DISCUSSION PAPER SERIES

DP14792

TRADE SHOCKS AND CREDIT REALLOCATION

Stefano Federico, Fadi Hassan and Veronica Rappoport

INTERNATIONAL TRADE AND REGIONAL ECONOMICS

ISSN 0265-8003

TRADE SHOCKS AND CREDIT REALLOCATION

Stefano Federico, Fadi Hassan and Veronica Rappoport

Discussion Paper DP14792
Published 21 May 2020
Submitted 20 May 2020

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

TRADE SHOCKS AND CREDIT REALLOCATION

Abstract

This paper shows that there are endogenous financial constraints arising from trade liberalization. Banks with a large share of loans on firms exposed to competition from China suffer an increase in non-performing loans and reduce their credit capacity. The drop in credit supply affects both firms directly exposed to import-competition from China, and firm expected to expand upon trade liberalization, with economically relevant implications in terms of employment, investment, and output. This financial spillover between losers and winners from trade retards the reallocation of factors of production between firms and sectors, crucial to the welfare implication of trade liberalization.

JEL Classification: F61, F62, G21

Keywords: N/A

Stefano Federico - stefano.federico@bancaditalia.it
Bank of Italy

Fadi Hassan - fadi.hassan@bancaditalia.it
Bank of Italy

Veronica Rappoport - v.e.rappoport@lse.ac.uk
London School of Economics and CEPR

Acknowledgements
We thank Rodrigo Adao, Pol Antras, David Atkin, David Autor, Francesco Caselli, Gabriel Chodorow-Reich, Federico Cingano, Stefania Garetto, Nicola Gennaioli, Tarek Hassan, Elhanan Helpman, Killian Huber, Asim Khwaja, Matteo Maggiori, Atif Mian, Claudio Michelacci, Eduardo Morales, Holger Mueller, Melina Paopoutsi, Matteo Piazza, Thomas Philippon, Kadee Russ, Fabiano Schivardi, Andrei Shleifer, Amir Sufi, and Jeremy Stein for very insightful comments and discussions. We thank also seminar participants at Harvard, MIT, Boston College, Duke, NYU-Stern, LSE, EIEF, Barcelona Summer Forum, NBER ITI, Berkeley-PIIE Trade & Macro Forum, and HEC Finance Spring Conference. The opinions expressed and arguments employed herein are those of the authors and do not reflect the official views of the Bank of Italy.

Trade Shocks and Credit Reallocation

Stefano Federico*, Fadi Hassan†, Veronica Rappoport‡

May 2020

Abstract

This paper shows that there are endogenous financial constraints arising from trade liberalization. Banks with a large share of loans on firms exposed to competition from China suffer an increase in non-performing loans and reduce their credit capacity. The drop in credit supply affects both firms directly exposed to import-competition from China, and firm expected to expand upon trade liberalization, with economically relevant implications in terms of employment, investment, and output. This financial spillover between losers and winners from trade retards the reallocation of factors of production between firms and sectors, crucial to the welfare implication of trade liberalization.

*Bank of Italy
†Bank of Italy and CEP
‡London School of Economics, CEP, and CEPR

We thank Rodrigo Adao, Pol Antras, David Atkin, David Autor, Francesco Caselli, Gabriel Chodorow-Reich, Federico Cingano, Stefania Garetto, Nicola Gennaioli, Tarek Hassan, Elhanan Helpman, Killian Huber, Asim Khwaja, Matteo Maggiori, Atif Mian, Claudio Michelacci, Eduardo Morales, Holger Mueller, Melina Paopoutsi, Matteo Piazza, Thomas Philippon, Kadee Russ, Fabiano Schivardi, Andrei Shleifer, Amir Sufi, and Jeremy Stein for very insightful comments and discussions. We thank also seminar participants at Harvard, MIT, Boston College, Duke, NYU-Stern, LSE, EIEF, Barcelona Summer Forum, NBER ITI, Berkeley-PIIE Trade&Macro Forum,and HEC Finance Spring Conference. The opinions expressed and arguments employed herein are those of the authors and do not reflect the official views of the Bank of Italy.

1 Introduction

The effect of trade liberalization on welfare and economic activity depends crucially on the ease of factors of production to move across firms, sectors, and regions, according to the changing patterns of comparative advantage. There is significant evidence of a slow adjustment of labor markets to trade shocks, which is associated to frictions in labor mobility due to geographical barriers or sector-specific skills.[1] This paper contributes to this debate by empirically identifying a financial friction that may hinder the reallocation of credit across firms and sectors in the aftermath of a trade shock: the endogenous funding constraint of banks whose loan portfolios are affected by the liberalization.

Our paper finds that trade liberalization not only negatively affects import-competing firms, but also indirectly impacts on banks' lending capacity, through the deterioration of their portfolios of loans. Given the role of credit for both investment in physical capital and working capital, a cut in the *supply of credit* due to trade liberalization could potentially restrain the reallocation of factors across firms.

To assess this hypothesis we investigate how China's accession to the WTO affects banks' supply of credit and the resulting consequences on the real economy of Italy. As Figure 1 shows, after China entered in the WTO at the end of 2001, there was an acceleration of imports from China, whereas exports to China were not particularly affected. Following the approach by Autor et al. (2013), we identify the sectors most affected by import competition from China and estimate bank exposure to this trade shock by looking at the share of loans to firms in more affected sectors. Then, we analyze the patterns of credit supply across banks with different degrees of exposure.

We find that banks with loan portfolios more exposed to the trade shock reduce the supply of credit relative to other banks. Importantly, these banks cut credit both to firms subject to competition from China, which we should expect to shrink, and to firms in sectors not affected or even benefiting from the trade shock, which we would expect to expand after the liberalization. This contraction in credit supply has real effects on firm

[1] See among others Topalova (2010), Menezes-Filho and Muendler (2011), Autor et al. (2013) , Kovak (2013) , Dix-Carneiro (2014) , Autor et al. (2014), Acemoglu et al. (2016), Hakobyan and McLaren (2016), Dix-Carneiro and Kovak (2017) , Utar (2018).

outcomes and it leads to significant losses in terms of employment, investments, and output. In other words, we find spillovers between losers and winners of trade liberalization that, through the bank lending channel, hinder resource reallocation across sectors.

For our analysis we rely on the credit registry data for Italy and match it to banks and firms balance sheet. Our dataset covers the universe of loans to firms above €75,000 that were made in Italy between 1998 and 2007. We then exploit bank and firm identifiers to link the credit data with detailed information about all banks operating in Italy and the universe of incorporated firms. This allows us to analyze credit patterns controlling for key bank characteristics and looking into real outcomes such as firm output, investment, and employment.

We begin our analysis by confirming that banks in Italy tend to specialize in industries. As found in Paravisini et al. (2017), banks are typically heterogeneous in their lending patterns and are skewed towards specific industries in which they specialize. We find a number of banks with portfolios heavily concentrated, through their related firms, in industries most affected by the rise in competition from China. Our source of variation of bank exposure to the trade shock relies on the share of loans that, before China accession to the WTO, banks have in sectors that turn out to be more severely affected by competition from China. Then, we compare the evolution of the allocation of credit across banks with different degrees of exposure.

We firstly use the Khwaja and Mian (2008) within-firm estimator to identify bank-specific changes in the supply of credit. We find that a bank with one standard deviation higher share of loans towards exposed sectors reduces credit supply to the same firm by 11% during the period 2002-2007. This effect holds not only for firms directly hit by the rise of import competition from China, but also for highly productive and exporting firms in sectors where Italy has a comparative advantage. These are firms that should actually expand and absorb more resources after the liberalization.

We investigate if the source of these financial spillovers towards firms not directly affected by import competition from China comes from local general equilibrium effects. We explore the geographical dimension of the trade shock and investigate whether the contraction of credit is deeper in provinces with a high degree of exposure to China. We

find that this is not the case as firms not subject to competition from China, located in provinces with low China exposure, still face a reduction in the relative supply of credit from more exposed banks. This suggests that the transmission mechanism of credit contraction comes from the internal capital market of banks and not from local general equilibrium factors. Our findings contrast with those in Autor et al. (2013) and Hakobyan and McLaren (2016) for the labor effects of a trade shock. While due to mobility frictions, labor markets effects tend to be localized, the bank credit channel propagates nationally as banks operate in multiple regions.

The within-firm comparison of lending by exposed relative to non-exposed banks does not inform us on the overall availability of credit to the firm. It may be the case, for example, that a firm could compensate for the loss in credit from exposed banks with an increase in funding coming from banks with low exposure. To analyze the total effect on credit, we compute the exposure of firms to the bank lending channel of the trade shock, as the weighted average of the exposure of all the banks lending to the firm. Then, we look at the effect of this measure on the total credit that a firm receives. We find that firms with one standard deviation higher share of their funding related to exposed banks experience a 8% drop in credit relative to firms borrowing from less exposed banks. This result applies both to firms in sectors directly and non-directly hit by import competition from China. In other words, firms were unable to substitute exposed banks with alternative sources of funding.

We look at the implications of the drop in credit supply on real variables such as employment, investment and output. Exposed banks account for a significant fraction of firms' credit, even among firms not subject to import competition from China. Comparing firms in the top 75 percentile relative to those in the bottom 25 percentile in terms of their share of credit in exposed banks, we find a reduction between 1% and 1.3% in employment, and between 2% and 1.3% reduction in investment, depending on the sector of activity.

To shed light on the mechanisms that could drive our results, we exploit detailed information on banks' balance sheets. Firstly, we observe that among firms in sectors subject to higher competition from China, the level of non-performing loans (NPLs) increases by

40% in the six years after China's entry to the WTO. This is not the case for firms not directly hit by import-competition from China. Banks with larger share of their loans portfolio in those affected sectors could not offset these losses with external funding. We find no effect on their interbank lending and they did not inject equity to offset the NPL losses —i.e., the core capital of the exposed banks decreased in a magnitude similar to the rise in NPLs. As a result, these banks reduced their commercial lending during 2002-2007. As further support for this conclusion, we confirm that exposed banks with more core capital, relative to regulatory requirements, were less constrained in their lending capacity during the same period.

The results of the paper are likely to extend to other contexts. Our findings are consistent with the prediction of classical banking models such as Froot et al. (1993), Holmstrom and Tirole (1997), Froot and Stein (1998) and Deyoung et al. (2015), which reinforces the generality of our results. In such frameworks, banks' losses cannot be immediately restored due to costs in raising external capital. Then, as long as banks have some degree of loan concentration in certain activities, a negative sector-specific shock may be transmitted to otherwise unaffected firms.[2]

This paper contributes to several strands of the literature. First, the paper is linked to the core question of how the economy adjusts to trade shocks. This literature has largely focused on the (slow) reallocation of workers across sectors as in Autor et al. (2014), Acemoglu et al. (2016), Dix-Carneiro (2014), Menezes-Filho and Muendler (2011), Utar (2018); or across regions in Autor et al. (2013), Dix-Carneiro and Kovak (2017), Hakobyan and McLaren (2016), Kovak (2013), Topalova (2010), Aghion et al. (2008). There is only very limited evidence on capital reallocation after trade shocks, even though, as argued by Dix-Carneiro (2014), quantifying the mobility of capital, and its interaction with labor mobility frictions, is essential to understanding the full transitional dynamics of the economy after a trade shock. A notable exception is Antràs and Caballero (2009) who focus on the effects of a trade shock on international capital flows across countries, and also Lanteri et al. (2019) who look at the reallocation of machines and physical capital in Peru

[2]Over time banks should be able to restore their core funding, so the credit effect of a trade shock should fade away over the medium run. Unfortunately, we are unable to analyze the medium-long run effects because of the global financial crisis hitting the banking system in 2008.

after the China shock.

This paper also contributes to the literature on credit and trade, such as Manova (2008), Amiti and Weinstein (2011), Minetti and Zhu (2011), Manova (2012), Chor and Manova (2012), Paravisini et al. (2015), and Antràs and Foley (2015). This literature looks at the effects of credit shocks on firms' exports. Here, we look at the effects of a trade shock on banks, which, through the lending channel, is transmitted to the rest of the economy.

Our paper is also related to the literature on the financial and real implications of shocks to banks (Khwaja and Mian, 2008; Paravisini, 2008; Amiti and Weinstein, 2011; Schnabl, 2012; Chodorow-Reich, 2014; Paravisini et al., 2015; Jiménez et al., 2014; Baskaya and Kalemli-Ozcan, 2016; Cingano et al., 2016; Huber, 2018; Amiti and Weinstein, 2018). In this literature, the identification strategy relies on shocks that directly affect the financial sector. Instead, the shock to banks in our analysis comes from the performance of firms in the real sector. This allows us to learn not only about the consequences of the trade shock under study, but about how real demand shocks spread into the general economy.

Finally, the paper is related to recent studies that look at how banks transmit liquidity shocks across geographical markets (Gilje et al., 2016; Cortés and Strahan, 2017; Bustos et al., 2017). We also find that national banks transmit geographically localized shocks –in our case, a trade liberalization shock– to otherwise not affected regions. We therefore add evidence on the banking sector's broader role in structural economic adjustment after trade liberalization.

The rest of the paper is structured as follows. Section 2 describes the data. Section 3 explains the empirical strategy; Section 4 reports the baseline results on the intensive and extensive margins of credit; Section 5 estimates the effects on total credit and the real effects on output, investment and employment; Section 6 focuses on the mechanism behind our findings; Section 7 discusses the robustness of our results; Section 8 concludes.

2 Data and Measurement

2.1 Data sources

Our analysis is based on a matched bank-firm dataset containing loans for a large sample of Italian companies. The final dataset is obtained by combining four sources: credit register, banks' balance sheets data, firms' balance sheets data, and world bilateral imports by product.

