Trade Credit and Collateral Market Valuation

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Abstract

Using firm-level time-series data from the US, I study the relationship between firms' collateral value and their trade credit linkages. Exploiting local variations in real estate prices as shocks to the collateral value of firms holding real estate, I find that a rise in the collateral market value relative to the capital level of firms increases their share of total costs financed via trade credit. These firms also increase the share of total sales made on a trade credit basis. As a net effect, the rise in the relative valuation of their physical assets makes firms net lenders from a trade credit perspective. This result is consistent with debt-related results showing that short-term borrowings of these firms rise with the relative market value of their collateral, including short-term bank credit. These effects are stronger in firms more likely to be financially constrained. They can be interpreted as evidence of the existence of borrowing constraints associated with firms' collateral value in a trade credit context, highlighting the relevance of collateral value in easing ex-ante financing and mitigating credit market frictions.

Keywords: Collateral liquidation, financial friction, trade credit, and real estate.

JEL Classification: D22 (Firm Behavior: Empirical Analysis), G30 (Corporate Finance and Governance: General), and R30 (Real Estate Markets, Production Analysis, and Firm Location: General).

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1 Introduction

Access to finance is a major concern for firms. Although there is broad heterogeneity in the sources that firms use to cover their financial needs, the most relevant ones are those related to external financing via credit. In the US, trade credit is the largest form of short-term, external finance for firms[1]. Trade credit supports around 90% of inter-firm trade between non-financial firms (Costello, 2019), with these firms holding an aggregate trade credit equivalent to more than 20% of GDP (García-Marín et al., 2020). This phenomenon is not exclusive to the US since trade credit finances around two-thirds of global trade (Bank of International Settlements, 2014). Given the magnitude and relevance of this financing source, it is important to identify its main set of determinants. In this project, I study the role of collateral valuation in trade credit relationships. More precisely, this project empirically uncovers a causal relationship between a firm's collateral value and its share of accounts receivable and payable[2]. By assessing the true role of collateral valuation on trade credit relationships, we can better understand the different implications of economic policies on credit allocation or economic recovery, among others. Although some theoretical literature emphasizes the relevance of collateral valuation in trade credit linkages, empirical evidence using firm-level data is notably scarce.

In the context of contract incompleteness, collateral pledging plays a key role in firms' debt capacity. By allowing lenders to liquidate pledged assets in case of borrowers default, collateral pledging eases ex-ante financing and mitigates some credit market frictions (Stiglitz and Weiss, 1981; Hart and Moore, 1994; Kiyotaki and Moore, 1997). Thus, by pledging the increased value of their collateral, credit-constrained firms can increase the amount of trade credit received. Adopting the methodology proposed in Chaney et al. (2012) to estimate the market value of the real estate held by firms, this project presents evidence showing that trade credit relationships have a relevant collateral component. Using yearly

[1]The definition here adopted of trade credit corresponds to the credit offered by a supplier that allows the customer to delay the payment of a transaction that involves the purchase of intermediate inputs. Through delayed payment, trade credit suppliers effectively fund their clients with short-term debt (Cuñat and García-Appendini, 2012).

[2]While accounts receivable correspond to trade obligations owed by customers to a firm for goods and services already delivered, accounts payable are total outstanding payments owed by this firm to its own suppliers for goods and services already delivered.

balance sheet data from Compustat for a panel of publicly traded, non-financial US firms between 1993 and 2018, I show that real estate represents a significant fraction of the set of tangible assets firms hold. More importantly, I show that when firms experience an increase in the market value of their real estate relative to their capital level, they increase their share of total costs financed via trade credit. I interpret this result as evidence of the existence of borrowing constraints associated with a firm's collateral value in a trade credit context. Moreover, I observe that these firms also increase the share of total sales they make on a trade credit basis. Results on net accounts receivable suggest that when firms experience this rise in the relative valuation of their physical assets, they increase the amount of credit supplied to their customers more than the amount received by their suppliers. In other words, the increase in the collateral value makes firms net lenders from a trade credit perspective. This last result is consistent with another one focused on the liability side of firms' balance sheets. Higher collateral value relative to a firm's capital increases the short-term borrowings of the firm, including short-term bank credit. Again, I interpret this result as evidence of the existence of borrowing constraints associated with a firm's collateral value. The set of key results can be summarized in the following way: firms' higher collateral value increases their share of total sales made on a trade credit basis, with this credit emission being supported by an increase in their share of total costs financed via trade credit and short-term borrowings[3]. Since real estate represents a sizable fraction of the set of tangible assets firms hold, one could expect a non-trivial effect of real estate shocks on the aggregate economy. Regarding long-term items of the liability side of firms' balance sheets, results show that a higher collateral valuation implies a higher level of issuance and repayment of long-term borrowings without significantly affecting the firm's net long-term position. Finally, I present some evidence of the existence of heterogeneous effects. More specifically, I show that the impact of shocks affecting real estate valuation on firms' trade credit relationships seems stronger in a set of firms more likely to be financially constrained.

[3]These results are consistent with the idea that firms charge an interest rate for the trade credit supplied. If this trade credit emission is costly, and the cost is decreasing in firms' own collateral value, given an increase in the market value of firms' collateral, they could act as financial intermediaries by extending credit to their customers. In the Appendix D section of this document, I propose a toy theoretical model that helps to rationalize some of the results obtained in the empirical section.

Different sources of endogeneity could bias my results. First, local real estate prices could be correlated with trade credit opportunities of firms in the location. More precisely, there could be a reverse causality problem since large firms' trade credit actions could affect local economic activity and significantly affect local prices. I adopt an instrumental variables strategy based on Mian and Sufi (2011) to address this issue. I show that the set of results survives this instrumental variable approach. Additionally, I run the set of main regressions using two different sub-samples. First, I restrict the sample to only those firms operating in the tradable goods sector, assuming that these firms are less sensitive to local economic conditions (Mian and Sufi, 2014). Second, I restrict the sample to only small firms located in large cities, assuming that they don't have a sizable impact on their own local conditions (Chaney et al., 2012). Most of the results are unaffected by these sample restrictions. A second endogeneity concern is related to the idea that firms' decision to hold real estate is not random. I address this concern by fixing firms' properties to the value at the start of the sample and relying solely on changes in local prices. But this procedure says nothing regarding firms' initial real estate holdings. A firm's initial acquisition of real estate could, however, reveal information regarding the performance of this firm in the early years of the sample, which could be endogenous as well. Although I do not have a proper set of instruments to deal with this source of endogeneity, I attempt to understand its severity. I show that the results are unaffected by the introduction of gaps of several years between firms' acquisition and the sample's start.

Related literature: This project is related to the collection of theoretical papers studying the role of firms' borrowing constraints in the area of macro-finance models (Townsend, 1979; Stiglitz and Weiss, 1981; Holmstrom and Tirole, 1997), especially those who explicitly take into account the existence of links between asset liquidation values and firms' debt capacity (Shleifer and Vishny, 1992, 2011; Hart and Moore, 1994; Kiyotaki and Moore, 1997; Bernanke et al., 1999; Brunnermeier and Pedersen, 2009; Dávila and Korinek, 2018). This project relates to this literature by presenting evidence of borrowing constraints associated with firms' collateral value in an inter-firm financing context. To quantify some possible aggregate effects associated with this particular microeconomic friction, it is necessary to correctly assess the empirical relevance of this constraint on firms' credit relationships. The presented project is an effort at what could be a potential quantification of these collateral-based constraints. It points toward disciplining a potential macroeconomic model with direct microeconomic evidence.

This study is closely related to the empirical literature analyzing the different consequences of changes in collateral valuation. A growing body of this literature studies how real estate prices affect household consumption or household portfolio choices through the behavior of homeowners (Mian et al., 2013; Chetty et al., 2017; Berger et al., 2018; DeFusco, 2018; Stroebel and Vavra, 2019). On the firms' side of the economy, most of this material is focused on providing evidence on the consequences of collateral valuation in firms' outcomes such as capital structure, investment, or employment level (Gan, 2007; Rampini and Viswanathan, 2010; Benmelech et al., 2011; Chaney et al., 2012; Cvijanovic, 2014; Bahaj et al., 2020). Among many of the contributions of Chaney et al. (2012), they propose a novel strategy to estimate the market value of real estate held by firms. Relying on this strategy, Cvijanovic (2014) examines the impact of real estate valuation on firms' capital structure decisions. This project complements this literature by introducing trade credit relationships as a possible outcome. Moreover, I empirically corroborate ideas and results regarding the causal effect of firms' collateral valuation on debt-related results.

