(L_D)$, with $\omega > 1$. On firms' side, we assume that all firms produce using a unique input (e.g., labor, Lab). In order to hire labor, firms need to rely to some extent on bank loans. We model this dependence in reduced form, by letting $Lab_D = f(L_D)$ and $Lab_G = g(L_G)$, with $f_{L_D} > 0$ and $g_{L_G} > 0$. To capture the higher relevance of external finance for globally active firms, we posit that the impact of bank loans on the labor used by globally

active firms exceeds the impact of bank loans on the labor used by domestically oriented firms. For example, $g(L_G) = \theta f(L_D)$, where $\theta > 1$. Formally, the domestic sales of domestically oriented firms and the foreign sales of globally active firms are given by

$$Y_D = ALab_D = Af(L_D) \tag{7}$$

$$Y_G = ALab_G = Ag(L_G) = A\theta f(L_D) \tag{8}$$

where A denotes the TFP common to all firms. After simple algebra, the bank's optimization problem becomes:

$$\max_{L_D, L_G, D} N' = \mathcal{R}(L_D) + \mathcal{R}(L_G) - (1+r)(L_D + L_G - NW) \tag{9}$$

$$s.t. \quad \frac{NW}{\psi} = L_D + L_G \tag{10}$$

$$\mathcal{R}'_D\left(\frac{NW}{\psi} - L_G\right) = \mathcal{R}'_G(L_G). \tag{11}$$

From the above,

$$\frac{\partial Y_D}{\partial NW} = f'(L_D)\frac{\mathcal{R}''_G(.)}{\psi\left[\mathcal{R}''_G(L_G) + \mathcal{R}''_D(.)\right]} = \frac{1}{\psi}f'(L_D)\frac{\mathcal{R}''_G(.)}{\left[\mathcal{R}''_G(L_G) + \mathcal{R}''_D(.)\right]}, \tag{12}$$

$$\frac{\partial Y_G}{\partial NW} = g'(L_D)\frac{\mathcal{R}''_D(.)}{\psi\left[\mathcal{R}''_G(L_G) + \mathcal{R}''_D(.)\right]} = \frac{1}{\psi}g'(L_D)\frac{\mathcal{R}''_D(.)}{\left[\mathcal{R}''_G(L_G) + \mathcal{R}''_D(.)\right]}. \tag{13}$$

Using the functional specifications detailed above, we obtain

$$\frac{\partial Y_D}{\partial NW} = \frac{A}{\psi}f'(L_D)\frac{\omega}{1+\omega} \tag{14}$$

$$\frac{\partial Y_G}{\partial NW} = \frac{A}{\psi}\theta f'(L_D)\frac{1}{1+\omega} \tag{15}$$

6.2 Back-of-the-envelop calculations

Using the expressions for $\frac{\partial Y_D}{\partial NW}$ and $\frac{\partial Y_G}{\partial NW}$ derived above, we obtain the following effects for a shock to banks' net worth (NW)

$$\frac{\partial Y_D}{\partial NW} = \frac{A}{\psi} f_{L_D} \frac{\mathcal{R}_G''(.)}{\mathcal{R}_G''(L_G) + \mathcal{R}_D''(.)}; \quad \frac{\partial Y_G}{\partial NW} = \frac{A}{\psi} g_{L_G} \frac{\mathcal{R}_D''(.)}{\mathcal{R}_G''(L_G) + \mathcal{R}_D''(.)} \tag{16}$$

where, to recapitulate, Y_D and Y_G are the total volumes of operations of domestically oriented and globally active firms, respectively; A denotes firms' TFP; ψ is banks' capital requirement; f_{L_D} and g_{L_G} denote the responses of the input demand of domestically oriented and globally active firms to changes in external bank financing, respectively; and $\mathcal{R}_D(.)$ and $\mathcal{R}_G(.)$ are banks' expected returns per unit of loan extended to domestically oriented and globally active firms. After simple algebra we obtain

$$\underbrace{\frac{\partial Y_G}{\partial NW} \Big/ \frac{\partial Y_D}{\partial NW}}_{\approx 1.6} = \underbrace{\theta}_{\approx 2 \text{ (Minetti and Zhu, 2011)}} \times \underbrace{\frac{1}{\omega}}_{\approx 0.8 \text{ (this paper)}}. \tag{17}$$

In the back-of-the-envelop calculation in (16), to gauge θ, we use the estimates in Minetti and Zhu (2011). According to their estimates, the reduction of foreign activities of an internationalized firm that is credit rationed by banks is twice as large as the reduction of domestic activities of a domestically oriented, credit rationed firm (38% versus 19%). In conjunction with our estimate of $\omega \simeq 1.25$, this suggests that a bank lending contraction could reduce the foreign sales of internationalized firms by approximately 60% more than the sales of domestically-oriented firms. Put differently, the mitigating effect of supply chain participation uncovered in our analysis could imply a (relatively) smaller drop of import-export up to 40%.

7   Conclusions

This paper has studied how firms' globalization influences credit allocation. In the context of a large credit crunch, such as that occurred during the Great Financial Crisis, we have

found that banks especially protected firms with a participation in global supply chains. This protection did not extend, however, to export activities broadly meant. The results also reveal that two mechanisms contribute to these findings. First, banks view global chain participation as a signal of value-enhancing activities of their clients. Second, banks protect global supply chain participants with the goal of minimizing negative spillovers on their own activities abroad. This second hypothesis confirms recent results that banks are sophisticated credit providers, that account for the broader consequences of their lending decisions (Giannetti and Saidi, 2019). More work is clearly needed to ascertain the relevance of these mechanisms.

An important question that remains unanswered in our setting is to what extent our findings reflect a "zero-sum game". In other words, do bank protect global supply chain participants to the expense of other clients? Or do our results reflect an overall more lenient attitude of banks when contracting credit in bad times? We leave this and other relevant questions to future research.

The results yield relevant policy implications. An intense debate has developed in recent years on the extent to which internationalized economies could be more or less resilient to financial crises. Our findings unveil an alternative mechanism through which a globally interconnected business sector may be more resilient to a credit crunch, based on the credit allocation decisions of the banking sector. From the viewpoint of the policy maker, promoting firms' participation in global chains could then turn out to be desirable not only in a long-run perspective of firms' growth, but also in a cyclical perspective, in order to better insulate the economy from the consequences of a credit crisis.