The first source is the Italian Credit Register administered by the Bank of Italy, which contains a monthly panel of the outstanding debt of every borrower (firms or individuals) with loans above EUR 75,000 with each bank operating in Italy. We focus on corporate borrowers and build an annual bank-firm panel, where loans are measured as the outstanding credit granted at the end of a given year. The baseline estimates are run on the subset of firms in the manufacturing sector. We also report results including firms in non-manufacturing sectors.

Banks' balance sheet data are from the Bank of Italy Supervisory reports, which provide detailed data on banks' assets and liabilities. Firms' balance sheet data (including variables such as revenues, investment, employment, wage bill) are taken from the CERVED database, which covers the universe of incorporated firms in Italy. We match the bank-firm loan data to banks' and firms' balance sheet data using unique bank and firm identifiers, respectively.

Finally, we use data from the UN Comtrade Database on imports from China at the six-digit Harmonized System (HS) product level for Italy and other advanced economies.[3] We convert the product classification to the more aggregate NACE 4-digit using concordance tables provided by Eurostat. This information is needed to identify the exposure of firms and banks (via their loan portfolio) to the China shock (see Subsection 2.2).

Table 1 shows the summary statistics of banks and firms characteristics in our sample. The unit of observation in our empirical analysis is at the bank-firm annual level. The dataset includes, on average, 504 banks and about 86 thousand manufacturing firms.

[3]The countries are USA, Australia, Denmark, Finland, France, Germany, Japan, New Zealand, Switzerland, and Spain.

Firms with multiple banking are very common in Italy, even among small firms (Detragiache et al., 2000). About 75% of firms in our sample borrow from two or more banks and the average number of banking relations per firm is 3.4. As we discuss in the following sections the fact that firms borrow from multiple banks is an essential feature of our identification strategy.

2.2 Defining firm and bank exposure to the China shock

To implement our empirical approach, we firstly need to identify sectors that were directly hit by import competition from China. We will refer to firms whose main activity is in those sectors as 'hit'. These hit firms are, based on their economic activity, *directly* affected by import competition from China. As it will become clear in the next sections, other firms were also *indirectly* affected through the lending channel mechanism studied here. We refer to banks with high share of loan portfolios towards hit borrowers as 'exposed'. For the first step, we follow closely Autor et al. (2013) in their empirical strategy and compute the following sector-level (4-digit) measure of exposure to the China shock:[4]

$$China_s^{IT} = \frac{\Delta M_s^{IT-CH}}{L_{s,1991}^{IT}} \tag{1}$$

The numerator is the difference in Italy's imports from China in a given 4-digit NACE sector s between the years after China's accession to WTO (2002-2007 average) and those before (1994-2001 average).[5] The denominator corresponds to the employment level in the same sector in 1991.[6] According to this measure, the five sectors with the highest exposure to the China shock are 'Coke oven products', 'Watches and clocks', 'Television and radio receivers', 'Games and toys', 'Other organic basic chemicals'. The least exposed sectors are instead 'Aircraft and spacecraft', 'Carpets and rugs', 'Beer', 'Sugar', 'Distilled alcoholic beverages'. This baseline measure does not account for input-output linkages,

[4]We exclude the oil and energy sectors, which are more volatile and subject to global fluctuations, if we include those sectors all results hold.

[5]The results are robust to using the difference in imports between 1994 and 2007.

[6]We take the year 1991 because it is the one with census data, before that the raise of China could affect the employment structure by sector. The alternative census year would be 2001, but it is likely to be less exogenous to the raise of China.

but only for the direct exposure to import competition from China. In the robustness section we account also for the indirect effect that upstream industries can suffer, as their clients shrink due to their exposure to China, and for the potential benefits of downstream industries that now can source cheaper inputs from China.

Using the baseline sector-level measure of exposure, we define firm i as subject to the China shock or more simply 'hit' ($D_{is}^{IT} = 1$) if its main sector of activity falls in the upper half of the distribution (i.e. its exposure is above the median values across 4-digit sectors):

$$D_{is}^{IT} = \begin{cases} 1, & \text{if } China_{s}^{IT} > \text{Median} \\ 0, & \text{otherwise} \end{cases} \tag{2}$$

For each bank b, we then measure its exposure to the China shock as the share of its loans to hit firms on its total loans to manufacturing companies. The results are robust to alternative definition of firm and bank exposures to the shock.[7] To attenuate endogeneity issues and possible portfolio adjustments by banks in anticipation of China's entrance into the WTO, we measure banks' exposure averaging the shares over the years 1998-2000. We prefer to average our measure of bank exposure over multiple years rather than taking a single year (e.g. 1998), so we avoid some bias that may arise from a year specific shock at the beginning of the period.[8]

$$Exposure_{b}^{IT} = \frac{\sum_{i} C_{ib} D_{is}^{IT}}{\sum_{i} C_{ib}} \tag{3}$$

where C_{ib} is outstanding credit of bank b to a manufacturing firm i.

As Table 1 shows, the median bank exposure amounts to 0.358, with a standard deviation of 0.218 (see Figure 2 for the density distribution). In Table 2 we follow the approach of Imbens and Wooldridge (2008) and show the balance of "exposed" (above median exposure) and "non-exposed" (below median exposure) banks by looking at the normalized difference of bank and borrower characteristics over the period 1998-2000. As a rule of

[7] Tables A1 and A2 in the Appendix show the results using a continuous measure of sectoral exposure to import competition, and measuring bank exposure relative to bank total assets, respectively.

[8] We start from 1998 because it is the first year with data on banks' balance sheet in our sample; and we end in 2000 as it is a year before China access into the WTO, so it is more exogenous than ending in 2001.

thumb, Imbens and Wooldridge (2008) argue that a normalized difference of covariates above 0.25 standard deviations is substantial. In our case, all variables are within this tolerance threshold, although banks' total assets and the share of core liabilities are close to it. Reassuringly, the characteristics of the borrower across the two groups show a high degree of overlap.

A standard concern is that Italy's imports from China might capture not only a pure 'China supply' effect but also shocks to Italian demand for imports, which could be correlated with lending decisions. In addition, there might be measurement issues, as this measure does not account for Italian exports to third countries being affected by the raise of China (e.g. Italian exports to Germany that are now substituted by Chinese exports to Germany). Following Autor et al. (2013), we instrument the trade shock using the variation in imports from China of a set of advanced economies other than Italy (ΔM_s^{OC}).[9]

This instrumental approach aims to recover supply-side determinants of imports from China, rather than Italian local factors. The motivation for this instrument is that high income economies are similarly exposed to growth in imports from China that is driven from Chinese supply shocks. However, the instrument relies on two key underlying assumptions: i) industry demand shocks should be uncorrelated across countries and ii) demand shocks from Italy do not trigger increasing returns to scale in Chinese manufacturing and do not induce them to export more to other high income countries. It is possible that industry demand shocks across European countries are correlated, so as a robustness we also use US imports only as an instrument and results hold.[10] Moreover, the instrument should capture the effect of Chinese competition that affects Italian firms not only domestically, but also in international markets. Specifically, we compute an industry-level measure of exposure to China shock based on imports from China by a group of other countries ($China_s^{OC}$) and use it to identify the corresponding set of 'exposed' sectors and firms (D_{is}^{OC}).

[9]The countries other than Italy chosen as benchmark are USA, Australia, Denmark, Finland, France, Germany, Japan, New Zealand, Switzerland, and Spain. The results are robust to variations in the set of other countries considered.

[10]Table A3 in the Appendix report the results of our baseline specification using only the US imports from China as an instrument.

$$China_s^{OC} = \frac{\Delta M_s^{OC-CH}}{L_{s,1991}^{IT}} \tag{4}$$

$$D_{is}^{OC} = \begin{cases} 1, & \text{if } China_s^{OC} > \text{Median} \\ 0, & \text{otherwise} \end{cases} \tag{5}$$

Armed with this different definition of directly 'hit' firms, we compute a measure of bank exposure which is exogenous to demand developments in Italy ($Exposure_b^{OC}$) and can therefore be used as an instrument in our estimation strategy. Moreover, this measure is also exogenous to the supply of credit of Italian banks, in fact, while on principle bank credit in Italy can affect Italian imports from China, it can hardly affect the imports of the US or Germany from China:

$$Exposure_b^{OC} = \frac{\sum_i C_{ib} D_{is}^{OC}}{\sum_i C_{ib}} \tag{6}$$

Our measure of bank exposure focuses on import-competing related firms and does not take into account the potential positive effect of China's entrance in the WTO on the export opportunities for Italian firms. As Figure 1 shows, the share of Italian exports to China after its access into the WTO was not different from the one in the early 1990s, so empirically the export channel is unlikely to be particularly relevant during the period under analysis. Still, in Subsection 4.2 we explore how the credit supply shock affects firms in exporting sectors where Italy has comparative advantages.

3 Empirical Strategy

For our identification strategy, we exploit the ex-ante heterogeneity across banks in terms of their exposure to the China shock, as defined in Equation 3. The goal of our empirical strategy is to identify the impact of bank exposure on the supply of credit to firms and the implication that this has on resource reallocation. Figure 3 compares the trends in aggregate lending to Italian manufacturing companies between banks that were ex-ante

above median of exposure to the China shock (blue continuous line) and below median (red dashed line). The two time series for aggregate credit are indexed to 100 at the end of 2001. While lending growth was initially very similar across the two groups of banks, since 2002 the two trends start diverging: lending by banks that were more exposed to the China shock grew significantly less compared to lending by non-exposed banks. However, this diverging pattern can be the result of both supply and demand effects, as firms subject to competition from China may shrink and demand less credit, driving the aggregate pattern of more exposed banks.

Therefore, Figure 4 further disaggregates lending by the two groups of banks according to borrowers characteristics. In particular, we distinguish between borrowers operating in sectors directly hit by import competition from China ('hit' firms) and those in sectors with below median exposure ('non-hit' firms). In this way we can compare the lending patterns across banks to firms with a similar evolution of credit demand. The figure shows that lending of exposed banks grew more slowly than that of non-exposed banks both for firms that were directly hit by import competition from China, and firms that were not. While these aggregate patterns provide suggestive evidence of differences in credit allocation between exposed and non-exposed banks, the results might be driven by compositional effects, demand shocks, and other multiple factors. We rely on our empirical strategy to properly identify such effects.

3.1 Baseline specification: the intensive margin of credit

Our empirical approach relies on the Khwaja and Mian (2008) within-firm estimation that allows to identify bank-specific credit supply shocks, exploiting the fact that 75% of the firms in our sample borrow from multiple banks (on average, firms borrow from 3.4 banks). For each bank-firm-year observation our baseline specification is:

$$\ln C_{ibt} = \beta_1 \, Exposure^{IT}_{-i,b} \times Post_t + \beta_2 \, Spec_{ibt} + \boldsymbol{X}'_{\boldsymbol{b}}\boldsymbol{\delta} \times Post_t + \alpha_{it} + \gamma_{ib} + \epsilon_{ibt} \qquad (7)$$

The dependent variable is the log of outstanding credit, C_{ibt}, granted by bank b to firm i at the end of year t. The variable $Exposure^{IT}_{-i,b}$ measures the ex-ante exposure of banks to

borrowers hit by the China shock (measured using Italian imports from China) and it is interacted with the dummy $Post_t$ equal to one for the years after China's accession to WTO (2002-2007), and zero for the earlier years (1998-2001).[11] This variable is instrumented using a measure of bank exposure computed taking other advanced countries' imports from China ($Exposure^{OC}_{-i,b}$), as defined in Equation 6. $\boldsymbol{X_b}$ is a vector of control variables (1998-2000 averages) of key bank attributes, interacted with a post-period dummy: the log-assets as a proxy of bank size; share of NPLs, which captures bank performance and management; bank core liabilities, which control for the funding structure of the bank; and the capital ratio, which controls for the degree of bank leverage. We include a set of firm-bank fixed effects (γ_{ib}), which control for potential non-random matching between firms and banks and all time-invariant factors that may affect the loan level for any bank-firm pair. Finally, we add firm-year fixed-effects (α_{it}), which capture any shock that hits a firm credit in year t across all related banks (including productivity shocks or demand for goods shocks).

This specification identifies credit supply shocks under the the assumption that changes in credit demand are absorbed by the firm-time fixed effects. Put simply, the approach assumes that credit demand shocks cannot induce firms to systematically shift their borrowing from one bank to another. However, in our setting, banks differ in the sectoral composition of their portfolio of loans. This heterogeneity may be the result of an underlying bank specialization, as the one discussed in Paravisini et al. (2017), in which case a negative sectoral shock may reduce credit demand disproportionately for banks specialized in that sector. To account for that possibility we add a specialization dummy that take the value of 1 if a bank is specialized in lending to the sector the firm operates.[12]

Given that our source of variation is at the bank level and the original China shock is defined at the sectoral level, we double cluster the standard errors at the bank and sector

[11] The measure of banks' exposure that we use in the regression is computed from Equation 3 leaving out firm i to avoid endogeneity with the dependent variable. In our sample credit to firm i is typically too small to affect the aggregate bank exposure: on average firms account for 0.0001% of bank credit. As a robustness we leave out also the entire sector that a firm belongs to and results hold, see Table A4 in the Appendix.