Finally, this project contributes to the literature on trade credit by analyzing the potential role of firms' collateral value in inter-firm credit linkages. Trade finance is widely used in domestic transactions (Petersen and Rajan, 1997; Klapper et al., 2012; Giannetti et al., 2011, 2020; Murfin and Njoroge, 2014; Costello, 2019, 2020) and international transactions (Antrás and Foley, 2015; Hoefele et al., 2016; Demir and Javorcik, 2018; García-Marín et al., 2020). Although there is some theoretical literature emphasizing the relevance of collateral valuation in trade credit linkages (Maksimovic and Frank, 1998; Longhofer and Santos, 2003; Fabbri and Menichini, 2010), and despite the relevance that this literature assigns to collateral-based borrowing constraints, empirical evidence using firm-level data is remarkably scarce[4]. The project's main contribution here is that it provides evidence of a causal

[4]A notable exception is Costello (2019). Using a modification in the US bankruptcy law that improved suppliers' rights on the liquidation value of pledged collateral, this paper shows that this exogenous shock increased the amount and duration of trade credit offered. This paper concludes that trade credit has a collateral component in a framework of strong legal institutions.

link between collateral values and trade credit decisions.

2 Data

Main database: This section describes the data used in this project. Most of the data comes from one database, Compustat North America. This database provides financial, statistical, and market information on more than 24,000 active and inactive publicly held companies from the United States and Canada. In particular, it contains income statements, balance sheets, statements of cash flows, and supplemental data items of these publicly traded firms. Annual history is available since 1950. The baseline sample used to perform the main set of regressions considers more than 2,500 unique firms coming from 53 different industries according to the two-digit Standard Industrial Classification (SIC2), with observations between 1993 and 2018, excluding 2008. The exact sample size of each empirical model here estimated is reported in the corresponding regression table. Regarding the baseline sample, it includes only firms whose headquarters are located in the United States. It excludes firms operating in the industries of finance, insurance, real estate, mining, construction, and those who are unclassified[5], as well as those firms involved in a major takeover operation. Moreover, I require firms to appear in the sample for at least three consecutive years, and I keep only firms that have available data every consecutive year they appear in the sample.

Computing real estate market value: Regarding the computation of the estimated value of the pool of real estate held by each firm, two main issues arise when using Compustat North America as a data source. First, the different categories of physical assets owned by firms are mostly represented in this database by the item of property, plant, and equipment[6]. The main problem is that these items are not marked to market value but to their historical cost. Second, the accumulated level of depreciation of these and other items was last reported in 1993 for most of the firms in the database. The steps followed in computing the

[5] In terms of the SIC2 coding, these sectors correspond to those identified with code numbers between 60 and 67, 10 and 19, and 99, respectively.

[6] In terms of the Compustat North America database, the item of total net property, plant, and equipment corresponds to the variable PPENT or item No. 8 of the Fundamentals, Balance Sheet category.

estimated market value of the set of real estate owned by a firm and finally overcoming both of the problems already described are those proposed in the standard procedure presented in Chaney et al. (2012). In simple words, the first step of this methodology is computing the average purchase year of real estate held by each firm. To achieve this purpose, the procedure uses the fraction of the gross book value of buildings claimed as depreciation[7] and assumes a linear depreciation and a depreciable life of 40 years for these assets[8]. Once the real estate average purchase year is computed, the second step is to inflate its historical value starting from the average purchase year calculated for each firm. This inflation procedure uses a cumulative property price index computed using Consumer Price Index (CPI) information before 1975 and local residential real estate prices after 1975. Data on residential real estate prices are obtained at the state and metropolitan statistical area (MSA)-level. Therefore, I compute two different series of real estate market values, one inflated using residential prices representative at state-level, and another inflated using residential prices representative at MSA-level. Moreover, notice that Compustat reports only the headquarters location of each firm, which is why the methodology adopted uses this particular location as a proxy of the location of the real estate owned by the firm[9]. From the description of the methodology, we can see that it has three important limitations. First, since accumulated depreciation is no longer available after 1993, the methodology restricts the sample to only those firms active in 1993. Second, a key assumption made by this methodology is that most of the real estate owned by a firm is in the same location as its headquarters. Regarding this last issue, Chaney et al. (2012) verify that this is a reasonable assumption showing that headquarters and production facilities tend to be clustered in the same location. Finally, since the property price index used to estimate the market value of the real estate held by each firm reflects the situation in the residential sector and not the commercial sector of the location, they

[7]In terms of the variables included in the Compustat North America database, the fraction of gross book value of buildings claimed as depreciation corresponds to the ratio of the variables DPACB and FATB or items No. 253 and No. 263 of the Fundamentals, Balance Sheet category.

[8]The historical real estate cost comprises the categories of Buildings at Cost, Construction in Progress at Cost, and Land and Improvements at Cost. In the Compustat North America database, they correspond to the variables FATB, FATC and FATP, or items No. 263, No. 266, and No. 260 of the Fundamentals, Balance Sheet category, respectively.

[9]In the project here presented, some missing data regarding firm's headquarter location is complemented using information from 10-K files. These forms are available through the U.S. Securities and Exchange Commission.

do not necessarily represent the true nature of the value of these assets. In other words, using residential prices instead of commercial prices could be a potential noise source in the regressions.

Baseline sample: Table 1 in the Appendix A section of this document presents summary statistics of most of the set of accounting variables included in the different regressions of this project. A very detailed description of the definition of each one of these variables, and the sources where they were obtained, is presented in the Appendix C section. For the median firm of the baseline sample, the market value of its real estate represents more than 20% of the book value of the accounting item of property, plant, and equipment. For the median real estate-holding firm, this figure is over 90%. Both of these results are highly consistent with the ones reported in Chaney et al. (2012). Simply put, these figures show that real estate is a relevant fraction of firms' tangible assets. In a similar exercise, for the median firm of the baseline sample, accounts receivable correspond to almost 14% of total assets, while accounts payable represents more than 17% of total liabilities. Although the baseline sample used in this project is a sample that survived highly restrictive requirements, these figures are consistent with those reported in the literature (Rajan and Zingales, 1995). In comparison, for the median non-financial firm in the Compustat North America database, accounts receivable corresponds to more than 12% of total assets, while accounts payable represent around 17% of total liabilities. It is worth mentioning that since trade credit is more intensively used by small and medium-sized firms that arguably face lower access to banking financing sources, because of the sample bias existing in Compustat, the figures showed previously represent just a lower bound of the trade credit usage in the economy of the United States. Moreover, the sample is further restricted because of the procedure used to estimate the market value of the real estate owned by each firm. Table 2 compares summary statistics of some relevant variables presented in the Compustat North America database. The comparison is made between the sample used in the set of baseline regressions of this project and the whole sample of the Compustat North America database, excluding firms operating in the industries of finance, insurance, real estate, mining, construction, and those who are unclassified, and considering only observations over the period between the years 1993 and 2018, excluding 2008. Notice that both samples seem highly skewed, with a relatively small number of large firms causing each sample's mean to be higher than the corresponding median. From the information presented in Table 2, I conclude that the main sample used in this project comprises smaller and older firms that show less trade credit usage and smaller balance sheets compared to the firms in the full sample. Specifically, they report lower accounts receivable and payable and lower total assets and long-term debt. These characteristics can be linked to the fact that the methodology employed here restricts the sample to only those firms active in 1993.

Some limitations: Finally, two significant shortcomings of the data available in Compustat North America are worth mentioning. First, the information needs to be more granular. It is only available at the firm level and not at the transaction level. In other words, there is no information regarding which transactions of the firm are made under trade credit contracts, the corresponding maturity of the credit, or which of those transactions are collateralized with physical assets. The relevant Compustat's accounts receivable and accounts payable variables consider aggregated numbers of the whole universe of transactions of the firm. Second, there is no information regarding prices and quantities involved in each transaction. Given an exogenous change in the real estate valuation of the firm, there could be a relevant adjustment through a price change of the goods and services involved in those transactions affected by the shock. This margin of adjustment could be relevant to analyze the effects of the shock. However, it cannot be studied with the data available[10].

3 Empirical strategy:

Main regressions: To answer how changes in the valuation of the real estate held by a firm affect its trade credit relationships, I run different specifications of the baseline empirical model presented in equation (1). More specifically, I estimate using ordinary least squares

[10] Some of these limitations can be partially overcome using Thomson Reuters' DealScan database. This dataset contains information on the commercial loan market, including detailed historical information on contract terms. The data covers around 75% of the total commercial loan market in the United States. In particular, it provides information about different types of collateral used against the loan. Moreover, the Compustat North America database can be merged with the DealScan database using the identifier links available in Chava and Roberts (2008).