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Tables and Figures

Figure 1. Credit, trade flows and GDP during the Great Financial Crisis
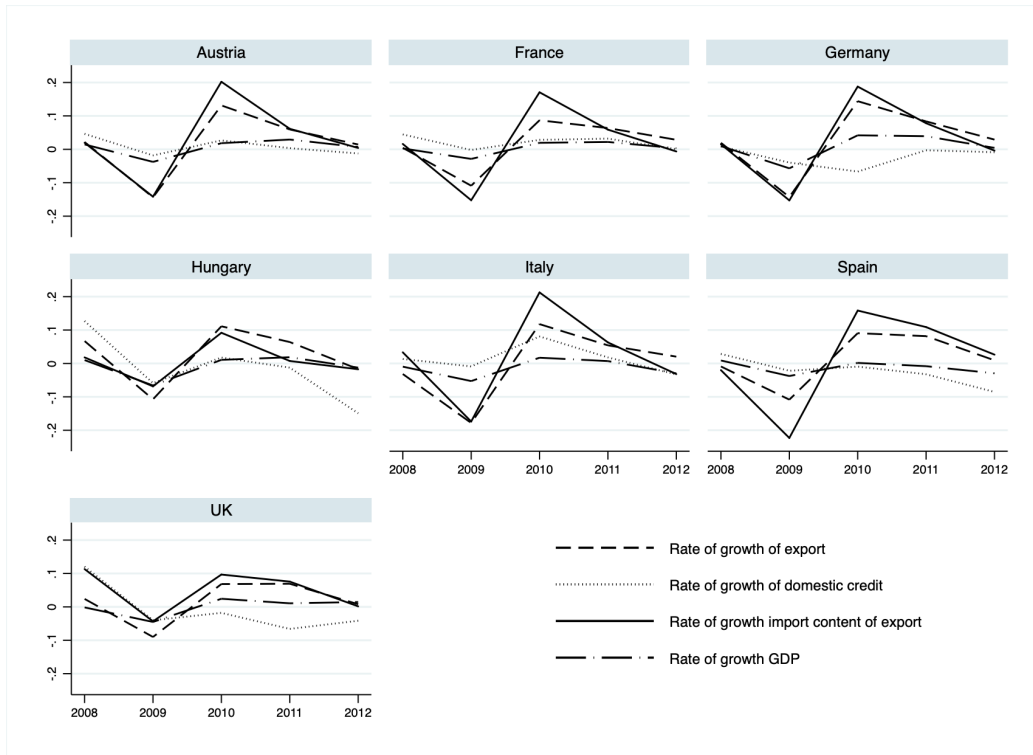
Notes: The figure displays the growth rate of domestic credit, export, import content of export, and GDP in seven European countries in 2008-2012. All growth rates are in real terms. Our calculations from World Bank data.

Figure 2. Credit rationing, global chain participation, and export in European regions

(a) Rationing   (b) Global value chains   (c) Export
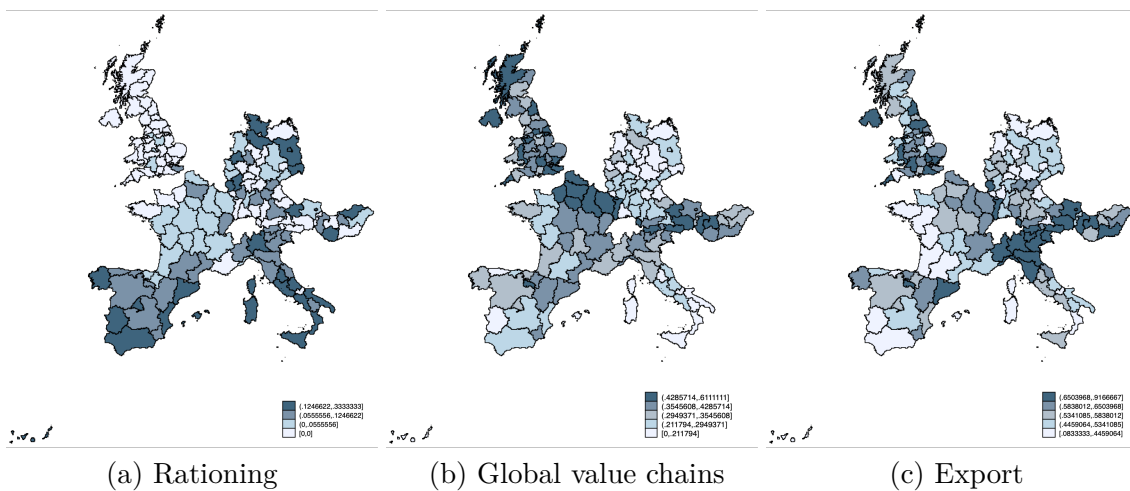
Notes: The figure shows the percentage of firms in European regions (NUTS-2) that are credit rationed, participate in global chains, and export computed from our sample data.

Figure 3. Distribution of global chain participants and exporters by sector
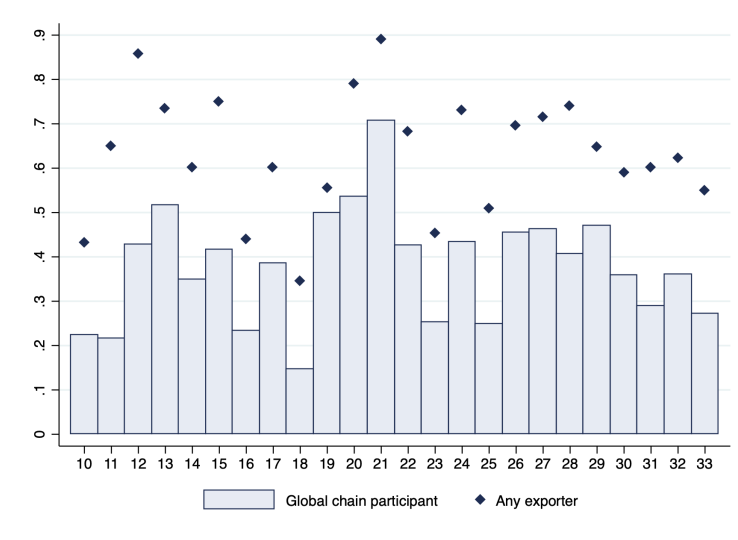
Notes: The figure shows the share of firms participating in global chains and exporting in each sector (EFIGE data). The x-axis reports the two-digit NACE codes for the manufacturing sectors: 10 Food products, 11 Beverages, 12 Tobacco products, 13 Textiles, 14 Wearing apparel, 15 Leather and related products, 16 Wood, except furniture, 17 Paper and paper products, 18 Printing and reproduction of recorded media, 19 Coke and refined petroleum products, 20 Chemicals and chemical products, 21 Pharmaceutical products, 22 Rubber and plastic products, 23 Other non-metallic mineral products, 24 Manufacture of basic metals, 25 Fabricated metal products, 26 Computer, electronic and optical products, 27 Electrical equipment, 28 Machinery and equipment, 29 Motor vehicles, 30 Other transport equipment, 31 Furniture, 32 Other manufacturing, 33 Repair and installation of machinery and equipment.