[12] Following Paravisini et al. (2017) a bank is considered to be specialized in one sector if its share of loans in that sector is above the sum of 75th percentile threshold and 1.5 the interquartile range across banks for a given sector-year.

level.[13] In the baseline specification, the observations are unweighted. However, as a robustness, we estimate Equation 7 also weighting observations by log-employment and results are confirmed.[14]

We are interested in the coefficient β_1 that identifies the marginal effect of bank exposure to the trade shock on the supply of credit for the average firm in the sample. Moreover, we estimate the heterogeneous effect across different groups of firms: (1) firms in sectors that do not compete with imports from China, or that are positively affected by trade liberalization according to their comparative advantage;[15] (2) firms in the top of the productivity distribution of their corresponding sector; (3) firms in regions less affected by the trade shock, based on the share of employment in exposed sectors. For that, we expand Equation 7 with an interaction dummy D_{di} equal to one for firms belonging to the corresponding group, and zero otherwise:

$$\ln C_{ibt} = \sum_d \beta_{1d} \, D_{di} \times \; Exposure^{IT}_{-i,b} \times Post_t + \beta_2 \, Spec_{ibt} + \boldsymbol{X}_{\boldsymbol{b}}' \boldsymbol{\delta} \times Post_t + \alpha_{it} + \gamma_{ib} + \epsilon_{ibt} \quad (8)$$

This approach is aimed at capturing the role of banks in the reallocation of resources across firms upon a trade liberalization episode. According to classic models of trade (e.g. Ricardo-Viner), firms in sectors with comparative advantage should benefit from China access to the WTO and the resulting overall expansion of global trade. Along the same lines, according to models of trade with firms heterogeneity, such as Melitz (2003), we should expect more productive firms to expand and absorb more resources, especially those in sectors not subject to competition from China. We look also at firms in manufacturing and service to disentangle the effect between the tradable and non-tradable sector. Finally, if, due to local general equilibrium effects, an entire region is hit by the trade shock (as in Autor et al., 2013), we should expect migration of resources towards firms in

[13] As a robustness, in the Appendix we also report shift-share IV coefficients, where standard errors are obtained from equivalent industry-level regressions (as in Borusyak et al., 2018).

[14] As a robustness, Table A5 in the Appendix shows the estimation of Equation 7 in first difference, taking the average of the pre- and post- period for the variables of interest, to address concerns of potential autocorrelation in standard errors (see Bertrand et al., 2004).

[15] In Section 4 we describe more in details the definitions of comparative advantage and productivity that we use for the analysis.

non-exposed sectors of unaffected geographical areas.

3.2 Effect on the number of bank-firm relationships

Our baseline specification in Equation 7 captures the effect of bank exposure to the trade shock on the *intensive* margin of credit supply, as they account only for bank-firm credit relations that exist before and after China's entrance in the WTO. However, we are also interested in its effect on the *extensive* margin of credit; that is, the impact of bank exposure on the probability of opening or closing lending relationships. We then run the following specification:

$$Entry_{ib}^{post} \ (Exit_{ib}^{post}) = \beta_1 \ Exposure_{-i,b}^{IT} + \beta_2 \ Spec_{ib} + \boldsymbol{X_b'\delta} + \alpha_i + \epsilon_{ib} \tag{9}$$

where the dependent variable takes the value of one if bank b and firm i starts (exit) a lending relation after 2001. The coefficient of interest β_1 captures the marginal effect of a bank's exposure to the trade shock on the probability that bank b starts (ends) a credit relation with firm i. The specification accounts for whether the bank is specialized in the sector the firm operates, for bank's pre-characteristics, and for firm fixed effects. Errors are clustered at the bank-sector (2-digits) level. We run this specification also distinguishing the effects on firms in sectors directly hit by to import competition from China, and on those that are not.

The effect of bank exposure on the credit extensive margin informs us of potential substitutability between sources of bank lending. High elasticity of both exit and entry margins may suggest the replacement of a exposed banks for a non-exposed banks. Moreover, in Section 5, we estimate the effect of firms' borrowing from exposed banks on their total available credit, accounting for both the intensive and extensive margins simultaneously.

4 Baseline results

4.1 Intensive margin of credit

Table 3 reports the results of OLS (column 2) and 2SLS (column 3) estimates of our baseline specification in Equation 7. Firm-time fixed effects, firm-bank fixed effects, bank specialization dummy and bank controls (interacted with the $Post_t$ dummy) are always included. The coefficient of interest on bank exposure is negative and statistically significant in both specifications. This suggests that banks that are exposed to the China shock reduce lending to manufacturing firms compared to non-exposed banks after China's accession to WTO. The effect is quantitatively significant. The coefficient on the full 2SLS model amounts to -0.11: for a given firm, a bank with one standard deviation higher exposure reduces credit supply by 11% after China entrance in the WTO.

The comparison between the coefficient on OLS and that on 2SLS suggests that the degree of endogeneity of Italian imports from China to Italian demand, or at least its effect on credit, is low. The rise in Chinese imports is mostly driven by an exogenous supply shock from China.

We exploit the panel structure of the data and estimate our coefficient of interest year-by-year. This dynamic diff-in-diff estimator is plot in Figure 5. We verify that credit supply by exposed and non-exposed banks did not show different pre-trends prior to the trade liberalization episode. The marginal effect of bank exposure on credit supply shows no clear pattern before 2001. The point estimate for 1998 is positive but not statistically different from zero, whereas it is practically zero for the three years before China access to the WTO. In 2002 we start to observe a decline in the supply of credit by exposed banks, but it is not yet statistically different from zero; the coefficient becomes significant after 2003. The point estimates for the years 2003-2007 are not statistically different from each other.[16] Unfortunately, we cannot test for the long-term effects of exposure on credit as the global financial crisis hit banks in 2008 and that would bias our estimates for the years after that.

[16]Results are similar if we split the sample between firms in sectors directly hit by import competition from China, and firms in other sectors.

4.2 Heterogeneous effect of the credit supply shock

We are interested in analyzing whether bank exposure to the China shock hinders the reallocation of credit across firms, following the liberalization episode. With that purpose, we analyze the heterogeneous effect on credit for those firms expected to expand after the shock, using the specification in Equation 8.

Columns 1 and 2 of Table 4 show the heterogeneous effect of bank exposure on credit, depending whether the borrowers are in sectors directly hit –or not– by import competition from China, according to the definition in (2).[17] We find that the supply of credit from more exposed banks decreases for both types of firms. The point-estimate of the coefficient is slightly lower for firms not directly competing with imports from China (-0.10 versus -0.11), but the two coefficients are not statistically different. This finding points to financial spillovers to firms that, although not directly hit by Chinese competition, end up facing a contraction in lending from banks exposed to the trade shock. Given the relevance that credit has for investment and working capital, this is likely to hinder the process of resource reallocation in the aftermath of a trade shock. In Section 5 we analyze more directly the effects of bank exposure on employment and investments for firms in different sectors.

We confirm these findings when analyzing other dimensions of firm heterogeneity that could also lead to reallocation of resources after the China shock. First, we distinguish between firms in sectors where Italy has a comparative advantage in exporting. Using COMTRADE data, we compute a standard Balassa index of revealed comparative advantage for each 3-digit sector for 1994-1998.[18] It corresponds to the ratio between the share of Italian exports on world exports in a given sector and the share of Italy on world aggregate exports. Italy has a comparative advantage in sectors with Balassa index above one. Among the sectors with comparative advantage, we identify those subject to competition from China above (Hit) and below (Non-Hit) the median. Columns 2 and 3 of Table 4 show that exposed banks reduce credit also to firms in the strongest exporting sectors,

[17] The results hold also if we define non-hit firms as those in the bottom quartile of exposure.

[18] World exports correspond to the sum of exports from 89 countries (i.e. countries for which Comtrade data are available in each year of the reference period).

the ones with comparative advantage and not subject to Chinese competition.

The reallocation channel of a trade shock might work not only across sectors but also within sectors, with the more productive firms absorbing the resources of the less productive ones (as in Melitz, 2003). To analyze the role bank credit supply in this process, we divide our sample between firms that have a productivity above and below the average of their sector before China's entrance in the WTO.[19] The results in columns 4 and 5 of Table 4 show that also high productivity firms suffer from a credit reduction, even in sectors that are not directly hit by competition from China. This suggests that also the within-sector reallocation was hindered by banks' exposure to the trade shock.

Finally, we look beyond manufacturing, extending our sample to firms in the service industry.[20] Column 6 in Table 4 shows the baseline results for firms in the service sector is negative and significant.

The trade shock has been found to have spillovers across sectors of production. Its effect on employment has been found to spread to non-directly hit sectors in the same geographical area through general equilibrium effects in local labor markets (Autor et al., 2013), and through input-output linkages (Acemoglu et al., 2016). Our results show that the financial effects of a trade shock generate another channel of negative spillovers across sectors. This holds for firms that, on principle, should be gaining from trade liberalization and be the engine of the reallocation channel.

4.3 The geographical dimension of the bank lending channel

In this subsection we investigate whether banks, which operate in different regions, propagate the trade shock geographically. This exercise is similar in spirit to Giroud and Mueller (2019), where firms' internal network propagate shocks across counties. In order to investigate this possibility, we look at our results across provinces with different

[19] We compute total factor productivity at the firm level (TFPR) following Levinsohn and Petrin (2003) and Wooldridge (2009). We take the firm average and the sector weighted average TFPR for the period 1998-2000 and we define high vs. low productive firms according to whether they are above or below their sectoral average.

[20] Services include wholesale and retails trade, transportation and storage, accommodation and food service activities, information and communication, and professional, scientific and technical services.

sectoral composition.[21] For each province, we compute the employment weighted average of its sectors' exposure to the China shock as defined in Equation 4. If the credit effects of the trade shock were local, we should see no effects in provinces with a low share of employment in hit sectors.

Table 5 reports the baseline results from Equations 7 and 8 dividing our sample between firms located in provinces above and below median share of employment in hit sectors. We see that there are negative and significant credit effects for firms located both in high and in low hit provinces. The magnitude of the point estimate of the effect for firms in high-hit provinces and sectors (-0.122) is larger than the one for firms in low-hit provinces and sectors (-0.097), but the two coefficients are not statistically different. These results suggest that exposed banks transmit the trade shock not only across firms in different economic sectors, but also across regions.

We further explore the geographical dimension of our results by looking at the following three regional characteristics: innovation, education, and industrial diversification. Recent studies suggest that the effect of trade shocks might be heterogeneous across geographical regions depending on the availability of skilled labor or innovation capabilities (Bloom et al., 2019; Eriksson et al., 2019). Regions with a well-diversified industrial structure might also be better able to move resources from declining sectors towards expanding sectors. Table 6 shows the results of our baseline specifications, splitting the sample of provinces above or below median in terms: i) the number of patents registered at the European Patent Office per 100,000 persons, ii) the share of adults with at least a high school degree, and iii) industrial diversification defined according to a Herfindahl-Hirschman index.[22] Consistent with Eriksson et al. (2019), we find that the effects of bank exposure to trade shock on credit supply are significantly reduced in provinces with a high degree of innovation. Still, they remain unaffected in more educated or industrially diversified provinces.

[21] In Italy there are about 100 provinces, these are administrative units of intermediate level between a municipality and a region, comparable to US counties.

[22] The source for each of these variables is Italy's National Statistical Institute.

4.4 Extensive margin

We then explore the extensive margin of credit supply. We compute an 'entry' dummy equal to one if a firm has no credit from a bank before 2002 and had credit from the same bank after 2002. This signals the start of a new credit relationship for a given firm-bank pair. Similarly, we compute an 'exit' dummy equal to one if a firm had credit from a bank before 2002 and has no credit from the same bank after 2002.

Table 7 reports the results of a linear probability model on Equation 9. Starting with columns 1 and 2, we find that banks that are more exposed to the China shock are less likely to start new credit relationships with firms after China's entry into the WTO. This holds for both firms in sectors directly hit and not directly hit by import competition, although the magnitude of the effect is larger (in absolute terms) for the former than for the latter. Exposed banks are also less likely to terminate credit relationships (columns 4-6), but the coefficient on the probability of exit is smaller and less tightly estimated than that on the probability of entry. This suggests that higher bank exposure is associated with a decrease in the net entry of credit relationships. For the full sample, a one standard deviation increase in bank exposure is associated with a decline in the probability of entry of 6 percentage points (out of an unconditional entry probability of 24%).

5 Aggregate credit and firm-level real outcomes

The previous section shows a significant negative effect of bank exposure to the China shock on the relative supply of credit to firms. However, this may not necessarily imply a negative effect on firms' overall credit availability. Given that multiple banking is fairly common among Italian borrowers, firms could offset the lower credit from an exposed bank with higher credit from non-exposed banks and from new credit relationships, ending up with no overall change in the firm-level amount of credit or real outcomes.

To assess this possibility, first, we compute the exposure of firms to the bank lending channel of the trade shock, as the weighted average of the exposure of all the banks a firm

was borrowing from, according to pre-2001 figures:

$$Firm\ Level\ Exposure_i = \sum_b Exposure^{IT}_{-i,b} \ \frac{Credit_{ib}}{Total\ Credit_i} \tag{10}$$

Then, using this firm level exposure as the main independent variable, we run the following regression at the firm-year level:

$$\ln Y_{it} = \beta_1\ Firm\ Level\ Exposure_i \times Post_t + \gamma_i + \delta_{st} + \epsilon_{ist} \tag{11}$$

where Y_{it} refers to the firm-level dependent variable (overall credit, employment, investment, and revenues depending on the specification) of firm i in year t, which is regressed on the interaction between firm level exposure and the post-2001 dummy, firm fixed effects γ_i, and sector-time fixed effects δ_{st}.

We start by analyzing the overall supply of credit to the firm (i.e., $Y_{it} = C_{it}$). We already established in the previous section that bank exposure to the trade shock ($Exposure^{IT}_{-i,b}$ in Equation 10) triggers a reduction in bank-level credit supply after 2001. We are now after its effect on the overall availability of credit to the firm.