(OLS)[11][12] the following linear model for firm i, established in location $l(i)$, and operating in industry $s(i)$ at period t:

$$dep_{i,t} \quad = \quad \alpha_i + \eta_{s(i),t} + \beta \times RE^j_{i,t} + \gamma \times P^j_{l(i),t} + (C_{i,t-1})' \, \Theta + \mathcal{X}^j_{i,l(i),t}\zeta + \varepsilon_{i,t} \tag{1}$$

where $dep_{i,t}$ corresponds to the dependent variable studied in the model. At this point, I will consider only two options as dependent variables: the share of accounts receivable in the amount of total sales of the firm and the share of accounts payable in the amount of total costs of production of the firm. In other words, $dep_{i,t} = \{(ar/sales)_{i,t}, (ap/costs)_{i,t}\}$. Notice that the first of these variables represents the share of total sales that have been made on a trade credit basis, while the second of these variables corresponds to share of total costs that have been covered on a trade credit basis by the firm. Moreover, α_i correspond to a firm fixed-effect that represents non-observables of firm i that remain constant across time, and $\eta_{s(i),t}$ correspond to an industry-time fixed-effect that controls for correlated shocks in a given sector s of the economy for a given period t. The matrix $C_{i,t}$ is a set of firm i's observable characteristics in period t. This set of control variables is composed of firm-specific observable characteristics that are usually identified as trade credit determinants in the literature (Klapper et al., 2012; Costello, 2019)[13]. This matrix is defined as:

$$(C_{i,t-1})' \quad = \quad [\ size_{i,t-1} \ \ cash_{i,t-1} \ \ debt_{i,t-1} \ \ inventories_{i,t-1} \ \ old_{i,t}\ ]$$

The baseline empirical model includes the variable $P^j_{l(i),t}$ as a regressor. It denotes the value of local residential real estate prices in location $l(i)$ during period t, with these prices being representative at j level. According to what I explained in the previous section,

[11] There are some reasons why I opt for an OLS estimation of the linear model presented in equation (1), rather than the employment of a different estimator such as Poisson pseudo-maximum likelihood (PPML), of a possible non-linear version of this model. First, the linear version presented here is the empirical model usually estimated in the literature analyzing the effects of real estate valuation on firms' level of investment (Chaney et al., 2012; Cvijanovic, 2014; Bahaj et al., 2020). I want my results to be comparable with those associated with this literature. Second, some of the debt-related variables that I will consider as the dependent variable in the model accept negative values. Therefore, for these specific ratios, a PPPML estimation is impossible.

[12] In terms of the most practical elements of the estimation, I use the Stata command for OLS estimation with multiple high-dimensional fixed-effects presented in Correia (2016).

[13] As I mentioned previously, a detailed description of all these variables, and the sources where they were obtained, is presented in the Appendix C section of this document.

data on residential real estate prices is obtained at the state and MSA level, i.e. $j = \{state, msa\}$. This variable controls for the overall impact of the real estate cycle on the dependent variable, irrespective of whether the firm owns real estate. Following the literature focused on the effects of changes in firms' real estate valuation on investment (Chaney et al., 2012; Cvijanovic, 2014; Bahaj et al., 2020), the empirical model includes the term $\mathcal{X}^j_{i,l(i),t}$. This matrix denotes firm i's initial controls interacted with the evolution of local residential real estate prices. More details about the inclusion of this term are given below. In simple words, I include:

$$\mathcal{X}^j_{i,l(i),t} = P^j_{l(i),t} \cdot (C_{i,1993})'$$

In every regression here estimated, standard errors are clustered at the state-year level when state-level prices are used to construct the primary independent variable and at the MSA-year level when MSA-level prices are used to construct the primary independent variable. Finally, I follow the investment-related literature in using the lagged value of a firm's capital as the scaling variable of the estimated market value of the real estate held by a firm (Fazzari et al., 1988; Kaplan and Zingales, 1997; Almeida et al., 2004; Chaney et al., 2012)[14]. Thus, the variable $RE^j_{i,t}$ represents the ratio of the estimated market value in period t of real estate held by firm i over the lagged value of the cost, less accumulated depreciation, of the tangible fixed property used in the production of revenue[15]. Notice that because of the procedure adopted to estimate the market value of the real estate, the variable $RE^j_{i,t}$ is computed using local real estate prices that are representative at j level. As I explained in the previous section, I had access to two different series of prices, and that is

[14] In the Compustat North America database, this item corresponds to the variable PPENT or item No. 8 of the Fundamentals, Balance Sheet category. This normalization is usually justified by models of investment under collateral constraints. Another possible option is to normalize the estimated market value of real estate using the lagged value of the firm's total assets, as in Cvijanovic (2014) or Bahaj et al. (2020). Most of the results obtained in this project are robust to scaling the estimated market value of the real estate by total assets.

[15] If the variable $PPENT_{i,t-1}$ denotes the lagged value of the item of property, plant, and equipment, and $L_{i,1993}$ is the initial amount of real estate hold by firm i. The value of the variable of interest $RE^j_{i,t}$ for the firm i operating in location $l(i)$ during period t is computed as:

$$RE^j_{i,t} = \frac{L_{i,1993} \times P^j_{l(i),t}}{PPENT_{i,t-1}}$$

the reason why I computed two different versions of the variable $RE^j_{i,t}$: one using residential real estate prices that are representative at state-level, and another one using residential real estate prices that are representative at MSA-level[16]. As Chaney et al. (2012) explains, the idea behind the methodology here adopted is to define $RE^j_{i,1993}$ as the initial market value of real estate held by a firm and study the effects coming from subsequent fluctuations of the market value of this specific set of assets, relative to firm's capital. In other words, following the corporate finance literature, the identification relies on fluctuations in the collateral's price, not quantity owned (Benmelech and Bergman, 2009). By fixing the composition of the real estate owned by a firm and exploiting its intensive rather than extensive margin fluctuations, this procedure helps to alleviate a possible identification concern related to the idea that the choice of real estate holdings is endogenous.

Finally, given the linear structure of the empirical model, the coefficient of interest β measures how a firm's accounts receivable and payable shares respond to each additional increase in the real estate market that the firm owns relative to its capital level. This specification allows the abstraction of local real estate shocks that affect firms with and without real estate on their balance sheet. This strategy is planning to exploit two sources of variation: one comes from variations across firms in the initial value of the real estate that they hold, and the other one comes from the different fluctuations in the local price of these assets. If some firms face borrowing constraints related to collateral valuation, the expectation is that the estimated coefficient β should be positive and significant.

Endogeneity concerns and instrumental variables approach: As I anticipated, two important endogeneity concerns are related to the estimation of the empirical model presented in equation (1). The first potential source of endogeneity is that local real estate prices could be correlated with trade credit opportunities of the firms in the location. More precisely, there could be a reverse causality problem. Large firms' actions could affect local business

[16] There is an important trade-off in using prices that are representative at MSA-level instead of prices that are representative at state-level. While more granular information allows more precise identification of the actual price variation firms face, the assumption that headquarters and production facilities are clustered in the same location strengthens. Moreover, as I explain below in the text, the endogeneity issue that arises from the idea that local prices respond to firms' actions gains more relevance when the identification relies on prices representative at a more detailed level. In the next section, I present results using both different series of prices showing that they are indifferent to the price index used.

activity and may significantly affect local real estate prices that react to an increase in the trade credit received or supplied by this type of firm. To address this issue, a simple possible solution is to restrict the sample only to those firms operating in the tradable sector of the economy. According to Mian and Sufi (2014), the demand of tradable firms is not systematically exposed to local demand shocks since national or even global elements usually determine it. Another possible and simple solution is to restrict the sample to only small firms operating in large locations, as in Chaney et al. (2012) or Bahaj et al. (2020), among others. The idea behind this strategy is that these firms are atomistic regarding local business activity, so they have no sizable impact on local real estate prices through a general equilibrium feedback[17]. A final approach is the one proposed by Mian and Sufi (2011), which is the strategy usually followed by the literature focused on the effects of a firm's real estate valuation (Chaney et al., 2012; Cvijanovic, 2014; Chetty et al., 2017; Bahaj et al., 2020). According to this strategy, the property price index can be instrumented using interactions of local housing supply elasticity and the long-term interest rate[18]. The logic behind this procedure is that if a set of locations experience an aggregate shock on their real estate demand, the effect on the local price of these assets is defined by the slope of the corresponding local supply. Consider initially an increase in the real estate demand motivated by an exogenous reduction in the applicable interest rate. If the local real estate supply is very inelastic, the increase in the demand translates into higher prices of these assets rather than an increase in the construction of the new real estate. The opposite occurs if the elasticity of the local real estate supply has a relatively low value. In this case, the increase in the demand implies an increase in the quantity of real estate rather than an increase in their

[17]As I explain in the next section, applying the tradable classification presented in Mian and Sufi (2014) leads to a subsample composed by very few firms. With the purpose of including more firms in the regressions, I use a more relaxed approach by restricting the sample to firms operating in the whole manufacturing sector. Here, the manufacturing sector serves as a proxy of tradable output, where manufacturing industries are those with SIC2 codes in the range of code numbers 20 and 39. Regarding the second simple solution, I follow Chaney et al. (2012) and define small firms as those in the bottom three quartiles of the firms' size distribution. Similarly, a large MSA is defined as anyone on the top 20 largest MSAs in terms of population size according to the 2000 Census.

