

Import Competition, Trade Credit, and Financial Frictions in General Equilibrium*

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May 2026

Abstract

We investigate the role of trade credit and financial frictions in propagating international trade shocks along supply chains. Using U.S. data, we show that exposure to Chinese import competition resulted in a significant increase in trade credit and a broader shift toward short-term financing. To quantify the economic effects of these adjustments, we develop a multi-country input-output trade model with borrowing constraints, trade credit, and endogenous employment. We find that borrowing constraints lead to negative effects of the China shock on employment and real wages. While trade credit mitigates these losses by half, it does not fully offset the effects of financial frictions.

Keywords: trade credit, trade shocks, financial frictions, borrowing constraints, employment.

JEL codes: E10, E44, F14, F15, F16, F62, G20.

*Authors contacts: fesposito4@fordham.edu, fadi.hassan@bancaditalia.it. We thank Laura Alfaro, Costas Arkolakis, David Atkin, Chaewon Baek, Arnaud Costinot, Dave Donaldson, Alan Finkelstein-Shapiro, Gordon Hanson, as well as seminars' participants at Harvard, LSE, MIT, Princeton, SEA Conference, EIIT and Tufts for helpful suggestions and comments. We thank Taige Wang for excellent research assistance. All remaining errors are our own.

1 Introduction

Gains from trade hinge critically on the reallocation of production factors across firms, sectors, and regions in response to the new patterns of comparative advantage induced by trade liberalization. While the literature has traditionally emphasized labor market frictions and low worker mobility as key factors limiting such reallocation¹, a growing body of research highlights the importance of the endogenous response of financial channels, particularly bank credit, to trade shocks (Federico et al., 2025; Correa et al., 2023). In this paper, we contribute to this latter line of research by analyzing how financial frictions and trade credit shape the adjustment of the U.S. economy to the rise of China as a global manufacturing powerhouse and its accession to the WTO.

First, we show empirically that U.S. sectors more exposed to import competition from China increase the use of trade credit, i.e. firms borrow more from their suppliers. The effect is economically meaningful and robust across a range of specifications. When we broaden the analysis to the overall liability structure, we find that higher exposure leads to a substitution of long-term debt with short-term debt, and that within short-term liabilities the share of trade credit rises disproportionately among sectors that are initially more financially constrained. Looking at the role of trade credit is relevant, not only because it is a key source of financing for firms' operations,² but also because creditor-debtor relationships embedded in supply chains can either amplify or buffer the effects of trade shocks.

Motivated by these findings, we analyze the general equilibrium effects of the China shock on employment and real wages in a multi-country input-output trade model with financial constraints in production and with endogenous employment. Firms can borrow either from an external financial sector or from suppliers through trade credit. In a frictionless world, trade liberalization with China generates positive gains from trade. However, we find that the presence of financial frictions can lead to sizable losses. Allowing firms to access trade credit substantially mitigates these losses, although it does not eliminate them. We also study the role of financial frictions and trade credit in alternative economic environments featuring unconstrained suppliers, internal liquidity, frictional unemployment, and buyer-supplier searching. Overall, the model provides a framework for understanding how financial frictions shape the gains from trade and the transmission of trade shocks across the economy.

¹See among others Topalova (2010), Autor et al. (2012), Kovak (2013), Dix-Carneiro (2014), Autor et al. (2014), Acemoglu et al. (2016), Hakobyan and McLaren (2016), Dix-Carneiro and Kovak (2017), Utar (2018), Caliendo et al. (2019), and Adao et al. (2026).

²In the U.S. Census Quarterly Financial Report accounts payable are 28% of total debt and exceed bank debt by 40% among manufacturing firms (2022 data). Comparable figures hold in other countries and are typically larger for smaller firms (Cuñat and Garcia-Appendini, 2012; Giannetti et al., 2011; Giannetti, 2003).

To identify the effects of Chinese import competition on firms’ financing choices, we exploit differences in sectors’ exposure to the China shock following the stacked first-differences approach of [Autor et al. \(2013\)](#) and [Acemoglu et al. \(2016\)](#). We construct sector-level measures of trade credit and other liability components by aggregating firm-level balance-sheet information from Compustat, which provides data on accounts payable and other financial variables for U.S. manufacturing firms between 1991 and 2007. The results are economically meaningful and robust to alternative specifications and controls.

The attention to trade credit is motivated by its importance as a source of firm financing and by a growing literature showing that disruptions to supplier financing can affect firms’ investment, employment, and output growth even in the long-run ([Adelino et al., 2023](#); [Bocola and Bornstein, 2023](#); [Costello, 2020](#)). Despite its short contractual maturity, trade credit is continuously rolled over and closely intertwined with other sources of finance, allowing its effects to persist well beyond the maturity of individual contracts. Moreover, the creditor-debtor relationships underlying trade credit are predominantly domestic in the U.S., implying that changes in trade credit primarily affect the transmission of shocks within the domestic production network.³

Our framework builds on a multi-country multi-sector Armington model with intermediate and final goods producers and introduces financial frictions and trade credit into the analysis. Firms must pay for labor and intermediate inputs before revenues are realized, creating a demand for external financing. Both intermediate and final goods producers borrow from a competitive financial sector, which we call banks for brevity, whereas final goods producers can also obtain financing from suppliers through trade credit. Borrowing from banks is subject to a revenue-based collateral constraint, in the spirit of [Lian and Ma \(2021\)](#), [Drechsel \(2023\)](#), and [Caglio et al. \(2021\)](#), whereby a decline in revenues reduces borrowing capacity and amplifies the effects of the trade shock. Importantly, the borrowing constraint is size dependent, in the spirit of [Gopinath et al. \(2017\)](#): firms can borrow up to a fraction of their revenues, and this fraction is increasing in firm size. This non-linearity is consistent with the heterogeneous adjustment of liability structures documented in our data and with recent empirical evidence on firms’ borrowing behavior in the United States ([Caglio et al., 2021](#)).

The model rationalizes the empirical increase in trade credit through two channels. The first is a “collateral effect”: following an increase in import competition, lower revenues reduce the value of firms’ collateral, tightening borrowing constraints and lowering the amount of credit available from banks. As a result, firms rely more heavily on trade credit from

³About 95% of trade payables by U.S. non-financial corporations in our sample period are owed to domestic suppliers. This figure is computed by combining information on trade payables from the U.S. Flow of Funds Accounts with the Net International Investment Position statistics.

suppliers. This channel resembles the mechanisms in [Kiyotaki and Moore \(1997\)](#) and [Jermann and Quadrini \(2012\)](#). In our framework, however, it also generates an upstream financial propagation effect, as greater reliance on trade credit by downstream producers increases the financing needs of their suppliers, which in turn borrow more from banks. The second channel is a relative “cost effect”: if input costs decline by less than labor costs following the shock, expenditure on intermediate inputs rises relative to revenues, increasing the use of trade credit. Quantitatively, we find that the collateral effect is substantially more important than the relative cost effect.

Next, we calibrate the model to match salient features of the data and assess its quantitative implications. The model reproduces the observed sectoral responses in trade credit, employment, and trade flows following the China shock. In a frictionless environment, the shock lowers manufacturing employment by about 3.2%, while aggregate employment remains broadly stable and real wages increase modestly, in line with the recent quantitative literature on the China shock, such as [Caliendo et al. \(2019\)](#) and [Galle et al. \(2022\)](#). Introducing borrowing constraints nearly doubles manufacturing employment losses to 6.3% and generates declines in both aggregate employment and real wages. These findings are consistent with the logic of second-best theory: the effects of lower trade barriers depend critically on the presence of other distortions in the economy. Allowing firms to access trade credit mitigates a substantial fraction of these losses by relaxing financing constraints and supporting production throughout the supply chain. Aggregate employment remains broadly stable, while real wage losses fall from 0.32% in the model with financial frictions alone to 0.15% once trade credit is introduced.

We also examine how financial frictions and trade credit interact with other environments emphasized in the literature. First, we relax the borrowing constraint of suppliers. Then we introduce internal liquidity as an additional source of financing alongside bank credit and trade credit. Third, we allow for frictional unemployment through a search-and-matching labor market. Finally, we relax the assumption of fixed buyer-supplier relationships and allow firms to search for alternative trading partners. We find that relaxing the financial frictions upstream greatly dampens the propagation of the trade shock reducing real wage losses significantly; also internal liquidity provides an additional buffer against trade shocks, attenuating employment and real wage losses. Labor market frictions amplify the employment effects of the shock, but do not eliminate the mitigating role of trade credit. Finally, greater flexibility in buyer-supplier relationships reduces the cost of supplier financing and further dampens the impact of financial frictions on real wages.

To better understand the mechanisms at work, we further focus on a parsimonious version of the model that preserves analytical tractability. This allows us to provide a first-

order decomposition of the employment effects of the China shock and quantify the relative importance of the different mechanisms at work. Some of these channels are familiar from the quantitative trade literature, but our framework allows us to assess their contribution in the presence of financial frictions and trade credit. A decline in the demand for U.S. products reduces firms’ revenues and labor demand (the “revenue effect”), while lower input costs raise labor demand when labor and intermediate inputs are complements (the “input-cost effect”). A third channel operates through the reallocation of international demand across countries and sectors, which changes the trade shares of U.S. suppliers (the “trade-shares effect”). The model also highlights a novel “credit-cost effect”. The higher use of trade credit following the shock increases the financing needs of suppliers, which must borrow more from banks to extend credit to their customers. This raises suppliers’ financial expenses and reduces their labor demand. In addition, the greater reliance on trade credit affects the financing costs faced by buyers, generating further repercussions for employment along the supply chain.

The decomposition also reveals a fundamental trade-off in the use of trade credit. On the one hand, trade credit relaxes buyers’ borrowing constraints, supporting production and reinforcing the revenue effect for both buyers and suppliers. On the other hand, extending trade credit increases financing needs and credit costs, exerting downward pressure on employment. Quantitatively, although the credit-cost effect is not negligible, the positive impact of trade credit on the revenue effect dominates, so that trade credit improves the responses of employment and real wages following the China shock.

Literature review

Our paper is related to the literature that uses static models with input-output linkages to analyze the general equilibrium effects of trade shocks ([Caliendo and Parro 2015](#) and [Costinot and Rodríguez-Clare 2014](#)). Compared to this literature, the distinctive feature of our paper is the introduction of borrowing constraints in production and the possibility of extending trade credit.⁴ While there is a strand of literature that introduces financial frictions in international trade models, and analyzes the role of finance and contract enforcement in trade, typically the focus is on the effect of these frictions on exports ([Manova 2013](#), [Schmidt-Eisenlohr 2013](#), [Muûls 2015](#), [Antras and Foley 2015](#), [Chaney 2016](#), [Niepmann and Schmidt-Eisenlohr 2017](#), [Kohn et al. 2020](#), and [Garcia-Marin et al. \(2025\)](#)). In our paper the presence of a borrowing constraint together with trade credit, generates network effects through both production and financial linkages. This feature allows us to analyze the role of financial frictions in the propagation of trade shocks along the supply chain.

⁴Our model also has an endogenous employment margin, which is a relatively recent introduction in trade models, see e.g. [Arkolakis and Esposito \(2014\)](#), [Adão \(2015\)](#), [Kim and Vogel \(2021\)](#).

A vast literature has documented employment losses in response to a rise in import competition in different settings ([Topalova 2010](#), [Autor et al. 2013](#), [Kovak 2013](#), [Pierce and Schott 2016](#) and [Dix-Carneiro and Kovak 2017](#)). Several papers focus on the role of labor market frictions in the aftermath of a negative trade shock ([Dix-Carneiro 2014](#), [Caliendo et al. 2019](#), [Galle et al. 2022](#), [Adao et al. 2026](#) and [Dix-Carneiro et al. 2023](#)), whereas a smaller but growing literature analyzes the role of other frictions, such as credit reallocation ([Federico et al. 2020](#)) physical capital adjustment ([Lanteri et al. 2020](#)), and nominal rigidities ([Rodríguez-Clare et al. 2022](#)). We contribute to this latter body of work by focusing on financial frictions and studying the combination of borrowing constraints and trade credit in the transmission of an import competition shock. We show that employment losses are greatly amplified by the presence of borrowing constraints, but they are reduced when suppliers extend trade credit to their customers.

Since the seminal work by [Petersen and Rajan \(1997\)](#), an extensive literature has analyzed the role of trade credit in the economy. On one hand, many papers document the amplification of shocks through trade credit linkages ([Raddatz 2010](#), [Kalemli-Ozcan et al. 2014](#), [Jacobson and Von Schedvin 2015](#), [Costello 2020](#), [Alfaro et al. 2021](#), [Reischer 2019](#), [Luo 2020](#), [Altinoglu 2021](#), [Bocola and Bornstein \(2023\)](#), [Shao 2025](#)). On the other hand, several studies emphasize the stabilizing role of trade credit. [Demir and Javorcik \(2018\)](#) show empirically, and through the lenses of a partial-equilibrium model, that trade credit attenuates the price adjustment of Turkish exporters exposed to the removal of quotas after the Multi-Fiber Arrangements in 2005. [Cunat \(2007\)](#) analyzes theoretically how trade credit can insure firms against liquidity shocks thanks to the suppliers' comparative advantage in lending to their customers relative to banks. [Garcia-Appendini and Montoriol-Garriga \(2013\)](#) find empirically that indeed trade credit provided liquidity insurance to firms more exposed to the 2008 credit crunch, improving their performance relative to firms that did not have access to trade credit. [Hardy and Saffie \(2019\)](#) analyze the role of trade credit in the context of an exchange rate depreciation shock in Mexico. [Amberg et al. \(2021\)](#) document how trade credit helps firms to manage liquidity shortages. [Ersahin et al. \(2022\)](#) show that trade credit enhances the stability of production networks against economic shocks, such as natural disasters. [Hardy et al. \(2022\)](#) study the general equilibrium stabilizing role of trade in business cycle fluctuations in Mexico. Finally, [Bocola and Bornstein \(2023\)](#) look at the role of trade credit in the transmission of financial shocks to output in the context of Italy.

Within this strand of the literature, [Demir and Javorcik \(2018\)](#) and [Hardy et al. \(2022\)](#) are the closest to our work. Relative to the former, we focus on the implications of an import competition shock through a rich general equilibrium model and we quantify the effects on sectoral employment and real wages. Relative to the latter, we study the long-run general

equilibrium implications of an international trade shock in an advanced economy such as the U.S. Moreover, we are able to formally characterize both the negative and positive effects of trade credit, and quantify their relative magnitudes.

Finally, our paper connects to the large literature that studies the role of production networks in macroeconomics, such as [Acemoglu et al. \(2012\)](#), [Baqaee and Farhi \(2019\)](#), [Carvalho and Tahbaz-Salehi \(2019\)](#), [Bigio and La'O \(2020\)](#), and [La'O and Tahbaz-Salehi \(2022\)](#). Relative to these papers, we focus on an international trade shock and emphasize the role of trade credit and borrowing constraints.

The rest of the paper proceeds as follows. Section 2 discusses the identification strategy, the data and the empirical results. Section 3 develops a theoretical framework to investigate the general equilibrium effects of trade shocks in the presence of financial frictions and trade credit. Section 4 calibrates the model and tests its predictions in the data. Section 5 quantifies the impact of the China shock on employment and real wages in the U.S. economy under alternative economic environments. Section 6 concludes.

2 Empirical motivation: trade credit and financial adjustments to the China shock

Our empirical analysis first shows that sectors more exposed to import competition from China experienced an increase in accounts payable relative to revenues - the trade credit received from suppliers. We then document that this increase occurred alongside a broader shift in firms' liabilities toward short-term debt, with trade credit becoming a more important source of financing in response to the shock, especially among sectors with higher initial indebtedness.

2.1 Identification strategy

In the initial specification, following [Autor et al. \(2013\)](#) and [Acemoglu et al. \(2016\)](#), we run a stacked first-differences regression at the 4-digit industry level over the two sub-periods 1991-2000 and 2000-2007:

$$\Delta TC_{st} = \beta_1 \Delta IP_{st} + \beta_2 X_{st} + \gamma_t + \epsilon_{st}. \quad (1)$$

This regression captures the average change in trade credit for the two sub-periods in sectors more exposed to competition from China (IP_{st}), controlling for other initial sectors' characteristics (X_{st}) that might affect trade credit, and for time period dummies (γ_t). We then extend this specification to other financial variables such as total debt and its decomposition

into long- and short-term debt.

A potential concern with equation (1) is that industries more exposed to the China shock differ systematically from less exposed ones in ways that also affect their use of trade credit. To the extent that these differences are time invariant, they are accounted for by the first-differences specification, which absorbs industry fixed effects. A separate concern is that the rise of China coincided with a broader increase in outsourcing and production fragmentation, both domestic and international. If industries more exposed to Chinese import competition also experienced greater fragmentation, our estimates could partly capture changes in firms' operating structure rather than a financial response to the China shock. To address this issue, we control for industry-specific trends (at the two-digit level), changes in the share of intermediate inputs over revenues as a proxy for production fragmentation, and changes in imports and exports over revenues as a proxy for broader exposure to globalization.

The coefficient β_1 in specification (1) is unbiased if, absent the rise of China, trade credit would have followed similar trends across industries with different exposure to Chinese import competition. While this assumption cannot be tested directly, Figure A.1 in the Appendix provides a first piece of evidence consistent with it. Prior to the late 1990s, industries in the top and bottom quartiles of the China-shock distribution display broadly similar dynamics in accounts payable relative to revenues. The divergence between the two groups becomes apparent after the acceleration of Chinese import penetration. We provide several additional pieces of evidence in support of this assumption. First, we conduct a falsification exercise by regressing past changes in trade credit on future changes in import exposure, allowing us to assess the presence of differential pre-trends. Second, we show that the results are robust to controlling for a rich set of predetermined sector characteristics and industry-specific trends. Third, following [Borusyak et al. \(2022\)](#), we examine the ex-ante balance of key sector characteristics related to employment, technology, and finance. If exposure to the China shock was as good as randomly assigned across industries, it should not systematically predict predetermined sector characteristics; we find that this is indeed the case. In what follows, we describe the construction of the main variables and discuss alternative specifications and robustness checks.

2.2 Data and measurement

The summary statistics of the main variables are in Table A.1 in the Appendix. Data on trade credit and financial variables are from Compustat's Fundamentals Quarterly database. We take the fourth quarter to identify the outstanding amounts of the relevant variables at the end of each year.⁵ We apply the following filters that are standard in the literature

⁵Working, instead, with averages in a given year does not substantially affect the results.

([Ottonello and Winberry, 2020](#); [Kroen et al., 2021](#)): first, we drop firms with leverage, defined as current debt plus long-term debt divided by assets, exceeding 10. Further, we drop firms with net current asset ratio, defined as current assets minus current liabilities over total assets, exceeding 10 or below -10. We then drop sectors with less than 20 firms. We end up with 157 manufacturing industries. Finally, for each 4-digit sector we aggregate firms' variables and compute the change between 1991 and 2000, and between 2000 and 2007, winsorizing at the 1 and 99 percentiles.

Note that data on accounts receivable is scarce before 2004, so we cannot look at net accounts payable (i.e., accounts payable minus accounts receivable). Reassuringly, the correlation between accounts payable and net accounts payable after 2004 is high (0.71). In addition, in a robustness exercise discussed below we compute a proxy for accounts receivable using data on input-output linkages, and results are very similar to the baseline.⁶

A potential concern with Compustat data is that listed firms may not be representative of the broader U.S. manufacturing sector. To assess this issue, we compare the evolution of accounts payable, total debt, and the share of short-term debt in our sample with the corresponding series from the Quarterly Financial Report (QFR) of the U.S. Census Bureau (Figure A.2 in the Appendix). The QFR covers U.S. manufacturing firms with assets above \$250,000, although in the early part of our sample it is available only at the two-digit industry level. Reassuringly, the Compustat and QFR series display very similar dynamics for accounts payable and the share of short-term debt. The evolution of total debt is also remarkably similar during the first sub-period. Over the second sub-period, the two datasets exhibit different timing patterns, with indebtedness rising earlier among Compustat firms and later among firms in the QFR. Nevertheless, the overall increase in debt over the period is similar across the two datasets. In addition, Table A.2 in the Appendix shows that the levels of accounts payable relative to revenues, total debt relative to revenues, and the share of short-term debt are comparable across the two datasets, both in terms of averages and interquartile ranges.⁷ Overall, these comparisons suggest that Compustat captures the broad financial patterns observed in the manufacturing sector.

We then use Compustat to construct sector-level controls for investment and inventories relative to total assets, winsorized at the 1st and 99th percentiles. To account for differences in employment structure and technology, we draw on [Acemoglu et al. \(2016\)](#) and include the initial share of production workers in total employment, the log average wage, the ratio

⁶We also estimate a specification using the change in net accounts payable between 2004 and 2007, with results qualitatively close to the baseline. Results are available upon request.