We interpret the coefficient β_1 in Equation 11 as the effect in overall firm-level credit supply, under the assumption that changes in the firm-level demand for credit are accounted for by the sector-time fixed effect. Moreover, for the regressions on credit, we also include, as an additional control, the firm-time fixed effects ($\hat{\alpha_{it}}$) estimated in Equation 7.[23] The estimated parameter $\hat{\alpha}_{it}$ captures changes in firm-level amount of credit that are common across all the firm's lenders. That includes both credit demand shocks *and* credit supply shocks, as long as they are spread across banks lending to the same firm. Then, for single-banking firms or for firms connected to multiple exposed banks, the inclusion of $\hat{\alpha}_{it}$ would conservatively bias our results. Columns 1 and 2 in Table 8 present the results with and without the inclusion of this firm-time fixed effect. The results are

[23]This procedure is followed, among others, by Cingano et al. (2016), Bofondi et al. (2017), Alfaro et al. (2019). An alternative approach, as used in Khwaja and Mian (2008) and Jiménez et al. (2014), is to rely on the correlation between supply and demand effects implied by differences between the OLS and FE estimates in Equation 7 and to correct the estimates of the aggregate credit regressions. Cingano et al. (2016) show that the two approaches are equivalent, but including the estimated demand shocks enables to easily compute appropriate standard errors and thus to conduct inference.

not statistically different. An increase of one standard deviation of firm level exposure results in a reduction in the supply of credit of around 8-9%.

Columns 3 to 7 in Table 8 show the 2SLS results of Equation 11 for different groups of firms. In columns 3 and 4 we report the effect for firms in sectors not directly hit, and directly hit, by competition from China respectively; in column 5 we focus on firms in exporting sectors with comparative advantage and not subject to competition from China; in column 6 firms that have high productivity within sectors not directly hit by the trade shock; and in column 7 we show the effect for firms in services. The point estimates are smaller for firms in sectors not directly hit by import competition (columns 3 and 5). Still, the coefficients are negative and significant across all groups of firms, which implies that firms cannot fully compensate lower credit supply from exposed banks with higher credit from non-exposed banks. We conclude that banks' exposure to trade shocks negatively affects related firms' access to credit after 2001.

Next, we analyze how firms' share of exposed credit affects real outcomes. Table 9 reports the marginal effects of firm-level share of credit by exposed banks on employment (column 1), investment (column 2), and revenues (column 3), controlling for firm and sector-time fixed effects. Row a shows the estimation for the full sample for firms. Results in row b and c correspond to the subsample of firms in sectors directly hit and non directly hit by competition from China, respectively. In row c, the sample is restricted to firms in sectors where Italy has comparative advantage and are not hit by the trade shock. In row d, we show the results for firms with high productivity within sectors not directly competing with imports from China. And, finally, row e shows the coefficient of interest for firms in Services.[24] These estimated coefficients combine two effects: the reduction in credit supply, estimated in Table 8, and the elasticity of the corresponding real outcomes to credit. As expected, investment is more elastic to the credit supply drop than employment or revenues (except for firms in Services). Interestingly, although credit supply was severely cut for firms in Services (column 7 in Table 8), its effect on real outcomes is milder. Still, in all cases, these results suggest that borrowing from exposed banks hinders not only the reallocation of credit, but also of employment and investments, towards

[24]The construction of the groups in each row follows the definitions in Subsection 4.2.

firms that should not be affected by the China shock or that were expected to expand in the absence reallocation friction.

These effects are economically significant. Exposed banks account for a sizeable share of firms' credit. By construction, this share is larger for firms directly hit by import competition from China. The firm level exposure to the bank lending channel for the bottom 25th percentile of these firms is 48%, and rises to 59% for the top 75th. According to our estimates, this 11 p.p. differential implies an additional 1.1% drop in overall bank credit supply, which in turn results in an extra 1.3% reduction in employment, 2% in investment, and 1.9% in revenues. In other words, for firms in sectors directly hit by import competition, the drop in credit supply deepened the severity of the trade shock.

Moreover, exposed banks also account for an important share of credit towards firms non directly affected by import competition. The firm level exposure of the bottom 25 percentile of these firms is 40%. An increase in 17 p.p. (top 75 percentile) implies a further reduction in 1.2% in bank credit, 1% in employment and 1.3% in investment. These results highlight how banks propagate the trade shocks suffered by a share of their borrowers, towards firms not directly affected by competition from China.

6 The underlying mechanism: banks' NPLs

In this section we investigate the mechanism that links the trade shock faced by firms with the patterns of credit allocation by related banks. Firstly, we look at the evolution of the value of non-performing loans of firms in sectors subject to competition from China above or below median (Figure 6). We see that the patterns of non-performing loans across the two groups diverge remarkably in the years after 2003. They both spike in 2003, coincidentally with the GDP slowdown of Italy, but for firms not competing with imports from China, they decline remarkably after that. For firms in sectors above median, the aggregate value of non-performing loans turns to be 40% higher in the period 2002-2007 relative to the years 1998-2002.

Next, we exploit detailed information on banks' balance sheet. In order to test more formally the link between bank exposure, NPLs, and the lending capacity of exposed

banks, we run the following specification:

$$Y_{bt} = \beta_1 \, Exposure_b^{IT} \times Post_t + \boldsymbol{X_b'\delta} \times Post_t + \gamma_b + \alpha_t + \epsilon_{bt} \tag{12}$$

the dependent variable Y_{bt} corresponds to the components of the bank's balance sheet. In particular, column 1 in Table 10 shows the results with $Y_{bt} = NPLs \; Ratio_{bt}$, the share of non-performing loans on total assets in banks' balance sheet. This is regressed on our measure of bank exposure as defined in Equation 3, which as usual is instrumented with Equation 6. We also control for a vector of bank pre-2001 characteristics interacted with a dummy for the years post 2002, bank fixed effects, and time dummies. We cluster the standard errors at the bank level. We confirm the evidence from Figure 6: a 10p.p. higher bank exposure to the trade shock is associated with a 0.3p.p. increase in the NPLs' ratio, which is equivalent to a 18% increase in NPLs for the average bank.

We also explore another potential channel. Banks' exposure to the trade shock could also be associated with a reduction in deposits, as affected firms or households in depressed regions could have reduced their assets. We find, however, that this is not the case. Column 3 in Table 10 shows the results of Equation 12 with $Y_{bt} = Deposits_{bt}$.

Finally, we confirm that exposed banks could not offset the deterioration of their balance sheet with external injection of funding. Column 5 shows that they did not increase their interbank lending. And column 7 reports that they did not inject equity to offset the NPL losses; the core capital of the exposed banks decreased in a magnitude similar to the rise in NPLs.

Overall, our results suggest that NPLs increased for firms in sectors directly hit by import competition from China. Banks with larger share of their loans portfolio in those affected sectors could not offset these losses with external funding and, as a result, reduced their commercial lending. As further support for this conclusion, we confirm the following corollary. Banks with more core capital, relative to regulatory requirements, are less constrained in their lending capacity.

Columns 2, 4 and 6 in Table 11 report the results of our baseline identification in (7) interacted with a dummy, *HighTier 1*, for banks with a Tier 1 capital ratio (i.e. core capital

relative to risk-weighted assets) in the top quartile of the distribution, taking the 1998-00 average. The findings show that highly capitalized banks do not reduce their credit supply after China entrance in the WTO. Notice, from columns 2, 4, 6 and 8 in Table 10, that the impact of the trade shock on banks' balance sheet does not vary across exposed banks with different ex-ante Tier 1 ratio. Still, exposed banks with more equity buffer are better prepared to absorb the shock, and end up being less constrained in their lending capacity.

7 Identification and robustness

In this section we address several potential identification challenges and explore the robustness of our results. Specifically, we expand the definition of 'exposed' sector and banks to include for input-output linkages, and address confounding factors that could potentially undermine our identification strategy.

Additionally, we report in the Appendix an extensive set of robustness checks with alternative measures of firms and banks exposure and with different econometric specifications. Tables A1-A6 in the Appendix show that all our main results are unchanged when: i) bank exposure is captured using a continuous measure of firm hit by imports from China rather than a median cutoff; ii) exposure to competition from China is instrumented using the change in imports of the US only, rather than of a larger set of advanced economies; iii) bank exposure is measured relative to banks' total assets rather than banks' corporate loans; iv) bank exposure is measured leaving out credit to the sector where the firm operates; v) estimating a first difference transformation of the baseline in Equations 7 and 8; vi) we allow for alternative clustering of the standard errors; and vii) observations are weighted by firm size.

7.1 Taking into account input-output linkages

Our baseline identification of sectors affected by competition from China in Equations 1 and 4 considers only the direct exposure of a given industry, and therefore ignores the

effects through input-output linkages, which could be either negative (lower demand of inputs from hit customers) or positive (cheaper inputs available from China). We follow Acemoglu et al. (2016) and adjust our measure of exposure to account for upstream input-output linkages, in order to capture trade shocks to the purchasers of a given industry's output, and also for downstream linkages, which relate to the potential benefit from cheaper inputs that industries could source from China.

For each industry j, we calculate an upstream effect, which is equal to the weighted average change in Chinese imports across all industries that purchase from industry j, where the weight is the share of industry j's total sales that are used as inputs by industry g. To measure these inter-industry linkages, we use the 1995 input-output table, which predates China's entry into the WTO. One limitation is that for Italy this is available at the 2-digit industry only. Therefore, we assume that for a given 4-digit industry its input and output shares are proportional to the corresponding shares of its 2-digit industry. We apply the same procedure for the downstream effects. Then, we compute a new overall indicator of bank exposure to the trade shock on the basis of this new sectoral definition.[25] Table 12 confirms the baseline results.

7.2 Confounding threats to identification

Potential threats to our identification strategy might be related to shocks that hit banks around the time of China access in the WTO and that can affect lending decisions. We are particularly concerned about i) the rise in Italian banks' cross-border funding since 2002, in the context of growing financial integration in the euro area; ii) a sharp slowdown of GDP growth in 2002-03, reflecting the global slowdown following the dot-com bubble and the attacks of September 11; and iii) the raise of securitization, which could affect bank liquidity and lending capacity.[26]

Italian banks experienced a boom in cross-border liabilities since the late 2002. The

[25] The correlation between the baseline measure of bank exposure and the new one is 0.83. At the industry level, about 10% of sectors shift classification.

[26] In the Appendix (Table A7), we consider the case of automation as an additional potential confounding factor that can hit firms and then propagate to banks in a similar way as our trade shock; we do not find evidence that this is the case.

foreign funding of banks increased from an average slightly above €200 billion in the period 1998-2002 (15% of GDP) to €900 billion in 2007 (56% of GDP). This increase in foreign funding was not unique to Italy, but was common to other European periphery countries such as Spain and Portugal and it was part of a loose global financial cycle. Our concern is that banks more exposed to the China shock could be the ones that benefited less from these capital inflows, so that our results are not driven by the exposure that a bank has to China, but to the boom of international capital flows that happens around that time. Following Cingano and Hassan (2019), we use bank share of foreign liabilities in the 1998-2001 period as an instrument for its overall capital inflows in the 2002-2007 period. In Table 13 as a robustness we run our baseline specification adding the share of foreign liabilities pre-2001 as a control and the results are confirmed.

Secondly, we explore the potential confounding factors related to the GDP slowdown in 2002-03. We are concerned that the decrease in lending captures an heterogeneous exposure to the GDP slowdown across banks, rather than to the trade shock. To account for this effect, we use balance sheet data to identify the sectors that experienced a decrease in revenues in the period 2002-03 relative to 2000-01 (i.e. the sectors more strongly subject to GDP slowdown). We then compute the share of loans to those sectors that banks have in their portfolio and regress it on the exposure to the China shock. We add the average share of loans to the declining sectors in the years 1998-2000 (interacted with a post-dummy)as an additional control in Table 13 in the regressions, and the results hold.

Finally, we control for the raise in securitization in the early 2000, which affected bank liquidity and, potentially, their lending capacity. If banks exposed to China have different degree of loan securization, our results can be biased. To account for this, we compute the average share of securitized lending by bank in the years 1998-2000 and add it as a control (interacted with the post-dummy) in our baseline regression.[27] Table 13 shows that also controlling for this confounding factor does not change our results in a significant way. The last column of Table 13 controls for all these possible confounding factors at the same time and the baseline results are confirmed. We report only the results for the full sample,

[27] As a robustness we also take the share of securitized loans in the year 2001, as the degree of securitization in the period 1998-2000 was still relatively low.

but the baseline results hold also if we distinguish between firms from sectors directly hit and non directly hit by competition from China.

8 Concluding Remarks

This study shows that the decrease in banks' supply of credit in the aftermath of a trade shock may be an important channel behind the welfare costs associated with trade liberalization episodes. Focusing on China access into the WTO as an exogenous shock, we find that banks with portfolio of loans concentrated in sectors exposed to competition from China decrease their lending relative to less exposed banks. Banks are themselves constrained in their sources of finance. Then, as import competition from China leads to higher Non-Performing Loans among competing firms, the balance sheet of exposed banks suffers losses that lead to an erosion of their core capital. Consequently, these banks reduce their credit supply.

This phenomenon results in substantial spillovers between losers and winners from trade liberalization, through the endogenous credit constraint of banks: Exposed banks reduce credit supply not only to firms that are directly subject to competition from China, but also to firms that are not affected by China and that should actually expand, including high productivity firms in sectors where Italy has a comparative advantage to export.