[18]It is important to mention that, although this strategy is broadly used in the literature, Mian and Sufi (2014) argues that this set of instruments could be correlated with household and local demand. If so, this set of instruments may not satisfy the exclusion restriction required when using the instrumental variable framework. An alternative approach is the one followed by Cvijanovic (2014), where local real estate prices are instrumented using an interaction between the elasticity of local housing supply and national real estate prices.

local prices (Glaeser et al., 2008). Using the data on the elasticity of local housing supply facilitated by Saiz (2010) as a proxy of the elasticity of local real estate supply, this strategy pretends to exploit variations in local housing supply elasticity across MSAs to construct an instrument of the local price of real estate. Specifically, I estimate using OLS the following specification for location l at period t[19]:

$$P^{msa}_{l,t} = \tau_l + \delta_t + \theta \times r_t + f\left((supply\ elasticity)_l, r_t\right)' \Phi + \upsilon_{l,t} \tag{2}$$

Where τ_l corresponds to a location fixed-effect that represents non-observables of location l that remain constant across time, and δ_t corresponds to a time fixed-effect that controls for correlated fluctuations on real estate prices in a given period t. The variable r_t denotes the interest rate used by the banking sector to refinance loans related to real estate acquisition[20], and the variable $(supply\ elasticity)_l$ denotes local housing supply elasticity in location l. Finally, the function $f(\cdot)$ included in the empirical model (2) denotes the structure through which the interaction between the interest rate and housing supply elasticity is constructed and included in the model. Following Chaney et al. (2012), the first structure that I consider is just a simple interaction between these two variables, i.e. $(supply\ elasticity)_l \times r_t$. Thus, in this case, the matrix of coefficients Φ is reduced to a single coefficient ϕ. As a second option, I interact the interest rate with a set of dummy variables denoting whether the elasticity of the location is in that quartile of the distribution of housing supply elasticity across MSAs. If we exclude the dummy corresponding to the first quartile of the elasticity distribution, the matrix of coefficients Φ can be defined as $[\phi_2\ \phi_3\ \phi_4]'$.

Finally, there is a second endogeneity concern in estimating the empirical model presented in equation (1). This concern is related to firms' decision to hold real estate is not random. For example, if large real estate-holding firms are also more sensitive to local demand shocks, my analysis would be based on a spurious correlation between real estate prices and trade credit relationships. I would overestimate the β coefficient. Initial real

[19]Notice that because data on local housing supply elasticity is only available at MSA-level, the proposed instrument can be constructed only for the series of local residential real estate prices that are representative at MSA-level and not for the series of prices representative at state-level.

[20]As I explain in the Appendix C section of this document, information of this variable is proxied by the series of contract rate on 30-years conventional home mortgage facilitated by the Board of Governors of the Federal Reserve System of the United States.

estate holding could correlate with omitted firm characteristics that govern the firm's sensitivity regarding real estate valuation. To address this issue, I follow Chaney et al. (2012) by introducing in the empirical model the set of firm i's initial controls interacted with the evolution of local residential real estate prices. In other words, I consider as a regressor the already defined variable $\mathcal{X}^{j}_{i,l(i),t}$. The logic behind this procedure is that if this set of observable controls $C_{i,t}$ identify those characteristics that determine a firm's real estate ownership and also make this firm more sensitive to price fluctuations, considering in the regression the interaction of their initial value and contemporaneous real estate prices controls for this extra sensitivity and allows the identification of the collateral channel that I am looking for. Chaney et al. (2012), Cvijanovic (2014), and Bahaj et al. (2020) show that the variables here considered do a relatively good job in predicting firms' status as real estate owners and the value of future real estate acquisitions. However, it is important to remark that this strategy only accounts for observable firm characteristics, and unobserved heterogeneity may vary significantly over time. If that is the case, this procedure could be insufficient in addressing the potential endogeneity discussed here.

4 Results

Main results: Table 3 presents the results of several OLS estimations of different versions of the baseline empirical model presented in equation (1). All of these regressions use the share of accounts receivable as the dependent variable, i.e. $dep_{i,t} = (ar/sales)_{i,t}$[21]. Notice that the first three columns of this table use residential prices that are representative at the state level, while the last three columns use residential prices that are representative at the MSA level. For each one of these two sets of regressions, the table builds up from the simplest specification adding elements into the regression until we reach the baseline results. The simplest estimation is the one presented in column (1). This model considers the presence of the lagged value of the set of control variables ($C_{i,t-1}$) but doesn't consider the

[21]the next set of estimations considers the share of accounts payable as the dependent variable of the model. These results are presented in Table 4 and explained later in this section.

interaction between the initial controls and the evolution of local real estate prices ($\mathcal{X}^j_{i,l(i),t}$) or the lagged value of the dependent variable. In this regression, the result on the estimation of the coefficient β is positive and statistically significant at 1% level, suggesting that firms holding real estate increase their share of trade credit supplied to their customers when they experience an increase in the valuation of their physical assets relative to their capital level. Column (2) introduces the interaction between the initial controls and the evolution of local real estate prices ($\mathcal{X}^j_{i,l(i),t}$). Because of the reasons explained in the previous section, this regression accounts for the observed heterogeneity in firms' real estate-holding decisions. Although the estimated coefficient β reduces in magnitude to a figure around 0.011, it remains positive and statistically significant at the 1% level. The preferred estimation using state-level prices is performed in column (3). It considers the lagged value of the control variables ($C_{i,t-1}$), the interaction between the initial controls, and the evolution of local real estate prices ($\mathcal{X}^j_{i,l(i),t}$), and the lagged value of the dependent variable as regressors. I define this as the baseline result when prices are representative at the state level. Again, the estimated coefficient β reduces in magnitude compared to column (1), but it remains positive and statistically significant at the 1% level. Its value is 0.011, and the causal effect seems to be economically large: a firm experiencing an increase in one standard deviation on its $RE^{state}_{i,t}$ variable increases its share of accounts receivable in around 9% of the standard deviation of this variable. Regarding the set of control variables included as regressors, the estimated coefficients' sign seems to align with what the literature allows to anticipate.

The last three columns of Table 3 replicate those regressions performed in the first three columns of the table but now consider residential prices that are representative at MSA-level instead of state-level. Notice that the low number of MSAs with available information on residential prices implies a significantly low number of observations and unique firms per regression. For example, column (1) uses 26,313 observations from 3,483 unique firms, while its analogous estimation using MSA-level prices employs only 16,115 observations from 1,938 different firms. The preferred estimation using MSA-level prices is performed in column (6). Since this regression is analogous to the one performed in column (3), it considers the lagged value of the control variables ($C_{i,t-1}$), the interaction between the initial controls and the evolution of local real estate prices ($\mathcal{X}^j_{i,l(i),t}$), and the lagged value of the dependent variable as regressors. Despite the difficulties of using prices representative at the MSA level, the relevant sensitivity remains relatively stable, positive, and highly significant. The result of the estimation of the coefficient β is now 0.011, and it is significant at the 1% level. Again, the causal effect is economically large: an increase in one standard deviation of the $RE^{msa}_{i,t}$ variable of a firm increases its share of accounts receivable in around 9% of the standard deviation of this variable. Notice that this main result is indifferent to the price index used in the regression. Therefore, I conclude that firms holding real estate effectively reduce the share of trade credit on total sales that they supply to their customers when they experience an increase in the valuation of these physical assets.

Table 4 repeats the set of regressions performed in Table 3, but using now the share of accounts payable as the dependent variable, i.e. $dep_{i,t} = (ap/costs)_{i,t}$ in the notation of the empirical model presented in equation (1). In each of the columns of this table, the estimated value of the set of corresponding coefficients is highly similar in magnitude and significance to the ones obtained in the previous table. Again, the preferred estimation using state-level prices is performed in column (3). The baseline result on the estimation of the coefficient β when the share of accounts payable is the dependent variable is 0.006, being significant at the 1% level. This result suggests that firms holding real estate increase the amount of trade credit received by their suppliers when they experience an increase in the valuation of their physical assets. Moreover, the causal effect is economically large: a firm experiencing an increase in one standard deviation of its $RE^{state}_{i,t}$ variable increases its share of accounts payable in around 5% of the standard deviation of this variable. When prices are representative at the MSA level, the preferred estimation is in column (6). Notice that the relevant sensitivity remains stable, positive, and significant. The coefficient β estimation is again 0.006, significant at the 5% level. Considering the whole set of results presented in Table 4, I conclude that firms holding real estate effectively increase the share of trade credit on total costs received by their suppliers when they experience an increase in the valuation of the real estate that they own relative to their capital level. Since the estimated coefficient β is positive and statistically significant, I interpret these results as evidence of borrowing constraints related to firms' collateral value in a trade credit context.

Table 5 and Table 6 summarize the set of preferred estimations when using prices representative at the state and MSA level. The first two columns of each table correspond to those cases where the dependent variable is the share of accounts receivable and payable, respectively. The last four columns of these tables are estimations performed with debt-related variables as the dependent variable. These debt-related results are detailed and explained below in the text. Finally, I want to briefly mention that column (3) in each of these tables presents an OLS estimation of the empirical model presented in equation (1), but using the variable of adjusted net accounts receivable as the dependent variable, i.e. $dep_{i,t} = (nar/sales)_{i,t}$. Adjusted net accounts receivable is computed as the difference in levels between total accounts receivable and total accounts payable, scaled by the level of total net sales of the firm. In this regression, the result of the estimation of the coefficient β is positive and statistically significant at the 1% level. As expected, this estimated coefficient is smaller than the one associated with the accounts receivable share in both tables. This result suggests that although firms holding real estate increase their shares of trade credit supplied to their customers and received by their suppliers when they experience an increase in the valuation of their physical assets relative to their capital level, they seem to increase accounts receivable more than accounts payable. In other words, the increase in the collateral valuation makes firms net lenders from the trade credit perspective.