Figure 4. Internationalization and debt dynamics pre and post crisis

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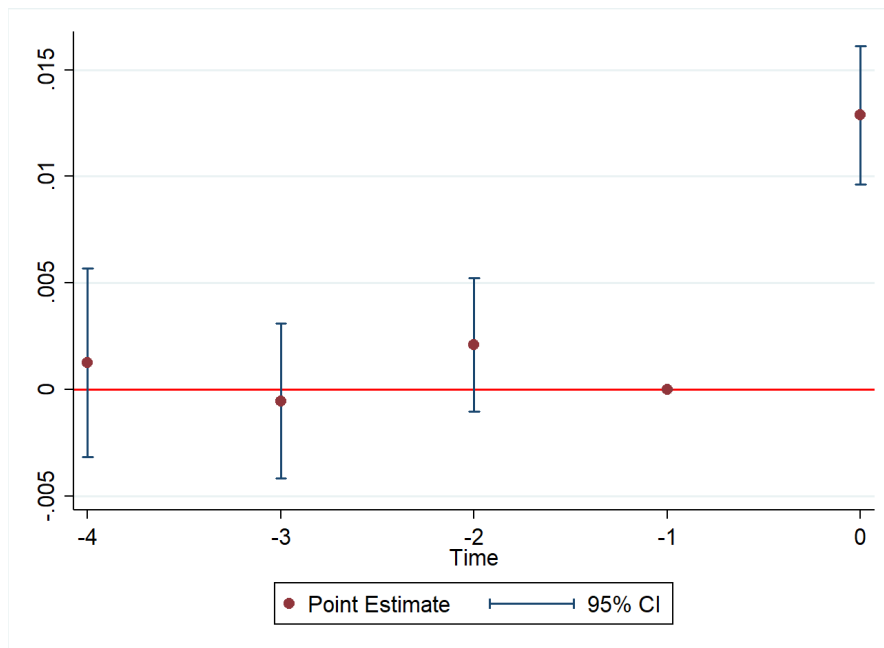
Figure 5. Banks' presence in world regions
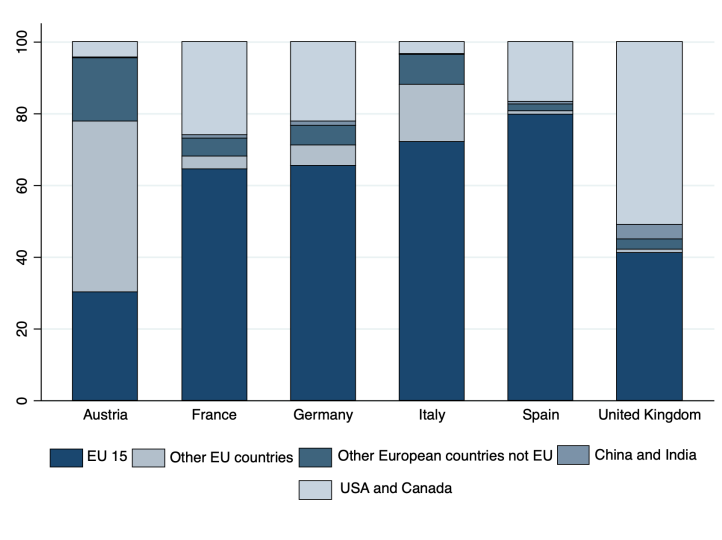
Notes: The figure shows the share of banks' foreign loan portfolios in world regions by banks' country of origin. Our calculations from Bank for International Settlement data.

Figure 6. Relevance of world countries in international banks' activities
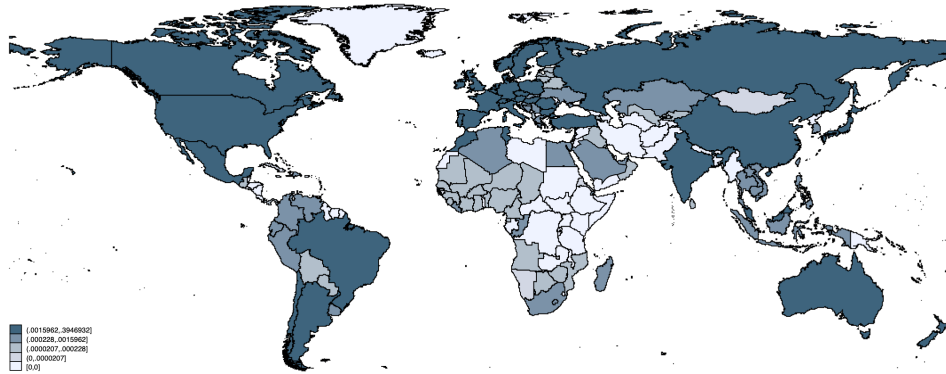
(a) Relevance of countries in international banks branch network
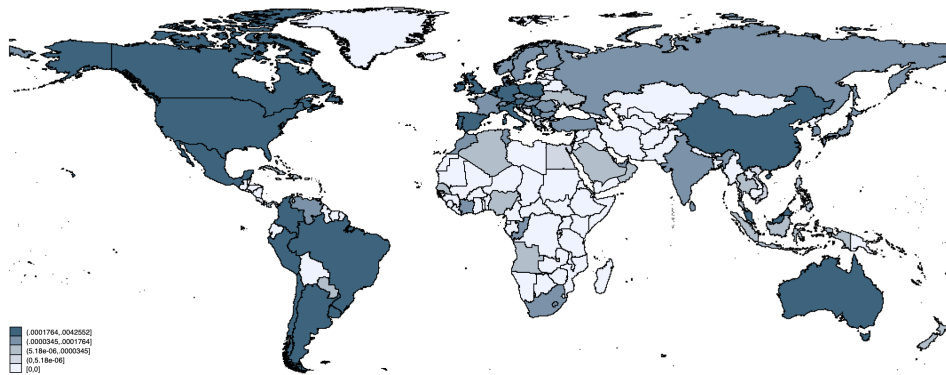
(b) Relevance of countries from (a), weighted by client firms' activity in the country

Notes: Panel (a) of this figure displays the share of foreign banks' subsidiaries in a country relative to the total number of subsidiaries of the banks. Panel (b) shows the same share weighted by the share of exporters to that country that are clients of the banks. Our computations from BankFocus, EFIGE and Orbis data.