We find that firms are unable to perfectly substitute negatively affected banks with alternative sources of credit. Therefore, the aggregate credit of firms linked to exposed banks decreases relative to other firms. This translates into real negative effects on employment, investments, and firm revenues and it has relevant aggregate effects.

References

Acemoglu, D., Autor, D., Dorn, D., Hanson, G. H. and Price, B. (2016), 'Import competition and the great us employment sag of the 2000s', *Journal of Labor Economics* **34**(S1), 141–198.

Acemoglu, D. and Restrepo, P. (2017), Robots and jobs: Evidence from us labor markets, NBER Working Papers 23285, National Bureau of Economic Research, Inc.

Adao, R., Kolesar, M. and Morales, E. (2018), Shift-share designs: Theory and inference, NBER Working Papers 24944, National Bureau of Economic Research, Inc.

Aghion, P., Burgess, R., Redding, S. J. and Zilibotti, F. (2008), 'The unequal effects of liberalization: Evidence from dismantling the license raj in india', *American Economic Review* **98**(4), 1397–1412.

Alfaro, L., García-Santana, M. and Moral-Benito, E. (2019), 'On the direct and indirect real effects of credit supply shocks'.

Amiti, M. and Weinstein, D. E. (2011), 'Exports and financial shocks', *The Quarterly Journal of Economics* **126**(4), 1841–1877.

Amiti, M. and Weinstein, D. E. (2018), 'How much do idiosyncratic bank shocks affect investment? evidence from matched bank-firm loan data', *Journal of Political Economy* **126**(2), 525–587.

Antràs, P. and Caballero, R. (2009), 'Trade and capital flows: A financial frictions perspective', *Journal of Political Economy* **117**(4), 701–744.

Antràs, P. and Foley, C. F. (2015), 'Poultry in motion: A study of international trade finance practices', *Journal of Political Economy* **123**(4), 809–852.

Autor, D. H., Dorn, D. and Hanson, G. H. (2013), 'The china syndrome: Local labor market effects of import competition in the united states', *American Economic Review* **103**(6), 2121–68.

Autor, D. H., Dorn, D., Hanson, G. H. and Song, J. (2014), 'Trade adjustment: Worker-level evidence', *The Quarterly Journal of Economics* **129**(4), 1799–1860.

Baskaya, Y. S. and Kalemli-Ozcan, S. (2016), Sovereign risk and bank lending: Evidence from 1999 turkish earthquake, Working Paper 22335, National Bureau of Economic Research.

Bertrand, M., Duflo, E. and Mullainathan, S. (2004), 'How much should we trust differences-in-differences estimates?', *Quarterly Journal of Economics* **119**(1), 249–275.

Bloom, N., Handely, K., Kurman, A. and Luck, P. (2019), The impact of chinese trade on us employment: The good, the bad, and the debatable.

Bofondi, M., Carpinelli, L. and Sette, E. (2017), 'Credit supply during a sovereign debt crisis', *Journal of the European Economic Association* **16**(3), 696–729.

Borusyak, K., Hull, P. and Jaravel, X. (2018), Quasi-experimental shift-share research designs, NBER Working Papers 24997, National Bureau of Economic Research, Inc.

Bustos, P., Garber, G. and Ponticelli, J. (2017), Capital accumulation and structural transformation.

Chodorow-Reich, G. (2014), 'The employment effects of credit market disruptions: Firm-level evidence from the 2008-9 financial crisis', *The Quarterly Journal of Economics* **129**(1), 1–59.

Chor, D. and Manova, K. (2012), 'Off the cliff and back? credit conditions and international trade during the global financial crisis', *Journal of International Economics* **87**(1), 117 – 133. Symposium on the Global Dimensions of the Financial Crisis.

Cingano, F. and Hassan, F. (2019), Foreign capital flows and productivity misallocation.

Cingano, F., Manaresi, F. and Sette, E. (2016), 'Does credit crunch investment down? new evidence on the real effects of the bank-lending channel', *Review of Financial Studies* **29**(10), 2737–2773.

Cortés, R. K. and Strahan, P. E. (2017), 'Tracing out capital flows: How financially integrated banks respond to natural disasters', *Journal of Financial Economics* **125**(1), 182 – 199.

Detragiache, E., Garella, P. and Guiso, L. (2000), 'Multiple versus single banking relationships: Theory and evidence', *Journal of Finance* **55**(3), 1133–1161.

Deyoung, R., Gron, A., Torna, G. and Winton, A. (2015), 'Risk overhang and loan portfolio decisions: Small business loan supply before and during the financial crisis', *Journal of Finance* **70**(6), 2451–2488.

Dix-Carneiro, R. (2014), 'Trade liberalization and labor market dynamics', *Econometrica* **82**(3), 825–885.

Dix-Carneiro, R. and Kovak, B. K. (2017), 'Trade liberalization and regional dynamics', *American Economic Review* **107**(10), 2908–46.

Eriksson, K., Russ, K., Shambaugh, J. C. and Xu, M. (2019), Trade shocks and the shifting landscape of u.s. manufacturing, NBER Working Papers 25646, National Bureau of Economic Research, Inc.

Froot, K. A., Scharfstein, D. S. and Stein, J. C. (1993), 'Risk management: Coordinating corporate investment and financing policies', *Journal of Finance* **48**(5), 1629–1658.

Froot, K. and Stein, J. C. (1998), 'Risk management, capital budgeting, and capital structure policy for financial institutions: an integrated approach', *Journal of Financial Economics* **47**, 55–82.

Gilje, E. P., Loutskina, E. and Strahan, P. E. (2016), 'Exporting liquidity: Branch banking and financial integration', *The Journal of Finance* **71**(3), 1159–1184.

Giroud, X. and Mueller, H. M. (2019), 'Firms' internal networks and local economic shocks', *American Economic Review* **109**(10), 3617–49.

Hakobyan, S. and McLaren, J. (2016), 'Looking for Local Labor Market Effects of NAFTA', *The Review of Economics and Statistics* **98**(4), 728–741.

Holmstrom, B. and Tirole, J. (1997), 'Financial intermediation, loanable funds, and the real sector', *The Quarterly Journal of Economics* **112**(3), 663–691.

Huber, K. (2018), 'Disentangling the effects of a banking crisis: Evidence from german firms and counties'.

Imbens, G. and Wooldridge, J. M. (2008), 'Recent Developments in the Econometrics of Program Evaluation', *Journal of Economic Literature* **47**(1), 5–86.

Jiménez, G., Mian, A., Peydró, J. L. and Saurina, J. (2014), The real effects of the bank lending channel.

Khwaja, A. and Mian, A. (2008), 'Tracing the impact of bank liquidity shocks: Evidence from an emerging market', *The American Economic Review* **98**(4), 1413–1442.

Kovak, B. K. (2013), 'Regional effects of trade reform: What is the correct measure of liberalization?', *American Economic Review* **103**(5), 1960–1976.

Lanteri, A., Medina, P. and Tan, E. (2019), Capital-reallocation frictions and trade shocks.

Levinsohn, J. and Petrin, A. (2003), 'Estimating production functions using inputs to control for unobservables', *Review of Economic Studies* **70**(2), 317–341.

Manova, K. (2008), 'Credit constraints, equity market liberalizations and international trade', *Journal of International Economics* **76**(1), 33 – 47.

Manova, K. (2012), 'Credit Constraints, Heterogeneous Firms, and International Trade', *The Review of Economic Studies* **80**(2), 711–744.

Melitz, M. J. (2003), 'The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity', *Econometrica* **71**(6), 1695–1725.

Menezes-Filho, N. A. and Muendler, M.-A. (2011), Labor reallocation in response to trade reform, NBER Working Papers 17372, National Bureau of Economic Research, Inc.

Minetti, R. and Zhu, S. C. (2011), 'Credit constraints and firm export: Microeconomic evidence from italy', *Journal of International Economics* **83**(2), 109 – 125.

Paravisini, D. (2008), 'Local bank financial constraints and firm access to external finance', *Journal of Finance* **63**(5), 2161–2193.

Paravisini, D., Rappoport, V. and Schnabl, P. (2017), Specialization in bank lending: Evidence from exporting firms.

Paravisini, D., Rappoport, V., Schnabl, P. and Wolfenzon, D. (2015), 'Dissecting the effect of credit supply on trade: Evidence from matched credit-export data', *Review of Economic Studies* **82**(1), 333–359.

Schnabl, P. (2012), 'The international transmission of bank liquidity shocks: Evidence from an emerging market', *The Journal of Finance* **67**(3), 897–932.

Topalova, P. (2010), 'Factor immobility and regional impacts of trade liberalization: Evidence on poverty from india', *American Economic Journal: Applied Economics* **2**(4), 1–41.

Utar, H. (2018), 'Workers beneath the floodgates: Low-wage import competition and workers' adjustment', *The Review of Economics and Statistics* **100**(4), 631–647.

Wooldridge, J. M. (2009), 'On estimating firm-level production functions using proxy variables to control for unobservables', *Economics Letters* **104**(3), 112–114.

Table 1: Summary statistics

	Unit	Mean	S.D.	p25	p50	p75
Bank characteristics						
Total Assets	€Millions	4,701	36,002	109	229	535
Liquid Assets	% Assets	30.5	14.1	21.8	27.9	37.9
Nonperforming Loans	% Assets	2.6	2.6	1.1	1.9	3.3
Credit to Firms	% Assets	37.6	13.1	28.8	39.3	47.3
Profits	% Assets	1	0.5	0.7	1	1.2
Core capital	% Assets	1.4	3.2	0.01	0.2	1.5
Tier 1 capital	% R.W. Assets	10	4.4	7.0	9.1	11.8
Core Funding	%Liabilities	52.5	17.7	44.4	51.9	64.4
Bank exposure to China	% Loans	35.8	21.8	21.8	35	48
Firm characteristics						
Bank Credit	€Millions	0.82	3.74	0.27	0.38	0.57
Revenues	€Thousands	4,173	5,673	743	1,751	4,708
Fixed Assets	€Thousands	870	1,388	71	258	928
Gross operating margin	% Revenues	7.9	2.4	7.1	7.6	8.3
Credit Score	Units	5.4	0.6	5.1	5.4	5.7

Note: The table reports averages for 1998-2007. Bank balance sheet data are from the Supervisory Reports-Bank of Italy. Credit data are from the Italian Credit Register. Firm balance sheet data are from CERVED. Liquid assets include cash, interbank deposits, and bond holdings. Core funding refers to deposits. Firms' credit score is computed by CERVED based on past defaults and firms' balance sheet information.

Table 2: Balancing tests

		Exposed Banks		*Non-exposed banks*		Normalized
	Unit	Mean	S.D.	Mean	S.D.	difference
Bank characteristics						
Total Assets	€Millions	5,780	3,671	3,430	1,228	0.22
Liquid Assets	% Assets	18.5	11.7	19.9	11.9	-0.12
Nonperforming Loans	% Assets	3.2	4.9	3.3	3.5	-0.02
Credit to Firms	% Assets	39.9	13.9	38.0	14.2	0.13
Profits	% Assets	1.5	0.8	1.8	2.4	-0.16
Core capital	% Assets	2.1	5.1	1.6	5.9	0.09
Tier 1 capital	% R.W. Assets	9.5	4.9	9.7	3.8	-0.05
Core Funding	%Liabilities	55.5	19.4	60.3	18.2	-0.25
Borrower characteristics						
Bank Credit	€Millions	0.80	2.1	0.84	4.8	-0.01
Revenues	€Thousands	5,230	3,780	4,864	3,942	0.09
Fixed Assets	€Thousands	1,337	1,050	1,387	1,070	-0.04
Gross operating margin	% Revenues	7.9	6.9	8.3	2.5	-0.07
Credit Score	Units	5.3	0.6	5.4	0.7	-0.09

Note: The table reports averages for 1998-2000. Exposed (non-exposed) banks have a share of loans to firms subject to competition from China above (below) median over the period 1998-2000. The last column shows the Normalized difference between the two groups. Following Imbens and Wooldridge (2008), an absolute value above 0.25 suggests an imbalance between the two groups.