Instrumental variables approach: As I explained in the previous section, there is an identification concern related to the possible reverse causality problem in the main specification. This potential source of endogeneity is related to the idea that large firms' actions could affect local business activity, and they may have a significant effect on local real estate prices that react to an increase in the trade credit received or supplied by this type of firm. Table 8 implements the already discussed instrumental variables (IV) strategy. The property price index is instrumented there using interactions of local housing supply elasticity and the long-term interest rate. But before discussing these second-stage results, let me refer to the ones obtained in first-stage regressions of this IV procedure. These first-stage results are presented in Table 7. Remember that these regressions correspond to different estimations of the model described in equation (2). As I mentioned in the previous section, I consider only two possible specifications, each one related to a possible structure $f(\cdot)$ through which the interaction between the interest rate and housing supply elasticity is constructed and included in the model. While column (1) uses a simple interaction between local housing supply elasticity and long-term interest rate, column (2) replaces the raw elasticity variable with a set of dummies denoting quartiles of the distribution of local housing supply elasticity across MSAs. In the first case, the matrix of coefficients Φ is reduced to a single coefficient ϕ, while in the second case, the matrix of coefficients Φ corresponds to $[\phi_2\ \phi_3\ \phi_4]'$[22]. Remember that the logic behind this procedure is that if a location experiences an exogenous shock on its real estate demand, the effect on the local price of these assets is defined by the slope of the corresponding local supply. Consider initially an increase in the real estate demand motivated by an exogenous reduction in the relevant interest rate. If the local real estate supply is very inelastic, the increase in the demand translates into a higher price of these assets rather than an increase in the construction of the new real estate. Because of this reason is that I anticipate a positive and significant value for the parameter ϕ. Column (1) of Table 7 shows that this coefficient's estimated value is positive and significant at the 1% level. Moreover, column (2) shows that estimated values of coefficients $\{\phi_k\}_{k=\{2,3,4\}}$ are positive and highly significant, confirming that the set of instruments considered is relevant. Notice that the magnitude and significance of these coefficients are higher when higher is the quartile of the elasticity distribution considered. The results in column (2) allow me to affirm that a decline in 100 basis points in the long-term interest rate increases the local residential price index by 3.8 percentage points more in constrained MSAs compared to unconstrained MSAs[23]. Running the corresponding F-tests on excluded instruments proves that the null hypothesis of weak instruments is rejected not only with the p-value information (Cragg and Donald, 1993), but the figures of this statistic are also well above the rule of thumb proposed by Stock and Yogo (2005)[24].

Regarding the second stage of the IV strategy, Table 8 and Table 9 present the main results. Table 8 uses the instrument constructed with the first adopted structure of the $f(\cdot)$ function ($Instrument^{1,msa}_{i,t}$), while Table 9 uses the instrument constructed with the second

[22] Notice that this notation implies that the dummy variable identifying the first quartile of the elasticity distribution is the one excluded in the regression to avoid multicollinearity.

[23] I consider a constrained MSAs as anyone in the top quartile of the elasticity distribution, while unconstrained MSAs are those in the bottom quartile of the elasticity distribution.

[24] In this context, the critical value for a tolerance level of 10% is just above 11. If the tolerance decays to 5%, the threshold value rises to nearly 20.

adopted structure of the $f(\cdot)$ function ($Instrument_{i,t}^{2,msa}$). The first two columns of each table present the preferred estimation using the share of accounts receivable and the share of accounts payable as the dependent variable. Notice that the results for both coefficients are very close to the ones obtained using the OLS estimator. Regarding the share of accounts receivable, its value is 0.012, which is significant at the 1% level for both instruments. Regarding the case where the share of accounts payable is the dependent variable, both estimations are very close to the one obtained using the OLS estimator. In the case of the first instrument, the estimated value is 0.007, which is significant at the 1% level, while the estimated value is 0.006 with a significance of 5% in the case of the second instrument. Therefore, this set of IV results reaffirms the main conclusion obtained from OLS estimations: firms holding real estate effectively increase their shares of trade credit supplied and received when they experience an increase in their real estate valuation. Finally, notice that the result related to firms being net lenders once they experience an increase in the market value of their collateral relative to their capital value survives the IV methodology. In both tables, the column that considers the share of net accounts receivable $(nar/sales)_{i,t}$ as the dependent variable presents an estimated coefficient β that is positive and significant at 1% level.

Different sub-samples: As a complementary exercise, Table 10 and Table 11 present results on two different robustness checks as alternative treatments to the potential endogeneity affecting the main specification. Both of these strategies are complements of the IV approach described above. As I mentioned in the previous section, one simple possible solution to address the potential endogeneity is to restrict the sample only to those firms operating in the tradable sector of the economy and compare a possible differential response of these particular firms. This strategy is based on the idea that the demand of tradable firms is not systematically exposed to local demand shocks since national or even global elements usually determine it. One natural procedure is to apply the tradable classification presented in Mian and Sufi (2014). The main problem of applying this strategy is that it implies a sub-sample composed of very few firms. To include more firms in the regressions, I adopted a more relaxed approach by restricting the sample to firms operating in the manufacturing sector. Therefore, I use this sector as a proxy of tradable output, where manufacturing industries are those with SIC2 codes in the range of code numbers between 20 and 39. Table 10 presents the results of implementing this sample restriction. As before, the preferred estimation when the share of accounts receivable is the dependent variable is the one performed in column (1), while the preferred estimation when the share of accounts payable is the dependent variable is the one performed in column (2). Notice that the results don't show important differences between these estimated coefficients and those defined as baseline results. This is consistent with the idea that local demand effects are not driving my results. Another possible and simple approach to address this endogeneity concern is restricting the sample to only small firms operating in large locations (Chaney et al., 2012; Bahaj et al., 2020). The idea behind this strategy is that these firms are atomistic regarding local business activity, so they have no sizable impact on local real estate prices through general equilibrium feedback. The definition here adopted considers small firms as those in the bottom three quartiles of firms' total assets distribution, while a large MSA is anyone on the top 20 largest MSAs in terms of population size according to the 2000 Census. Table 11 presents the results of implementing this new sample restriction. Again, the preferred estimation when the share of accounts receivable is the dependent variable is the one performed in column (1), while the preferred estimation when the share of accounts payable is the dependent variable is the one performed in column (2). Notice that both estimations of the relevant coefficient remain significant at the 1% level. Although both of these estimated values are significantly larger than those obtained using the whole sample, the main conclusion holds: firms holding real estate effectively reduce the share of trade credit supplied and received when they experience an increase in the valuation of the real estate that they own relative to their capital level. One possible reason why these coefficients are significantly larger than the baseline is related to the fact that this sample restriction implies around 700 firms per regression. Thus, these results are conditional to a particular sample of firms that can report the required information to compute the relevant variables. Moreover, this restriction seems to generate a sample bias by including mostly firms facing credit constraints. As I explain in the next section, trade credit relationships of firms facing this type of constraint are more sensitive to the corresponding real estate valuation.

Table 12 reproduces the set of main regressions using sub-samples from three different periods. The first sub-sample considers the period defined between 1997 and 2007, the second sub-sample corresponds to those years after 2009, and the third sub-sample aggregates both previous periods. Notice that for simplicity, and because the set of main results is indifferent to the price index used, this table only includes results using local prices representative at the state level. The purpose of this exercise is twofold. First, it allows me to study a possible heterogeneity in the relevant sensitivity over time. Regarding the model where the share of accounts receivable is the dependent variable, columns (1) and (2) show that the estimated coefficient is only significant in the pre-crisis period, with a magnitude not statistically different from the baseline result. Regarding the share of accounts payable, results go in the same direction. Column (4) shows an estimated coefficient for the pre-crisis period similar to the baseline result, while column (6) shows that the coefficient obtained for the post-crisis period is not significant at all. The second purpose of this exercise is related to the idea that firms' decision to hold real estate is not random. More specifically, firms' initial real estate holdings could be potentially endogenous. As I described previously, by fixing the composition of real estate owned by a firm and exploiting its intensive rather than extensive margin fluctuations, I prevent any shock that jointly determines firms' real estate demand and firms' trade credit relationships after the initial year in the sample, affects the results. But this procedure says nothing regarding firms' initial real estate holdings. For example, a firm's initial acquisition of real estate could reveal some knowledge regarding the firm's performance in the early years of the sample. That is why the third sub-sample considered in Table 12 leaves a gap of at least four years between a firm's acquisition of real estate and the start of the sample. With this adjustment, the assumption that the firm's initial acquisition of real estate is more related to historical arguments rather than the current firm's situation gets milder. Regarding the model where the share of accounts receivable is the dependent variable, column (3) shows that the estimated coefficient is 0.011 and significant at the 1% level. Regarding the model where the share of accounts payable is the dependent variable, column (7) shows that the estimated coefficient is 0.007 and significant at the 1% level. Again, these results are consistent with those defined as baseline results.

Dynamic effects: Notice that all the effects presented above are contemporaneous. Figure 1 in the Appendix B section of this document explore the dynamic aspect of this response.