⁷Figure A.3 in the Appendix further shows that the main financial variables are well dispersed across sectors in the initial year of both sub-periods, alleviating concerns that the results are driven by a small number of industries.

of capital stock to value added, computer investment as a share of total investment, and high-tech equipment as a share of total investment. Finally, to capture industry exposure to fragmentation and outsourcing, we use data from the NBER Manufacturing Database to measure changes in intermediate input expenditure, imports, and exports relative to revenues.

Our baseline measure of trade exposure follows Autor et al. (2013) and is the change in the imports from China for U.S. manufacturing industries, normalized by initial industry employment in 1991:

$$\Delta IP_{st} = \frac{\Delta M_{st}^{US-CN}}{L_{s,91}^{US}}, \quad (2)$$

where the numerator ΔM_{st}^{US-CN} is the change of sector s (SIC four-digit industries) imports from China to the U.S. in sub-period t (we take two sub-periods 1991-2000 and 2000-2007), whereas $L_{s,91}^{US}$ is the initial level of employment in sector s in 1991.⁸

A standard concern about (2) is that observed changes in US imports ratio may reflect not only supply shocks in China, e.g. productivity shocks, but also demand shocks to US industries. To capture the supply-driven component in US imports from China, we use the imports of other advanced countries as an instrument:

$$\Delta IPO_{st} = \frac{\Delta M_{st}^{OTH-CN}}{L_{s,80}^{US}}, \quad (3)$$

where ΔM_{st}^{OTH-CN} is the growth of imports from China in sub-period t of other high-income countries excluding the US.⁹ The underlying assumptions for using (3) as an instrument are that i) high-income economies are similarly exposed to supply shocks in China, ii) industry-specific import demand shocks are uncorrelated across high-income countries, and iii) US demand shocks increasing imports from China are not large enough to generate positive productivity shocks to Chinese industries, which end up raising the imports of other advanced countries.

Our instrument is based directly on the change in Chinese import penetration in other advanced economies and is defined at the sector level. Unlike the shift-share instruments commonly used in the China-shock literature, it does not combine sector-specific exposure shares with aggregate shocks. Accordingly, we cluster standard errors at the 3-digit sector level, whereas the correction proposed by Adão et al. (2019) is not applicable in our setting. Following the diagnostic exercises recommended in the recent shift-share literature (e.g.,

⁸As in Autor et al. (2013), we multiply import growth in the two sub-periods by 10/9 and 10/7 respectively, to be expressed in a comparable 10-years scale.

⁹The countries are Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland, which are the countries for which Autor et al. (2013) obtained disaggregated trade data at the HS level back to 1991.

Borusyak et al. 2022), Table 1 examines whether exposure to the China shock is systematically related to predetermined sector characteristics.¹⁰ These include the initial reliance on trade credit, total debt over revenues, the share of short-term debt, investment and inventories relative to assets, and a range of variables capturing the structure of employment, technology, and internationalization. The only exceptions are that sectors more exposed to the China shock tend to exhibit lower initial debt and a somewhat higher share of investment in high-tech equipment. However, the economic magnitude of these differences is contained relative to the variables' means.¹¹ To be conservative, we include all these variables as controls in our econometric specification.

Table 1: Shock balance test, 1991-2007

Variable	Coefficient	Standard Error
Accounts payable over revenues	-0.003	(0.008)
Capital exp. over assets	0.002	(0.002)
Inventories over assets	0.006	(0.006)
Total debt over assets	-0.032**	(0.015)
Total debt over revenues	-0.192***	(0.058)
Prod. workers share of employment (1991)	-2.054	(2.31)
Log average wage in 1991	0.002	(0.03)
Capital/value added in 1991	-0.002	(0.03)
Computer investment as share of total (1990)	0.014	(0.01)
High-tech investment as share of total (1990)	0.010*	(0.01)
Intermediates expenditure over revenues	0.011	(0.010)
Imports over revenues	0.017	(0.026)
Exports over revenues	-0.031	(0.021)
Share of accounts payable in short-term debt	0.023	(0.016)
Long-term debt in total debt	-0.017	(0.010)

Note: Regressions of the industry-level covariates on the China shock as in Borusyak et al. (2022). The regressions control for period dummies and are weighted by average industry exposure shares. Clustered standard errors (at the 3-digit SIC level) are in parentheses.

¹⁰In a similar vein, Greenland et al. (2024) analyze the types of firms most affected by the China shock, and show that more exposed publicly-listed firms tend to have a lower market capitalization and have lower Tobin's Q, although they do not differ systematically along most other observable dimensions.

¹¹Moreover, through the lenses of the model, a lower initial leverage would imply a reduced need to rely on trade credit, thus this initial imbalance would work against our baseline finding on trade credit.

2.3 Empirical results

Table 2 reports the baseline results on trade credit. Column 1 shows that a one-standard-deviation increase in exposure to Chinese import competition is associated with a 2.7 percentage point increase in accounts payable relative to revenues, equivalent to approximately 10% of the sectoral average at the beginning of each period. Instrumenting exposure using equation (3) yields somewhat larger estimates (column 2), suggesting that attenuation bias, if anything, may lead OLS to understate the effect. The estimated coefficient remains positive and statistically significant throughout. In our preferred specification, which includes sector-level financial characteristics, the controls used in [Acemoglu et al. \(2016\)](#), measures of globalization and production fragmentation, and two-digit industry trend, a one-standard-deviation increase in exposure to Chinese import competition is associated with a 5.3 percentage point increase in accounts payable relative to revenues (column 6). Finally, column 7 reports a placebo exercise based on an earlier period and finds no statistically significant relationship between future exposure to Chinese import competition and past changes in trade credit, providing additional evidence against differential pre-trends.

As an additional check for differential pre-trends, we estimate a dynamic difference-in-differences specification using China’s WTO accession in 2001 as the benchmark year and the change in exposure to Chinese import competition between 2001 and 2007 as the key explanatory variable. Figure A.4 in the Appendix shows no evidence of differential movements in accounts payable relative to revenues prior to 2001. The estimated coefficients become positive and statistically significant only after China’s WTO accession, consistent with the baseline results.

Table 2: Exposure to Imports from China and Trade Credit

	OLS	IV					IV, Placebo
Dep. var: ΔTC_{st}	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta Exposure_{st}$	0.027** (0.011)	0.036** (0.016)	0.032** (0.016)	0.34*** (0.013)	0.049*** (0.013)	0.053*** (0.012)	0.006 (0.040)
Period dummy	✓	✓	✓	✓	✓	✓	✓
Financial controls			✓	✓	✓	✓	✓
Acemoglu et al (2016) controls				✓	✓	✓	✓
Globalization controls					✓	✓	✓
2-digit Sector dummies						✓	✓
Observations	314	314	314	304	304	304	287
First Stage F-stat		269	44	144	150	184	184

Note: Sample of 157 manufacturing industries (4-digit level), stacked across two sub-periods and weighted by initial assets. Columns (1) to (6) consider the sub-periods 1991-2000 and 2000-2007, while column (7) consider the period 1970-1989. Column (1) uses an OLS estimator, columns (2) to (7) use an IV estimator. Financial controls include inventories over assets, capital expenditures over assets, debt over assets at the beginning of each period. Acemoglu et al (2016) controls include production workers as a share of total employment, the log average wage, and the ratio of capital to value added in 1991; and computer investment as a share of total investment and high-tech equipment as a share of total investment in 1990. Globalization controls include the change in intermediate input expenditure, imports, and exports relative to revenues. Clustered standard errors (at the 3-digit level) are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

One caveat of our analysis is that we cannot observe accounts payable net of accounts receivable, as data on accounts receivable is scarce before 2004. To address this issue, we construct a proxy for net trade credit and re-estimate the baseline specification.¹² Table A.3 in the Appendix shows that the results are similar to the baseline.

A potential concern is that Chinese exporters may have systematically offered more favorable trade credit terms, thereby facilitating the increase in U.S. imports from China. If so, industries purchasing goods from China could experience an increase in accounts payable. Importantly, this additional mechanism would affect industries exposed to China through their input purchases, rather than industries directly competing with Chinese imports, which are the focus of Table (2). To assess the relevance of this channel, we construct a measure of downstream exposure to the China shock following [Acemoglu et al. \(2016\)](#). Specifically, we test whether U.S. industries that source a larger share of inputs from sectors more exposed to Chinese import competition experienced a greater increase in trade credit. We find no statistically significant effect of exposure through input-output linkages on accounts payable

¹²For each sector, we estimate accounts receivable as a weighted average of the change in accounts payable of its downstream industries (i.e., its customers), where downstream linkages and weights are obtained from the BEA Input-Output Tables. This approach assumes that production linkages are a reasonable proxy for trade credit linkages at the industry level.

(see Table A.4 in the Appendix), providing little evidence that exposure to China through purchasing linkages increased the use of trade credit among U.S. industries.

Taken together, these results indicate that sectors more exposed to Chinese import competition increased their reliance on supplier financing through trade credit.¹³ This novel empirical fact is robust across alternative specifications, controls, and measures of trade credit, and we find no evidence that exposure to China through purchasing linkages increased the use of trade credit. Accounts payable of U.S. non-financial firms originate overwhelmingly from domestic counterparties. Between 1990 and 2007, cross-border trade credit represented only 4.5% of total trade payables. Moreover, foreign trade credit to U.S. firms did not increase following China’s entry into the WTO.¹⁴ This implies that the economic consequences of the China shock via trade credit operate primarily through domestic U.S. input-output linkages.

Next, we extend the analysis to the broader financial adjustment induced by the China shock, focusing on both the level and composition of firms’ liabilities. Specifically, we examine total debt, its decomposition into long- and short-term debt, and, within short-term liabilities, the role of trade credit. To study the role of financial constraints, we proxy sectors’ financial tightness using the ratio of total debt to revenues at the beginning of each sub-period. The underlying idea is that sectors with higher debt relative to their revenue stream are more likely to be closer to their borrowing limit.¹⁵ While sectors may differ structurally in their reliance on external finance, these differences are absorbed by our first-difference specification, so that variation in the debt-to-revenues ratio is less likely to simply reflect sectors’ structural financing needs. The results in Table 3 build on the baseline specification in equation (1), augmented with the full set of controls and the instrumental-variable approach based on equation (3). As dependent variables, we consider alternative measures of financial liabilities and examine how they respond to exposure to the China shock, ex-ante financial tightness, and their interaction.

Column 1 examines the change in total debt relative to revenues. We find that sectors more exposed to the China shock increase their indebtedness. At the same time, sectors with higher initial debt relative to revenues exhibit a smaller increase in leverage, although the interaction term is not statistically significant. Finally, sectors that were more indebted at

¹³The result holds if we use a firm-level measure of exposure to China based on abnormal returns following [Greenland et al. \(2024\)](#). However, a firm-level analysis is less aligned with the quantitative trade model we use, which is structured at the sector level. Results are available upon request.

¹⁴Calculations are based on trade credit and advances of non-financial corporations from the Flows of Funds in the National Accounts, and trade credit liabilities from the Net International Investment Position statistics (NIIP) of the BEA. Notice that trade credit liabilities from the NIIP include not only non-financial corporation, but all U.S. firms. This implies that our estimate is an upperbound of the true reliance of non-financial firm on foreign trade credit.

¹⁵This is in line with [Ottonello and Winberry \(2020\)](#) who show that leverage is a good proxy for firm default risk.

the beginning of the period experience a decline in debt relative to revenues over time. These patterns are consistent with the idea that sectors more exposed to the China shock increase their reliance on external finance, while sectors that are initially more financially tight have less scope to further expand their borrowing.

Column 2 examines the composition of debt. We find that sectors more exposed to the China shock experience a significant decline in the share of long-term debt relative to total debt. Combined with the increase in total indebtedness documented in column 1, this result indicates that the financial adjustment to import competition operates primarily through short-term borrowing.

Column 3 focuses on the composition of short-term debt. We find that the response of trade credit depends critically on sectors' ex-ante financial tightness. While exposure to the China shock is associated with a decline in the share of accounts payable within short-term liabilities, the interaction between exposure and financial tightness is positive and statistically significant. As a result, the effect of import competition on the use of trade credit becomes increasingly positive as sectors move closer to their borrowing limit. The linear combination of the two coefficients is positive and statistically significant for sectors above the median level of indebtedness. We also find that accounts payable account for a larger share of short-term debt in sectors that were more financially tight before the shock. These findings suggest that trade credit becomes a particularly important source of financing when borrowing constraints are more likely to bind. Our model explicitly incorporates this feature by allowing the use of trade credit to depend on the tightness of the borrowing constraint.

Overall, the evidence points to a reallocation of firms' liability structure following the China shock. Sectors more exposed to import competition shift toward short-term borrowing and, when initially more financially tight, rely disproportionately on trade credit. These empirical patterns motivate the role of financial constraints and trade credit in the quantitative framework developed in the next section.

Table 3: Exposure to Imports from China, financial tightness, and financial liabilities

Dep. var:	IV		
	Total debt relative to revenues	Long-term debt relative to total debt	Accounts payable relative to short-term debt
	(1)	(2)	(3)
$\Delta Exposure_{st}$	0.107** (0.050)	-0.050*** (0.012)	-0.055*** (0.019)
$\Delta Exposure_{st} * Financial\ tightness_{st}$	-0.105 (0.114)	0.059 (0.036)	0.096** (0.046)
$Financial\ tightness_{st}$	-0.584*** (0.063)	-0.009 (0.011)	0.051** (0.019)
Period dummy	✓	✓	✓
Financial controls	✓	✓	✓
Acemoglu et al (2016) controls	✓	✓	✓
Globalization controls	✓	✓	✓
2-digit Sector dummies	✓	✓	✓
Observations	304	304	304
First Stage F-stat	102	269	44

Note: Sample of 153 manufacturing industries (4-digit level), stacked across two sub-periods and weighted by initial assets. Financial tightness is defined as the share of total debt relative to revenues at the beginning of each sub-period. Financial controls include inventories over assets and capital expenditures over assets at the beginning of each period. Acemoglu et al (2016) controls include production workers as a share of total employment, the log average wage, and the ratio of capital to value added in 1991; and computer investment as a share of total investment and high-tech equipment as a share of total investment in 1990. Globalization controls include the change in intermediate input expenditure, imports, and exports relative to revenues. Clustered standard errors (at the 3-digit level) are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

3 A trade model with financial constraints and trade credit

Motivated by the response of trade credit and the broader financial adjustment to the rise of import competition from China, we develop a model that links international trade shocks to firms' financing. In the next sections, we use the model to analyze and quantify the general-equilibrium implications of trade credit for employment and real wages following the China shock.

We start from a workhorse multi-country, multi-sector Armington trade model with input-output linkages. We enrich this framework by adding financial frictions, trade credit and endogenous employment. Our model features intermediate and final goods producers. The former use only labor and the latter use labor and intermediate inputs. Both types of producers must pay for production inputs before revenues are realized and therefore rely on

external financing from a competitive financial sector. For brevity, we refer to this sector as “banks,” although the model is consistent with firms borrowing from a broader set of external lenders. Producers are subject to a revenue-based borrowing constraint, which limits their access to external finance. A key distinction between the two types of producers is that intermediate-goods producers can rely only on bank credit, whereas final-goods producers have access to both bank credit and trade credit extended by their suppliers.

Following an increase in import competition, producers experience a decline in revenues and therefore a tightening of their borrowing constraint. Under the assumption of a size-dependent borrowing constraint, in the spirit of [Gopinath et al. \(2017\)](#) and consistent with both our data and the evidence in [Caglio et al. \(2021\)](#), a decline in revenues leads to a more-than-proportional reduction in bank credit. As a result, final-goods producers increase their reliance on trade credit from suppliers, a mechanism we refer to as the “collateral effect.” The model also features a “relative cost effect.” Because labor and intermediate inputs are complements, a decline in import prices that lowers input costs less than labor costs raises expenditure on intermediates relative to revenues, thereby increasing the use of trade credit. In Section 4, we show that the collateral effect is the dominant mechanism in the model, accounting for most of the increase in trade credit documented in Section 2, whereas the relative-cost effect plays a more limited quantitative role.

3.1 Environment

The world economy is a collection of N countries that trade with each other. In each country there is a fixed measure $\bar{L}_i$ of individuals who make consumption choices and decide whether to work or not. Each country i consists of a set of sectors, $s \in \mathcal{S}_i$. In each country-sector, there is a firm producing a differentiated final good (à la Armington) for consumers and a firm producing an intermediate good used by final goods producers. Throughout the paper, we refer to final goods producers as “buyers” and intermediate goods producers as “suppliers.” Production occurs under perfect competition in both stages of the supply chain. We use the notation $x_{ij,ks}$ to denote flows from country i and sector k to country j and sector s . International shipping is subject to iceberg trade costs $\tau_{ij,ks}$, which are assumed to be identical across destination sectors, i.e. $\tau_{ij,ks} = \tau_{ij,k}$.

3.1.1 Preferences

The demand for goods follows a nested gravity structure as in [Costinot and Rodríguez-Clare \(2014\)](#):

$$C_i = \prod_s \left[\left(\sum_j (q_{ji,s})^{\frac{\sigma_s}{1+\sigma_s}} \right)^{\frac{1+\sigma_s}{\sigma_s}} \right]^{\xi_{i,s}}, \quad (4)$$

such that optimal demand is given by:

$$q_{ji,s} = \frac{p_{ji,s}^{-(1+\sigma_s)}}{P_i^{-\sigma_s}} \xi_{i,s} I_i, \quad (5)$$

where I_i is the income spent in country i , $\xi_{i,s}$ is the (constant) share of income spent by country i on goods in sector s , σ_s denotes the elasticity of substitution across final goods from different origins and P_i is the national price index. The latter can be expressed as:

$$P_i = \prod_s \left[\sum_j (p_{ji,s})^{-\sigma_s} \right]^{\frac{\xi_{i,s}}{-\sigma_s}}. \quad (6)$$

The gravity structure of demand implies that the share of i 's expenditure on goods of sector s from country j is:

$$\lambda_{ji,s} = \frac{(p_{ji,s})^{-\sigma_s}}{\sum_n (p_{ni,s})^{-\sigma_s}} \xi_{i,s}. \quad (7)$$

We assume that labor is perfectly substitutable across sectors, so that there exists a single national wage. Individual ι , if employed, supplies $l(\iota)$ efficiency units of labor, obtaining a net income of $v_i w_i l(\iota)$, where v_i equals 1 minus the income tax rate. If non-employed, individual ι 's income is $v_i b_i u(\iota)$, with $u(\iota)$ denoting ι 's private benefit of not working. The pair of potential incomes $(l(\iota), u(\iota))$ is independently drawn from a Frechet distribution with shape parameter $\phi > 1$ and scale 1, so that the employment rate in country i is a function of wages and non-employment benefit:

$$n_i = \Pr \left[v_i \frac{w_i}{P_i} l(\iota) \geq v_i \frac{b_i}{P_i} u(\iota) \right] = \frac{w_i^\phi}{w_i^\phi + b_i^\phi}. \quad (8)$$

This labor supply structure is similar to recent quantitative trade and geography models featuring Logit functions of labor supply across sectors and regions (see e.g. [Burststein et al. 2019](#), [Lee 2020](#) and [Galle et al. 2022](#)).¹⁶ We follow [Adao et al. \(2026\)](#) and assume that the

¹⁶In Appendix A.3.4 we consider an extension, based on [Kim and Vogel \(2021\)](#) and [Adao et al. \(2026\)](#), with frictions in the labor market, which imply the existence of both voluntary and non-voluntary unemployment.

non-employment benefit is a Cobb-Douglas function of the wage and price index:

$$b_i = P_i^\kappa w_i^{1-\kappa}. \quad (9)$$

3.1.2 Final goods producers

Final goods producers (the “buyers”) use labor l^B and a CES aggregator M of intermediate inputs from different sectors and origins:

$$Q_{i,s}^B = \left((l_{i,s}^B)^{\frac{\rho-1}{\rho}} + (M_{i,s})^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}, \quad \text{where} \quad M_{i,s} = \Pi_k \left(\frac{x_{i,ks}}{\alpha_{i,ks}} \right)^{\alpha_{i,ks}}$$

with $\sum_k \alpha_{i,ks} = 1$. The demand for inputs from different origin markets in sector k is given by the following constant elasticity function:

$$x_{i,ks} = \left[\sum_n (x_{ni,ks})^{\frac{\epsilon_k}{1+\epsilon_k}} \right]^{\frac{1+\epsilon_k}{\epsilon_k}}$$

where $x_{ni,ks}$ is the good produced by sector k in market n and used as input by sector s in country i , and $\epsilon_k > 1$ is the elasticity of substitution across inputs from different origins.