Table 1

Summary statistics and univariate tests

| | All firms | | | GVC participation | | | | |
| | | | | Global chain participant =1 | | Global chain participant =0 | | t-test |
	Mean	Std. Dev.	Obs	Mean	Obs	Mean	Obs	
Credit rationing:								
Rationing	0.087	0.282	6,749	0.088	2,304	0.086	4,445	*-0.268*
Foreign activity:								
Global chain participant	0.327	0.469	14,758					
Any exporter	0.580	0.494	14,758			0.376	9,930	
Global chain participant: services	0.079	0.269	14,758	0.241	4,828			
Global chain participant: intermediate goods	0.306	0.461	14,758	0.935	4,828			
Regular global chain participant	0.288	0.453	14,758	0.880	4,828			
Relatively downstream	0.112	0.316	14,758	0.344	4,828			
Relatively upstream	0.215	0.411	14,762	0.656	4,828			
Global chain participant: Europe	0.307	0.461	14,758	0.939	4,828			
Global chain participant: Asia	0.127	0.333	14,758	0.388	4,828			
Global chain participant: America	0.103	0.304	14,758	0.314	4,828			
Global chain participant: good sold in domestic mkt.	0.279	0.449	14,758	0.853	4,828			
Control variables:								
Age	34.53	30.63	14,725	37.58	4,811	33.06	9,913	*-8.182*
Number of employees	71.64	142.96	11,442	114.57	3,944	49.05	7,497	*-19.865*
Debt ratio	0.652	0.274	13,873	0.632	4,622	0.662	9,250	*6.105*
ROA	0.046	0.140	10,849	0.042	3,841	0.048	7,007	*1.980*
Asset tangibility	0.255	0.195	13,788	0.238	4,589	0.263	9,198	*7.317*
Labour productivity	52.25	43.61	9,645	56.24	3,469	50.01	6,175	*-6.585*
Family firm	0.704	0.457	14,727	0.650	4,815	0.730	9,911	*9.744*
Group	0.221	0.415	14,759	0.350	4,828	0.158	9,930	*-24.639*
Instrumental variables:								
IT access (sales/purchase network)	22.236	26.254	14,695	25.877	4,804	20.470	9,890	*-11.557*
IT access (e-commerce)	11.946	22.875	14,695	14.090	4,804	10.906	9,890	*-7.656*
Countries:								
Austria	0.030	0.171	14,759	0.038	4,828	0.026	9,930	*-3.684*
France	0.201	0.401	14,759	0.236	4,828	0.185	9,930	*-6.986*
Germany	0.199	0.399	14,759	0.136	4,828	0.230	9,930	*14.425*
Italy	0.205	0.403	14,759	0.201	4,828	0.206	9,930	*0.741*
Hungary	0.033	0.179	14,759	0.039	4,828	0.030	9,930	*-2.848*
Spain	0.192	0.394	14,759	0.182	4,828	0.197	9,930	*2.228*
UK	0.140	0.347	14,759	0.169	4,828	0.126	9,930	*-6.695*

Notes: The table reports summary statistics and univariate tests for the main variables used in the regressions. All of the variables are defined in Table A1.

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Table 2

Baseline results: firms' internationalization and bank rationing

| Dep. Variables | Biv Probit | Biv Probit | Biv Probit | Biv Probit | Biv Probit |
| | Rationing | Rationing | Rationing | Rationing | Rationing |
	(1)	(2)	(3)	(4)	(5)
Global chain participant	-0.023**				
	(0.011)				
Regular global chain participant		-0.020**			
		(0.010)			
Global chain participant (i. including non-importing subcontractors of intermediates)			-0.021*		
			(0.012)		
Global chain participant (ii. excluding importers of raw materials)				-0.054***	
				(0.017)	
Global chain participant (i + ii)					-0.063***
					(0.014)
Age (ln)	0.003	0.003	0.003	0.004	0.005
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Number of employees (ln)	0.009**	0.009**	0.008**	0.014*	0.015**
	(0.004)	(0.004)	(0.004)	(0.008)	(0.007)
Debt ratio	0.058***	0.046***	0.057***	0.078**	0.083***
	(0.019)	(0.017)	(0.020)	(0.032)	(0.025)
ROA	-0.049*	-0.043*	-0.049	-0.060*	-0.067**
	(0.029)	(0.026)	(0.031)	(0.033)	(0.033)
Asset tangibility	-0.001	-0.003	-0.001	-0.007	-0.007
	(0.005)	(0.005)	(0.005)	(0.010)	(0.010)
Labour productivity (ln)	-0.001	0.000	-0.001	-0.003	-0.004
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)
Family firm	-0.001	-0.001	-0.001	-0.002	-0.002
	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)
Group	0.010*	0.010**	0.010*	0.018*	0.019**
	(0.005)	(0.005)	(0.005)	(0.011)	(0.010)
Instrumental variables:					
IT access (sales/purchase network)	0.002***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	5,061	5,061	5,061	5,061	5,061
F-instruments	10.85	8.12	7.83	19.91	20.18