This figure presents the results of estimating the β coefficient using the corresponding dependent variable's different lagged and forward values. In other words, I estimate using OLS the empirical model presented in equation (1) using $dep_{i,t+h}$, where $h \in \{-4, \dots, 4\}$. I alter the horizon of the dependent variable to study the dynamic trade credit response to current changes in collateral market valuation. In particular, Figure 1 presents those results obtained when prices are representative at the state level. Notice that the horizon $h = 0$ corresponds to those contemporaneous effects already shown in Table 5. Regarding the results with the share of accounts receivable as the dependent variable, the dynamic response is relatively stable in the current period and the following year before decaying and becoming statistically insignificant. Several mechanisms not studied in this project could explain these results. A possible explanation is that the increase in the accounts receivable is allowed by a relaxation of borrowing constraints associated with other credit sources of the firm. If the ease of some of these constraints occurs with a delay because of the possible time that some lenders require to update their valuations and extend trade credit opportunities, the response of the share of accounts receivable variable would be partially delayed too. Regarding the results obtained when the dependent variable is the share of accounts payable, the response is significant only in the contemporaneous period.

5 Heterogeneous effects

Financially constrained firms: This section presents results regarding some heterogeneity in the sensibility of firms' trade credit relationships to the market valuation of their own real estate. As I argue later, the patterns presented here are consistent with the idea that higher collateral values relax some specific firms' borrowing constraints. The strategy is to run equation estimations (1) using two different samples. One sample is composed only of firms classified as "constrained" according to a well-defined ex-ante measure of financial constraint, while the remaining sample is formed only by firms classified as "unconstrained" according to the same measure. The different financial or credit constraint definitions adopted in this project are primarily based on Almeida et al. (2004). The first definition of ex-ante credit constraint is based on bond rating. Following Faulkender and Petersen (2006), this definition classifies as unconstrained firms those with long-term debt outstanding and bonds rated by Standard and Poor's (S&P) company, while constrained firms are those without S&P bond rating[25]. Table 13 presents the results based on this first constraint definition. The comparison when prices are representative at the MSA level, and the share of accounts receivable is the dependent variable, is between those results presented in column (3) and column (4). Notice that the estimated coefficient of the unconstrained sample is very close to the one obtained in the OLS baseline regression, its value is 0.012, and it is significant at the 1% level. Although the estimated value of the constrained sample is also positive and significant at the 1% level, its magnitude is more than three times as large as the baseline result. Regarding the share of accounts payable, the comparison when prices are representative at the MSA level is between those results presented in column (7) and column (8). Although the estimated value of the unconstrained sample is positive, it is not significant at all. In contrast, the estimated value of the constrained sample is not only positive and significant at the 1% level, as in the share of accounts receivable case, but its absolute magnitude is also several times as large as the baseline result. In other words, the trade credit sensitivity to the market valuation of a firm's real estate seems greater for constrained firms. The second definition classifies constrained firms as those in the bottom three deciles of the dividend payout distribution, while unconstrained firms are those in the top three deciles of the same distribution. Notice that this decile distribution, and the firm's constraint classification, are computed yearly in the sample. The dividend payout variable is calculated as the ratio of the aggregation of total common dividends and repurchase of common and preferred stocks, scaled by the income before extraordinary items variable[26]. Table 15 presents the results of using this sample selection. Notice that the number of observations and unique firms per regression are higher than those used in Table 13, especially in the case of the constrained sample. However, the main set of results remains relatively stable. This project's third and

[25] In terms of the variables included in Compustat North America database, total long-term debt corresponds to the variable DLTT or item No. 9 of the Fundamentals, Balance Sheet category, and the S&P quality rating correspond to the variable SPCSRC or item No. 280.

[26] In terms of the notation used in Compustat North America database, these variables correspond to the ones identified as DVC, PRSTKC, and IB, or items No. 21, No. 115, and No. 18 of the Fundamentals, Income Statement, Cash Flow, and Income Statement categories, respectively.

final definition of ex-ante credit constraint is based on firms' size distribution. According to this definition, constrained firms are those in the bottom three deciles of total assets distribution, while unconstrained firms are those in the top three deciles of the same distribution[27]. Again, this ranking and the firm's constraint classification are computed yearly in the sample. Table 14 presents the results from using a sample classification based on this third definition. In this case, the main set of results remains stable only when using prices representative at the MSA level. The main conclusion of this section is that the effects of shocks affecting real estate valuation on firms' trade credit relationships seem to be relatively more substantial in a set of firms that are more likely to be financially constrained.

6 Capital structure

Some debt-related results: Given the results obtained in previous sections, I now explore a possible channel through which real estate valuation affects trade credit relationships. The main idea is that in the context of a firm's financing under the presence of borrowing constraints, higher collateral value relaxes constraints related to some specific financing sources. Thus, given the existence of some substitutability between these different credit sources, higher collateral valuation affects a firm's financing choice. To answer the question of how changes in the valuation of the real estate held by a firm affect its capital structure, I estimate using OLS the linear model presented in equation (1) but using now a set of debt-related variables as dependent variables[28]. This set of debt-related variables is composed of the following sections of the liability side of firms' balance sheet: total adjusted notes payable $(notes\ pay)_{i,t}$, total adjusted long-term debt issuance $(debt\ iss)_{i,t}$, total adjusted long-term debt repayment $(debt\ rep)_{i,t}$, and total adjusted long-term debt net change $(debt\ cha)_{i,t}$. As

[27] As I explain in Appendix C section of this document, total assets correspond to the variable AT or item No. 6 of Fundamentals, Balance Sheet category of Compustat North America database.

[28] Although the data used for these estimations come from Compustat North America database, it is worth mentioning that the Capital Structure section of Compustat IQ provides extensive information about the debt capital structure of a sample of non-financial firms included in the Compustat North America database. This dataset captures attributes such as secure level, interest rate, or maturity date of different categories of debt, including bank debt, bonds, and mortgage or equipment debt, among others. The coverage of this database started in 2001. Unfortunately, I do not have access to its content. Instead, this project uses the firm-level aggregate categories of debt included in the Compustat North America dataset.

I mentioned previously, a very detailed description of the definition of each one of these variables and the sources where they were obtained is presented in the Appendix C section. Following some literature analyzing the effects of real estate valuation on firms' capital structure as Chaney et al. (2012), these variables have been scaled by the lagged value of the item of property, plant, and equipment of the firm[29][30].

Columns (4) to (7) of Table 5 show the results of estimating the empirical model presented in equation (1) when prices are representative at the state level. Each of these estimations employs one of the four already mentioned debt ratios as the dependent variable. In particular, column (4) presents those results obtained when total adjusted notes payable is the dependent variable. Remember that notes payable correspond to a short-term liability, including categories such as bank acceptances, bank overdrafts, bond assets, and loans payable to stockholders. The estimated coefficient β is positive and highly significant, its estimated value is 0.017, and it is significant at the 1% level. This effect is economically significant: given an increase in one standard deviation in the $RE_{i,t}^{state}$ variable, this short-term borrowing increases by 5% of its standard deviation. Consistent with the set of results obtained in previous sections, this new result suggests that firms increase their short-term borrowings when they experience an increase in the valuation of their own real estate. On the other hand, columns (5) and (6) analyze the effects of real estate valuation on firms' long-term debt inflow and outflow. In particular, column (5) uses total adjusted long-term debt issuance as the dependent variable, while column (6) uses total adjusted long-term debt repayment as the dependent variable. These columns show that both coefficients β estimations are positive and highly significant, with magnitude values relatively close among them. More precisely, the estimated coefficients are 0.038 and 0.044, being significant at the 5% and 1% level, respectively[31]. Therefore, firms' long-term debt issuance and repayment increase

[29] Another possible option is to normalize each of these debt-related variables using the lagged value of total assets of the firm, as in Cvijanovic (2014). On the other hand, Bahaj et al. (2020) scales these variables by the accounting item of overall turnovers.

[30] Following Bahaj et al. (2020), and to prevent any spurious correlation arising from the same denominator in the main independent variable and the dependent variable, I include the inverse of the lagged value of the item of property, plant, and equipment as an additional control. Otherwise, the same denominator in both variables would imply a mechanical correlation between them, concluding in an overestimation of the β coefficient.

[31] Although both of these coefficients seem to be significantly smaller than those reported in Chaney et al. (2012), the main conclusion holds. Moreover, the coefficient related to the long-term debt issuance variable is

when the value of the real estate they hold increases. This result is consistent with the idea that firms use higher collateral valuation to renegotiate former long-term debt contracts by reimbursing former loans and issuing new ones with more favorable terms. The total adjusted long-term debt net change variable captures the difference between these long-term debt inflows and outflows. As a complement to both previous results, column (7) presents the results obtained when long-term debt net change is the dependent variable. Notice that the coefficient β result gives an estimated value that is small in magnitude and not significant at all. In conclusion, the set of debt-related results presented in Table 5 allows me to conclude that firms increase their short-term borrowings given an increase in the market valuation of their real estate relative to their capital level. The firm's debt structure is modified as a response to collateral value fluctuations. Finally, it is possible to observe in Table 6 that these results are corroborated when using prices that are representative at MSA-level. Moreover, as Table 8 and Table 9 demonstrate, they are robust to using the two different instruments constructed through the IV procedure described in previous sections. Finally, most of these results are also robust to restricting the sample only to those firms operating in the tradable sector of the economy and only to small firms operating in large locations. To conclude this section, I want to emphasize the main conclusions obtained here. A higher collateral value relative to a firm's capital seems to increase not only the level of short-term borrowings of the firm, including the item of short-term bank credit but also it seems to imply a higher level of issuance and repayment of long-term borrowings. Moreover, this collateral appreciation doesn't significantly affect the firm's net long-term debt.