The production of final goods occurs in two stages. First, buyers pay for intermediate inputs at a competitive price and produce the final good; second, they sell their product to consumers and pay workers. This timing structure implies that buyers face a working capital constraint: because they pay for intermediate inputs before selling their goods, they must rely on external finance in the first stage. For simplicity, we assume that firms do not have any ex-ante liquidity available to finance expenditures. In Appendix A.3.3 we consider an extension where buyers and suppliers have some internal liquidity at the beginning of the period.

We assume that producers obtain external financing from a perfectly competitive financial sector but are subject to borrowing constraints due to moral hazard. We introduce a size-dependent borrowing constraint based on revenues that takes the following functional form:

Assumption 1: $BC_{i,s} \leq \psi_{i,s} (Y_{i,s}^B)^{1+\beta}$

where $BC_{i,s}$ denotes external credit, $Y_{i,s}^B$ refers to revenues, $\psi_{i,s} > 0$ is a leverage factor, and $\beta \geq 0$ is the parameter that shapes the convexity of the borrowing constraint. In the rest of the paper we refer to $BC_{i,s}$ as bank credit for simplicity, but as shown by [Lian and Ma \(2021\)](#) a flow-based borrowing constraint applies equally to bond financing, and our estimate of the convexity of the size-dependent borrowing constraint is going to be based on total

debt, encompassing also bonds and other sources of funding.¹⁷

Assumption 1 implies that the amount of credit banks can offer is bounded above by an increasing and convex function of revenues. This borrowing constraint depends on a flow (revenues) rather than on a stock variable (such as fixed assets). This is in line with evidence that flow-based borrowing is predominant in the U.S. For instance, [Lian and Ma \(2021\)](#) and [Drechsel \(2023\)](#) show that most U.S. firms' borrowing is obtained against earnings.¹⁸ Moreover, the non-linear relationship between debt and revenues implied by Assumption 1 is consistent with empirical evidence from our dataset and with recent findings on firms' borrowing in the U.S. ([Caglio et al., 2021](#)).¹⁹ Such a relationship can be micro-founded in a model in which firms incur an increasing and convex cost of default, but never choose to default in equilibrium (see [Gopinath et al. 2017](#)).

Producers borrow at a constant and exogenous interest rate $r_{i,s}$. Once the buyers exhaust the credit available from banks, they turn to their suppliers and ask for trade credit, i.e. they postpone input payments to the second stage of production, at an implicit interest rate $r_{i,s}^T$. This pecking order of financing sources is akin to the one modeled in recent papers ([Altinoglu 2021](#), [Alfaro et al. 2021](#)), and is consistent with the empirical evidence in [Restrepo et al. \(2019\)](#), [Costello \(2020\)](#), and [Hardy et al. \(2022\)](#), which show that bank credit and trade credit are substitutes. Therefore, to capture this feature, we impose the following relationship between the cost of trade credit and bank credit:

Assumption 2: $r_{i,s}^T \geq r_{i,s}$

where $r_{i,s}^T$ is the interest rate charged on trade credit. Assumption 2 is consistent with a vast empirical literature that documents how trade credit is typically more costly than bank credit, due to high penalties imposed on delayed payments (see [Petersen and Rajan 1997](#), [Giannetti et al. 2011](#), [Cuñat and Garcia-Appendini 2012](#)). This implies that buyers have an incentive to exhaust bank credit before resorting to trade credit. In this baseline version of the model, we take both $r_{i,s}$ and $r_{i,s}^T$ as exogenous to preserve tractability and highlight the main mechanisms at work. However, we relax this assumption in the quantitative version of the model and allow interest rates to be determined endogenously as a function of leverage

¹⁷We note that only about 15% of firms in Compustat issued bonds during our sample period. Moreover, evidence from [Becker and Ivashina \(2014\)](#) and [Goel and Zemel \(2018\)](#) indicates that switching between bonds and bank loans is rare and limited to the largest and least constrained firms.

¹⁸Other models with flow-based borrowing constraints are used in [Bianchi \(2011\)](#) and [Ottonello et al. \(2022\)](#). The constraint nests the standard models in the literature when $\beta = 0$, such as [Jermann and Quadrini \(2012\)](#), [Midrigan and Xu \(2014\)](#), [Buera and Moll \(2015\)](#).

¹⁹In our data we observe a positive and convex relationship between long-term debt and firm revenues. In a quadratic specification of log-debt on log-revenues with firm and year fixed effects, we find a positive and significant coefficient on the quadratic term of 0.06 (as well as a positive and significant coefficient of 0.41 on the linear term).

(see Appendix A.3.2).

Assumption 1 implies that the credit received from the financial sector equals:

$$BC_{i,s} = \min \left\{ \sum_{o,k} p_{oi,k}^M x_{oi,ks}, \psi_{i,s} (Y_{i,s}^B)^{1+\beta} \right\}, \quad (10)$$

and the amount of trade credit asked to cover the remaining expenses equals

$$TC_{i,s} = \sum_{o,k} p_{oi,k}^M x_{oi,ks} - BC_{i,s} \geq 0. \quad (11)$$

We assume that buyers always pay back suppliers in full and there is no default risk on trade credit. In this version of the model, we also assume that the suppliers extend trade credit to existing buyers. As discussed in [Cuñat and Garcia-Appendini \(2012\)](#), this is beneficial to the supplier because it guarantees the survival of a long-term commercial relationship.²⁰ We will relax this assumption in a model extension (Appendix A.3.5) in which suppliers have the opportunity to not extend trade credit and search for a different buyer.

The profits of the buyer in country i and sector s equal the value of production net of labor costs and intermediate input costs. The latter include a “credit wedge” arising from the use of bank and trade credit:

$$\pi_{i,s} = A_{i,s} \sum_j p_{ij,s} q_{ij,s} - w_i l_{i,s}^B - \sum_o \sum_k p_{oi,k}^M x_{oi,ks} \delta_{i,s}$$

where $A_{i,s}$ is a country-sector productivity shifter, and the credit wedge $\delta_{i,s}$ is given by:

$$\delta_{i,s} \equiv \gamma_{i,s}(1 + r_{i,s}) + (1 - \gamma_{i,s})(1 + r_{i,s}^T) \geq 1 \quad (12)$$

The variable $\gamma_{i,s}$ is the fraction of input expenditures financed with bank credit, which can be expressed as:

$$\gamma_{i,s} = \frac{BC_{i,s}}{\sum_o \sum_k p_{oi,k}^M x_{oi,ks}} \leq 1. \quad (13)$$

Under perfect competition, the price of the final good of sector s produced in country i and shipped to country j equals:

$$p_{ij,s} = \frac{c_{i,s} \tau_{ij,s}}{A_{i,s}}. \quad (14)$$

²⁰This is also consistent with the concept of input specificity in [Barrot and Sauvagnat \(2016\)](#): if the inputs are tailor-made for the buyer, it may be very costly for the supplier to sell the goods to another partner.

where the marginal cost of production combines labor and input costs:

$$c_{i,s} = \left[(w_i)^{1-\rho} + (P_{i,s}^M)^{1-\rho} \right]^{\frac{1}{1-\rho}} \quad (15)$$

with the aggregate cost of inputs given by

$$P_{i,s}^M = \prod_k \left[\sum_o (p_{oi,k}^M \delta_{i,s})^{-\epsilon_k} \right]^{-\frac{\alpha_{i,ks}}{\epsilon_k}}. \quad (16)$$

Note that the credit wedge $\delta_{i,s}$ affects the aggregate cost of intermediate inputs $P_{i,s}^M$. If there are no financial frictions, or if credit is costless, the credit wedge is equal to 1, and the model becomes isomorphic to a standard gravity trade model.

Finally, the structure of production implies that the share of revenues spent by sector s in country i on inputs from country n and sector k is:

$$\lambda_{ni,ks}^M = \left(\frac{P_{i,s}^M}{c_{i,s}} \right)^{1-\rho} \chi_{ni,ks}^M \quad (17)$$

where $\chi_{ni,ks}^M \equiv \frac{(p_{ni,ks}^M)^{-\epsilon_k}}{\sum_o (p_{oi,ks}^M)^{-\epsilon_k}} \alpha_{i,ks}$ is the share of expenditure on a given input in total intermediate-input spending.

3.1.3 Intermediate goods producers

We turn to the intermediate goods producers' problem (the "suppliers"). They use a simple production function linear in labor:

$$Q_{i,s}^S = A_{i,s} l_{i,s}^S$$

where $Q_{i,s}^S$ is the quantity produced and $A_{i,s}$ is a country-sector specific productivity shifter. Since buyers pay upfront only part of their input expenditures and suppliers must pay production costs in the first stage, suppliers also face a working capital constraint. To overcome this constraint, suppliers ask for bank credit, which is given by the difference between labor costs and the payment received on spot by the buyers:

$$BC_{i,s}^S = w_i l_{i,s}^S - \sum_{n,k} \gamma_{n,k} P_{in,sk}^M x_{in,sk}.$$

This implies that the tightness of the suppliers' constraint fluctuates endogenously with the buyers' revenues. Therefore, a demand shock to buyers can generate negative financial

spillovers to upstream industries. For analytical tractability, here we assume that the banking sector always satisfies the suppliers' demand for credit. However, we relax this assumption in the quantitative part of the model, so that the analysis in Section 5 will refer to the case where suppliers are subject to the same type of borrowing constraint as the buyers. The derivation is provided in Appendix A.3.1.

The profit maximization problem of the supplier is then:

$$\max_{x_{in,sk}, l_{i,s}^S} \pi_{i,s} = \sum_{n,k} p_{in,sk}^M x_{in,sk} - w_i l_{i,s}^S - r_{i,s} BC_{i,s}^S.$$

Note that we are omitting from the profit function any interest rate payments that the supplier collects from extending trade credit to its customers, i.e. $\sum_{n,k} (1 - \gamma_{n,k}) r_{nk}^T p_{in,sk}^M x_{in,sk}$, because these are collected in the second stage, and thus cannot be used for production in the first stage. Plugging the expression for bank credit in the profit function and rearranging we obtain:

$$\max_{x_{in,sk}, l_{i,s}^S} \pi_{i,s} = \sum_{n,k} (1 + \gamma_{n,k} r_{i,s}) p_{in,sk}^M x_{in,sk} - (1 + r_{i,s}) w_i l_{i,s}^S.$$

As standard, the supplier problem can be solved first by choosing the amount of labor that minimizes production costs, given the quantity produced. This leads to a marginal cost of $c_{i,s}^S = \frac{w_i}{A_{i,s}}$. The supplier then chooses output to maximize profits, taking marginal costs and trade costs as given. This yields the following expression for the price of intermediate inputs:

$$p_{in,sk}^M = \frac{1 + r_{i,s}}{1 + \gamma_{n,k} r_{i,s}} \frac{\tau_{in,s} w_i}{A_{i,s}}. \quad (18)$$

Equation (18) shows that the financing conditions of buyers affect suppliers' pricing decisions. In fact, $\frac{\partial p_{in,sk}^M}{\partial \gamma_{n,k}} < 0$, i.e., the optimal price is decreasing in $\gamma_{n,k}$ - the share of buyers' inputs financed with bank credit - and thus is increasing in the share of trade credit extended by the supplier. This relationship arises because when buyers demand more trade credit (e.g., due to tighter borrowing constraints as revenues decline), suppliers must borrow more from banks to finance production. Since bank borrowing is costly, suppliers' marginal costs increase, leading to higher equilibrium prices under perfect competition.²¹

In the limit case where the buyer pays the entire amount on spot, i.e. $\gamma_{n,k} = 1$, the price equals the marginal cost of production, as in the standard frictionless model. The dependence

²¹This mechanism is consistent with the widespread use of early-payment discounts in trade credit contracts. Buyers that pay earlier reduce suppliers' financing needs and are therefore charged lower effective prices (see e.g. [Petersen and Rajan 1997](#), [Cunat 2007](#)).

of the supplier on external financing also implies that the price of the intermediate input is increasing in the supplier's cost of credit, $r_{i,s}$. As we show in the quantitative analysis of Section 5, the pricing mechanism in equation (18) is an important channel through which trade shocks propagate across the production network.

3.1.4 Market clearing

We now describe the market clearing conditions and define the equilibrium. First, total labor payments received by workers in country i are:

$$W_i = \bar{L}_i \tilde{\Gamma} w_i(n_i)^{1-\frac{1}{\phi}}, \quad (19)$$

where $\bar{L}_i$ is population, $\tilde{\Gamma} \equiv \Gamma\left(1 - \frac{1}{\phi}\right)$ and Γ is the gamma function. The expression above depends on the gamma function and the Frechet shape parameter ϕ because workers self-select into employment according to their heterogeneous efficiency level $l(\iota)$. This heterogeneity in turn affects the average efficiency in the economy and thus the aggregate labor payments (see Appendix A.2.1 for details).

We assume that banks operate only domestically and do not lend abroad, whereas trade credit can be extended to foreign buyers. Both banks and intermediate goods producers are ultimately owned by consumers, so the profits from bank lending and trade credit are directly rebated to them. We further assume that the tax rate is chosen such that the aggregate income tax revenues equal the total value of non-employment benefits.

Therefore, total income equals:

$$I_i = \underbrace{\bar{L}_i \tilde{\Gamma} w_i(n_i)^{1-\frac{1}{\phi}}}_{\text{Labor income}} + \underbrace{\sum_{k,j,s} \frac{r_{i,k}(1 - \gamma_{j,s} + \gamma_{j,s}r_{i,k})}{1 + r_{i,k}} \lambda_{ij,ks}^M Y_{j,s}^B}_{\text{Profits from bank credit to suppliers}} + \underbrace{\sum_s r_{i,s} \gamma_{i,s} Y_{i,s}^B (1 - \varpi_{i,s})}_{\text{Profits from bank credit to buyers}} + \underbrace{\sum_{s,j,k} (1 - \gamma_{j,k}) r_{j,k}^T \lambda_{ij,sk}^M Y_{j,k}^B}_{\text{Profits from trade credit}}. \quad (20)$$

Total revenues of buyers and suppliers are respectively:

$$Y_{i,s}^B = \sum_j \lambda_{ij,s} I_j \quad (21)$$

and

$$Y_{i,s}^S = \sum_{h,j} \lambda_{ij,sh}^M Y_{j,h}^B \quad (22)$$

where $\lambda_{ij,s}$ and $\lambda_{ij,sh}^M$ are the expenditure shares on final and intermediate goods. Labor market clearing at the country level requires that value added equals total labor payments:

$$\sum_s Y_{i,s}^B \varpi_{i,s} + \sum_k \sum_{n,s} \frac{(1 + \gamma_{n,s} r_{i,k})}{(1 + r_{i,k})} \lambda_{in,ks}^M Y_{n,s}^B = W_i \quad (23)$$

The equilibrium is defined as a vector of wages $\mathbf{w} \equiv \{w_i\}_i$, employment rates $\mathbf{n} \equiv \{n_i\}_i$, non-employment benefits $\mathbf{b} \equiv \{b_i\}_i$, national consumption price indices $\mathbf{P} = \{P_i\}_i$, sectoral input price indices $\mathbf{P}^M = \{P_{i,s}^M\}_{i,s}$, sectoral buyers' revenues $\mathbf{Y}^B = \{Y_{i,s}^B\}_{i,s}$, sectoral suppliers' revenues $\mathbf{Y}^S = \{Y_{i,s}^S\}_{i,s}$, sectoral bank credit shares $\boldsymbol{\gamma} \equiv \{\gamma_{i,s}\}_{i,s}$, satisfying equations (6)-(23) for a given numeraire wage normalized to $w_m \equiv 1$.

3.2 The effect of a trade shock on trade credit

We now investigate the effects of economic shocks on trade credit. For concreteness, we focus on a change in international trade barriers, although the analysis applies more broadly to any shock that affects firms' operating conditions. To ease exposition, we will maintain the notation that $\tilde{x} \equiv \Delta \log(x)$ for any x .

First note that the share of trade credit over revenues is given by the following expression:

$$tc_{i,s} \equiv \frac{TC_{i,s}}{Y_{i,s}^B} = \frac{\sum_{o,k} p_{oi,k}^M x_{oi,ks} - BC_{i,s}}{Y_{i,s}^B}.$$

When the borrowing constraint binds, trade credit is positive. In such case, using equation (11), in Appendix A.2.3 we show that, up to a first-order approximation:

Proposition 1. *The change in the share of trade credit over revenues after a shock is:*

$$\Delta tc_{i,s} \approx \underbrace{-\beta \gamma_{i,s} (1 - \varpi_{i,s}) \tilde{Y}_{i,s}^B}_{\text{Collateral effect}} + \underbrace{(1 - \rho) (1 - \varpi_{i,s}) \varpi_{i,s} \left(\tilde{P}_{i,s}^M - \tilde{w}_i \right)}_{\text{Relative cost effect}}$$

The proposition highlights two channels that determine the response of trade credit. The first is a ‘‘collateral effect.’’ For instance, suppose that the domestic country reduces trade barriers to foreign goods, or foreign producers become more productive. If this shock lowers the revenues of final goods producers ($\tilde{Y}_{i,s}^B < 0$), then the value of the collateral declines, and banks extend less credit to producers. With less credit from banks, the buyers are forced to request more trade credit from their suppliers, increasing the share of trade credit in revenues with an elasticity of β . Note that the collateral effect is stronger the higher is $\gamma_{i,s}$, i.e. the fraction of input expenditures initially financed through bank credit. Intuitively, the larger is the share of expenditures initially financed through bank credit, the stronger is the effect of a reduction in collateral on trade credit demand. Such collateral channel resembles the mechanism highlighted in [Kiyotaki and Moore \(1997\)](#) and [Jermann and Quadrini \(2012\)](#):

in presence of a borrowing constraint, a negative demand shock translates into lower bank credit and thus into a liquidity shortage. In our setting the presence of trade credit generates an additional financial propagation along the supply chain.

The second channel at play is a “relative cost effect”: if labor and intermediate inputs are complements in production (i.e. when $\rho < 1$, which is the empirically relevant case), then the share of trade credit increases as long as $\tilde{P}_{i,s}^M > \tilde{w}_i$. Intuitively, if after the shock the input costs increase more (or decline less) than labor costs, expenditure on intermediates rises relative to revenues, increasing the demand for trade credit. Note that if the production function is a Cobb-Douglas between labor and inputs, then the relative cost effect disappears.

Proposition 1 highlights how the model can rationalize the empirical evidence shown in Section 2. Consider a decline in trade barriers vis-a-vis China and/or an increase in the productivity of Chinese firms, such that $\Delta \log(\tau_{China,j,s}) < 0$. As domestic producers lose competitiveness, their revenues decline and borrowing constraints tighten, reducing the amount of bank credit available and increasing the use of trade credit. In addition, if the China shock lowers wages by more than it lowers input prices, expenditure on intermediates rises relative to revenues, generating a further increase in trade credit through the relative cost effect. In Section 4, we evaluate these mechanisms empirically and find that the collateral effect accounts for most of the observed increase in trade credit, whereas the relative cost effect plays a more limited role.

3.3 Alternative economic environments

We use our framework to study how financial frictions and trade credit shape the adjustment to trade shocks in the presence of other features emphasized by the literature. Specifically, we consider three settings. First, we introduce internal liquidity as an additional source of financing alongside bank credit and trade credit. Second, we study the response of the economy in a model with frictional unemployment through search and matching in the labor market. Third, we relax the assumption of fixed buyer-supplier relationships and allow firms to search for alternative trading partners in the intermediate-goods market. Together, these environments help characterize the role of financial frictions and trade credit under alternative assumptions about financing, labor markets, and production networks.

We begin by considering an environment in which buyers have some initial liquidity to finance input expenditures. We assume that buyers first use their liquidity, then they borrow from banks, and finally, if necessary, they ask for trade credit from their suppliers. In Appendix A.3.3 we derive a new version of Proposition 1, which shows that sectors with more liquidity at the onset of the shock rely less on trade credit when hit by a negative trade shock, which is consistent with evidence discussed in [Garcia-Appendini and Montoriol-Garriga \(2013\)](#)

and [Amberg et al. \(2021\)](#).

Next, we introduce frictional unemployment as in [Kim and Vogel \(2021\)](#). We assume that firms post vacancies that are randomly filled by heterogeneous agents who choose to search for a job, according to a constant return-to-scale matching technology. We show that the employment rate depends not only on the labor force participation margin, as in the baseline model, but also on the matching rate. The characterization of this model is presented in Appendix A.3.4.

Finally, while in the baseline model we keep buyer-supplier relationships fixed, we allow suppliers to choose between extending trade credit to an existing buyer or searching for a new buyer who pays fully on spot (see Appendix A.3.5). The equilibrium interest rate on trade credit is determined by an arbitrage condition: suppliers are indifferent between maintaining the existing relationship and extending trade credit or switching to a new spot-paying buyer. This indifference reflects a trade-off between margins and volumes. Extending trade credit increases suppliers' financing costs, which raises input prices and reduces demand, but it also generates an additional financial return through the interest charged on deferred payments. By contrast, selling to a new buyer that pays on delivery allows suppliers to charge a lower price and sell a larger quantity, but eliminates the financial return associated with trade credit. This trade-off is pinned down by the elasticity of demand, the supplier's borrowing cost, and the buyer's reliance on bank credit (see equation A.19).²² While this extension captures the outside option of suppliers, it does not account for assortative matching or heterogeneity in bargaining power between suppliers and buyers – key features emphasized in the trade credit literature (e.g., [Giannetti et al. 2021](#)) and promising directions for future research.