Notes: This table reports the effects of firms' internationalization on credit rationing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. The table also reports the Kleibergen-Paap Wald F-statistic from the first stage. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
Panel A: Number of units (2008)					
Dep. Variables	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)
Global chain participant	-0.028**				
	(0.013)				
Regular global chain participant		-0.026**			
		(0.011)			
Global chain participant			-0.026*		
(i. including non-importing subcontractors of intermediates)			(0.015)		
Global chain participant				-0.082***	
(ii. excluding importers of raw materials)				(0.031)	
Global chain participant (i + ii)					-0.090***
					(0.031)
Number of units 2008	-0.003*	-0.003	-0.003*	-0.006*	-0.006*
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Instrumental variables:					
IT access (sales/purchase network)	0.002***	0.002***	0.002***	0.003**	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Baseline control variables	Yes	Yes	Yes	Yes	Yes
Sectoral & regional fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4,880	4,880	4,880	4,880	4,880
F-instruments	7.82	9.71	7.90	15.22	14.80
Panel B: ISO 9000					
Global chain participant	-0.024**				
	(0.012)				
Regular global chain participant		-0.019*			
		(0.010)			
Global chain participant			-0.021*		
(i. including non-importing subcontractors of intermediates)			(0.012)		
Global chain participant				-0.055***	
(ii. excluding importers of raw materials)				(0.016)	
Global chain participant (i + ii)					-0.064***
					(0.014)
ISO9000	0.005	0.004	0.004	0.009	0.009
	(0.003)	(0.003)	(0.003)	(0.006)	(0.006)
Instrumental variables:					
IT access (sales/purchase network)	0.002***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Baseline control variables	Yes	Yes	Yes	Yes	Yes
Sectoral & regional fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	5,059	5,059	5,059	5,059	5,059
F-instruments	7.17	8.08	7.62	19.74	20.04
Panel C: ISO 9000 and availability of investment opportunities					
Global chain participant	-0.048*				
	(0.025)				
Regular global chain participant		-0.025			
		(0.021)			
Global chain participant			-0.046*		
(i. including non-importing subcontractors of intermediates)			(0.027)		
Global chain participant				-0.077***	
(ii. excluding importers of raw materials)				(0.015)	
Global chain participant (i + ii)					-0.086***
					(0.031)
ISO9000	0.010	0.006	0.009	0.015**	0.014*
	(0.006)	(0.005)	(0.006)	(0.007)	(0.007)
Investment opportunities (lack of)	-0.026***	-0.018*	-0.027***	-0.031***	-0.034***
	(0.009)	(0.010)	(0.010)	(0.006)	(0.005)
Instrumental variables:					
IT access (sales/purchase network)	0.002***	0.003***	0.002***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Baseline control variables	Yes	Yes	Yes	Yes	Yes
Sectoral & regional fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4,331	4,331	4,331	4,331	4,331
F-instruments	8.86	10.16	10.72	19.96	21.69

Notes: In this table we re-estimate the baseline regressions by inserting additional controls. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. The table also reports the Kleibergen-Paap Wald F-statistic from the first stage. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 4

More on the identification strategy

Dep. Variables	Panel A: Additional fixed effects			Panel B: Relationship lending measures	
	Sector × Region	+ Bank	+ Main dest. countries	Lending relationship longer than 5 years	Information acquisition through personal interviews
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)
Global chain participant	-0.003***	-1.479***	-1.529***	-0.040***	-0.014*
	(0.001)	(0.126)	(0.171)	(0.011)	(0.007)
Instrumental variables:					
IT access (sales/purchase network)	0.002***	0.002	0.001	0.002***	0.003**
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)
Control variables	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	No	Yes	No	Yes	Yes
Regional fixed effects	No	Yes	No	Yes	Yes
Sectoral × regional fixed effects	Yes	Yes	Yes	No	No
Bank fixed effects	No	Yes	Yes	No	No
Destination country fixed effects	No	No	Yes	No	No
Observations	5,061	2,229	1,990	3,882	2,613

Notes: This table reports additional robustness checks on the identification strategy. In Panel A, we report the results of our baseline regression with the inclusion of additional fixed effects. In Panel B, we report the effects of firms' internationalization on credit rationing for the subsample of firms with a lending relationship longer than 5 years and for the subsample of firms that declare that most of the information acquisition of loan officers occurs through personal interviews. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measure for firms' global chain participation is instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 5
Refinements on measurements

Dep. Variables	Panel A: Robustness on measurement			Panel B: Position in the GVC		Panel C: Intensity of inter-firm linkages	
						Intermediates purchases/Output < median	Intermediates purchases/Output ≥ median
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global chain participant	-0.023**					-0.003	-0.062***
	(0.011)					(0.003)	(0.018)
Global chain participant: services		-0.041***					
		(0.002)					
Global chain participant: intermediate goods			-0.037**				
			(0.015)				
Relatively downstream				-0.077***			
				(0.001)			
Relatively upstream					-0.057***		
					(0.014)		
Instrumental variables:							
IT access (sales/purchase network)	0.002***	0.002**	0.002***	0.000	0.001	0.002	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,061	5,061	5,061	5,061	5,061	2,208	2,853

Notes: This table reports robustness tests for the effects of global value chain participation on credit rationing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. In Panel A we run robustness tests for the measurement of global chain participation. In Panel B we study the effect of the position in the global chain. In Panel C we study the effect on credit rationing of the intensity of inter-firm linkages along supply chains. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 6
The relevance of the effects

Dep. Variables	Firm age		External financial dependence		Reliance on bank financing	
	Age < 25 years	Age ≥ 25 years	High dependence on external finance	Low dependence on external finance	Only bank debt as source of financial debt	Other forms of financial debt besides bank debt
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)
Global chain participant	-0.029**	-0.003	-0.061***	0.071	-0.051**	-0.001
	(0.011)	(0.015)	(0.015)	(0.150)	(0.022)	(0.003)
Instrumental variables:						
IT access (sales/purchase network)	0.004***	0.001	0.001	0.005*	0.001	0.005***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,506	2,555	3,707	1,354	3,588	1,471

Notes: This table reports the effects of key firm characteristics on the relationship between firms' internationalization and credit rationing. In columns (1) and (2) we study the effect of firms' age, by classifying firms based on the median value of the sample (25 years); in columns (3) and (4) we study the effect of firms' external financial dependence; in columns (5) and (6) we study the effect of firms' reliance on bank financing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 7

Firms' internationalization and debt dynamics

	Panel A: Summary statistics								
	Δ Non current liabilities pre-crisis = 2.6% Δ Non current liabilities crisis = -3.3%			Δ Total asset pre-crisis = 1.4% Δ Total asset crisis = -7.4%			Δ Non curr. liab. / Tot. ass. pre-crisis = 4.1% Δ Non curr. liab. / Tot. ass. crisis = 2.6%		