7 Conclusion

This project aims to determine if firms' collateral value plays a role in their trade credit relationships. Adopting the methodology proposed in Chaney et al. (2012) to estimate the market value of the real estate held by firms, I present evidence showing that trade credit

very close to the one reported in Bahaj et al. (2020), and both are very close to those reported in Cvijanovic (2014).

relationships have a relevant collateral component. When firms experience an appreciation of their real estate market value over their capital level ratio, they increase their share of total sales made on a trade credit basis. Moreover, these firms also increase their share of total costs financed via trade credit. Results on net accounts receivable suggest that when firms experience this rise in the relative valuation of their physical assets, they increase the amount of trade credit supplied to their customers more than the amount received by their suppliers. In other words, the increase in the collateral value makes firms net lenders from a trade credit perspective. These results are consistent with some capital structure results. These debt-related results show that a higher collateral value relative to a firm's capital increases the level of short-term borrowings of the firm, where the item of short-term bank credit is included. Moreover, this higher collateral valuation also implies a higher level of issuance and repayment of long-term borrowings without significantly affecting the firm's net long-term position. One probable explanation is that firms could use the higher collateral value to renegotiate long-term borrowings, improving their contract terms. To summarize, a higher collateral valuation increases the share of total sales made on a trade credit basis, and this new credit emission is supported by an increase in the share of total costs financed via trade credit and short-term borrowings. While these results are valid for the sample studied, the conditions placed on the sample to obtain all the necessary information restrict the external validity of this project.

Furthermore, I present evidence regarding the existence of heterogeneous effects. The impact of shocks affecting real estate valuation on firms' trade credit relationships is more robust in firms more likely to be financially constrained. Since real estate represents a sizable fraction of firms' tangible assets, one could expect a non-trivial effect of real estate shocks on aggregate trade credit levels. However, the group of credit-constrained firms is probably composed mainly of small firms. This fact lessens the aggregate impact that real estate shocks could have. To understand the macroeconomic implications of this microeconomic friction, it is necessary to develop a theoretical framework to assess its relevance for the aggregate economy correctly.

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Appendix A

Table 1: Descriptive statistics of main variables[a].

Variable	Mean	Median	Std. Dev.	Min	Max	Obs.
Accounts receivable: $ar_{i,t}$	85.07	13.50	140.42	0.00	448.91	31,576
Accounts payable: $ap_{i,t}$	50.31	7.58	83.09	0.00	258.44	32,213
Net accounts receivable: $nar_{i,t}$	25.00	3.99	65.60	-164.31	172.28	31,574
Share of accounts receivable: $(ar/sales)_{i,t}$	0.17	0.15	0.15	0.00	0.82	27,236
Share of accounts payable: $(ap/costs)_{i,t}$	0.17	0.12	0.16	0.00	0.72	27,867
Real estate value using state-level prices: $REval^{state}_{i,t}$	120.27	1.08	209.07	0.00	604.10	32,508
Real estate value using MSA-level prices: $REval^{msa}_{i,t}$	83.10	0.00	143.58	0.00	407.05	19,186
Adjusted real estate value using state-level prices: $RE^{state}_{i,t}$	0.72	0.06	1.19	0.00	4.80	28,134
Adjusted real estate value using MSA-level prices: $RE^{msa}_{i,t}$	0.67	0.00	1.15	0.00	4.37	17,126
Log of net sales: $size_{i,t}$	4.84	4.88	2.68	-6.91	13.12	31,079
Cash flow from operations: $cash_{i,t}$	-0.01	0.09	0.32	-0.99	1.13	31,050
Adjusted total long-term debt: $debt_{i,t}$	0.22	0.13	0.29	0.00	1.94	31,088
Adjusted total inventories: $inventories_{i,t}$	0.18	0.14	0.19	0.00	1.00	30,972
Adjusted notes payable: $(notes\ pay)_{i,t}$	0.19	0.00	0.48	0.00	1.93	28,007
Adjusted long-term debt issuance: $(debt\ iss)_{i,t}$	0.56	0.00	1.19	0.00	4.66	26,908
Adjusted long-term debt repayment: $(debt\ rep)_{i,t}$	0.39	0.08	0.72	0.00	2.85	27,366
Adjusted long-term debt net change: $(debt\ cha)_{i,t}$	0.10	0.00	0.52	-0.65	1.86	26,352

[a] The statistics are computed for all the firms in the sample used in baseline regressions. This sample considers around 2,500 unique firms with observations over the period between the years 1993 and 2018, excluding 2008. It includes firms whose headquarters are located in the United States. It excludes firms operating in finance, insurance, real estate, utilities, and those who are unclassified, as well as firms involved in a significant takeover operation. I require firms to appear for at least three consecutive years, and I keep only firms that have available data every consecutive year they appear in the sample. All variables are winsorized at the median plus/minus five times the interquartile range to prevent outliers from distorting the results. Since the interquartile range of debt-related ratios is close to zero, they are winsorized using the fifth and ninety-fifth percentiles as thresholds. This document presents a detailed description of all these variables in the Appendix C section.

Table 2: Comparison of main variables between two different samples[a].

Variable	Baseline sample			Compustat North America		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Accounts receivable: $ar_{i,t}$	97.73	15.37	161.94	108.03	17.01	179.31
Accounts payable: $ap_{i,t}$	61.86	9.86	102.05	73.53	10.65	122.05
Net accounts receivable: $nar_{i,t}$	26.12	3.96	71.65	20.98	2.57	66.92
Net sales or SALE in Compustat	950.30	163.60	1,556.43	1,011.16	167.53	1,672.51
Total assets or AT in Compustat	859.73	135.82	1,407.18	1,202.29	180.55	1,993.71
Total long-term debt or DLTT in Compustat	190.06	8.78	331.31	289.48	11.76	502.89
Total inventories or INVT in Compustat	94.57	13.51	158.05	85.88	10.84	144.69
Total current debt change or DLCCH in Compustat	0.00	0.00	2.65	0.06	0.00	3.16
Notes payable or NP in Compustat	1.72	0.00	3.06	3.11	0.00	5.49
Total long-term debt issuance or DLTIS in Compustat	35.60	0.22	62.18	62.30	0.50	108.99
Total long-term debt repayment or DLTR in Compustat	35.38	1.76	60.93	52.49	1.86	91.00
Age	10.04	8.00	7.60	8.65	7.00	8.15

[a] The statistics in the section "Baseline sample" are computed considering all the firms in the sample used for the set of baseline regressions. The statistics in the section "Compustat North America" are calculated using all the firms in the original Compustat North America database, excluding firms operating in the industries of finance, insurance, real estate, utilities, and those who are unclassified, and considering only observations over the period between the years 1993 and 2018, excluding 2008. All variables are winsorized at the median plus/minus five times the interquartile range to prevent outliers from distorting the results.

Table 3: Pooled OLS with accounts receivable as the dependent variable (1993-2018)[a].

	Share of accounts receivable $(ar/sales)_{i,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$RE^{state}_{i,t}$	0.012***	0.011***	0.011***			
	(0.002)	(0.002)	(0.002)			
$RE^{msa}_{i,t}$				0.009***	0.011***	0.011***
				(0.002)	(0.002)	(0.002)
$size_{i,t-1}$	0.044***	0.044***	0.047***	0.041***	0.045***	0.045***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
$cash_{i,t-1}$	-0.023***	-0.023***	-0.008	-0.014**	-0.019***	-0.004
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
$debt_{i,t-1}$	-0.011**	-0.009	0.000	-0.014**	-0.006	0.005
	(0.005)	(0.006)	(0.005)	(0.007)	(0.007)	(0.007)
$inventories_{i,t-1}$	0.026**	0.030**	0.036***	0.028**	0.035**	0.042***
	(0.012)	(0.013)	(0.014)	(0.014)	(0.016)	(0.016)
$old_{i,t}$	-0.009	-0.008	0.049	-0.008	-0.004	0.050
	(0.006)	(0.006)	(0.038)	(0.010)	(0.009)	(0.038)
Fixed-effects						
- firm	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	No	No	Yes	No	No	Yes
Init. controls # R.E. prices	No	Yes	Yes	No	Yes	Yes
Observations	26,313	23,302	20,369	16,115	14,483	13,022
Adjusted R^2	0.511	0.515	0.569	0.450	0.481	0.545
Firms	3,483	3,054	2,824	1,938	1,776	1,688

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included in some regressions but not reported.

Table 4: Pooled OLS with accounts payable as the dependent variable (1993-2018)[a].