Table 3: Baseline results

Dependent Var : $\ln C_{ibt}$	OLS (1)	2SLS (2)
$Exposure^{IT}_{-i,b} \times Post_t$	-0.078***	-0.11***
	(0.008)	(0.014)
Bank-firm specialization	✓	✓
Bank controls	✓	✓
Firm-time F.E.	✓	✓
Firm-bank F.E.	✓	✓
	First stage	
$Exposure^{OC}_{-i,b} \times Post_t$		0.65***
		(0.02)
AR-Wald test, F		32.1
Observations	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83

Note: The table reports the results of specification (7). The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. $Exposure^{IT}_{-i,b}$ captures bank exposure to China's entrance in the WTO, as defined in (3), instrumented with $Exposure^{OC}_{-i,b}$ defined in (6). Bank-firm specialization is a dummy $Spec_{bit}$ that captures whether firm operates in a sector in which the bank specializes its lending activities. Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects and firm-bank dummies. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 4: Heterogeneous Effects (2SLS)

Dependent Variable: $\ln C_{ibt}$	(1)	(2)	(3)	(4)	(5)	(6)
$Exposure^{IT}_{-i,b} \times Post_t \times \ldots$						
$\ldots NonHit_i$	-0.100***					
	(0.015)					
$\ldots Hit_i$	-0.110***					
	(0.024)					
$\ldots CompAdv_i$		-0.110***				
		(0.018)				
$\ldots CompAdv_i \times NonHit_i$			-0.092***			
			(0.018)			
$\ldots CompAmp_i \times Hit_i$			-0.095***			
			(0.030)			
$\ldots NonCompAdv_i$		-0.093***	-0.092***			
		(0.024)	(0.020)			
$\ldots HighProd_i$				-0.110***		
				(0.018)		
$\ldots HighProd_i \times NonHit_i$					-0.115***	
					(0.018)	
$\ldots HighProd_i \times Hit_i$					-0.124**	
					(0.030)	
$\ldots LowProd_i$				-0.095***	-0.095***	
				(0.018)	(0.018)	
$\ldots Services_i$						-0.060***
						(0.009)
$\ldots Manufacturing_i$						-0.086***
						(0.010)
Bank-firm specialization	✓	✓	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓	✓	✓
Observations	1,945,334	1,740,734	1,740,734	1,945,334	1,945,334	3,584,419
Adj. R^2	0.83	0.83	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	28.3	22	15.8	24.8	18.6	18.2

Note: The table reports the 2SLS results of specification (8). $Exposure^{IT}_{-i,b}$ defined in (3) is instrumented with $Exposure^{OC}_{-i,b}$ defined in (6). In column 1, firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). In columns 2 and 3, they are further grouped according to their comparative advantage (Balassa index above or below 1). In columns 4 and 5, firms with high (low) productivity are those with TFPR above (below) their sectoral average for the period 1998-2000. In column 6, they are grouped in services and manufacturing. Other bank controls include bank characteristics (pre-2001) interacted with a post-2001 dummy. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector of bank specialization. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 5: Geographical effects by province exposure (2SLS)

Dependent variable: $\ln C_{ibt}$	*High exposed provinces* (1)	(2)	*Low exposed provinces* (3)	(4)
$Exposure^{IT}_{-i,b} \times Post_t$	-0.122***		-0.097***	
	(0.022)		(0.016)	
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$		-0.118***		-0.092***
		(0.02)		(0.019)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$		-0.128***		-0.104***
		(0.039)		(0.025)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-Time F.E.	✓	✓	✓	✓
Firm-Bank F.E.	✓	✓	✓	✓
Observations	1,006,653	1,006,653	937,021	937,021
$Adj.R^2$	0.90	0.90	0.90	0.90
First Stage AR-Wald test, F	26.1	15.8	32.3	16.8

Note: The table reports results of specifications (7) and (8) for firms grouped according to the exposure of their province. High (Low) exposed provinces correspond to those with share of employment in hit sectors above (below) the median. In columns 2 and 4, we further interact the geographical dimension with two sectoral groups, depending whether it is directly hit or not by the trade shock. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ is instrumented with $Exposure^{OC}_{-i,b}$, defined in (6). Other bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 6: Geographical heterogeneity (2SLS)

Dependent variable: $\ln C_{ibt}$	*High innovation*		*Low innovation*		*High skilled*		*Low skilled*		*High diversification*		*Low diversification*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Exposure^{IT}_{-i,b} \times Post_t$	-0.08***		-0.13***		-0.10***		-0.12***		-0.12***		-0.10***	
	(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)	
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$		-0.09***		-0.11***		-0.11***		-0.10***		-0.12***		-0.09***
		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$		-0.06***		-0.15***		-0.10***		-0.13***		-0.11***		-0.12***
		(0.03)		(0.02)		(0.03)		(0.03)		(0.04)		(0.03)
Bank-firm specialization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm-Time F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm-Bank F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,006,653	1,006,653	937,021	937,021								
$Adj.R^2$	0.90	0.90	0.83	0.83	0.83	0.83	0.82	0.83	0.82	0.83	0.83	0.82
First Stage AR-Wald test, F	26.1	15.8	32.3	16.8	26.1	15.8	32.3	16.8	26.1	15.8	32.3	16.8

Note: The table reports the results of specifications (7) and (8), for sub-samples of firms defined according to the characteristics of their provinces. In columns 1-4, provinces are high (low) innovation if they are above (below) the average number of patents per person. In Columns 5-8, high (low) skilled corresponds to provinces with share of adults with high-school education above (below) the median. Columns 9-12, high (low) diversification refers to HHI index below (above) the median. In columns 2,4,6,8,10, and 12, we further interact the geographical dimension with two sectoral groups, depending whether it is directly hit or not by the trade shock. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ is instrumented with $Exposure^{OC}_{-i,b}$, defined in (6). Other bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 7: Firms entry and exit (2SLS)

Dependent: $Entry_{ib}$ & $Exit_{ib}$	*Entry*		*Exit*	
	(1)	(2)	(3)	(4)
$Exposure^{IT}_{-i,b} \times Post_t$	-0.059***		-0.011*	
	(0.008)		(0.005)	
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$		-0.037***		-0.002
		(0.01)		(0.006)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$		-0.086***		-0.021**
		(0.01)		(0.009)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm F.E.	✓	✓	✓	✓
Time F.E.	✓	✓	✓	✓
Observations	416,549	416,549	416,549	416,549
$Adj.R^2$	0.14	0.14	0.12	0.12
First Stage AR-Wald test, F	44.8	24.1	13.6	12.5

Note: The table reports the results of the extensive margin specification in (9). The dependent variable is a dummy that takes the value of 1 if firm i starts (entry) or ends (exit) a credit relation with bank b after China's entrance to the WTO. $Exposure^{IT}_{-i,b}$ is instrumented with $Exposure^{OC}_{-i,b}$, defined in (6). In columns 2 and 4, firms are grouped into sectors directly and not directly hit by the trade shock, as defined in Equation 4. Other bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm fixed effects, year dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 8: Effects on firms' total credit (2SLS)

Dependent: $\ln C_{it}$	Full-sample		Non-Hit	Hit	Comparative Adv. Non-Hit	High Product. Non-Hit	Services
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$FirmLevelExposure_i \times Post_t$	-0.083***	-0.095***	-0.071***	-0.096***	-0.068**	-0.093***	-0.12**
	(0.014)	(0.028)	(0.016)	(0.016)	(0.019)	(0.017)	(0.052)
Credit Demand	✓		✓	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓	✓	✓	✓
Firm-F.E.	✓	✓	✓	✓	✓	✓	✓
Sector-time F.E.	✓	✓	✓	✓	✓	✓	✓
Observations	451,145	451,145	451,145		400,886	451,145	899,397
$Adj.R^2$	0.96	0.91	0.96		0.94	0.95	0.95
AR-Wald test, F	34.3	11.2	18.2		10.9	19.2	24.2

Note: The table reports the coefficients of the aggregate specification in Equation 11 for the corresponding sample of firms. The dependent variable is the log of total outstanding credit of firm i in year t, $\ln C_{it}$. $FirmLevelExposure_i$ captures the weighted average of the exposure of banks a firm was borrowing from. All regressions include firm fixed effects, sector-time dummies, and the firm-time fixed effects estimated in Equation 7 as a proxy of credit demand (except column 2), a vector of weighted average lender characteristics pre-2001 (log-assets, share of NPLs, core-funding ratio, and the capital ratio). Standard errors are clustered at the sector-main bank level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 9: Real effects on firms (2SLS)

Dependent Variable	$\ln E_{it}$ (1)	$\ln I_{it}$ (2)	$\ln R_{it}$ (3)
Independent Variable	$FirmLevelExposure_i \times Post_t$		
Results for:			
a. Full Sample	-0.082***	-0.110***	-0.100***
	(0.02)	(0.02)	(0.02)
b. Non-Hit Firms	-0.061***	-0.075***	-0.060**
	(0.02)	(0.02)	(0.02)
c. Hit firms	-0.110***	-0.170***	-0.160***
	(0.02)	(0.04)	(0.03)
d. Comparative Adv and Non-Hit firms	-0.064**	-0.090**	-0.076**
	(0.02)	(0.03)	(0.03)
e. High productivity and Non-Hit firms	-0.120***	-0.150***	-0.130***
	(0.02)	(0.03)	(0.03)
d. Services	-0.039***	-0.026	-0.034
	(0.01)	(0.02)	(0.03)
Firm-F.E.	✓	✓	✓
Sector-time F.E.	✓	✓	✓

Note: The table reports the results on specification (11). The explanatory variable $FirmLevelExposure_i$, defined in (10), captures the weighted average of the exposure of banks a firm was borrowing from. The dependent variable is (log of) employment in column 1, investment in 2, revenues in 3. The estimation is based on the full sample of firms (row a), firms directly hit (row b) and not hit (row c) by competition from China, firms in non-hit sectors with export comparative advantages (row d), high-productivity firms in non-hit sectors (row e), and firms in services (row d). All regressions include firm fixed effects, sector-time fixed effects, and a weighted average of firms' lenders characteristics pre-2001 (log-assets, share of NPLs, core-funding ratio, and the capital ratio). Standard errors are clustered at the sector-main bank level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 10: Bank exposure and balance sheet effects (2SLS)

	NPLs		Deposits		Interbank (net liability)		Core Capital	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Exposure_b^{IT} \times Post_t$	0.031***	0.031***	-0.01	-0.015	0.02	0.015	-0.034**	-0.029**
	(0.008)	(0.01)	(0.02)	(0.016)	(0.012)	(0.031)		(0.015)
$Exposure_b^{IT} \times HighTier1_b \times Post_t$		-0.003		0.013		-0.02		-0.015
		(0.015)		(0.033)		(0.038)		(0.013)
$HighTier1_b \times Post_t$		0.005		0.013		0.008		0.022
		(0.005)		(0.012)		(0.008)		(0.015)
Interactive terms	✓	✓	✓	✓	✓	✓	✓	✓
Bank Controls	✓	✓	✓	✓	✓	✓	✓	✓
Bank F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Time F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Observations	5,014	5,014	5,014	5,014	5,014	5,014	5,014	5,014
$Adj.R^2$	0.65	0.65	0.94	0.94	0.83	0.83	0.51	0.51
First Stage AR-Wald test, F	19.1	19.1	27.3	27.3	25.7	25.7	18.7	18.7

Note: The table reports the results of specification (12) with the following dependent variables: 1) Non Performing Loans ratio (columns 1-2), Deposits (columns 3-4), Net interbank borrowing (columns 5-6), and Core Capital –or equity– (columns 7-8). All variables are expressed as a share of bank overall liabilities. $HighTier1_b$ is a dummy variable equal to 1 if the ratio of bank-b's core capital on its risk-weighted assets (1998-2000 average) is in the top quartile of the distribution. The variable $Exposure_b^{IT}$ captures bank exposure to China's entrance in the WTO, as defined in (3) instrumented (6). All regressions include the complete set of the corresponding interactions, bank controls interacted with a post-2001 dummy (i.e., pre-2001 log-assets, core-funding ratio, and the capital ratio), bank fixed effects, and year dummies. Standard errors are clustered at the bank level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 11: Baseline results: the interaction with Tier 1 capital (2SLS)

Dependent var: $\ln C_{ibt}$	Full Sample		Non-Hit Firms		Hit Firms	
	(1)	(2)	(3)	(4)	(5)	(6)
$Exposure_b^{IT} \times Post_t$	-0.11***	-0.12***	-0.10***	-0.126***	-0.11***	-0.112***
	(0.014)	(0.013)	(0.15)	(0.015)	(0.024)	(0.021)
$Exposure_b^{IT} \times HighTier1_b \times Post_t$		0.14***		0.122**		0.159***
		(0.04)		(0.058)		(0.058)
$HighTier1_b \times Post_t$		0.028		0.033		0.027
		(0.017)		(0.034)		(0.018)
Interactive terms	✓	✓	✓	✓	✓	✓
Bank-Firm specialization	✓	✓	✓	✓	✓	✓
Bank Controls	✓	✓	✓	✓	✓	✓
Firm-Bank F.E.	✓	✓	✓	✓	✓	✓
Firm-Time F.E.	✓	✓	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	32.1	20.1	28.3	14	28.3	14

Note: The table reports results of specifications (7) and (8), adding an interaction term $HighTier1_b$ in columns 2, 4, and 6 (i.e., a dummy equal 1 if the ratio of core capital to risk-weighted assets for 1998-2000 average is in the top quartile of the distribution). The results correspond to non-interacted coefficients (columns 1-2), interacted with Non-Hit dummy (columns 3-4), and interacted with Hit dummy (columns 5-6). The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure_{-i,b}^{IT}$ captures bank exposure to China's entrance in the WTO, is instrumented with (6). All regressions include the rest of the corresponding interaction terms, bank controls interacted with a post-2001 dummy (i.e., pre-2001 log-assets, share of NPLs, core-funding ratio, and the capital ratio), firm-year fixed effects, and firm-bank dummies. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 12: Bank exposure accounting for upstream and downstream linkages

Dependent : $\ln C_{ibt}$	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)
$Exposure^{IT}_{-i,b} \times Post_t$	-0.071***	-0.092***		
	(0.007)	(0.016)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.065***	-0.10***
			(0.009)	(0.020)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.079***	-0.078**
			(0.012)	(0.024)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	-	19.2	-	10.1