The quantitative implications of trade shocks for employment and real wages across these alternative environments are discussed in Section 5.1.

4 Model Validation and Calibration

In this section, we first empirically assess the mechanisms highlighted by Proposition 1, which relates changes in the use of trade credit to a collateral effect and a relative-cost effect. We then present the calibration of the model and assess the extent to which the model can match the observed cross-sectional responses of key variables.

²²In a previous version of the model we also allowed for a fixed search cost, introducing an additional friction in buyer-supplier linkages. The current formulation allows us to compare a setting with fixed buyer-supplier relationships to one in which relationships are determined entirely by market forces.

4.1 Reduced-form test of Proposition 1

Proposition 1 provides a decomposition of sectoral changes in trade credit into two components. The first reflects the effect of changes in collateral values on firms' borrowing capacity, while the second captures the effect of changes in relative input costs. To guide the empirical analysis, we rewrite the proposition as:

$$\Delta tc_{i,s} = \beta_1 \underbrace{bc_{i,s} \Delta \log Y_{i,s}^B}_{\text{Collateral effect}} + \beta_2 \underbrace{\varpi_{i,s} \Delta \log \varpi_{i,s}}_{\text{Relative cost effect}} \quad (24)$$

where $bc_{i,s} = \frac{BC_{i,s}}{c_{i,s}Q_{i,s}}$ is the ratio between total debt and production costs and $\varpi_{i,s}$ is the share of value added in revenues.²³ Equation (24) delivers a simple empirical implication of the model: sectors experiencing larger declines in revenues or larger increases in relative input costs should reduce their reliance on trade credit. We compute annual log changes in sectoral revenues ($\Delta \log Y_{i,s}^B$) from Compustat and changes in the share of value added ($\Delta \log \varpi_{i,s}$) from the NBER manufacturing database.²⁴ Finally, we use total debt divided by the cost of goods sold (both from Compustat) to compute $bc_{i,s}$.

In Table 4, we estimate equation (24) by regressing annual changes in the share of trade credit, $\Delta tc_{i,s}$, on the collateral and relative cost effects (column 1). Both channels have the negative sign predicted by Proposition 1 and are statistically significant. The collateral channel is substantially more important quantitatively, with an estimated coefficient that is an order of magnitude larger than that of the relative-cost channel (both variables are standardized). Importantly, the coefficient on the collateral channel has a structural interpretation in the model: it corresponds to the parameter β governing the convexity of the borrowing constraint with respect to revenues. Column (2) repeats the analysis using earnings before interest, taxes, depreciation, and amortization (EBITDA) in place of revenues. This alternative specification reflects a borrowing constraint based on firms' profitability rather than revenues, as in [Hardy et al. \(2022\)](#). Reassuringly, the results are similar to those in column (1).

We next assess the relevance of the collateral channel in the context of the China shock. To do so, we estimate a stacked first-differences specification at the sector level over the

²³To obtain this expression, first note that the labor share in production equals $\varpi_{i,s} = \frac{w_i L_{i,s}}{Y_{i,s}} = \left(\frac{w_i}{c_{i,s}} \right)^{1-\rho}$. In log changes:

$$\begin{aligned} \Delta \log \varpi_{i,s} &= (1 - \rho) (\Delta \log w_i - \Delta \log c_{i,s}) = \\ &= (1 - \rho) [\Delta \log w_i - (\varpi_{i,s} \Delta \log w_i + (1 - \varpi_{i,s}) \Delta \log P_{i,s}^M)] = \\ &= (1 - \rho)(1 - \varpi_{i,s}) [\Delta \log w_i - \Delta \log P_{i,s}^M]. \end{aligned}$$

²⁴We rely on the NBER database because Compustat lacks comprehensive data on the cost of labor.

periods 1991–2000 and 2000–2007, instrumenting the collateral component in equation (24) with Chinese import penetration as defined in equation (2). This exercise does not have the structural interpretation of the previous specification, but it provides an additional test of whether the mechanism highlighted by Proposition 1 is quantitatively relevant for the trade shock studied in the paper. Since only the collateral channel is instrumented, the coefficient on the relative-cost channel should not be given a causal interpretation. Reassuringly, its quantitative contribution is negligible in the baseline specification, suggesting that any resulting bias is likely to be limited. Columns (3) and (4) provide further evidence for the importance of the collateral channel in the context of the China shock. The estimated effect remains large and statistically significant, although it is estimated less precisely due to the smaller sample size.

Table 4: Test of Proposition 1

	Proposition 1, annual estimation		IV China shock, stacked first-differences	
	Revenues	EBITDA	Revenues	EBITDA
Dep. var: Δtc_{st}	(1)	(2)	(3)	(4)
Collateral Effect	-0.104*** (0.014)	-0.070*** (0.019)	-0.518* (0.309)	-0.259** (0.107)
Relative Cost Effect	-0.007** (0.003)	-0.009* (0.005)	0.017 (0.033)	0.021 (0.020)
Sector dummies	✓	✓	✓	✓
Time Fixed Effect	✓	✓	✓	✓
Observations	2,352	2,291	314	314

Note: Sample of 157 manufacturing industries (4-digit level) weighted by initial assets. Columns (1) and (2) use annual changes between 1991 and 2007. Columns (3) and (4) use stacked changes across two periods 1991–2000 and 2000–2007. Robust standard errors in parentheses are clustered at the 3-digit level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.2 Calibration

The previous subsection provided reduced-form evidence consistent with the mechanism highlighted by Proposition 1. We now calibrate the model and assess its quantitative performance. Following the standard approach in the quantitative trade literature pioneered by [Dekle et al. \(2007\)](#), we express the general equilibrium system in terms of “hat changes.” Specifically, all endogenous variables are written as $\hat{x} = x'/x$, where x' denotes the value of the variable after a given shock and x its initial level. This formulation allows us to

characterize equilibrium responses without requiring information on the levels of all structural parameters. The derivations of the hat-change system are provided in Appendix A.4.

4.2.1 Initial Conditions and Parameters

We calibrate the model separately for 1991 and 2000 to match the initial conditions prevailing at the start of each of the two sub-periods considered in the empirical analysis. On the demand side, the economy comprises 157 four-digit manufacturing sectors for which we observe both accounts payable and bank credit. On the supply side, we include all 392 manufacturing sectors in [Acemoglu et al. \(2016\)](#).²⁵ We also include a non-manufacturing sector, which can be interpreted broadly as the service sector. The world economy consists of three regions: the United States, China, and the Rest of the World (RoW). The calibration of the initial equilibrium and of the parameters governing production and international trade follows standard procedures in the quantitative trade literature and is described in detail in Appendix A.5. Here, we focus on the calibration of the financial parameters.

First, we calibrate the convexity parameter of the borrowing constraint (β in Assumption 1) using the estimated coefficient on the collateral effect reported in Table 4. Our preferred estimate is obtained from column (1), which yields $\beta = 0.1$. As discussed in Section 3, this estimate is remarkably close to the coefficient on the quadratic term from a firm-level panel regression of log debt on log revenues that includes firm and year fixed effects. This similarity provides independent empirical support for the magnitude of the borrowing-constraint nonlinearity implied by the model.

Second, we calibrate $\gamma_{i,s}$, the share of input expenditures financed through bank credit. Because firms finance intermediate-input purchases using a combination of trade credit and bank credit, so that $M_{i,s}P_{i,s}^M = TC_{i,s} + BC_{i,s}$, we measure this parameter as $\gamma_s = \frac{BC_{i,s}}{TC_{i,s} + BC_{i,s}}$. For U.S., we use sectoral aggregates of total debt and accounts payable from Compustat. For foreign countries, we scale the U.S. value of $\gamma_{US,s}$ by a measure of financial development relative to the United States. Specifically, we use the ratio of bank credit to GDP from the World Bank database as a proxy for financial development and adjust sectoral bank-credit shares proportionally across countries.

Third, we calibrate $\psi_{i,s}$, the leverage parameter governing the borrowing constraint. Because all sectors in the data exhibit positive levels of trade credit, the model implies that the borrowing constraint in Assumption 1 binds in equilibrium. We therefore use the borrowing constraint directly to recover $\psi_{i,s}$. Specifically, imposing the constraint with

²⁵Although it would have been possible to calibrate an economy with only the 157 sectors for which financial data are available, we include all manufacturing sectors as suppliers in order to provide a more comprehensive representation of production linkages in the U.S. economy.

equality and using the estimated value of β , we compute $\psi_{i,s}$ as the ratio of observed financing needs to $Y_{i,s}^{1+\beta}$.

Fourth, we calibrate $r_{i,s}$, the interest rate on bank credit. For each U.S. sector, we measure the average annual borrowing rate as the ratio of interest expenses to total debt in Compustat. We then compute a sector-specific credit spread as the difference between this borrowing rate and the U.S. policy rate. For foreign countries, we assume that sectoral differences in borrowing costs are proportional to those observed in the United States. Specifically, we construct $r_{i,s}$ by adding the U.S. sector-specific spread to the policy rate prevailing in the corresponding country.

Fifth, we calibrate $r_{i,s}^T$, the interest rate on trade credit. Because sector-level data on trade credit interest rates are not available in Compustat, we begin with the aggregate estimate in [Giannetti et al. \(2011\)](#), who report an average annualized trade credit interest rate of 28% for U.S. firms in 1998, the midpoint of our sample period. We then introduce sectoral variation by adding to this benchmark the sector-specific credit spreads estimated by [Gilchrist and Zakrajšek \(2012\)](#). For foreign countries, we follow the same approach used to calibrate the interest rate on bank credit. Specifically, we take the U.S. sectoral values of $r_{i,s}^T$ and adjust them by the difference between the foreign and U.S. policy interest rates. This procedure preserves the cross-sectoral variation in trade credit costs observed in the United States while allowing average financing conditions to differ across countries.

4.2.2 Measuring the China shock

To conduct the quantitative analysis below, we first back out the sector-specific trade shocks that rationalize the observed changes in trade flows within the model. This inversion is facilitated by the gravity structure of the model, which implies that changes in trade flows from country i to country j in sector s can be decomposed into a trade-cost component, an origin-sector component, and a destination-sector component. Formally,

$$\Delta \log X_{ij,s} = -\sigma_s \Delta \log \tau_{ij,s} + o_{i,s} + d_{j,s}, \quad (25)$$

where $o_{i,s}$ and $d_{j,s}$ are the origin-sector and destination-sector components respectively, and σ is the elasticity of substitution.

To be consistent with our empirical analysis, we start from the China shock measured in equation (3), i.e. the per-worker growth of imports from China of eight high-income countries, $\Delta IPO_s = \sum_{j \in \mathcal{J}} \frac{\Delta X_{China,j,s}}{L_{US,s}}$. Substituting equation (25) into ΔIPO_s and taking a first-order approximation yields:

$$\Delta IPO_s \approx \sum_j \frac{X_{\text{China}j,s}}{L_{\text{US},s}} (-\sigma_s \Delta \log \tau_{\text{China}j,s} + o_{\text{China},s} + d_{j,s}). \quad (26)$$

The structural relationship in equation (26) indicates that the change in sectoral imports from China depends on three components. The first is proportional to the change in China's trade costs, $\Delta \log \tau_{\text{China}j,s}$. The second captures the change in Chinese production costs in a given sector, $o_{\text{China},s}$. The third reflects the changes in sectoral demand $d_{j,s}$ across destinations.

Assuming that the change in trade barriers with China is the same across advanced countries, we can invert equation (26) to find the structural shock as:

$$\Delta \log \tau_{\text{China},s}^t = \frac{1}{\sigma_s} \left[-\frac{\sum_j \Delta X_{\text{China}j,s}^t}{\sum_j X_{\text{China}j,s}^{t_0}} + o_{\text{China},s}^t + \sum_j \frac{X_{\text{China}j,s}^{t_0}}{\sum_j X_{\text{China}j,s}^{t_0}} d_{j,s}^t \right]. \quad (27)$$

To compute the structural shock $\Delta \log \tau_{\text{China},s}^t$, we first estimate sectoral gravity regressions by sub-period using bilateral trade flows from UN Comtrade, with origin and destination fixed effects, to obtain $o_{\text{China},s}$ and $d_{j,s}$.²⁶ We then use data on imports from China to compute $X_{\text{China}j,s}^t$. Figure A.5 in Appendix A.5 shows that the structural shock $\Delta \log \tau_{\text{China},s}^t$ is highly correlated, across sectors, with the empirical measure of the China shock ΔIPO_s^t , suggesting that the structural shock captures well the rise of import competition from China.

Finally, Table A.7 in Appendix A.5.2 assesses the model's ability to reproduce the observed cross-sectional responses of key economic outcomes across U.S. sectors. The results show that the model has substantial explanatory power and successfully captures the qualitative pattern of adjustment in the data. Quantitatively, the model closely matches the responses of trade credit and employment, although it tends to overpredict the cross-sectoral dispersion of import responses.

5 Quantitative analysis and mechanism decomposition

We now investigate the quantitative general equilibrium impact of the China shock on U.S. employment and real wages. We begin by quantifying the aggregate effects implied by our baseline model and by the alternative economic environments introduced in Section 3.3. We then characterize analytically the different channels driving the employment response along the supply chain and quantify their relative importance.

²⁶We assume that the elasticity of substitution is the same across sectors and is equal to 6, as in [Adao et al. \(2026\)](#).

5.1 Aggregate effects

Table 5 reports the aggregate effects of the China shock on employment and real wages across different economic environments.²⁷ We report the cumulative effects across the two sub-periods. We begin with a frictionless benchmark model (column 1), with no borrowing constraints and no role for trade credit. This environment is akin to the workhorse quantitative trade model with input-output linkages (Caliendo and Parro 2015), augmented with endogenous employment. In this frictionless world, the China shock lowers manufacturing employment by 3.16%, but aggregate employment remains broadly stable, as workers displaced from manufacturing are absorbed by the non-tradable sector. Real wages also increase modestly, in line with the findings of the recent quantitative literature on the China shock, such as Caliendo et al. (2019), Galle et al. (2022) and Adao et al. (2026).

Next, we analyze the role of financial frictions by introducing a borrowing constraint into the model while shutting down the possibility of trade credit (column 2). The decline in manufacturing employment nearly doubles relative to the frictionless benchmark, reflecting the tightening of borrowing constraints following the fall in revenues induced by the China shock. Intuitively, lower borrowing capacity reduces production and labor demand, limiting the reallocation of workers toward expanding sectors. As a result, aggregate employment declines by 0.02%. The model also generates a decline in real wages of about 0.32%. These findings highlight how financial frictions can substantially amplify the effects of trade shocks. More broadly, they are consistent with the logic of second-best theory: reducing one distortion (trade barriers with China) can generate economic losses when other distortions remain in place.

Introducing trade credit mitigates a substantial fraction of the losses generated by financial frictions (column 3). Manufacturing employment losses fall from 6.3% to 3.8%, while aggregate employment is essentially unchanged. By providing an alternative source of financing when bank credit contracts, trade credit relaxes borrowing constraints and supports production throughout the supply chain. Real wage losses are also reduced by more than half, from 0.32% to 0.15%. These results suggest that the ability of firms to obtain financing from their suppliers acts as an important buffer against adverse trade shocks, although it does not fully offset the distortions generated by financial frictions.

We relax the borrowing constraint of the suppliers while retaining financial frictions for buyers in column 4. Aggregate employment remains broadly stable, while real wage losses decline markedly from 0.15% to 0.04%. The intuition is that suppliers can accommodate the increase in trade credit demand without facing tighter financing conditions themselves. This

²⁷As discussed in Section 3, our calibrated quantitative model incorporates endogenous interest rates and financially constrained suppliers.

weakens the transmission of financial frictions through input-output linkages and dampens the aggregate effects of the shock. This result suggests that suppliers' financing conditions contribute to the propagation of trade shocks through production networks.

Column 5 introduces internal liquidity as a source of financing, providing firms with an additional buffer against the tightening of borrowing constraints following the China shock. As a result, manufacturing employment losses are further attenuated, declining to about 3.5%. Real wage losses fall significantly from 0.15% to 0.06%. This suggests that internal liquidity and trade credit are complementary sources of financing that allow firms to smooth the effects of adverse trade shocks and reduce their reliance on external finance.

Introducing frictional unemployment through a search-and-matching labor market leads to aggregate employment losses of 0.02% (column 6), reflecting the additional frictions that hinder the reallocation of workers across sectors following the China shock. The negative effect on real wages increases relative to the baseline model with trade credit, but remains below the model with financial frictions alone. These findings suggest that labor market frictions amplify the effects of the shock, but do not eliminate the mitigating role of trade credit.

Finally, we relax the assumption of fixed buyer-supplier relationships and allow firms to search for alternative trading partners in the intermediate-goods market (column 7). This introduces greater flexibility in production networks and endogenizes the terms at which trade credit is provided. The effect on employment is modest. However, real wage losses decline from 0.15% to 0.11%. This finding suggests that flexibility in buyer-supplier relationships can mitigate the impact of financial frictions on the gains from trade by improving firms' outside options and reducing the cost of supplier financing.

Table 5: General Equilibrium Effects of China Shock, 1991-2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Borrowing constraint Buyers:	No	Yes	Yes	Yes	Yes	Yes	Yes
Borrowing constraint Suppliers:	No	Yes	Yes	No	Yes	Yes	Yes
Trade Credit:	No	No	Yes	Yes	Yes	Yes	Yes
Manufacturing employment	-3.155	-6.345	-3.803	-3.376	-3.461	-3.963	-3.740
Total employment	0.002	-0.017	-0.008	-0.004	-0.003	-0.024	-0.006
Real wage	0.046	-0.323	-0.146	-0.044	-0.064	-0.254	-0.109

Note: Numbers are expressed in log points x 100, summed across the two periods 1991-2000 and 2000-2007. Column 1 refers to a frictionless benchmark model. Column 2 features a model with a borrowing constraint for buyers and suppliers. Column 3 introduces trade credit. Column 4 allows suppliers to borrow without constraint. Column 5 adds initial liquidity as an additional source of financing. Column 6 features a model with frictional unemployment. Column 7 allows for search between buyers and suppliers.

5.2 Employment response along the supply chain

To gain further intuition on the role of financial frictions and trade credit, we now return to the parsimonious version of the model presented in Section 3. This simpler framework allows us to characterize analytically the different channels affecting employment and quantify their relative importance.

5.2.1 Analytical characterization

We first characterize analytically the channels through which a trade shock affects employment along the supply chain. To ease exposition, we assume that the U.S. wage is the numeraire and we define the cost of intermediate inputs net of the credit wedge as $P_{i,s} \equiv \prod_k \left[\sum_o (p_{oi,k}^M)^{-\epsilon_k} \right]^{-\frac{\alpha_{i,ks}}{\epsilon_k}}$ and the international trade shares, net of trade credit, as $\nu_{ji,ks}^M \equiv \left(\frac{p_{i,s}^M}{c_{i,s}} \right)^{1-\rho} \frac{(\tau_{ji,k} w_j)^{-\epsilon_k}}{\sum_o (\tau_{oi,k} w_o)^{-\epsilon_k}} \alpha_{i,ks}$. We use the notation that $\tilde{x} \equiv \Delta \log(x)$ for any x . In Appendix A.2.4 we prove the following result:

Proposition 2. *Up to a first-order approximation, the log change in buyers employment following a trade shock is*

$$\tilde{L}_{i,s}^B = \underbrace{\tilde{Y}_{i,s}^B}_{\text{Revenue effect}} - \underbrace{\chi_{i,s} \tilde{P}_{i,s}}_{\text{Input-cost effect}} - \underbrace{\mu_{i,s} \tilde{T}C_{i,s}}_{\text{Credit-cost effect}}$$

whereas the log change in suppliers employment is

$$\tilde{L}_{i,s}^S = \underbrace{\sum_{h,j} \xi_{ij,sh}^1 \tilde{Y}_{j,h}^B}_{\text{Revenue effect}} + \underbrace{\sum_{h,j} \xi_{ij,sh}^1 \tilde{\nu}_{ij,sh}^M}_{\text{Trade shares effect}} - \underbrace{\sum_{h,j} \xi_{ij,sh}^2 \tilde{T}C_{j,h}}_{\text{Credit-cost effect}}$$

where $\chi_{i,s}$, $\mu_{i,s}$, $\xi_{ij,sh}^1$ and $\xi_{ij,sh}^2$ are sector-country terms that depend on initial conditions and parameters.