	Panel B: Panel fixed effects regressions									
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dep. Variables	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.	Non curr. liab./ Tot. ass.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Global chain participant $\times$ Post	0.015** (0.006)	0.147** (0.056)								
Global chain participant (time varying indicator)			0.006 (0.006)							
Global chain participant $\times$ Post (time varying indicator)			0.015** (0.006)							
Global chain participant $\times$ Post (i. including non-importing subcontractors of intermediates)					0.016** (0.006)	0.151** (0.058)				
Global chain participant $\times$ Post (ii. excluding importers of raw materials)							0.014* (0.008)	0.134*** (0.050)		
Global chain participant (i + ii) $\times$ Post									0.015* (0.008)	0.138*** (0.051)
Number of employees (ln)	-0.054** (0.021)	-0.054** (0.021)	-0.054** (0.021)		-0.054** (0.021)	-0.054** (0.021)	-0.054** (0.021)	-0.054** (0.021)	-0.054** (0.021)	-0.054** (0.021)
ROA	0.012 (0.061)	0.005 (0.060)	0.012 (0.061)		0.012 (0.061)	0.004 (0.059)	0.012 (0.061)	0.010 (0.061)	0.012 (0.061)	0.009 (0.060)
Asset tangibility	0.183*** (0.029)	0.185*** (0.029)	0.183*** (0.029)		0.183*** (0.029)	0.185*** (0.030)	0.184*** (0.029)	0.188*** (0.028)	0.184*** (0.029)	0.188*** (0.029)
Labour productivity (ln)	-0.082** (0.035)	-0.080** (0.035)	-0.082** (0.035)		-0.082** (0.035)	-0.080** (0.035)	-0.082** (0.035)	-0.082** (0.035)	-0.082** (0.035)	-0.081** (0.035)
Instrumental variables:										
IT access (sales/purchase network)		0.002*** (0.000)		(0.001)		0.002*** (0.000)		0.002*** (0.000)		0.002*** (0.000)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	34,178	34,178	34,178	34,178	34,178	3 4,178	34,178	34,178	34,178	34,178
F-instruments		42.39				38.18		38.99		37.23

Notes: This table reports the effects of firms' internationalization on non current liabilities over total assets. All the columns report the coefficients and all the regressions include firm and year effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. The table also reports the Kleibergen-Paap Wald F-statistic from the first stage. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 8

Any exporter

Dep. Variables	Baseline	Additional controls			More on the identification strategy	
		Number of units (2008)	ISO9000	ISO9000 & Inv. Opport.	Lending relationship longer than 5 years	Information acquisition through personal interviews
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)
Any exporter	0.017***	0.021***	0.017***	0.026***	0.012***	0.006
	(0.002)	(0.003)	(0.001)	(0.004)	(0.002)	(0.005)
Number of units (2008)		-0.002				
		(0.001)				
ISO9000			0.001	0.003		
			(0.001)	(0.002)		
Investments opportunities				-0.013**		
				(0.005)		
Instrumental variables:						
IT access (e-commerce)	0.003**	0.004**	0.003**	0.005***	0.004**	0.002
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,061	4,880	5,059	4,331	3,882	2,613

Notes: This table reports the effects of firms' export activities on credit rationing. In column (1) we report the baaseline result. In columns (2)-(4), we add the additional controls listed in Table 3. In columns (5) and (6) we report the effects of firms' export activities on credit rationing for the subsample of firms with a lending relationship longer than 5 years and for the subsample of firms that declare that most of the information acquisition of loan officers occurs through personal interviews. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' export status are instrumented using a proxy of firms' reliance on IT systems for e-commerce interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 9

Mechanisms: Global chain participation as a signal

Dep. Variables	Panel A: Expanding global network		Panel B: Improving brand recogn.		Panel C: Supply chain riskiness		Panel D: Use of collateral for lending decisions			
	Expanding the distribution network	Not expanding the distribution network	Improving brand recognition and quality	Not improving brand recognition and quality	Low volatility of intermediates flows	High volatility of intermediates flows	Collateral	No collateral	No collateral (smaller firms)	No collateral (larger firms)
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Global chain participant	-0.051**	-0.018	-0.018***	-0.023*	-0.099***	0.002	-0.011	-0.005**	-0.002***	-0.000
	(0.023)	(0.030)	(0.005)	(0.014)	(0.004)	(0.004)	(0.021)	(0.002)	(0.001)	(0.000)
Instrumental variables:										
IT access (sales/purchase network)	0.001	0.003***	0.001	0.002**	0.001	0.004**	0.003***	0.002	0.002	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,066	2,995	1,128	3,933	2,191	2,870	2,603	2,443	1,063	1,456

Notes: This table studies the first mechanism that could drive the effect of firms' global engagement on bank credit rationing: banks could view global supply chain participation as a signal of the quality and prospects of their client firms. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. In Panel A we study the effect of the implementation of activities aimed at expanding the firms' global network; in Panel B we study the effect of the implementation of activities aimed at improving brand recognition and product quality; in Panel C we study the effect of the riskiness of the chain linkages of the industry; in Panel D we study the effect of the request of collateral guarantees by the lender. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 10

Mechanisms: Internalizing the spillover effects of credit rationing

	Panel A: Nature of the bank		Panel B: Origin and destination markets			
	Local banks & domestic without int. network	National with int. network & foreign banks	Full sample	Europe	Asia	America
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
Dep. Variables	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)
Global chain participant	-0.025** (0.012)	-0.051*** (0.016)	-0.023** (0.011)			
Global chain participant: Europe				-0.022** (0.011)		
Global chain participant: Asia					0.003** (0.001)	
Global chain participant: America						0.002 (0.002)
Instrumental variables:						
IT access (sales/purchase network)	0.002*** (0.001)	0.001 (0.002)	0.002*** (0.001)			
IT access (sales/purchase network In Europe)				0.002*** (0.000)		
IT access (sales/purchase network in Asia)					0.003*** (0.001)	
IT access (sales/purchase network in America)						0.004*** (0.001)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,658	1,193	5,061	5,061	5,061	5,061

	Panel C: Exposure of banks to EU15 countries		Panel D: Exposure of banks to Other EU countries	
	Exposure > 60%	Exposure ≤ 60%	Exposure > 10%	Exposure ≤10%
	Biv Probit	Biv Probit	Biv Probit	Biv Probit
Dep. Variables	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)
Global chain participant	-0.034*** (0.012)	-0.008 (0.006)	-0.128*** (0.004)	-0.027** (0.013)
Instrumental variables:				
IT access (sales/purchase network)	0.002 (0.002)	0.003*** (0.001)	0.003*** (0.001)	0.002 (0.002)
Control variables	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Observations	1,102	3,704	1,831	2,901

Notes: This table studies the second mechanism that could drive the effect of firms' global engagement on bank credit rationing: banks could protect supply chain participants because they internalize the negative consequences that a denial of credit can have on their own foreign business.. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. In Panel A we study the effect of the nature of the bank; in Panel B we study the effect of origin and destination markets; in Panel C we study the exposure to EU15 countries of the banks located in the country of origin of the firm; in Panel D we study the exposure to Other EU countries of the banks located in the country of origin of the firm. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 11

Mechanisms: Internalizing the spillover effects of credit rationing (cont.)