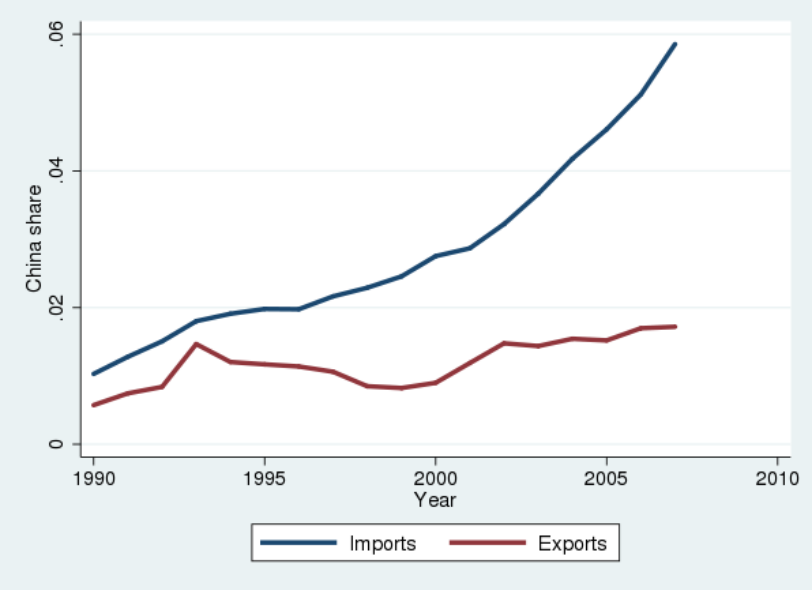
Note: The table reports the coefficients of Equation 7 (Columns 1 and 2) and Equation 8 (Columns 3 and 4), where bank exposure is based on sectors' sum of direct, upstream, and downstream exposure to the China shock. In Columns 3 and 4 firms are grouped into sectors directly and not directly hit by the trade shock (above and below the median of the sum direct, upstream, and downstream exposure to the China shock). The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ captures bank exposure to China's entrance in the WTO, as defined in Equation 3. In columns (2) and (4) this is instrumented with the variable $Exposure^{OC}_{-i,b}$, where bank exposure is defined using imports from China of other advanced countries, as defined in Equation 6. $Spec_{bst}$ is a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects and firm-bank dummies. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 13: Robustness to potential confounding factors (2SLS)

Dependent variable: $\ln C_{ibt}$	Baseline (1)	Foreign funding (2)	Recession (3)	Securitization (4)	All (5)
$Exposure^{IT}_{-i,b} \times Post_t$	-0.11***	-0.116***	-0.108***	-0.109***	-0.105***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
$Foreign\ Funding\ Share_b \times Post_t$		0.24***			0.10**
		(0.06)			(0.05)
$Recession\ Share_b \times Post_t$			-0.11**		-0.20***
			(0.05)		(0.05)
$Securitization\ Share_b \times Post_t$				-0.96***	-1.01***
				(0.08)	(0.09)
Bank-firm specialization	✓	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓	✓
Firm.bank F.E.	✓	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.82	0.82	0.83	0.83	0.83
First Stage AR-Wald test, F	32.1	73.2	55.9	62.7	51.5

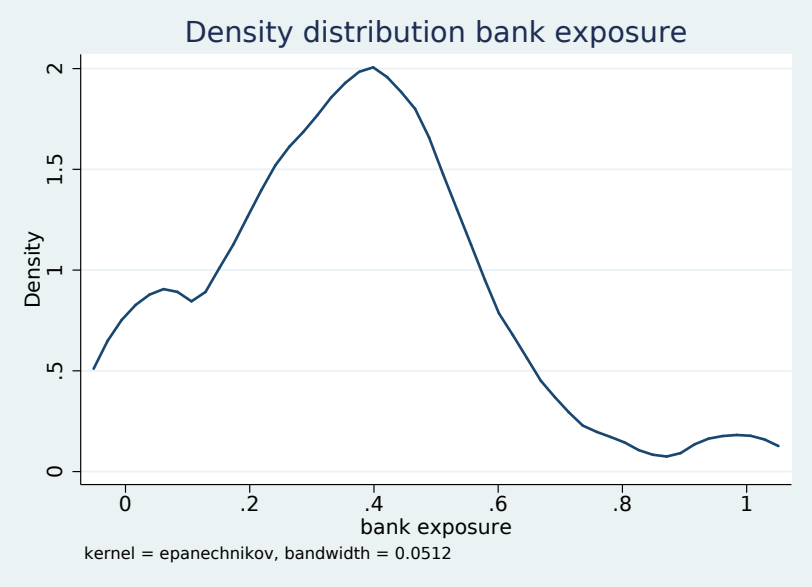
Note: The table reports the coefficients of the baseline specification in Equation 7 to which we add controls for potential confounding factors. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. Results are for the full sample of firms, but they deliver similar results if we look at firms in sectors directly and not directly hit by the trade shock. The variable $Exposure^{IT}_{-i,b}$ captures bank exposure to China's entrance in the WTO, as defined in Equation 3 and this is instrumented with the variable $Exposure^{OC}_{-i,b}$, where bank exposure is defined using imports from China of other advanced countries, as defined in Equation 6. Other bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Figure 1: Italian Import and Export Shares, from and to China



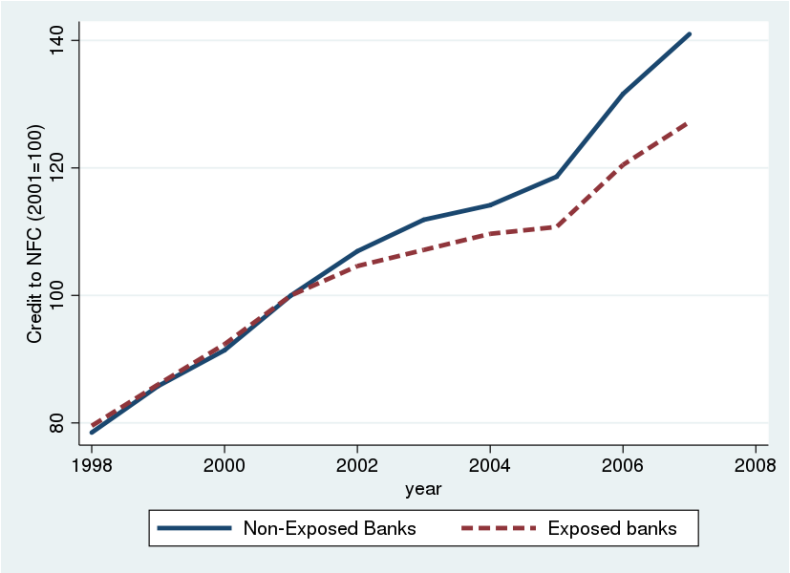
Note: The figure reports the evolution of the share of exports and imports of Italy to and from China relative to total Italian exports and imports. Data from COMTRADE.

Figure 2: Bank exposure: density distribution



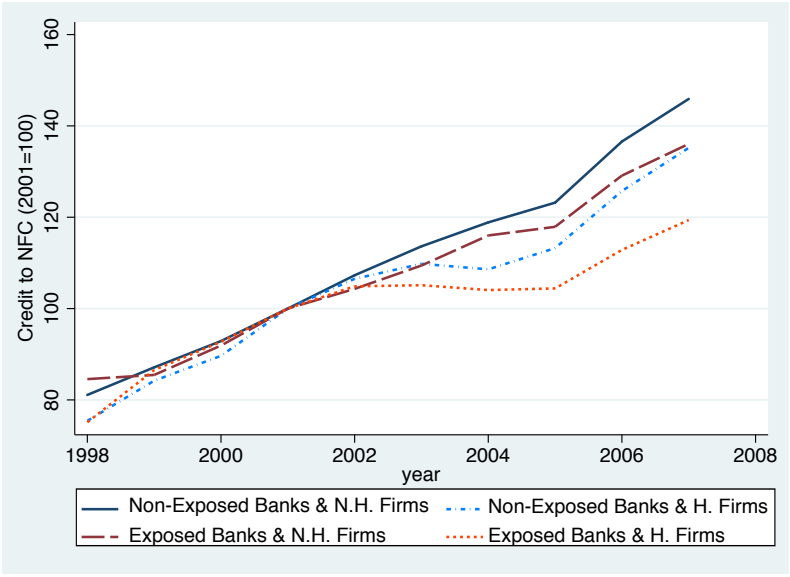
Note: The figure reports the distribution of values of bank exposure to China access in the WTO as defined in Equation 3. Data from the credit registry of the Bank of Italy.

Figure 3: Aggregate credit, exposed vs. non-exposed banks



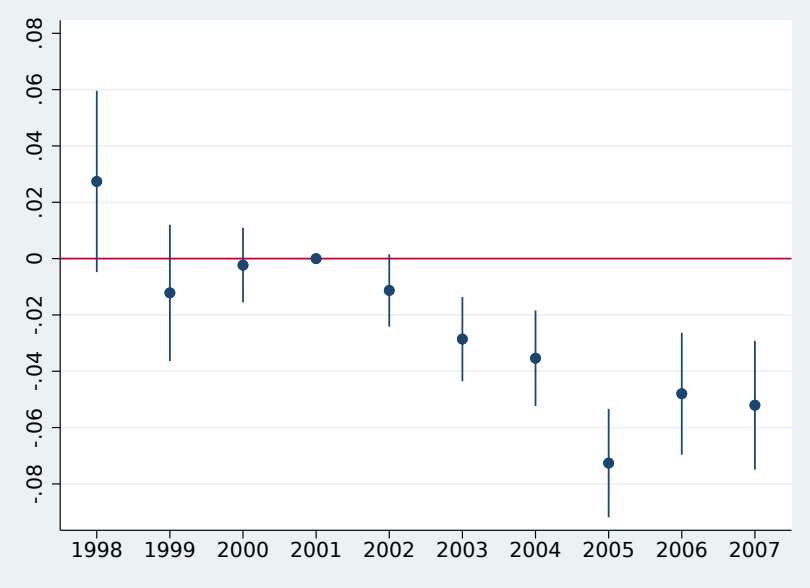
Note: The figure reports the evolution of the total outstanding credit of exposed and non-exposed banks. Bank exposure is defined as in Equation 3 and we divide the sample of banks above and below median of that measure.

Figure 4: Aggregate credit, exposed vs. non-exposed banks & hit vs. non-hit firms



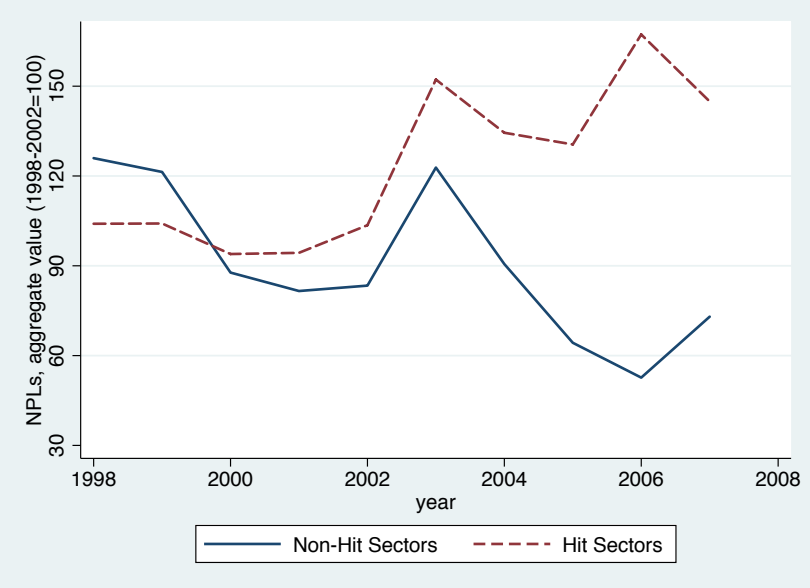
Note: The figure reports the evolution of the total outstanding credit of exposed and non-exposed banks give to firms in sectors directly hit by import competition (Hit) and those that are not (Non-Hit). Bank exposure is defined as in Equation 3 and we divide the sample of banks above and below median of that measure. Firms are defined to be hit or non-hit according to whether they are in a sector subject to China competition above or below median as defined in Equation 2

Figure 5: Dynamic Diff-in-Diff (95% CI)



Note: The figure reports the coefficients, with 95% confidence interval of the variable $Exposure^{IT}_{-i,b}$, instrumented with the variable $Exposure^{OC}_{-i,b}$, coming from the dynamic diff-in-diff regression of specification (7). The variable $Exposure^{IT}_{-i,b}$, as well as, bank level controls, are interacted with year dummies. Results are similar if we distinguish between hit and non-hit firms.

Figure 6: The underlying mechanism: the role of NPLs



Note: The figure reports the evolution of the total amount of NPLs of firms operating in sectors direcly and not directly hit by the trade shock, as defined in 2. The average value of NPLs before 2001 is normalized to 100.

Appendix For Online Publication

Baseline results with alternative variables and specifications

This Appendix reports the baseline results with alternative variables and specifications.

Table A1 reports the coefficients of a specification similar to Equation 7 and 8, where, in order to measure bank exposure, we do not divide sectors between hit and non-hit groups, using instead use a continuous measure for sector exposure to competition from China.

Table A2 reports the coefficients of a specification similar to Equation 7 and 8, where bank exposure is measured as the ratio of loans to hit firms relative to banks' total assets rather than on banks' overall corporate loans.

Table A3 reports the coefficients of a specification similar to Equation 7 and 8, where bank exposure is instrumented using imports from China of the United States only rather than a group of advanced countries.

Table A4 reports the coefficients of a specification similar to Equation 7 and 8, where bank exposure is defined leaving out the sector where the firm operates.

Table A5 reports the coefficients of a first-difference transformation of the baseline Equation 7 and 8 with two periods.

Table A6 reports the coefficients of the baseline specification in Equation 7 and 8, where observations are weighted by the log-employment of firms.

Table A7 reports the coefficients of a specification similar to Equation 7 and 8, which includes an additional control for the interaction between ex-ante bank exposure to automation and the Post dummy. Bank exposure to automation is computed as a weighted average of the industry level of automation, where weights are based on the industry share on banks' total loans. The level of automation in a given sector is measured as the change in the number of robots per thousand workers across seven European countries between 1993 and 2007, as reported by Acemoglu and Restrepo (2017).