The general-equilibrium effect of a trade shock on buyers' employment can be decomposed into three terms. The first is a “revenue effect”: lower expenditure on final goods reduces output and, in turn, employment. This is the main channel that the empirical literature on the China shock has documented (Autor et al. 2013 and Acemoglu et al. 2016): the rise of China has eroded U.S. sectors' market shares, bringing down the demand for domestic labor in manufacturing.²⁸

The second channel is the effect of the change in the cost of inputs (domestic and imported): if the trade shock lowers the cost of the inputs used by a U.S. sector (for instance, as documented by Jaravel and Sager (2019) for the China shock), labor demand increases as long as labor and inputs are complements (when $\rho < 1$).

A third channel, which we refer to as the “credit-cost effect”, arises from the fact that trade credit is typically more expensive than bank credit. When $r_{i,s}^T > r_{i,s}$, we have $\mu_{i,s} > 0$, implying that an increase in trade credit lowers employment. This does not mean that trade credit is detrimental overall. On the contrary, access to supplier financing relaxes buyers' financing constraints, expands their production possibilities, and contributes positively to the revenue effect described above. The credit-cost effect instead captures the fact that a greater reliance on trade credit increases the average cost of external financing. Higher financing costs raise the credit wedge $\delta_{i,s}$ and production costs $c_{i,s}$, which reduces final sales and, ultimately, employment.

We now turn to the effects of the China shock on suppliers' employment. The first channel is akin to the revenue effect for the buyers: if a trade shock lowers final goods' sales, the demand for intermediate inputs declines too, lowering suppliers' revenues and labor demand. The domestic component of this effect ($\sum_h \xi_{ii,sh}^1 \tilde{Y}_{i,h}^B$), i.e. a weighted average of sales to domestic sectors, is connected to the upstream propagation channel studied empirically by Acemoglu et al. (2016) and subsequent contributions.

The second channel, the “trade shares effect”, arises from the reallocation of international demand across countries and sectors following the shock, which affects the trade shares of U.S.

²⁸Note that the sector-level structure of the model incorporates both the intensive and extensive margin jointly, and cannot separately identify the two margins.

suppliers. If buyers around the world divert their expenditures away from U.S. suppliers (for instance, by sourcing more inputs from China following a decline in $\tau_{China,j,s}$), U.S. suppliers experience a reduction in sales and labor demand.

Lastly, suppliers are also subject to a “credit-cost effect.” When buyers increase their use of trade credit, suppliers must extend additional financing to their customers, tightening their own working-capital constraint. To fund this additional credit, suppliers borrow more from banks, which raises their financial expenditures and production costs. To break even, suppliers raise prices (see equation 18). Higher prices reduce consumption and production, lowering labor demand. This generates co-movement across connected sectors and amplifies the initial shock, consistent with the findings of [Raddatz \(2010\)](#), who documents a positive correlation in output among industry-country pairs linked through input-output relationships and trade credit. However, this is only one side of the role of trade credit. As discussed above, by relaxing financing constraints for downstream buyers, trade credit also expands production and sales throughout the supply chain, strengthening the revenue effect. The overall impact of trade credit therefore reflects the balance between these opposing forces. In the next section we assess their quantitative relevance.

5.2.2 Quantitative decomposition

Table 6 shows the decomposition of employment changes for buyers and suppliers in the different channels described in the previous section. In the benchmark frictionless model (column 1), the revenue effect is the largest component of the overall decline in employment for both buyers and suppliers. In contrast, the input-cost effect, which captures the gains from cheaper imported inputs, is quantitatively small and offsets only a limited fraction of the employment losses generated by lower revenues. Thus, despite the availability of cheaper inputs, the dominant force shaping manufacturing employment is the contraction in demand faced by U.S. producers.

Introducing financial frictions substantially amplifies the revenue effect (column 2). As revenues decline, borrowing constraints tighten, reducing firms’ ability to finance production and further lowering labor demand. This mechanism magnifies the contractionary impact of the China shock on both buyers and suppliers. In addition, the trade-shares effect becomes more negative for suppliers, reflecting the loss of competitiveness of U.S. producers relative to foreign competitors when borrowing constraints distort production decisions.

Table 6: General Equilibrium Effects of China Shock, Decomposition

	(1)	(2)	(3)	(4)
Borrowing constraint Buyers:	No	Yes	Yes	Yes
Borrowing constraint Suppliers:	No	Yes	Yes	No
Trade Credit:	No	No	Yes	Yes
<i>Buyers</i>				
Manufacturing employment	-1.47	-2.85	-2.68	-2.50
Revenue effect	-1.74	-3.85	-3.05	-2.37
Input-cost effect	0.28	1.00	0.45	-0.07
Credit-cost effect	0.00	0.00	-0.07	-0.06
<i>Suppliers</i>				
Manufacturing employment	-1.69	-3.93	-1.54	-1.20
Revenue effect	-1.13	-1.70	-1.30	-1.00
Trade-shares effect	-0.56	-2.23	-0.10	-0.13
Credit-cost effect	0.00	0.00	-0.13	-0.07

Note: Numbers are expressed in log points x 100, summed across the two periods 1991-2000 and 2000-2007. Column 1 refers to a frictionless benchmark model. Column 2 features a model with a borrowing constraint for buyers and suppliers. Column 3 introduces trade credit. Column 4 allows suppliers to borrow without constraint.

Allowing for trade credit (column 3) has a buffering effect on the revenue channel. By relaxing buyers' borrowing constraints, trade credit supports production and employment throughout the supply chain, strengthening the revenue effect for both buyers and suppliers. This is the beneficial side of trade credit. However, trade credit also generates a credit-cost effect. Employment declines by an additional 0.07% for buyers and 0.13% for suppliers because greater reliance on trade credit increases financing costs. Proposition 2 shows that, for buyers, this occurs because trade credit is more expensive than bank credit. For suppliers, it arises because extending more trade credit tightens their working-capital constraint and raises borrowing costs. Nevertheless, the positive impact of trade credit through the revenue channel dominates quantitatively, so that its overall effect on employment remains positive.

Relaxing the borrowing constraint of suppliers (column 4) improves the employment response of both types of producers, although the effects are quantitatively stronger for suppliers than for buyers. The revenue effect becomes less negative for suppliers, reflecting the weaker transmission of financial distress along the supply chain once upstream firms are no longer constrained in their access to credit. The credit-cost effect also becomes less negative, as suppliers can finance the trade credit extended to their customers at a lower cost.

More generally, these results suggest that the main contribution of trade credit is not to eliminate financial frictions, but rather to attenuate their consequences by allowing firms to continue producing despite tighter borrowing constraints.

6 Conclusions

In this paper we study the role of financial frictions and trade credit in shaping the response of employment and real wages to international trade shocks. Our analysis focuses on the rise of China and its accession to the WTO as a large and exogenous shock to the U.S. economy.

We find that sectors more exposed to import competition from China rely more on trade credit from their suppliers. This occurs within a broader shift in firms' liability structure toward short-term borrowing following the trade shock, with trade credit accounting for an important share of the adjustment, particularly among sectors that are more likely to face binding borrowing constraints.

Motivated by these findings, we develop a multi-country input-output trade model with borrowing constraints, trade credit, and endogenous employment. The framework allows us to quantify the role of financial frictions in shaping the effects of trade shocks, analyze how these effects propagate along supply chains, and disentangle the different channels through which trade credit affects employment and real wages. Our results show that financial frictions can transform a shock that would otherwise generate modest gains in real wages into one associated with real wage losses and weaker employment outcomes, while trade credit mitigates a large fraction of these losses by relaxing firms' financing constraints.

A key insight of the paper is that trade credit plays a dual role in the transmission of trade shocks. On the one hand, it relaxes financing constraints, sustains production, and supports employment throughout the supply chain. On the other hand, greater reliance on trade credit raises financing costs for both buyers and suppliers, generating what we call a credit-cost effect. Quantitatively, the beneficial effects dominate the credit-cost effect, implying that trade credit acts as an important buffer against adverse trade shocks. More broadly, our findings suggest that the consequences of trade shocks depend not only on the reallocation of labor and production across sectors, but also on how financial relationships embedded in production networks adjust to changing competitive pressures.

Several extensions remain for future research. An important avenue would be to incorporate a richer banking sector that is itself affected by trade shocks and endogenously adjusts the supply of credit to firms and supply chains. Another would be to incorporate nominal rigidities and transitional dynamics, which may influence the medium-run adjustment of employment and wages following changes in international trade patterns.

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Appendix

This Appendix consists of Section A.1 that reports summary statistics on the sample used in the empirical analysis of Section 2 and the robustness exercises described in Section 2.3. Section A.2 provides all the proofs for the analytical results shown in Section 3. Section A.3 outlines different extensions of the model. Section A.4 shows the baseline model written in “hat-changes.” Section A.5 provides the details of the calibration.

A.1 Summary statistics and robustness results

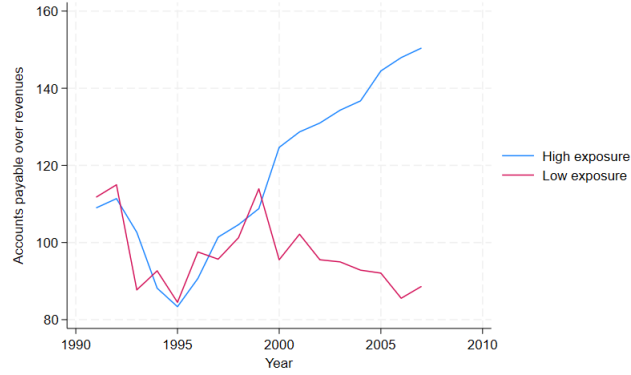
In this section we report some summary statistics, the comparison between Compustat and QFR aggregate trends discussed in Section 2.2, and the robustness exercises discussed in Section 2.3.

Table A.1: Summary Statistics, 1991-2007

	Mean	Std	Min	Max
Trade credit over revenues (TC_{st})	0.31	0.13	0.02	0.95
Change in trade credit over revenues (ΔTC_{st})	0.00	0.17	-1.38	0.77
$\Delta Exposure_s$	20.86	63.12	-35.18	592
IV for $\Delta Exposure_s$	13.87	37.13	-17.62	408
Capital exp. over assets	0.04	0.02	0.00	0.15
Inventories over assets	0.14	0.07	0.00	0.41
Debt over assets	0.22	0.12	0.00	0.71
Prod. workers share of employment (1991)	0.66	0.15	0.19	0.90
Log average wage in 1991	10.58	0.26	9.85	11.09
Capital/value added in 1991	0.99	0.64	0.19	3.52
Computer investment as share of total (1990)	0.08	0.07	0.00	0.44
High-tech investment as share of total (1990)	0.09	0.05	0.01	0.18
Intermediates expenditure over revenues	0.49	0.13	0.10	0.89
Import share over revenues	0.39	0.28	0.00	1
Export share over revenues	0.37	0.27	0.00	1
Total debt over revenues	1.19	0.75	0.17	5.77
Share of accounts payable in short-term debt	0.57	0.19	0.05	0.97
Long-term debt over total debt	0.74	0.17	0.02	0.99

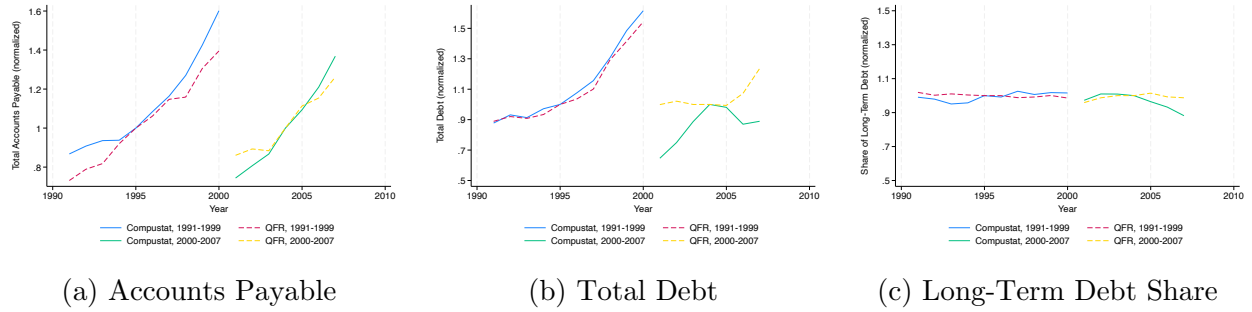
Note: Statistics computed over a sample of 157 manufacturing industries at the 4-digit level. $\Delta Exposure_s$ and IV $\Delta Exposure_s$ are taken from Autor et al. (2013). Trade credit over revenues, capital expenditure over assets, inventories over assets, debt over assets, total debt over revenues, share of accounts payable in short-term debt, long-term debt over total debt are taken from Compustat. Intermediates expenditure, imports and exports are from the NBER dataset. All remaining variables are from Acemoglu et al. (2016).

Figure A.1: Sectoral evolution of trade credit by exposure to the China shock



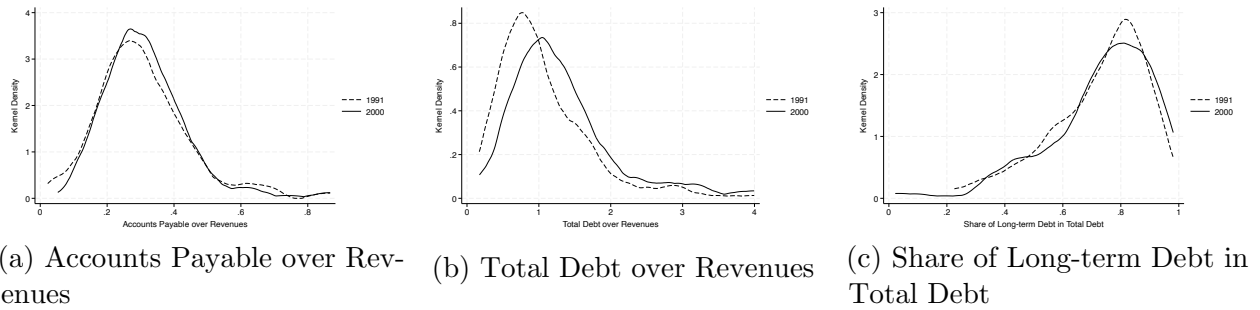
Note: The Figure reports the evolution of accounts payable over revenues for sectors in the top and bottom quartile of exposure to the China shock as defined in [Autor et al. \(2013\)](#).

Figure A.2: Comparison of financial variables in Compustat and Quarterly Financial Report



Note: The Figure reports the evolution of total accounts payable (panel a), total debt (panel b) and the share of long-term debt relative to total debt (panel c) in the two sub-periods of our stacked differences specification for firms in Compustat and in the Quarterly Financial Report of the Census.

Figure A.3: Distribution of financial variables in 1991 and 2000.



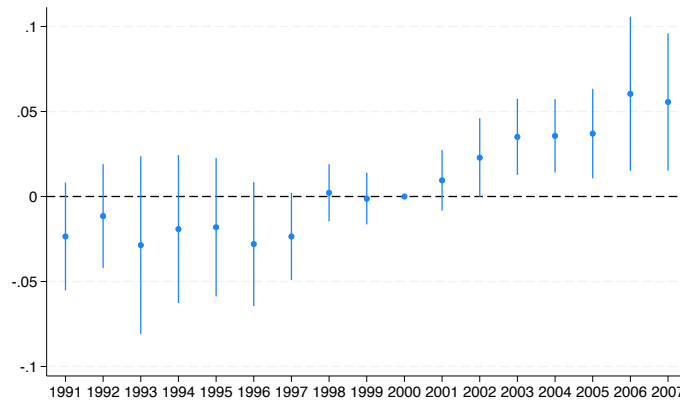
Note: The Figure reports the sectoral distribution in our sample of accounts payable over revenues (panel a), total debt over revenues (panel b) and the share of long-term debt relative to total debt (panel c) in the initial years of the two sub-periods of our stacked differences specification.

Table A.2: Comparison between Compustat and QFR

	Average		P25		P75	
	Compustat	QFR	Compustat	QFR	Compustat	QFR
Accounts Payable to Revenue	0.32	0.29	0.22	0.25	0.36	0.32
Total Debt to Revenue	1.10	0.98	0.64	0.70	1.41	1.19
Share of Long-term Debt	0.77	0.85	0.68	0.81	0.90	0.91

Note: The table shows distributional statistics of some key financial variables in Compustat and QFR.

Figure A.4: China Shock and Trade Credit, dynamic diff-in-diff



Note: The figure reports the coefficients, with 95 percent confidence interval, of a Two-Stage Least Squares difference-in-differences specification using exposure to China after 2001 as the main dependent variable. The specification includes sector controls and the Acemoglu et al (2016) controls both measured at the beginning of the period and interacted with the year-by-year dummies, the time-varying internationalization controls, and 2-digit industry trends. Errors are clustered at the 3-digit level.

Table A.3: Exposure to Imports from China and Net Trade Credit, Robustness

	OLS	IV					IV, Placebo
Dep. var: $\Delta Net TC_{st}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta Exposure_{st}$	0.024** (0.011)	0.033** (0.016)	0.029* (0.016)	0.31** (0.015)	0.046*** (0.012)	0.050*** (0.012)	0.012 (0.009)
Period dummy	✓	✓	✓	✓	✓	✓	✓
Financial controls			✓	✓	✓	✓	✓
Acemoglu et al (2016) controls				✓	✓	✓	✓
Globalization controls					✓	✓	✓
2-digit Sector dummies						✓	✓
Observations	314	314	314	304	304	304	287
First Stage F-stat		269	44	144	150	184	184

Note: Sample of 157 manufacturing industries (4-digit level), stacked across two sub-periods and weighted by initial assets. Columns (1) to (6) consider the sub-periods 1991-2000 and 2000-2007, while column (7) consider the period 1970-1989. Column (1) uses an OLS estimator, columns (2) to (7) use an IV estimator. Financial controls include inventories over assets, capital expenditures over assets, long-term debt over assets at the beginning of each period. Acemoglu et al (2016) controls include production workers as a share of total employment, the log average wage, and the ratio of capital to value added in 1991; and computer investment as a share of total investment and high-tech equipment as a share of total investment in 1990. Globalization controls include the change in intermediate expenditure, imports, and exports relative to revenues. Clustered standard errors (at the 3-digit level) are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A.4: Downstream Exposure to Imports from China and Trade Credit

	OLS		IV			
Dep. var: ΔTC_{st}	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Upstream Exposure_{st}$	0.004 (0.008)	0.000 (0.012)	-0.003 (0.014)	-0.001 (0.014)	-0.003 (0.020)	-0.003 (0.024)
Period dummy	✓	✓	✓	✓	✓	✓
Financial controls			✓	✓	✓	✓
Acemoglu et al (2016) controls				✓	✓	✓
Globalization controls					✓	✓
2-digit Sector dummies						✓
Observations	314	314	314	304	304	304
First Stage F-stat		269	44	144	150	184

Note: Sample of 157 manufacturing industries (4-digit level), stacked across two sub-periods 1991-2000 and 2000-2007 and weighted by initial assets. Downstream exposure is defined, following Acemoglu et al. (2016), as the weighted average of Chinese import penetration across input-supplying industries, where weights are the input shares from the BEA input-output tables (4-digit level). Financial controls include inventories over assets, capital expenditures over assets, debt over assets at the beginning of each period. Acemoglu et al (2016) controls include production workers as a share of total employment, the log average wage, and the ratio of capital to value added in 1991; and computer investment as a share of total investment and high-tech equipment as a share of total investment in 1990. Globalization controls include the change in intermediate input expenditure, imports, and exports relative to revenues. Clustered standard errors (at the 3-digit level) are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

A.2 Proofs

In this section we report the proofs of all the analytical results shown in Section 3. We first show how to derive the expression for the employment rate in equation (8) and aggregate wage payments in equation (19). We then show how to solve the final goods producers' maximization problem. Then we provide the proofs for Proposition 1 and Proposition 2.