	Bank not present in the main destination countries	Share of bank subsidiaries in the main destination countries <1.4%	Share of bank subsidiaries in the main destination countries >1.4% <4.8%	Share of bank subsidiaries in the main destination countries >4.8%	Share of bank subsidiaries in the main destination countries >4.8% (larger firms)	Share of bank subsidiaries in the main destination countries >4.8% (smaller firms)
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
Dep. Variables	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(3)	(4)
Global chain participant	0.002***	0.012***	-0.008*	-0.010***	-0.099***	-0.030
	(0.000)	(0.001)	(0.005)	(0.001)	(0.007)	(0.127)
Instrumental variables:						
IT access (sales/purchase network)	-0.002	0.001	0.010*	-0.000	-0.000	-0.001
	(0.002)	(0.001)	(0.006)	(0.002)	(0.003)	(0.007)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	880	163	236	510	362	193

Notes: This table reports the effects of firms' internationalization and areas of operation of internationally active banks on credit rationing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. The table also reports the Kleibergen-Paap Wald F-statistic from the first stage. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 12

Mechanisms: the role of banks' knowledge

	Panel A: Nature of banks-excluding firms with a foreign main bank				Panel B: Nature of products exported		
	Bank not present in the main destination countries	Share of bank subsidiaries in the main destination countries <1.2%	Share of bank subsidiaries in the main destination countries >1.2% <4.5%	Share of bank subsidiaries in the main destination countries >4.5%	Excluding opaque products		Excluding products not sold domestically
					Sectoral fraction of inputs not sold on exchange	Sectoral fraction of inputs not sold on exchange (conservative)	
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
Dep. Variables	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global chain participant	0.090*** (0.006)	0.821*** (0.005)	0.257*** (0.015)	-0.080*** (0.008)	-0.034** (0.014)	-0.021** (0.009)	
Global chain participant: good sold in domestic market							-0.023** (0.009)
Instrumental variables:							
IT access (sales/purchase network)	-0.003* (0.002)	0.003 (0.012)	0.003 (0.006)	-0.002 (0.002)	0.002*** (0.001)	0.001 (0.002)	0.002** (0.001)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	829	132	209	456	3,095	1,094	4,811

	Panel C: Bank specialization			
	Bank specialization in the sector of the company		Bank specialization in the contiguous sector	
	Concentration < median	Concentration > median	Concentration < median	Concentration > median
	Biv Probit	Biv Probit	Biv Probit	Biv Probit
Dep. Variables	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)
Global chain participant	-0.061*** (0.005)	-0.014 (0.016)	0.080*** (0.004)	-0.032** (0.016)
Instrumental variables:				
IT access (sales/purchase network)	0.000 (0.002)	0.001 (0.002)	0.002 (0.002)	-0.001 (0.002)
Control variables	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Observations	825	843	825	843

Notes: This table studies how the banks' knowledge could drive the effect of firms' global engagement on bank credit rationing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' global chain participation are instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. In Panel A we study the effect of the nature of banks-excluding firms with a foreign main bank; in Panel B we study the effect of the nature of product exported; in Panel C we consider the bank sepcialization in the sector of the company and in the contigous sector. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Online Appendix

IV strategy for relationship length.

In Table A3, in the spirit of Guiso et al. (2004) and Herrera and Minetti (2007), we propose an IV approach for the subsample of Italian firms by instrumenting the relationship lending dummy with variation in the tightness of the 1936 Italian banking regulation across local banking markets (at the provincial level).

The instrumental variables rely on identifying exogenous restrictions on the local banking system that affect firms' opportunity and availability of borrowing from a main bank on a relational basis but do not directly affect banks' decisions about credit rationing. To this end we exploit the 1936 Banking Law which subjected the Italian banking system to strict regulation of entry and branch opening in provinces, freezing the size and bank-composition of the local credit markets until the beginning of the 1990s. The rationale for using this regulatory event to instrument relationship length is the theoretical and empirical evidence showing that the likelihood of close bank-firm relationships depends on the concentration, size and organizational structure of local credit markets (see, e.g., Boot and Thakor, 2000; Hauswald and Marquez, 2006).

The 1936 Banking Law imposed strict limits on the ability of different types of banking institutions to open new branches. Specifically, each bank type was attributed a geographical area of competence based on its presence in 1936, and its ability to grow and lend was restricted to that area. In particular, national banks could open branches only in the main cities; cooperative and local commercial banks could open branches within the boundaries of the province; savings banks could expand within the boundaries of the region. Guiso et al. (2004) demonstrate that the geographical distribution of bank branches in 1936 was broadly uncorrelated with the geography of economic development, and that it deeply impacted local credit markets in the decades that followed. Entry into the local markets was liberalized only during the 1990s.

In Table A3, we use as instruments three indicators that Guiso et al. (2004) employ to characterize the local structure of the banking system in 1936: (i) the share of bank branches owned by local banks over total banks in the province in 1936, (ii) the number of popular bank branches in the province per 100,000 inhabitants in 1936, and (iii) the number of bank branches in the province per 100,000 inhabitants in 1936.