Table A8 reports shift-share IV coefficients that are obtained from a weighted IV regression at the industry level, as in Borusyak et al. (2018). Standard errors allow for clustering at the level of four-digit sector and are valid in the framework of Adao et al. (2018).

Figure A1 provides a visual representation of the identifying variation at the industry-level. Since our baseline specification where bank exposure is defined using a median cutoff between hit and non-hit firms does not easily lend to a visual representation of the identifying variation, we define bank exposure using a continuous measure for sector exposure to competition from China (as in Table A1). The figure plots binned scatterplots of industry-level outcome and treatment residuals against a continuous measure of sector exposure to competition from China (as in Borusyak et al., 2018). Outcome and treatment residuals are obtained from a regression which includes the same controls as in the baseline specification and are then averaged for the pre- and post-2001 periods; the difference between pre- and post-2001 average is then taken for both outcome and treatment residuals. The lower panel of figure A1 replicates the same visual analysis excluding outliers.

Table A1: Baseline results with a continuous measure of firms' treatment

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b} \times Post_t$	-0.054***	-0.053***		
	(0.007)	(0.009)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.070***	-0.078***
			(0.010)	(0.012)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.029***	-0.039***
			(0.014)	(0.011)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	-	18.5	-	15.4

Note: The table reports the coefficients of a specification similar to Equation 7 and 8, where, in order to measure bank exposure, we do not divide hit and non-hit sectors, using instead a continuous measure for sector exposure to competition from China. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ is instrumented with the variable $Exposure^{OC}_{-i,b}$, where bank exposure is defined using imports from China of other advanced countries. In columns (3) and (4) firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A2: Baseline results with exposure relative to bank total assets

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b} \times Post_t$	-0.064***	-0.066***		
	(0.004)	(0.004)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.059***	-0.061***
			(0.004)	(0.005)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.068***	-0.070***
			(0.005)	(0.005)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	-	26.1	-	26.3

Note: The table reports the coefficients of a specification similar to Equation 7 and 8, where bank exposure is measured as the ratio of loans to hit firms on banks' total assets rather than on banks' overall loans. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{b}$ captures bank exposure to China's entrance in the WTO, similarly to definition in Equation 3 but using banks' total assets in the denominator. In columns (2) and (4) this is instrumented with the variable $Exposure^{OC}_{b}$, where bank exposure is defined using imports from China of other advanced countries, as defined in Equation 6. In columns (3) and (4) firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A3: Baseline results with instrument based on U.S. imports only

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b} \times Post_t$	-0.078***	-0.089***		
	(0.008)	(0.014)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.075***	-0.084***
			(0.009)	(0.014)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.082***	-0.088**
			(0.012)	(0.023)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.84	0.83	0.83	0.83
First Stage AR-Wald test, F	-	36.4	-	21.3

Note: The table reports the coefficients of a specification similar to Equation 7 and 8, where bank exposure is instrumented using imports from China of the United States only rather than a group of advanced countries. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ captures bank exposure to China's entrance in the WTO, as defined in Equation 3. In columns (2) and (4) this is instrumented with the variable $Exposure^{US}_{-i,b}$, where bank exposure is defined using imports from China of the United States (instead of a group of advanced economies as in Equation 6). In columns (3) and (4) firms are grouped into sectors directly and not directly hit by the trade shock. Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A4: Baseline results with bank exposure leaving sectoral credit out

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b} \times Post_t$	-0.078***	-0.103***		
	(0.008)	(0.015)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.078***	-0.100***
			(0.012)	(0.009)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.078***	-0.105***
			(0.024)	(0.015)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	-	47.3	-	26.6

Note: The table reports the coefficients of a specification similar to Equation 7 and 8, where bank exposure is defined leaving out the sector where the firm operates. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-s,b}$ is instrumented with $Exposure^{OC}_{-s,b}$, where bank exposure is defined using imports from China of other advanced economies as in Equation 6). In columns (3) and (4) firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A5: Baseline results: First differences

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b}$	-0.077***	-0.093***		
	(0.007)	(0.014)		
$Exposure^{IT}_{-i,b} \times NonHit_i$			-0.073***	-0.08***
			(0.011)	(0.024)
$Exposure^{IT}_{-i,b} \times Hit_i$			-0.081***	-0.102***
			(0.01)	(0.016)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	188,664	188,664	188,664	188,664
$Adj.R^2$	0.19	0.41	0.19	0.41
First Stage AR-Wald test, F	-	12.1	-	7.3

Note: The table reports the coefficients of a first-difference transformation of Equation 7 and 8 with two periods only. The dependent variable is the change in the log of outstanding credit between bank b and firm i between the average of 1998-2001 and that of 2002-2007, $\Delta \ln C_{ib}$. The variable $Exposure^{IT}_{-i,b}$ captures bank exposure to China's entrance in the WTO, as defined in Equation 3. In columns (2) and (4) this is instrumented with the variable $Exposure^{OC}_{-i,b}$, where bank exposure is defined using imports from China of other advanced countries, as defined in Equation 6. In columns (3) and (4) firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm fixed effects, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A6: Baseline results: Weighted Least Squares

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b} \times Post_t$	-0.078***	-0.11***		
	(0.009)	(0.016)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.076***	-0.10***
			(0.01)	(0.026)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.081***	-0.11***
			(0.014)	(0.02)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.84	0.83	0.83	0.83
First Stage AR-Wald test, F	-	12.1	-	12.3

Note: The table reports the coefficients of the baseline specification in Equation 7 and 8, where observations are weighted by the log-employment of firms. The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ captures bank exposure to China's entrance in the WTO, similarly to definition in Equation 3 but using banks' total assets in the denominator. In columns (2) and (4) this is instrumented with the variable $Exposure^{OC}_{-i,b}$, where bank exposure is defined using imports from China of other advanced countries, as defined in Equation 6. In columns (3) and (4) firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Standard errors are double clustered at the bank and sector level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A7: Baseline results controlling for exposure to automation

Dependent : $\ln C_{ibt}$	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
$Exposure^{IT}_{-i,b} \times Post_t$	-0.079***	-0.109***		
	(0.008)	(0.015)		
$Exposure^{IT}_{-i,b} \times Post_t \times NonHit_i$			-0.076***	-0.105***
			(0.009)	(0.015)
$Exposure^{IT}_{-i,b} \times Post_t \times Hit_i$			-0.083***	-0.113***
			(0.012)	(0.024)
$Automation^{IT}_{-i,b} \times Post_t$	-0.002	-0.006	-0.002	-0.006
	(0.004)	(0.004)	(0.004)	(0.004)
Bank-firm specialization	✓	✓	✓	✓
Bank controls	✓	✓	✓	✓
Firm-time F.E.	✓	✓	✓	✓
Firm-bank F.E.	✓	✓	✓	✓
Observations	1,945,334	1,945,334	1,945,334	1,945,334
$Adj.R^2$	0.83	0.83	0.83	0.83
First Stage AR-Wald test, F	-	28.3	-	32.1

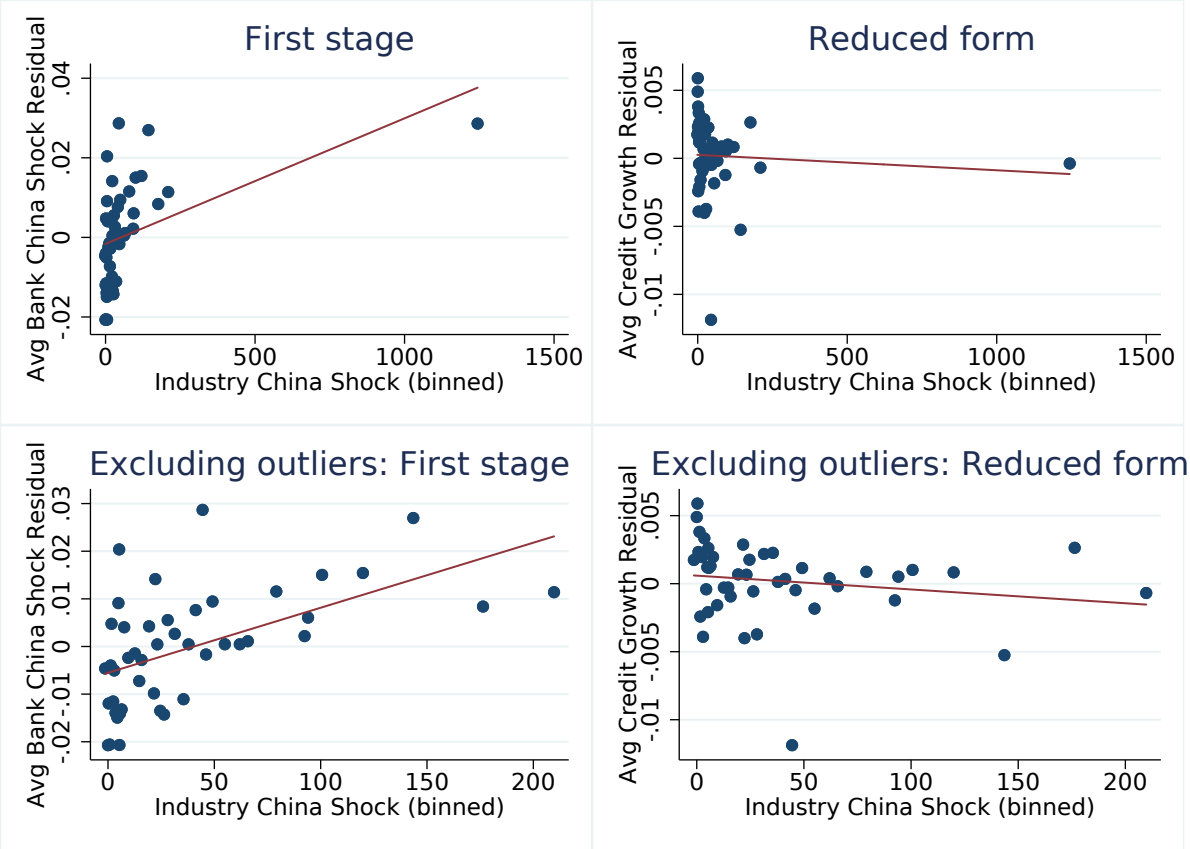
Note: The table reports the coefficients of the baseline specification in Equation 7 (Columns 1 and 2) and in Equation 8 (Columns 3 and 4), with the inclusion of an additional control for the interaction between ex-ante bank exposure to automation and the Post dummy. In Columns 3 and 4 firms are grouped into sectors directly and not directly hit by the trade shock, as defined in (4). The dependent variable is the log of outstanding credit between bank b and firm i in year t, $\ln C_{ibt}$. The variable $Exposure^{IT}_{-i,b}$ captures bank exposure to China entrance in the WTO, as defined in Equation 3. In columns (2) and (4) this is instrumented with the variable $Exposure^{OC}_{-i,b}$, where bank exposure is defined using imports from China of other advanced countries, as defined in Equation 6. The variable $Automation^{IT}_{-i,b}$ captures bank exposure to automation, where automation in a given sector is measured as the change in the number of robots per thousand workers across seven European countries between 1993 and 2007. $Spec_{bst}$ is a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. Bank controls include bank characteristics pre-2001 interacted with a post-2001 dummy, these are log-assets, share of NPLs, core-funding ratio, and the capital ratio. All regressions include firm-year fixed effects and firm-bank dummies. Standard errors are clustered at the bank-sector (2-digit) level. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table A8: Shift-share clustering

Dependent : $\ln C_{ibt}$	Full sample		Hit		Non-Hit	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
$Exposure_b^{IT} \times Post_t$	-0.088***	-0.109**	-0.099***	-0.119*	-0.007***	-0.094*
	(0.010)	(0.049)	(0.016)	(0.070)	(0.010)	(0.049)
Observations	2,080	2,080	2,080	2,080	2,080	2,080
$Adj.R^2$	0.10	0.10	0.10	0.09	0.05	0.05
First Stage AR-Wald test,	-	42.5	-	42.3	-	35.7

Note: The table reports shift-share IV coefficients from equivalent industry-level regressions (as in Borusyak et al., 2018). Standard errors allow for clustering at the level of four-digit sector, and are valid in the framework of Adao et al. (2018). Columns (1) and (2) report OLS and IV estimates on the full sample, Columns (3) and (4) on the subsample of hit firms, Columns (5) and (6) on the subsample of non-hit firms. In contrast to the baseline estimates, for this table bank exposure is computed without leaving out firm i from credit weights in equation 3. The reported number of observations refers to the number of observations in the equivalent industry-level regressions. The variable $Exposure_{-i,b}^{IT}$ is instrumented with the variable $Exposure_{-i,b}^{OC}$, where bank exposure is defined using imports from China of other advanced countries. Outcome and treatment residuals are obtained from specifications which include bank controls (the following bank characteristics pre-2001 interacted with a post-2001 dummy: log-assets, share of NPLs, core-funding ratio, and the capital ratio), firm-year fixed effects, firm-bank dummies, and a dummy that captures if a firm operates in a sector in which the bank specializes its lending activities. ***significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Figure A1: Industry-level variation in the specification where bank exposure is defined using a continuous measure for sector exposure to competition from China



Note: The figure plots binned scatterplots of industry-level outcome and treatment residuals against a continuous measure of sector exposure to competition from China (as in Borusyak et al., 2018). Outcome and treatment residuals are obtained from a regression which includes the same controls as in the baseline specification and are then averaged for the pre- and post-2001 periods; the difference between pre- and post-2001 average is then taken for both outcome and treatment residuals. The lower panel replicates the same visual analysis excluding outliers (i.e. sectors in the bin with the largest value of industry China shock.)