A.2.1 Deriving the labor supply equation

Each individual ι , if employed, supplies $l(\iota)$ efficiency units, obtaining a net labor income of $v_i w_i l(\iota)$, where v_i equals 1 minus the income tax rate. If non-employed, individual ι 's income is $v_i b_i u(\iota)$, with $u(\iota)$ denoting ι 's non-employment income potential. We assume that the pair $(l(\iota), u(\iota))$ is drawn independently from a Frechet distribution with shape parameter $\phi > 1$ and scale 1:

$$F(l, u) = e^{-l^{-\phi}} e^{-u^{-\phi}}.$$

This implies that the employment rate, i.e. the probability that an individual has a total income from working higher than the non-employment benefit, is:

$$\begin{aligned} n_i &= \int_0^\infty e^{-(w_i l/b_i)^{-\phi}} \phi l^{-\phi-1} e^{-l^{-\phi}} dl = \\ &= \phi \int_0^\infty l^{-\phi-1} e^{-[1+(w_i/b_i)^{-\phi}] l^{-\phi}} dl. \end{aligned}$$

Let $x \equiv [1 + (w_i/b_i)^{-\phi}] l^{-\phi}$ and $dx \equiv -\phi [1 + (w_i/b_i)^{-\phi}] l^{-\phi-1}$, then n_i can be re-written as:

$$\begin{aligned} n_i &= -\frac{1}{[1 + (w_i/b_i)^{-\phi}]} \int_\infty^0 e^{-x} dx = \\ &= \frac{1}{[1 + (w_i/b_i)^{-\phi}]} [-e^{-x}]_0^\infty = \\ &= \frac{1}{[1 + (w_i/b_i)^{-\phi}]} = \\ &= \frac{w_i^\phi}{w_i^\phi + b_i^\phi}, \end{aligned}$$

as in equation (8). Moreover, we compute aggregate wage payments as

$$W_i = \bar{L}_i w_i \int_{ub_i \leq l w_i} l dF(l, u) = \phi \int_0^\infty l^{-\phi} e^{-[1+(w_i/b_i)^{-\phi}] l^{-\phi}} dl.$$

As before, let $x \equiv [1 + (w_i/b_i)^{-\phi}] l^{-\phi}$ and $dx \equiv -\phi [1 + (w_i/b_i)^{-\phi}] l^{-\phi-1}$, then W_i equals:

$$\begin{aligned} W_i &= -\bar{L}_i w_i \frac{1}{[1 + (w_i/b_i)^{-\phi}]} [1 + (w_i/b_i)^{-\phi}]^{\frac{1}{\phi}} \int_\infty^0 x^{-\frac{1}{\phi}} e^{-x} dx = \\ &= \bar{L}_i w_i [1/n_i]^{\frac{1-\phi}{\phi}} \Gamma\left(1 - \frac{1}{\phi}\right) = \\ &= \bar{L}_i \tilde{\Gamma} w_i (n_i)^{1-\frac{1}{\phi}} \end{aligned}$$

where $\tilde{\Gamma} \equiv \Gamma\left(1 - \frac{1}{\phi}\right)$, and Γ is the gamma function. This proves the expression shown in equation (19).

A.2.2 Solving the final goods producers' problem

We start with the cost minimization problem of choosing the optimal labor and inputs:

$$\min w_i L_{i,s} + P_{i,s}^M M_{i,s} - \mu \left[\left((L_{i,s})^{\frac{\rho-1}{\rho}} + (M_{i,s})^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}} - Q_{i,s} \right]$$

The first order conditions are:

$$\begin{aligned} (L_{i,s})^{\frac{-1}{\rho}} \left((L_{i,s})^{\frac{\rho-1}{\rho}} + (M_{i,s})^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}-1} &= w_i \\ (M_{i,s})^{\frac{-1}{\rho}} \left((L_{i,s})^{\frac{\rho-1}{\rho}} + (M_{i,s})^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}-1} &= P_{i,s}^M \end{aligned}$$

Take their ratio and rearrange:

$$L_{i,s} = M_{i,s} \left(\frac{w_i}{P_{i,s}^M} \right)^{-\rho}.$$

Plugging this back into the production function

$$Q_i = \left(\left(M_{i,s} \left(\frac{w_i}{P_{i,s}^M} \right)^{-\rho} \right)^{\frac{\rho-1}{\rho}} + (M_{i,s})^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}},$$

we can invert and find $M_{i,s}$:

$$M_i = Q_{i,s} \left(\frac{P_{i,s}^M}{c_{i,s}} \right)^{-\rho},$$

where $c_{i,s} \equiv \left[(w_i)^{1-\rho} + (P_{i,s}^M)^{1-\rho} \right]^{\frac{1}{1-\rho}}$. Then the optimal labor demand equals:

$$L_{i,s} = Q_{i,s} \left(\frac{w_i}{c_{i,s}} \right)^{-\rho},$$

and the total cost function equals

$$C_{i,s} = w_i L_{i,s} + P_{i,s}^M M_{i,s} = Q_{i,s} c_{i,s}.$$

Given the optimal $M_{i,s}$, the firm chooses the optimal bundle of intermediate inputs

$$P_{i,s}^M = \min_{Q_{i,ks}} \sum_k \tilde{p}_{i,ks} x_{i,ks}$$

subject to

$$M_{i,s} = \Pi_k \left(\frac{1}{\alpha_{i,ks}} x_{i,ks} \right)^{\alpha_{i,ks}}.$$

The F.O.C. is

$$\tilde{p}_{i,ks} = \lambda \alpha_{i,ks} (x_{i,ks})^{-1} M_{i,s}.$$

Take the ratio of two F.O.C.s

$$\frac{\tilde{p}_{i,1s}}{\tilde{p}_{i,2s}} = \frac{\alpha_{i,1s} x_{i,2s}}{\alpha_{i,2s} x_{i,1s}}.$$

Generalizing for any k:

$$x_{i,ks} = \frac{\tilde{p}_{i,2s}}{\tilde{p}_{i,ks}} \frac{\alpha_{i,ks}}{\alpha_{i,2s}} x_{i,2s}.$$

Replace this into the production function

$$M_{i,s} = \Pi_k \left(\frac{\tilde{p}_{i,2s}}{\tilde{p}_{i,ks}} \frac{1}{\alpha_{i,2s}} x_{i,2s} \right)^{\alpha_{i,ks}} = \frac{\tilde{p}_{i,2s}}{\alpha_{i,2s}} x_{i,2s} \Pi_k (\tilde{p}_{i,ks})^{-\alpha_{i,ks}}.$$

Generalizing again:

$$x_{i,ks} = \frac{\alpha_{i,ks}}{\tilde{p}_{i,ks}} M_{i,s} \Pi_n (\tilde{p}_{i,ns})^{\alpha_{i,ns}}.$$

Thus the marginal cost of production equals:

$$P_{i,s}^M = \min_{x_{i,ks}} \sum_k \tilde{p}_{i,ks} x_{i,ks} = M_{i,s} \sum_k \alpha_{i,ks} \Pi_n (\tilde{p}_{i,ns})^{\alpha_{i,ns}} = \Pi_n (\tilde{p}_{i,ns})^{\alpha_{i,ns}}.$$

Given the sectoral price index for the intermediate inputs $\tilde{p}_{i,ks}$, the firm chooses the optimal bundle across origins

$$\tilde{p}_{i,ks} = \min_{x_{ji,ks}} \sum_j \delta_{i,s} p_{ji,ks}^M x_{ji,ks}$$

subject to

$$x_{i,ks} = \left[\sum_j (x_{ji,ks})^{\frac{\epsilon_k}{1+\epsilon_k}} \right]^{\frac{1+\epsilon_k}{\epsilon_k}}.$$

The F.O.C. is

$$\delta_{i,s} p_{ji,ks}^M = \lambda (x_{ji,ks})^{\frac{-1}{1+\epsilon_k}} \left[\sum_j (x_{ji,ks})^{\frac{\epsilon_k}{1+\epsilon_k}} \right]^{\frac{1}{\epsilon_k}}.$$

Take the ratio for any two origins

$$\frac{\delta_{i,s} p_{1i,ks}^M}{\delta_{i,s} p_{2i,ks}^M} = \frac{(x_{1i,ks})^{\frac{-1}{1+\epsilon_k}}}{(x_{2i,ks})^{\frac{-1}{1+\epsilon_k}}}.$$

Generalizing

$$\left(\frac{p_{ji,ks}^M}{p_{2i,ks}^M} \right)^{-1-\epsilon_k} x_{2i,ks} = x_{ji,ks}.$$

Replace this back into the production function

$$x_{i,ks} = \left[\sum_j \left(\left(\frac{p_{ji,ks}^M}{p_{2i,ks}^M} \right)^{-1-\epsilon_k} x_{2i,ks} \right)^{\frac{\epsilon_k}{1+\epsilon_k}} \right]^{\frac{1+\epsilon_k}{\epsilon_k}},$$

and find the optimal demand:

$$x_{ji,ks} = (p_{ji,ks}^M)^{-(1+\epsilon_k)} x_{i,ks} \left[\sum_n (p_{ni,ks}^M)^{-\epsilon_k} \right]^{-\frac{1+\epsilon_k}{\epsilon_k}}. \quad (\text{A.1})$$

Thus the marginal cost equals

$$\begin{aligned} \tilde{p}_{i,ks} &= \sum_j \delta_{i,s} (p_{ji,ks}^M)^{-\epsilon_k} x_{i,ks} \left[\sum_n (p_{ni,ks}^M)^{-\epsilon_k} \right]^{-\frac{1+\epsilon_k}{\epsilon_k}} = \\ &= \left[\sum_n (\delta_{i,s} p_{ni,ks}^M)^{-\epsilon_k} \right]^{-\frac{1}{\epsilon_k}}. \end{aligned}$$

By combining the previous results, the marginal cost equals

$$c_{i,s} = \left[(w_i)^{1-\rho} + \left(\Pi_k \left[\sum_o (p_{oi,ks}^M \delta_{i,s})^{-\epsilon_k} \right]^{\frac{\alpha_{i,ks}}{-\epsilon_k}} \right)^{1-\rho} \right]^{\frac{1}{1-\rho}}.$$

To compute the trade shares, first note that the trade share within the same sector k is

$$\begin{aligned} \lambda_{ji,ks}^1 &= \frac{x_{ji,ks} \delta_{i,s} p_{ji,ks}^M}{x_{i,ks} \tilde{p}_{i,ks}} = \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k} x_{i,ks} (\tilde{p}_{i,ks})^{1+\epsilon_k}}{x_{i,ks} \tilde{p}_{i,ks}} = \\ &= \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k}}{(\tilde{p}_{i,ks})^{-\epsilon_k}}. \end{aligned}$$

The trade share across all sectors is

$$\lambda_{ji,ks}^2 = \frac{x_{ji,ks} \delta_{i,s} p_{ji,ks}^M}{\sum_k x_{i,ks} \tilde{p}_{i,ks}} = \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k} x_{i,ks} (\tilde{p}_{i,ks})^{1+\epsilon_k}}{\sum_k x_{i,ks} \tilde{p}_{i,ks}} =$$

$$= \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k}}{(\tilde{p}_{i,ks})^{-\epsilon_k}} \alpha_{i,ks}$$

since

$$\alpha_{i,ks} = \frac{x_{i,ks} \tilde{p}_{i,ks}}{\sum_k x_{i,ks} \tilde{p}_{i,ks}}.$$

The trade share in terms of total revenues, instead, is:

$$\begin{aligned} \lambda_{ji,ks}^M &= \frac{x_{ji,ks} \delta_{i,s} p_{ji,ks}^M}{Y_{i,s}^B} = \frac{\sum_k x_{i,ks} \tilde{p}_{i,ks}}{Y_{i,s}^B} \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k} x_{i,ks} (\tilde{p}_{i,ks})^{1+\epsilon_k}}{\sum_k x_{i,ks} \tilde{p}_{i,ks}} = \\ &= \frac{P_{i,s}^M Q_{i,s} \left(\frac{P_{i,s}^M}{c_{i,s}}\right)^{-\rho}}{Y_{i,s}^B} \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k} x_{i,ks} (\tilde{p}_{i,ks})^{1+\epsilon_k}}{\sum_k x_{i,ks} \tilde{p}_{i,ks}}. \end{aligned}$$

Note that $\frac{Q_{i,s}}{Y_{i,s}^B} = \frac{1}{c_{i,s}}$, thus

$$\begin{aligned} \lambda_{ji,ks}^M &= \frac{P_{i,s}^M \left(\frac{P_{i,s}^M}{c_{i,s}}\right)^{-\rho}}{c_{i,s}} \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k} x_{i,ks} (\tilde{p}_{i,ks})^{1+\epsilon_k}}{\sum_k x_{i,ks} \tilde{p}_{i,ks}} = \\ &= \left(\frac{P_{i,s}^M}{c_{i,s}}\right)^{1-\rho} \frac{(\delta_{i,s} p_{ji,ks}^M)^{-\epsilon_k}}{(\tilde{p}_{i,ks})^{-\epsilon_k}} \alpha_{i,ks}. \end{aligned}$$

Recalling that

$$(\tilde{p}_{i,ks})^{-\epsilon_k} = \sum_o (p_{oi,ks}^M \delta_{i,s})^{-\epsilon_k},$$

we get

$$\begin{aligned} \lambda_{ji,ks}^M &= \left(\frac{P_{i,s}^M}{c_{i,s}}\right)^{1-\rho} \frac{(p_{ji,ks}^M \delta_{i,s})^{-\epsilon_k}}{\sum_o (p_{oi,ks}^M \delta_{i,s})^{-\epsilon_k}} \alpha_{i,ks} = \\ &= \left(\frac{P_{i,s}^M}{c_{i,s}}\right)^{1-\rho} \frac{(p_{ji,ks}^M)^{-\epsilon_k}}{\sum_o (p_{oi,ks}^M)^{-\epsilon_k}} \alpha_{i,ks}. \end{aligned}$$

A.2.3 Proof of Proposition 1

The share of trade credit in revenues equals

$$tc_{i,s} = \frac{TC_{i,s}}{Y_{i,s}^B} = \frac{\sum_o \sum_k p_{oi,ks}^M x_{oi,ks} - \psi_{i,s} (Y_{i,s}^B)^{1+\beta}}{Y_{i,s}^B}$$

In log changes

$$\begin{aligned}
\Delta \log tc_{i,s} &= \Delta \log \left(M_{i,s} P_{i,s}^M - \psi_{i,s} (Y_{i,s}^B)^{1+\beta} \right) - \Delta \log (Y_{i,s}^B) = \\
&\approx \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} \Delta \log (M_{i,s} P_{i,s}^M) - \frac{BC_{i,s}}{TC_{i,s}} \Delta \log \left(\psi_{i,s} (Y_{i,s}^B)^{1+\beta} \right) - \Delta \log (Y_{i,s}^B) = \\
&= \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} \Delta \log \left(Q_{i,s} \left(\frac{P_{i,s}^M}{c_{i,s}} \right)^{-\rho} P_{i,s}^M \right) - (1+\beta) \frac{BC_{i,s}}{TC_{i,s}} \Delta \log (Y_{i,s}^B) - \Delta \log (Y_{i,s}^B) = \\
&= \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} \Delta \log \left(\frac{Y_{i,s}^B}{c_{i,s}} \left(\frac{P_{i,s}^M}{c_{i,s}} \right)^{-\rho} P_{i,s}^M \right) - (1+\beta) \frac{BC_{i,s}}{TC_{i,s}} \Delta \log (Y_{i,s}^B) - \Delta \log (Y_{i,s}^B) = \\
&= \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} \left[(1-\rho) (\Delta \log P_{i,s}^M - \Delta \log c_{i,s}) + \Delta \log (Y_{i,s}^B) \right] - \frac{BC_{i,s}}{TC_{i,s}} (1+\beta) \Delta \log (Y_{i,s}^B) - \Delta \log (Y_{i,s}^B) = \\
&= (1-\rho) (\Delta \log P_{i,s}^M - \Delta \log c_{i,s}) \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} - \frac{BC_{i,s}}{TC_{i,s}} \beta \Delta \log (Y_{i,s}^B) + \left[\frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} - \frac{BC_{i,s}}{TC_{i,s}} - 1 \right] \Delta \log (Y_{i,s}^B) = \\
&= (1-\rho) (\Delta \log P_{i,s}^M - \Delta \log c_{i,s}) \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} - \gamma_{i,s} \frac{M_{i,s} P_{i,s}^M}{TC_{i,s}} \beta \Delta \log (Y_{i,s}^B) = \\
&= \frac{M_{i,s} P_{i,s}^M}{Y_{i,s}^B} \frac{Y_{i,s}^B}{TC_{i,s}} \left[(1-\rho) (\Delta \log P_{i,s}^M - \Delta \log c_{i,s}) - \gamma_{i,s} \beta \Delta \log (Y_{i,s}^B) \right] = \\
&= \frac{1 - \varpi_{i,s}}{tc_{i,s}} \left[(1-\rho) (\Delta \log P_{i,s}^M - \Delta \log c_{i,s}) - \gamma_{i,s} \beta \Delta \log (Y_{i,s}^B) \right] = \\
&= \frac{1 - \varpi_{i,s}}{tc_{i,s}} \left[(1-\rho) \varpi_{i,s} (\Delta \log P_{i,s}^M - \Delta \log w_i) - \gamma_{i,s} \beta \Delta \log (Y_{i,s}^B) \right]
\end{aligned}$$

where we have used the equality $TC_{i,s} + BC_{i,s} = P_{i,s}^M M_{i,s}$. Multiplying by $tc_{i,s}$ we obtain the expression for $\Delta tc_{i,s}$ shown in Proposition 1.

A.2.4 Proof of Proposition 2

We consider first the buyers' employment:

$$L_{i,s}^B = \frac{Y_{i,s}^B}{c_{i,s}} \left(\frac{w_i}{c_{i,s}} \right)^{-\rho},$$

so the log change in $L_{i,s}^B$ is:

$$\tilde{L}_{i,s}^B = \tilde{Y}_{i,s}^B + (1-\rho) (\tilde{w}_i - \tilde{c}_{i,s}) - \tilde{w}_i =$$

$$\begin{aligned}
&= \tilde{Y}_{i,s}^B + (1 - \rho) \left(\tilde{w}_i - \left[\varpi_{i,s} \tilde{w}_i + (1 - \varpi_{i,s}) \tilde{P}_{i,s}^M \right] \right) - \tilde{w}_i = \\
&= \tilde{Y}_{i,s}^B + (1 - \rho) \left(\tilde{w}_i - \left[\varpi_{i,s} \tilde{w}_i + (1 - \varpi_{i,s}) \left(\tilde{\delta}_{i,s} + \tilde{P}_{i,s} \right) \right] \right) - \tilde{w}_i =
\end{aligned}$$

where $\tilde{P}_{i,s} = \sum_k \alpha_{i,k} \log \left[\sum_o \left(p_{oi,k}^M \right)^{-\epsilon_k} \right]^{-\frac{1}{\epsilon_k}}$. Note that $\tilde{\delta}_{i,s} = \frac{\gamma_{i,s} (r_{i,s} - r_{i,s}^T)}{\delta_{i,s}} \tilde{\gamma}_{i,s}$ and $\tilde{TC}_{i,s} = -\frac{\gamma_{i,s}}{1-\gamma_{i,s}} \tilde{\gamma}_{i,s}$. Setting the U.S wage as the numeraire,

$$\begin{aligned}
\tilde{L}_{i,s}^B &= \tilde{Y}_{i,s}^B - (1 - \rho) (1 - \varpi_{i,s}) \left(-\frac{1 - \gamma_{i,s}}{\gamma_{i,s}} \frac{\gamma_{i,s} (r_{i,s} - r_{i,s}^T)}{\delta_{i,s}} \tilde{TC}_{i,s} + \tilde{P}_{i,s} \right) = \\
&= \underbrace{\tilde{Y}_{i,s}^B}_{\text{Revenue effect}} - \underbrace{\chi_{i,s} \tilde{P}_{i,s}}_{\text{Input-cost effect}} - \underbrace{\mu_{i,s} \tilde{TC}_{i,s}}_{\text{Credit-cost effect}}
\end{aligned}$$

where $\mu_{i,s} \equiv (1 - \rho) (1 - \varpi_{i,s}) \frac{(1 - \gamma_{i,s}) (r_{i,s}^T - r_{i,s})}{\delta_{i,s}}$ and $\chi_{i,s} \equiv (1 - \rho) (1 - \varpi_{i,s})$.