Table A1
Variable definitions

Variable	Description and source
Credit rationing:	
Rationing	Dummy variable equal to one if the firm unsuccessfully applied for credit, and zero otherwise. (EFIGE)
Foreign activity:	
Global chain participant	Dummy variable equal to one if the firm participates in a global value chain, and zero otherwise. We define firms involved in a global value chain as firms that import intermediate goods and/or services and export their own products/services in 2008. (EFIGE)
Any exporter	Dummy variable equal to one if the firm is an exporter, zero otherwise. We define firms as being exporters if they sold abroad some or all of its own products/services in 2008. (EFIGE)
Global chain participant: services	Dummy variable equal to one if the firm participates in a global value chain (by importing services), and zero otherwise. (EFIGE)
Global chain participant: intermediate goods	Dummy variable equal to one if the firm participates in a global value chain (by importing intermediate goods), and zero otherwise. (EFIGE)
Regular global chain participant	Dummy variable equal to one if the firm has participated regularly (since before 2008) in a global value chain, and zero otherwise. (EFIGE)
Global chain participant (i)	Dummy variable equal to one for global chain participants and for non-importing firms that are subcontractors of intermediate goods, and zero otherwise. (EFIGE)
Global chain participant (ii)	Dummy variable equal to one for global chain participants with the exclusion of importers of raw materials and/or intermediate goods, and zero otherwise.(EFIGE)
Global chain participant (i and ii)	Dummy variable equal to one for global chain participants with the exclusion of importers of raw materials and/or intermediate goods, and for non-importing firms that are subcontractors of intermediate goods, and zero otherwise. (EFIGE)
Relatively downstream	(EFIGE)
Relatively upstream	(EFIGE)
Global chain participant: Europe	Dummy variable equal to one if the firm participates in a global value chain with partners located in Europe, and zero otherwise. (EFIGE)
Global chain participant: Asia	Dummy variable equal to one if the firm participates in a global value chain with partners located in Asia, and zero otherwise. (EFIGE)
Global chain participant: America	Dummy variable equal to one if the firm participates in a global value chain with partners located in America, and zero otherwise. (EFIGE)
Global chain participant: good sold in domestic market	Dummy variable equal to one if the firm participates in a global value chain (by exporting goods sold also in the domestic market), and zero otherwise. (EFIGE)
Control variables:	
Age (ln)	Logarithm of the number of years since inception. (EFIGE)
Number of employees (ln)	Logarithm of the number of workers employed in the firm. (EFIGE)
Debt ratio	Total debt over total assets. (BvD-Amadeus)
ROA	EBIT over total assets. (BvD-Amadeus)
Asset tangibility	Tangible fixed assets over total assets. (BvD-Amadeus)
Labour productivity	Value added (EBITDA plus labour costs) over the number of employees. (BvD-Amadeus)
Family firm	Dummy variable equal to 1 if the firm's main shareholder is a family or an individual, and zero otherwise. (EFIGE)
Group	Dummy variable equal to 1 if the firm belongs to a business group, and zero otherwise. (EFIGE)
Region dummies	Region where the firm is located (at the NUTS-2 level). (BvD-Amadeus)
Sector dummies	Activity sector of the firm (NACE rev2 code). (BvD-Amadeus)
Instrumental variables:	
IT access (sales/purchase network)	Triple interaction among a dummy variable equal to one if the firm declares to have access to a broadband connection (zero otherwise), a dummy variable equal to one if the firm declares the reliance on IT systems for managing the sales/purchase network (zero otherwise), and a regional indicator of broadband connection diffusion (households' broadband access). (EFIGE and Eurostat)
IT access (e-commerce)	Triple interaction among a dummy variable equal to one if the firm declares to have access to a broadband connection (zero otherwise), a dummy variable equal to one if the firm declares the reliance on IT systems for the e-commerce (zero otherwise), and a regional indicator of broadband connection diffusion (households' broadband access). (EFIGE and Eurostat)

Table A2

Baseline results: firms' internationalization and likelihood of rationing
(Probit model and alternative IVs strategy)

Dep. Variables	Panel A: Probit model				Panel B: Alternative IVs strategy
	Global value chain vs Export		Services vs Intermediate goods		Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)
Global chain participant	0.012				-0.021*
	(0.011)				(0.011)
Any exporter		0.022**			
		(0.009)			
Global chain participant: services			-0.007		
			(0.013)		
Global chain participant: intermediate goods				0.020*	
				(0.011)	
Instrumental variables:					
IT access (sales/purchase network)					0.002**
					(0.001)
IT access (e-commerce)					0.002**
					(0.001)
Control variables	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4,618	4,618	4,618	4,618	4,618
Pseudo R2	0.117	0.118	0.116	0.118	0.116
F-instruments	-	-	-	-	5.91

Notes: This table reports the effects of firms' internationalization on credit rationing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. See Table A1 and Section 3.2.3 for details on the control variables. The table also reports the Kleibergen-Paap Wald F-statistic from the first stage. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table A3

Instrumenting the dummy for relationship lending

Dep. Variables	Subsample of Italian firms			
	Probit	Probit	Probit	Probit
	Rationing	Global chain participant	Rel. Length > 5 years	Global chain participant × Rel. Length > 5 years
	(1)	(2)	(3)	(4)
Global chain participant (pred.)	-0.234			
	(0.205)			
Relationship length >5 years (pred.)	-0.123			
	(0.179)			
Global chain participant * Rel. Length >5 years (pred.)	-0.110*			
	(0.064)			
Instrumental variables:				
IT access (sales/purchase network)		0.001*		-0.044***
		(0.000)		(0.002)
IT access (sales/purchase network) * Rel. length >5 years				0.046***
				(0.002)
Popular banks in 1936			-0.041*	
			(0.022)	
Local banks in 1936			-0.185**	
			(0.091)	
Branches over population in 1936			0.004**	
			(0.002)	
Control variables	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Observations	1,743	2,815	1,743	1,745

Notes: This table reports the effects of firms' internationalization on credit rationing for the firms with a lending relationship longer than 5 years. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measure for firms' global chain participation is instrumented using a proxy of firms' reliance on IT systems for managing the sales/purchase network interacted with a regional indicator of broadband access. The measure for firms' lending relationship is instrumented using the indicators of the 1936 Italian banking regulation (see, e.g., Guiso et al., 2004, and the Appendix for more details on these instruments). See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table A4
Mechanisms: export

Dep. Variables	Panel A: Destination market and rationing				Panel B: Use of collateral for lending decisions	
	Full sample	Europe	Asia	America	Collateral	No collateral
	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit	Biv Probit
	Rationing	Rationing	Rationing	Rationing	Rationing	Rationing
	(1)	(2)	(3)	(4)	(5)	(6)
Any exporter	0.017***				0.021***	-0.001
	(0.002)				(0.002)	(0.002)
Exporter in Europe		0.001				
		(0.001)				
Exporter in Asia			0.001			
			(0.001)			
Exporter in America				-0.001***		
				(0.000)		
Instrumental variables:						
IT access (e-commerce)	0.003**				0.002	0.006***
	(0.001)				(0.002)	(0.002)
IT access (e-commerce) * Destination in Europe		0.001*** (0.001)				
IT access (e-commerce) * Destination in Asia			0.002*** (0.001)			
IT access (e-commerce) * Destination in America				0.001*** (0.000)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,061	5,061	5,061	5,061	2,603	2,443

Notes: This table studies how destination markets (Panel A) and the use of collateral for lending decisions (Panel B) could drive the effect of firms' export status on bank credit rationing. All the columns report the marginal effects and all the regressions include industry and regional fixed effects. The measures for firms' export status are instrumented using a proxy of firms' reliance on IT systems for managing the e-commerce interacted with a regional indicator of broadband access. See Table A1 and Section 3.2.3 for details on the control variables. In parentheses are standard errors that are robust to heteroskedasticity and clustered at the regional level. *Significant at 10%; **significant at 5%; ***significant at 1%.