We next consider the suppliers' employment. By replacing the optimal pricing of the suppliers into the profit function, and using the fact that profits are zero in equilibrium, gives the following expression for the suppliers' value added:

$$L_{i,s}^S w_i = \sum_{j,h} \frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} p_{ij,sh}^M x_{ij,sh} \quad (\text{A.2})$$

Since the U.S. wage is the numeraire, in log changes this becomes:

$$\begin{aligned}
\tilde{L}_{i,s}^S &\approx \sum_{h,j} \frac{\frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \lambda_{ij,sh}^M Y_{j,h}^B}{L_{i,s}^S w_i} \Delta \log \left(\frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \lambda_{ij,sh}^M Y_{j,h}^B \right) = \\
&\approx \sum_{h,j} \frac{\frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \lambda_{ij,sh}^M Y_{j,h}^B}{L_{i,s}^S w_i} \Delta \log \left(\frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \left(\frac{P_{j,h}^M}{c_{j,h}} \right)^{1-\rho} \chi_{ij,sh}^M \alpha_{j,sh} Y_{j,h}^B \right) = \\
&\approx \sum_{h,j} \frac{\frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \lambda_{ij,sh}^M Y_{j,h}^B}{L_{i,s}^S w_i} \left(\frac{r_{i,s} \gamma_{j,h}}{(1 + \gamma_{j,h} r_{i,s})} \tilde{\gamma}_{j,h} + (1 - \rho) \left(\tilde{P}_{j,h}^M - \tilde{c}_{j,h} \right) + \tilde{\chi}_{ij,sh}^M + \tilde{Y}_{j,h}^B \right) = \\
&\approx \sum_{h,j} \alpha_{ij,sh}^3 \left(\frac{r_{i,s} \gamma_{j,h}}{(1 + \gamma_{j,h} r_{i,s})} \tilde{\gamma}_{j,h} + (1 - \rho) \varpi_{j,h} \left(\tilde{P}_{j,h}^M - \tilde{w}_j \right) + \tilde{\chi}_{ij,sh}^M + \tilde{Y}_{j,h}^B \right) = \\
&\approx \sum_{h,j} \alpha_{ij,sh}^3 \left(\frac{r_{i,s} \gamma_{j,h}}{(1 + \gamma_{j,h} r_{i,s})} \tilde{\gamma}_{j,h} + (1 - \rho) \varpi_{j,h} \left(\tilde{\delta}_{j,h} + \tilde{P}_{j,h} - \tilde{w}_j \right) + \tilde{\chi}_{ij,sh}^M + \tilde{Y}_{j,h}^B \right) =
\end{aligned}$$

$$\begin{aligned} &\approx \sum_{h,j} \alpha_{ij,sh}^3 \left(\frac{r_{i,s} \gamma_{j,h}}{(1 + \gamma_{j,h} r_{i,s})} \tilde{\gamma}_{j,h} + (1 - \rho) \varpi_{j,h} \left(\frac{\gamma_{j,h} (r_{j,h} - r_{j,h}^T)}{\delta_{j,h}} \tilde{\gamma}_{j,h} + \tilde{P}_{j,h} - \tilde{w}_j \right) + \tilde{\chi}_{ij,sh}^M + \tilde{Y}_{j,h}^B \right) = \\ &\approx \sum_{h,j} \alpha_{ij,sh}^3 \left(g_{ij,sh} \tilde{\gamma}_{j,h} + (1 - \rho) \varpi_{j,h} \tilde{P}_{j,h} - (1 - \rho) \varpi_{j,h} \tilde{w}_j + \tilde{\chi}_{ij,sh}^M + \tilde{Y}_{j,h}^B \right) = \end{aligned}$$

where $\alpha_{ij,sh}^3 = \frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \alpha_{ij,sh}^1$, $\alpha_{ij,sh}^1 = \frac{\lambda_{ij,sh}^M Y_{j,h}^B}{L_{i,s}^S w_i}$, $g_{ij,sh} = \frac{r_{i,s} \gamma_{j,h}}{(1 + \gamma_{j,h} r_{i,s})} + (1 - \rho) \varpi_{j,h} \frac{\gamma_{j,h} (r_{j,h} - r_{j,h}^T)}{\delta_{j,h}}$.
Substitute for the change in trade shares:

$$\tilde{L}_{i,s}^S = \sum_{h,j} \alpha_{ij,sh}^3 \tilde{Y}_{j,h}^B + \sum_{h,j} \alpha_{ij,sh}^4 \tilde{\gamma}_{j,h} + \sum_{h,j} \alpha_{ij,sh}^3 (1 - \rho) \varpi_{j,h} (\tilde{P}_{j,h} - \tilde{w}_j) - \epsilon_s \sum_{h,j} \alpha_{ij,sh}^3 \tilde{p}_{ij,sh}^M + \epsilon_s \sum_{h,j} \alpha_{ij,sh}^3 \sum_o \chi_{oj,sh}^M \tilde{p}_{oj,sh}^M$$

where $\alpha_{ij,sh}^4 = g_{ij,sh} \alpha_{ij,sh}^3$. Substitute for the change in the price:

$$\tilde{L}_{i,s}^S = \sum_{h,j} \alpha_{ij,sh}^3 \tilde{Y}_{j,h}^B + \sum_{h,j} \alpha_{ij,sh}^5 \tilde{\gamma}_{j,h} + \sum_{h,j} \alpha_{ij,sh}^3 (1 - \rho) \varpi_{j,h} (\tilde{P}_{j,h} - \tilde{w}_j) - \epsilon_s \sum_{h,j} \alpha_{ij,sh}^3 [\tilde{\tau}_{ij,s} + \tilde{w}_i] + \epsilon_s \sum_{h,j} \alpha_{ij,sh}^3 \sum_o \chi_{oj,sh}^M [\tilde{\tau}_{oj,s} + \tilde{w}_o]$$

where $\alpha_{ij,sh}^5 = \alpha_{ij,sh}^4 + \epsilon_s \alpha_{ij,sh}^3 \frac{\gamma_{j,h} r_{i,s}}{(1 + \gamma_{j,h} r_{i,s})} - \epsilon_s \alpha_{ij,sh}^3 \sum_o \chi_{oj,sh}^M \frac{\gamma_{j,h} r_{o,s}}{1 + \gamma_{j,h} r_{o,s}}$. Replace for trade credit:

$$\tilde{L}_{i,s}^S = \sum_{h,j} \alpha_{ij,sh}^3 \tilde{Y}_{j,h}^B - \sum_{h,j} \alpha_{ij,sh}^6 \tilde{TC}_{j,h} + \sum_{h,j} \alpha_{ij,sh}^3 (1 - \rho) \varpi_{j,h} (\tilde{P}_{j,h} - \tilde{w}_j) - \epsilon_s \sum_{h,j} \alpha_{ij,sh}^3 [\tilde{\tau}_{ij,s} + \tilde{w}_i] + \epsilon_s \sum_{h,j} \alpha_{ij,sh}^3 \sum_o \chi_{oj,sh}^M [\tilde{\tau}_{oj,s} + \tilde{w}_o]$$

where $\alpha_{ij,sh}^6 = \alpha_{ij,sh}^5 \frac{1 - \gamma_{j,h}}{\gamma_{j,h}}$. Putting this back into the previous equation (setting $\tilde{\tau}_{ij,s} = 0$ for $i = US$), setting the U.S. wage as numeraire we obtain

$$\tilde{L}_{i,s}^S = \sum_{h,j} \xi_{ij,sh}^1 \tilde{Y}_{j,h}^B + \sum_{h,j} \xi_{ij,sh}^1 \left[\sum_o \chi_{oj,sh}^M \epsilon_s (\tilde{\tau}_{oj,s} + \tilde{w}_o) - (1 - \rho) \varpi_{j,h} (\tilde{P}_{j,h} - \tilde{w}_j) \right] - \sum_{h,j} \xi_{ij,sh}^2 \tilde{TC}_{j,h}$$

where

$$\xi_{ij,sh}^1 = \frac{(1 + \gamma_{j,h} r_{i,s})}{(1 + r_{i,s})} \frac{\lambda_{ij,sh}^M Y_{j,h}^B}{L_{i,s}^S w_i} \quad (\text{A.3})$$

and

$$\xi_{ij,sh}^2 = \left(\xi_{ij,sh}^1 g_{ij,sh} + \epsilon_s \xi_{ij,sh}^1 \sum_o (1 - \chi_{oj,sh}^M) \frac{\gamma_{j,h} r_{o,s}}{1 + \gamma_{j,h} r_{o,s}} \right) \frac{1 - \gamma_{j,h}}{\gamma_{j,h}}. \quad (\text{A.4})$$

Defining $\nu_{ji,ks}^M \equiv \left(\frac{P_{i,s}^M}{c_{i,s}} \right)^{1-\rho} \frac{(\tau_{ji,k} w_j)^{-\epsilon_k}}{\sum_o (\tau_{oi,k} w_o)^{-\epsilon_k}} \alpha_{i,ks}$, the expression above coincides with the decomposition in Proposition 2. This proves the result.

A.3 Extensions

In this section we describe the extensions to the baseline model. First, we derive the model with suppliers facing the same borrowing constraint as buyers (section A.3.1). Second, we

consider the case in which the interest rates on bank and trade credit are endogenous to the market conditions (section A.3.2). Third, we assume that buyers have some liquidity available to finance input expenditures (section A.3.3). Fourth, we consider the case of frictional unemployment in a search-and-match framework (section A.3.4). In the final extension, we allow suppliers to choose between extending trade credit to a current buyer or finding a new buyer that pays fully on spot (section A.3.5).

A.3.1 Constrained Suppliers

In this extension we consider the case in which also the suppliers, as the buyers, are subject to a size-dependent borrowing constraint:

Assumption 3: $BC_{j,k}^S \leq \psi_{j,k} (Y_{j,k}^S)^{1+\beta}$

where $Y_{j,k}^S$ are revenues and $\beta > 0$. Given the constraint, the credit received from the banking sector equals

$$BC_{j,k}^S = \min \left\{ w_j l_{j,k}^S - \sum_{i,s} \gamma_{i,s} p_{ji,ks}^M x_{ji,ks}, \psi_{j,k} (Y_{j,k}^S)^{1+\beta} \right\}.$$

We assume that suppliers and buyers agree on the price of the input at the beginning of the period (thus the price is the same as in the baseline model), but depending on the market conditions in the second stage, they can renegotiate the quantity sold. If the amount of bank credit needed is lower than the value of the collateral, i.e. the constraint is slack, then the amount of production is the same as in the baseline model. If instead the constraint is binding, i.e. $BC_{j,k}^S = \psi_{j,k} (Y_{j,k}^S)^{1+\beta}$, the supplier is forced to scale back production, as it does not have enough resources to produce the desired quantity. It is easy to verify that the quantity produced under a binding borrowing constraint is:

$$Q_{j,k}^{S,constr} = \frac{A_{j,k}}{w_j} \left[\sum_{i,s} \gamma_{i,s} \lambda_{ji,ks}^M Y_{i,s}^B + \psi_{j,k} \left(\sum_{i,s} \lambda_{ji,ks}^M Y_{i,s}^B \right)^{1+\beta} \right]$$

while the unconstrained quantity is, as in the baseline setting,

$$Q_{j,k}^S = \frac{A_{j,k}}{w_j} \left[\sum_{i,s} \frac{(1 + \gamma_{i,s} r_{j,k})}{(1 + r_{j,k})} \lambda_{ji,ks}^M Y_{i,s}^B \right].$$

Whenever the suppliers are collateral constrained, also the buyers may have to scale back their production, if one or more of their suppliers is constrained. The quantity that the buyer in sector s in country i buys from the supplier in sector k in country j is the minimum

between the constrained quantity and the unconstrained one:

$$x_{ji,ks} = \min \{x_{ji,ks}^{constr}, x_{ji,ks}^{unc}\}. \quad (\text{A.5})$$

We assume that constrained suppliers allocate their available sales proportionally across destinations. Define the revenue share of buyer (i, s) in the unconstrained allocation as

$$\iota_{ji,ks} \equiv \frac{p_{ji,ks}^M x_{ji,ks}^{unc}}{\sum_{i,s} p_{ji,ks}^M x_{ji,ks}^{unc}}. \quad (\text{A.6})$$

When the supplier is constrained, total sales revenue equals $Y_{j,k}^{S,constr}$. Revenue allocated to each buyer is therefore

$$p_{ji,ks}^M x_{ji,ks}^{constr} = \iota_{ji,ks} Y_{j,k}^{S,constr}, \quad (\text{A.7})$$

which implies

$$x_{ji,ks}^{constr} = \frac{\iota_{ji,ks} Y_{j,k}^{S,constr}}{p_{ji,ks}^M}. \quad (\text{A.8})$$

Input demand by buyer (i, s) is then given by

$$x_{i,ks} = \left[\sum_j \left(\min \{x_{ji,ks}^{constr}, x_{ji,ks}^{unc}\} \right)^{\frac{\epsilon_k}{1+\epsilon_k}} \right]^{\frac{1+\epsilon_k}{\epsilon_k}}, \quad (\text{A.9})$$

and buyer revenues satisfy

$$Y_{i,s}^B = \frac{P_{i,s}^M}{1 - \varpi_{i,s}} \prod_k \left(\frac{x_{i,ks}}{\alpha_{i,ks}} \right)^{\alpha_{i,ks}}. \quad (\text{A.10})$$

The equation above implies that collateral-constrained suppliers reduce the revenues of final goods producers, lowering their demand for labor. This generates a negative feedback loop: lower buyer revenues tighten borrowing constraints and reduce bank credit, increasing reliance on trade credit. In turn, suppliers must borrow more from banks and, because they also face borrowing constraints, may be forced to scale back production, further depressing buyers' revenues.

A.3.2 Endogenous interest rates

In the baseline model, for tractability we impose that the interest rates on both bank and trade credit are exogenous. In this extension we consider the more realistic case in which both

rates are endogenous to the market conditions. In particular, we follow [Chod et al. \(2019\)](#) and we model the bank interest rate as an increasing function of the borrower's leverage, defined as bank loan amount over borrower's revenues, such that:

$$r_{i,s} = \zeta_{i,s} \frac{BC_{i,s}}{Y_{i,s}^B} \quad (\text{A.11})$$

where $\zeta_{i,s}$ is a sector-specific parameter calibrated from the data. This functional form implies that the total cost of bank credit is convex in the borrower's leverage. Theoretically, convexity of the cost of debt financing emerges endogenously from several microeconomic foundations, such as agency problems ([Myers 1977](#)), adverse selection ([Stein 1998](#)), regulatory capital requirements or managerial risk aversion ([Becker and Josephson 2016](#)), or costly verification ([Bernanke et al. 1999](#)).

Following the same logic, we assume that also the interest rate on trade credit increases linearly with the buyer's exposure to trade credit, which we define as the fraction of trade credit in revenues:

$$r_{i,s}^T = \theta_{i,s} \frac{TC_{i,s}}{Y_{i,s}^B} \quad (\text{A.12})$$

where $\theta_{i,s}$ is a sector-specific parameter calibrated from the data.

A.3.3 Initial liquidity

We consider an extension in which buyers have available some exogenous amount of liquidity $X_{i,s}$ to finance input expenditures. We assume that the buyers first use their liquidity, then they borrow funds from banks, and then, if necessary, they ask for trade credit from their suppliers.

Defining as $\eta_{i,s} = \frac{X_{i,s}}{\sum_o \sum_k p_{oi,k}^M x_{oi,k}}$ the fraction of input expenditures paid with ex-ante liquidity, the credit wedge becomes:

$$\delta_{i,s} = \gamma_{i,s}(1 + r_{i,s}) + (1 - \gamma_{i,s} - \eta_{i,s})(1 + r_{i,s}^T) > 1 \quad (\text{A.13})$$

The presence of initial liquidity also changes the optimal price charged for intermediate inputs:

$$p_{ji,ks}^M = \frac{1 + r_{j,k}}{1 + (\gamma_{i,s} + \eta_{i,s})r_{j,k}} \frac{\tau_{ji,k} w_j}{A_{j,k}} \quad (\text{A.14})$$

The less the buyer pays on spot, using either existing liquidity or bank credit, the more trade credit the supplier gives to the buyer, and the higher is the price charged by the supplier.

With exogenous liquidity, Proposition 1 becomes:

$$\Delta tc_{i,s} = \underbrace{-\beta \gamma_{i,s} (1 - \varpi_{i,s}) \tilde{Y}_{i,s}^B}_{\text{Collateral effect}} + \underbrace{(1 - \rho) (1 - \varpi_{i,s}) \varpi_{i,s} (\tilde{P}_{i,s}^M - \tilde{w}_i)}_{\text{Relative cost effect}} + \underbrace{(1 - \varpi_{i,s}) \eta_{i,s} \tilde{Y}_{i,s}^B}_{\text{Liquidity effect}} \quad (\text{A.15})$$

There is now a liquidity effect: the higher the initial level of liquidity available, the lower the increase in trade credit following a negative trade shock.

A.3.4 Frictional unemployment

We outline an extension of the baseline model featuring frictional unemployment. We consider the same preferences as in our baseline model, with $l(\iota)$ and $u(\iota)$ denoting ι 's efficiency units and non-employment income, independently drawn from a Frechet distribution with shape parameter $\phi > 1$ and scale 1.

As in our baseline, each sector s of country i has a representative firm that produces a differentiated good subject to iceberg trade costs. In order to produce, firms need to get matched with workers. We consider a competitive search environment in which all firms post the same wage w_i and then are randomly matched with workers in the economy.

The matching technology is such that, if V_i vacancies are posted and N_i^p workers search for a job, the number of matches is

$$M_i = (V_i)^\alpha (N_i^p)^{1-\alpha}. \quad (\text{A.16})$$

We first solve for the share of individuals in market i that look for a job given an offered wage rate of w_i . Consider the case in which individual ι searches for a job. With probability M_i/N_i^p , she finds a job and has a payoff of $(1 - v_i)w_i l(\iota)/P_i$; with probability $1 - M_i/N_i^p$, she does not find a job and has a payoff of $(1 - v_i)b_i u(\iota)/P_i$. If the same individual ι does not search for a job, she gets a payoff of $(1 - v_i)b_i u(\iota)/P_i$. Thus, the maximization of expected utility implies that the market's labor force participation is

$$n_i^p = \Pr \left[\frac{M_i}{N_i^p} w_i l(\iota) + \left(1 - \frac{M_i}{N_i^p} \right) b_i u(\iota) > b_i u(\iota) \right] = \Pr [w_i l(\iota) > b_i u(\iota)] \quad \Rightarrow \quad n_i^p = \frac{w_i^\phi}{w_i^\phi + b_i^\phi}, \quad (\text{A.17})$$

as in our baseline model. This implies that the average efficiency of the individuals searching for jobs is $\bar{l}_i = \tilde{\Gamma}(n_i^p)^{-\frac{1}{\phi}}$.

In equilibrium, the number of successful matches must be equal to the number of employed individuals, so $M_i = L_i$, and $N_i^p = n_i^p \bar{L}_i$, with $N_i^p \geq M_i$.

We assume that each hiring is managed by a specialized firm, the ‘‘recruiter’’, and that

there is an infinite pool of potential recruiters. If the recruiter does not post any vacancy, she gets an outside option payoff of $\bar{v}_i$. If it does post a vacancy and there is a match, it gets paid a constant markup over the cost of labor, μw_i with $\mu > 1$, but it has to pay for the worker's salary.²⁹ In equilibrium, the free entry condition imposes that the expected profit of posting a vacancy must be equal to the outside option of not posting it. The expected profits of posting a vacancy equal the fee minus the labor costs, which in turn equal the wage times the expected efficiency of a match, $\bar{l}_i$. Given that the probability of filling a vacancy is M_i/V_i , we have that

$$\bar{v}_i = (\mu w_i - w_i) \bar{l}_i \frac{M_i}{V_i}.$$

Using the matching function, and inverting, we have:

$$\frac{N_i^p}{V_i} = \left(\frac{\bar{v}_i}{(\mu - 1)w_i \bar{l}_i} \right)^{\frac{1}{1-\alpha}}$$

The share of individuals searching for a job that get matched to a producer is $n_i^m = \frac{M_i}{N_i^p}$. Using again the definition for M and replacing for $\frac{N_i^p}{V_i}$, we obtain:

$$n_i^m = \left(\frac{(\mu - 1)w_i \bar{l}_i}{\bar{v}_i} \right)^{\frac{\alpha}{1-\alpha}}$$

Lastly, using the expression for $\bar{l}_i$, and assuming that the outside option of recruiters equals to the non-employment benefit ($\bar{v}_i = b_i$), we derive the expression for the share of individuals in market i that are employed:

$$\begin{aligned} n_i &= n_i^m n_i^p = \left(\frac{(\mu - 1)w_i \tilde{\Gamma} (n_i^p)^{-\frac{1}{\phi}}}{b_i} \right)^{\frac{\alpha}{1-\alpha}} n_i^p = \left(\frac{(\mu - 1)w_i \tilde{\Gamma}}{b_i} \right) (n_i^p)^{\frac{\phi(1-\alpha)-\alpha}{\phi(1-\alpha)}} = \\ &= (\mu - 1) \tilde{\Gamma} \frac{w_i}{b_i} \left(\frac{w_i^\phi}{w_i^\phi + b_i^\phi} \right)^{\frac{\phi(1-\alpha)-\alpha}{\phi(1-\alpha)}} \end{aligned}$$

A.3.5 Outside option

In the baseline model, suppliers always extend trade credit to their buyers at an exogenously given interest rate $r_{i,s}^T$. We now relax this assumption and allow suppliers to terminate the relationship and sell their output to another buyer within the same country-sector market.

²⁹Posting a vacancy and getting no match is costless.

Suppose that, after receiving a request for trade credit, a supplier can either maintain the existing relationship or switch to a new buyer who pays fully on spot. The interest rate on trade credit is then determined by the supplier's indifference condition between these two options:

$$(1 + r_{oi,ks}^T) p_{oi,ks}^M (1 - \gamma_{i,s}) x_{oi,ks} = p_{oi,ks}^{new} x_{oi,ks}^{new} \quad (\text{A.18})$$

The left-hand side represents the revenue obtained by extending trade credit and remaining in the relationship. The right-hand side represents the revenue obtained by switching to a new buyer who pays immediately.

The indifference condition highlights a trade-off between margins and volumes. Extending trade credit generates an additional financial return through the interest charged on deferred payments. However, it also increases the supplier's financing needs. Since suppliers must borrow from banks to finance production before receiving payment, the higher financing requirement raises production costs and leads to a higher price of the intermediate input. Under downward-sloping demand, the higher price reduces the quantity sold.

By contrast, a new buyer who pays fully on spot does not require supplier financing. In this case the supplier charges the frictionless price, $p_{oi,k}^{new} = \frac{\tau_{oi,k} w_o}{A_{o,k}}$, which is lower than the price charged when trade credit is extended. The lower price increases demand and therefore the quantity sold. Switching buyers thus increases volumes but eliminates the financial return associated with trade credit.

Inverting the indifference condition yields the equilibrium interest rate on trade credit:

$$r_{oi,ks}^T = \frac{1}{1 - \gamma_{i,s}} \left(\frac{1 + r_{o,k}}{1 + \gamma_{i,s} r_{o,k}} \right)^{\epsilon_k} - 1 \quad (\text{A.19})$$

Equation (A.19) shows that the equilibrium cost of trade credit is determined by three key factors: the supplier's borrowing cost $r_{o,k}$, the elasticity of demand ϵ_k , and the fraction of the buyer's expenditures financed through bank credit, $\gamma_{i,s}$.

The role of $\gamma_{i,s}$ reflects two opposing forces. First, when buyers rely more heavily on bank credit, a smaller fraction of purchases is financed through trade credit. To compensate suppliers for extending a smaller volume of trade credit, the equilibrium interest rate tends to increase. Second, greater reliance on bank credit reduces the supplier's financing burden, narrowing the gap between the price charged under trade credit and the frictionless price. This reduces the quantity advantage associated with switching to a new buyer and therefore weakens the supplier's outside option, tending to reduce the equilibrium interest rate. Whether the cost of trade credit rises or falls with $\gamma_{i,s}$ depends on the relative strength of these two

forces.³⁰

A.4 Writing the model in “hat changes”

In this section we follow Dekle et al. (2007) and re-write the general equilibrium model in “hat-changes.” Define $\hat{x} = \frac{x'}{x}$ to be the ratio between the variable x after the shock, x' , over the variable before the shock, x . For clarity, we always use s to indicate final goods sectors (buyers), and k for intermediate inputs sectors (suppliers). The change in production cost for buyers is:

$$\hat{c}_{i,s} = \left[\varpi_{i,s} (\hat{w}_i)^{1-\rho} + (1 - \varpi_{i,s}) \left(\hat{P}_{i,s}^M \right)^{1-\rho} \right]^{\frac{1}{1-\rho}} \quad (\text{A.20})$$

where $\varpi_{i,s}$ is the initial share of labor payments in total costs, and

$$\hat{P}_{i,s}^M = \prod_k \left(\hat{\delta}_{i,s} \left[\sum_o \chi_{oi,ks}^M \left(\frac{1 + \gamma_{i,s} r_{o,k}}{1 + \hat{\gamma}_{i,s} \gamma_{i,s} r_{o,k}} \hat{\tau}_{oi,k} \hat{w}_o \right)^{-\epsilon_k} \right]^{-\frac{1}{\epsilon_k}} \right)^{\alpha_{i,ks}} \quad (\text{A.21})$$

is the change in the price index of intermediate inputs, where $\chi_{oi,ks}^M \equiv \frac{(p_{oi,ks}^M)^{-\epsilon_k}}{\sum_n (p_{ni,ks}^M)^{-\epsilon_k}}$ is the observed sectoral trade share in intermediates. The change in trade shares for final goods are

$$\hat{\lambda}_{ji,s} = \frac{(\hat{\tau}_{ji,s} \hat{c}_{j,s})^{-\sigma_s}}{\sum_n \chi_{ni,s} (\hat{\tau}_{ni,s} \hat{c}_{n,s})^{-\sigma_s}}, \quad (\text{A.22})$$

where $\chi_{ji,s} \equiv \frac{(p_{ji,s})^{-\sigma_s}}{\sum_n (p_{ni,s})^{-\sigma_s}}$ is the observed within-sector trade share in final consumption, while the change in trade shares for intermediate inputs is

$$\hat{\lambda}_{ji,ks}^M = \left(\frac{\hat{P}_{i,s}^M}{\hat{c}_{i,s}} \right)^{1-\rho} \frac{\left(\frac{1 + \gamma_{i,s} r_{j,k}}{1 + \hat{\gamma}_{i,s} \gamma_{i,s} r_{j,k}} \hat{\tau}_{ji,k} \hat{w}_j \right)^{-\epsilon_k}}{\sum_o \chi_{oi,ks}^M \left(\frac{1 + \gamma_{i,s} r_{o,k}}{1 + \hat{\gamma}_{i,s} \gamma_{i,s} r_{o,k}} \hat{\tau}_{oi,k} \hat{w}_o \right)^{-\epsilon_k}}. \quad (\text{A.23})$$

The change in the buyers’ credit wedge is

$$\hat{\delta}_{i,s} = \gamma_{i,s} \hat{\gamma}_{i,s} \frac{(r_{i,s} - r_{i,s}^T)}{\delta_{i,s}} + \frac{(1 + r_{i,s}^T)}{\delta_{i,s}} \quad (\text{A.24})$$

where

$$\hat{\gamma}_{i,s} = \left(\frac{Y_{i,s}^{B'}}{Y_{i,s}^B} \right)^\beta \left(\frac{\hat{c}_{i,s}}{\hat{P}_{i,s}^M} \right)^{1-\rho}. \quad (\text{A.25})$$

Revenues of final goods producers in the counterfactual equilibrium are

³⁰A sufficient condition for $r_{oi,ks}^T$ to be decreasing in $\gamma_{i,s}$ is $\epsilon_k r_{o,k} (1 - \gamma_{i,s}) > 1 + \gamma_{i,s} r_{o,k}$.

$$Y_{i,s}^{B'} = \sum_j \hat{\lambda}_{ij,s} \lambda_{ij,s} I'_j, \quad (\text{A.26})$$

with total income in the counterfactual equilibrium being

$$I'_i = W_i (\hat{n}_i)^{\frac{\phi-1}{\phi}} \hat{w}_i + \Pi'_i \quad (\text{A.27})$$

where $W_i = \bar{L}_i \tilde{\Gamma} w_i (n_i)^{1-\frac{1}{\phi}}$ are the labor payments (or, value added) in the initial equilibrium, and Π'_i are the profits from credit in the counterfactual equilibrium (from equation 20). The labor market clearing condition is:

$$\sum_s Y_{i,s}^{B'} \varpi_{i,s} \left(\frac{\hat{w}_i}{\hat{c}_{i,s}} \right)^{1-\rho} + \sum_k \sum_{n,s} \frac{(1 + \gamma_{n,s} \hat{\gamma}_{n,s} r_{i,k})}{(1 + r_{i,k})} \lambda_{in,ks}^M \hat{\lambda}_{in,ks}^M Y_{n,s}^{B'} = W_i (\hat{n}_i)^{\frac{\phi-1}{\phi}} \hat{w}_i \quad (\text{A.28})$$

where the change in the national employment rate is

$$\hat{n}_i = \frac{\hat{w}_i^\phi}{\hat{w}_i^\phi n_i + \hat{b}_i^\phi (1 - n_i)}. \quad (\text{A.29})$$

Lastly, the price index for final goods equals, in changes:

$$\hat{P}_i = \prod_s \left[\sum_j \chi_{ji,s} (\hat{\tau}_{ji,s} \hat{c}_{j,s})^{-\epsilon_s} \right]^{\frac{\xi_{i,s}}{-\epsilon_s}} \quad (\text{A.30})$$

while the change in the non-employment benefit is

$$\hat{b}_i = \hat{P}_i^\kappa \hat{w}_i^{1-\kappa}. \quad (\text{A.31})$$

A.5 Calibration details

In this section we discuss the calibration of initial conditions and parameters of the baseline model, as well as of the main extensions. We then report the fit of the model to the data.

A.5.1 Initial conditions and parameters

We calibrate the initial conditions of the model in 1991 and 2000.

- n_i , the national employment rate: for U.S., we compute it from County Business Patterns ($n_{US} = 0.7$ in both periods); we assume that $n_i = 1$ for China and RoW.
- $\chi_{oi,s}$, trade shares in final goods: we compute them combining data from UN Comtrade and EORA. We use the same procedure used in [Adao et al. \(2026\)](#) and [Esposito \(2022\)](#).

- $\chi_{oi,ks}^M$, trade shares in intermediate inputs: given the lack of comprehensive data at the 4-digit level of aggregation, we use the fact that, if $r_{j,k} \approx r_k$ for all j and if the elasticity of substitution across goods within a sector is the same for intermediate and final goods ($\epsilon_s = \sigma_s$), then $\chi_{oi,ks}^M = \frac{\left(\frac{1+r_{o,k}}{1+\gamma_{i,s}r_{o,k}} \frac{\tau_{oi,k}w_o}{A_{o,k}}\right)^{-\epsilon_k}}{\sum_n \left(\frac{1+r_{n,k}}{1+\gamma_{i,s}r_{n,k}} \frac{\tau_{ni,k}w_n}{A_{n,k}}\right)^{-\epsilon_k}} \approx \frac{\left(\frac{1+r_k}{1+\gamma_{i,s}r_k} \frac{\tau_{oi,k}w_o}{A_{o,k}}\right)^{-\epsilon_k}}{\sum_n \left(\frac{1+r_k}{1+\gamma_{i,s}r_k} \frac{\tau_{ni,k}w_n}{A_{n,k}}\right)^{-\epsilon_k}} = \frac{\left(\frac{\tau_{oi,k}w_o}{A_{o,k}}\right)^{-\epsilon_k}}{\sum_n \left(\frac{\tau_{ni,k}w_n}{A_{n,k}}\right)^{-\epsilon_k}} = \chi_{oi,k}$. Thus we use the same sectoral trade shares for both final consumption and intermediates, as often assumed in the quantitative trade literature (see e.g. [Caliendo and Parro 2015](#))
- $\alpha_{i,ks}$, the share of expenditures of sector s in country i on goods from sector k : for the U.S. we use the 1992 IO tables constructed by the Bureau of Economic Analysis (the same used in [Acemoglu et al. 2016](#)); we assume that foreign countries have the same IO shares as the U.S.
- $\varpi_{i,s}$, share of value added in production costs: for U.S. we use the NBER Manufacturing database; we assume the foreign countries have the same shares as the U.S.³¹
- $\xi_{i,s}$, sectoral consumption shares: for the U.S. we use the consumption share computed from the 1992 IO tables of the BEA; we assume the foreign countries have the same shares as the U.S.
- $\gamma_{i,s}$, the share of input expenditures financed through bank credit. Because firms finance intermediate-input purchases using a combination of trade credit and bank credit, so that $M_{i,s}P_{i,s}^M = TC_{i,s} + BC_{i,s}$, we measure this parameter as $\gamma_s = \frac{BC_{i,s}}{TC_{i,s} + BC_{i,s}}$. For U.S., we use sectoral aggregates of total debt and accounts payable from Compustat. For foreign countries, we scale the U.S. value of $\gamma_{US,s}$ by a measure of financial development relative to the United States. Specifically, we use the ratio of bank credit to GDP from the World Bank database as a proxy for financial development and adjust sectoral bank-credit shares proportionally across countries.
- $\psi_{i,s}$, the leverage parameter governing the borrowing constraint. Because all sectors in the data exhibit positive levels of trade credit, the model implies that the borrowing constraint in Assumption 1 binds in equilibrium. We therefore use the borrowing constraint directly to recover $\psi_{i,s}$. Specifically, imposing the constraint with equality

³¹Compustat lacks comprehensive data on employment and wages. Only 5% of non-financial firms consistently disclose labor earnings (item XLR) in Compustat.

and using the estimated value of β , we compute $\psi_{i,s}$ as the ratio of observed financing needs to $Y_{i,s}^{1+\beta}$.

- $r_{i,s}$, interest rate on bank credit: for the U.S., we measure the average annual interest rate as the ratio of interest expenses to total debt in Compustat. For foreign countries, we take the national policy interest rate and add the sectoral spread computed for the U.S. (relative to the national average).
- $r_{i,s}^T$, interest rate on trade credit: we first rely on an aggregate estimate from [Giannetti et al. \(2011\)](#) that finds an average annualized trade credit interest rate of 28% for U.S. firms. Then we add the sectoral credit spreads for the U.S. computed in [Gilchrist and Zakrajšek \(2012\)](#). For foreign countries, we take the U.S. values and add the spread between the foreign policy interest rate and the U.S. one.
- $\delta_{i,s}$, sectoral credit wedge: we compute it using equation (12).
- $Y_{i,s}^B$, revenues of final goods producers: we use data from UN Comtrade and EORA. We then use these to compute the suppliers' value added and national value added W_i using the labor market clearing condition in the initial equilibrium. We set the profit-retention ratio to 30%, a value broadly consistent with the payout policies of publicly traded U.S. firms during the 1990–2007 period, when dividends and share repurchases accounted for a substantial share of corporate earnings (see [Fama and French \(2001\)](#) and [Brav et al. \(2005\)](#)).

We next discuss how we calibrate the remaining parameters of the model.

- $\epsilon_s = \sigma_s$: we assume that this parameter is the same for both final and intermediate goods, and is constant across sectors. We set it to 6, so the implied elasticity of substitution across goods is 5, the preferred value in [Head and Mayer \(2014\)](#).
- ϕ , the labor supply elasticity: we set it to 3.54, the value estimated for the U.S. by [Adao et al. \(2026\)](#) using the China shock. This value implies an extensive margin elasticity of labor supply similar to the one estimated in [Chetty et al. \(2013\)](#).
- ρ , the elasticity of substitution between labor and inputs: we use the recent estimate of $\rho = 0.5$ from [Atalay \(2017\)](#).
- κ , price index share in non-employment benefit function: we set it to 0.05, as estimated in [Adao et al. \(2026\)](#).

- β , convexity parameter in the borrowing constraint: we set it to 0.1, from column (1) in Table 4.

Lastly, we discuss how we calibrate the additional parameters that are needed to implement the various extensions of the model.

- $\eta_{i,s}$: for the extension with internal liquidity, we compute it as the ratio between cash and equivalents from Compustat and inputs expenditure.
- $\zeta_{i,s}$: for the extension where the interest rate on bank credit is endogenous, we calibrate it as $\zeta_{i,s} = r_{i,s} \frac{Y_{i,s}}{BC_{i,s}}$.
- $\theta_{i,s}$: for the extension where the interest rate on trade credit is endogenous, we calibrate it as $\theta_{i,s} = r_{i,s}^T \frac{Y_{i,s}}{TC_{i,s}}$.
- α : for the extension with frictional unemployment, we set the matching technology parameter α to 0.5, as in [Chugh and Finkelstein Shapiro \(2025\)](#).
- n_p : for the extension with frictional unemployment, we set it to 0.66, equal to the average U.S. labor force participation rate throughout our period of analysis.

Tables A.5 and A.6 present summary statistics for the key parameters and variables used in the calibration.

Table A.5: Parameters

Parameter	Description	Value
β	Convexity borrowing constraint	0.1
ϕ	Labor supply elasticity	3.54
κ	Price share in non-employment benefit	0.5
$\epsilon\text{-}\sigma$	Elasticity of subst. between goods	6
ρ	Elasticity of subst. between labor and inputs	0.5

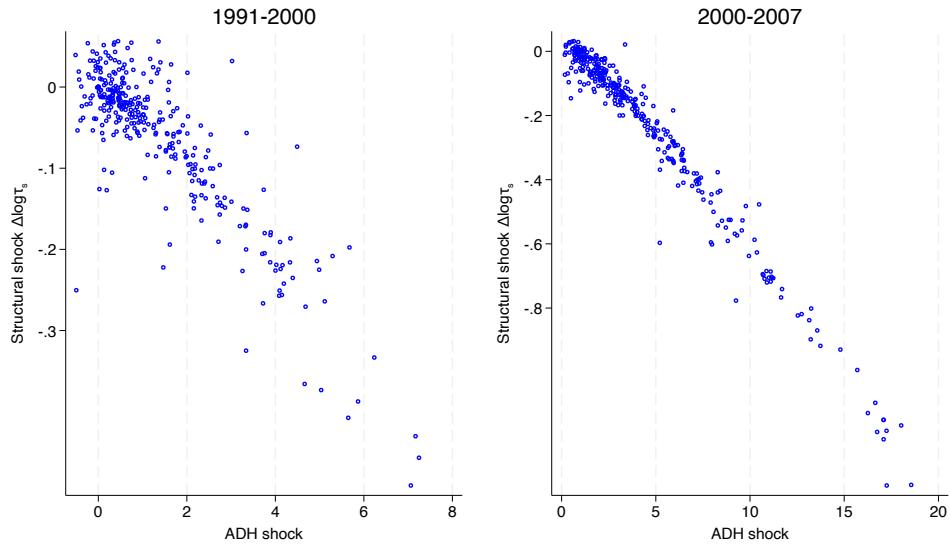
Table A.6: Summary statistics on financial parameters

	1991				2000			
	U.S.		Foreign		U.S.		Foreign	
	Average	Std	Average	Std	Average	Std	Average	Std
Leverage factor: ψ_{is}	0.16	0.07	0.10	0.04	0.15	0.07	0.08	0.04
Int. rate on BC: r_{is}	0.09	0.01	0.11	0.03	0.08	0.02	0.07	0.03
Int. rate on TC: r_{st}^T	0.30	0.01	0.27	0.03	0.31	0.01	0.27	0.01
Bank credit share: γ_{is}	0.58	0.14	0.35	0.09	0.57	0.17	0.31	0.11
Credit wedge: δ_{is}	1.18	0.03	1.20	0.04	1.18	0.04	1.20	0.03

A.5.2 China shock and Model fit

We first report how the structural shock that we back out from the model is correlated with the China shock used in the empirical analysis, i.e. the per-worker change in imports from China in 8 high-income countries.

Figure A.5: The China shock



Note: Relationship between the structural shock $\Delta \log \tau_{\text{China},s}^t$ and the ADH shock ΔIPO_s^t . The structural shock is obtained using equation (27), rescaled and winsorized at 10%. Sample of 392 U.S. 4-digit manufacturing sectors.

With the calibrated model and the structural China shock at hand, we test whether

the predictions of the model are aligned with outcomes observed in the data. To this end, we regress the log-change of different economic variables observed in the data on the corresponding log-change predicted by the model after the China shock:

$$\Delta \log Z_{st}^{data} = \alpha + \rho \Delta \log Z_{st}^{model} + \delta_t + \epsilon_{st}, \quad (\text{A.32})$$

where Z_{st} is an economic outcome.

Table A.7: Fit of the Model across U.S. sectors

	Trade Credit	Employment	Imports from China
	(1)	(2)	(3)
Model Prediction	1.10 (0.35)	0.86 (3.31)	0.44 (0.08)
Observations	304	314	305
R^2	0.27	0.30	0.59
P-value $H_0 : \beta = 1$	0.78	0.97	0

Notes: Regression of log-changes in the data on corresponding log-changes predicted by the model after exposure to the China shock. Sample of 157 manufacturing sectors, stacked using periods 1991-2000 and 2000-2007. Period dummies are included. Robust standard errors in parentheses are clustered by 3-digit sectors. The p-values report tests of the null hypotheses that the slope coefficient is equal to one.

Table A.7 reports the coefficient of such regression for the sectoral log-change in U.S. trade credit, employment, and imports from China. Table A.7 evaluates the ability of the model to reproduce the cross-sectional responses observed in the data. For trade credit, the estimated slope is 1.10 and is statistically indistinguishable from one (p-value = 0.78), indicating that the model accurately captures both the direction and magnitude of the observed responses. For employment, the estimated slope is 0.86 and is also statistically indistinguishable from one (p-value = 0.97), although the estimate is imprecise and the model explains a smaller share of the variation in the data. Finally, for imports from China, the estimated slope is 0.44 and is statistically different from both zero and one. The relatively high R^2 of 0.59 indicates that the model successfully captures a substantial share of the cross-sectional variation in observed import responses. However, the estimated slope below one implies that the model overstates the magnitude of cross-sectional differences across observations. In other words, while the model correctly predicts which sectors experience larger and smaller import adjustments, it generates a wider distribution of responses than observed in the data. Overall, the results suggest that the model performs well in reproducing the qualitative pattern of adjustment across outcomes and provides a particularly good quantitative fit for trade credit and employment, while tending to overpredict the dispersion of import responses.