	Share of accounts payable $(ap/costs)_{i,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$RE^{state}_{i,t}$	0.009***	0.009***	0.006***			
	(0.002)	(0.002)	(0.002)			
$RE^{msa}_{i,t}$				0.008***	0.010***	0.006**
				(0.002)	(0.002)	(0.002)
$size_{i,t-1}$	0.033***	0.033***	0.034***	0.027***	0.030***	0.030***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$cash_{i,t-1}$	0.003	0.008	-0.001	0.010	0.011	-0.001
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
$debt_{i,t-1}$	-0.001	-0.005	-0.002	-0.010	-0.013*	-0.006
	(0.005)	(0.006)	(0.005)	(0.007)	(0.007)	(0.007)
$inventories_{i,t-1}$	0.070***	0.076***	0.071***	0.067***	0.069***	0.063***
	(0.012)	(0.014)	(0.013)	(0.015)	(0.017)	(0.015)
$old_{i,t}$	-0.017***	-0.016***	0.006	-0.025***	-0.019**	0.015
	(0.005)	(0.005)	(0.038)	(0.008)	(0.008)	(0.038)
Fixed-effects						
- firm	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	No	No	Yes	No	No	Yes
Init. controls # R.E. prices	No	Yes	Yes	No	Yes	Yes
Observations	26,351	23,336	20,401	16,127	14,496	13,042
Adjusted R^2	0.538	0.539	0.617	0.491	0.505	0.610
Firms	3,487	3,059	2,824	1,938	1,777	1,688

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included in some regressions but not reported.

Table 5: Pooled OLS using state-level prices (1993-2018)[a].

	$(ar/sales)_{i,t}$	$(ap/costs)_{i,t}$	$(nar/sales)_{i,t}$	$(notes\ pay)_{i,t}$	$(debt\ iss)_{i,t}$	$(debt\ rep)_{i,t}$	$(debt\ cha)_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$RE^{state}_{i,t}$	0.011***	0.006***	0.006***	0.017***	0.038**	0.044***	-0.004
	(0.002)	(0.002)	(0.002)	(0.006)	(0.019)	(0.010)	(0.010)
$size_{i,t-1}$	0.047***	0.034***	0.016***	0.002	-0.011	0.034***	-0.032***
	(0.003)	(0.003)	(0.003)	(0.007)	(0.020)	(0.010)	(0.010)
$cash_{i,t-1}$	-0.008	-0.001	0.024***	-0.085***	-0.023	-0.040	0.024
	(0.006)	(0.006)	(0.006)	(0.020)	(0.054)	(0.030)	(0.026)
$debt_{i,t-1}$	0.000	-0.002	-0.005	0.021	-0.053	0.354***	-0.205***
	(0.005)	(0.005)	(0.006)	(0.022)	(0.064)	(0.036)	(0.038)
$inventories_{i,t-1}$	0.036***	0.071***	0.005	0.256***	0.706***	0.010	0.234***
	(0.014)	(0.013)	(0.015)	(0.052)	(0.141)	(0.071)	(0.074)
$old_{i,t}$	0.049	0.006	-0.061**	0.063	-0.097	-0.118	0.015
	(0.038)	(0.038)	(0.030)	(0.062)	(0.310)	(0.094)	(0.135)
Fixed-effects							
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,369	20,401	20,367	20,401	18,981	19,619	18,468
Adjusted R^2	0.569	0.617	0.623	0.534	0.316	0.427	0.0914
Firms	2,824	2,824	2,824	2,824	2,775	2,790	2,750

[a] Standard errors are reported in parenthesis, clustered at the state-year level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported.

Table 6: Pooled OLS using MSA-level prices (1993-2018)[a].

	$(ar/sales)_{i,t}$	$(ap/costs)_{i,t}$	$(nar/sales)_{i,t}$	$(notes\ pay)_{i,t}$	$(debt\ iss)_{i,t}$	$(debt\ rep)_{i,t}$	$(debt\ cha)_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$RE^{msa}_{i,t}$	0.011***	0.006**	0.008***	0.018**	0.023	0.035**	-0.001
	(0.002)	(0.002)	(0.002)	(0.007)	(0.026)	(0.014)	(0.013)
$size_{i,t-1}$	0.045***	0.030***	0.018***	0.007	0.004	0.031***	-0.021*
	(0.004)	(0.003)	(0.004)	(0.008)	(0.024)	(0.012)	(0.012)
$cash_{i,t-1}$	-0.004	-0.001	0.017**	-0.083***	-0.068	-0.009	-0.011
	(0.007)	(0.007)	(0.007)	(0.026)	(0.066)	(0.036)	(0.032)
$debt_{i,t-1}$	0.005	-0.006	-0.006	0.019	-0.064	0.429***	-0.233***
	(0.007)	(0.007)	(0.008)	(0.023)	(0.082)	(0.047)	(0.042)
$inventories_{i,t-1}$	0.042***	0.063***	-0.007	0.282***	0.734***	0.073	0.161*
	(0.016)	(0.015)	(0.017)	(0.064)	(0.178)	(0.093)	(0.085)
$old_{i,t}$	0.050	0.015	-0.058*	0.047	-0.121	-0.107	-0.023
	(0.038)	(0.038)	(0.030)	(0.064)	(0.301)	(0.091)	(0.128)
Fixed-effects							
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,022	13,042	13,022	13,038	12,177	12,565	11,835
Adjusted R^2	0.545	0.610	0.621	0.522	0.267	0.399	0.0774
Firms	1,688	1,688	1,688	1,681	1,676	1,679	1,667

[a] Standard errors are reported in parenthesis, clustered at the MSA-year level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported.

Table 7: First-stage of the two-stage least square regression (1993-2018)[a].

	MSA residential prices	
	(1)	(2)
r_t	-0.272***	-0.266***
	(0.007)	(0.007)
$(supply\ elasticity)_l \times r_t$	0.017***	
	(0.003)	
$Q_2(supply\ elasticity)_l \times r_t$		0.015*
		(0.008)
$Q_3(supply\ elasticity)_l \times r_t$		0.032***
		(0.007)
$Q_4(supply\ elasticity)_l \times r_t$		0.038***
		(0.006)
Fixed-effects		
- MSA	Yes	Yes
- year	Yes	Yes
Observations	2,136	2,136
Adjusted R^2	0.853	0.854
MSAs	88	88
F-stat on excluded instruments	1,196.03	645.59
P-value of F-stat	0	0

[a] Standard errors are reported in parenthesis, clustered at MSA-level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects are included but not reported. While column (1) uses a simple interaction between local housing supply elasticity and the long-term interest rate, column (2) replaces this variable with a set of dummies denoting quartiles of the distribution of local housing supply elasticity. $Q_k(supply\ elasticity)_l$ denotes a dummy variable that identifies whether the elasticity of location l is in the quartile k of the distribution of housing supply elasticity across MSAs.

Table 8: Pooled OLS using the first instrument (1993-2018)[a].

	$(ar/sales)_{i,t}$	$(ap/costs)_{i,t}$	$(nar/sales)_{i,t}$	$(notes\ pay)_{i,t}$	$(debt\ iss)_{i,t}$	$(debt\ rep)_{i,t}$	$(debt\ cha)_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Instrument^{1,msa}_{i,t}$	0.012***	0.007**	0.009***	0.029***	0.018	0.035**	-0.000
	(0.003)	(0.003)	(0.003)	(0.009)	(0.032)	(0.017)	(0.017)
$size_{i,t-1}$	0.046***	0.032***	0.022***	0.007	0.001	0.033***	-0.019
	(0.004)	(0.003)	(0.004)	(0.009)	(0.028)	(0.012)	(0.013)
$cash_{i,t-1}$	-0.008	-0.003	0.018**	-0.073***	-0.044	-0.008	0.001
	(0.007)	(0.008)	(0.008)	(0.026)	(0.073)	(0.041)	(0.033)
$debt_{i,t-1}$	0.007	-0.004	-0.006	0.018	-0.063	0.388***	-0.213***
	(0.008)	(0.007)	(0.008)	(0.026)	(0.084)	(0.047)	(0.049)
$inventories_{i,t-1}$	0.043**	0.067***	-0.006	0.275***	0.825***	0.092	0.149
	(0.018)	(0.016)	(0.018)	(0.068)	(0.185)	(0.089)	(0.093)
$old_{i,t}$	0.022	-0.012	-0.047*	0.055	-0.243	-0.138	-0.035
	(0.039)	(0.039)	(0.026)	(0.062)	(0.212)	(0.094)	(0.111)
Fixed-effects							
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,039	11,061	11,039	11,054	10,310	10,653	10,022
Adjusted R^2	0.529	0.606	0.619	0.517	0.258	0.389	0.0786
Firms	1,480	1,480	1,480	1,473	1,467	1,477	1,461

[a] Standard errors are reported in parenthesis, clustered at the MSA-year level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported.

Table 9: Pooled OLS using the second instrument (1993-2018)[a].

	$(ar/sales)_{i,t}$	$(ap/costs)_{i,t}$	$(nar/sales)_{i,t}$	$(notes\ pay)_{i,t}$	$(debt\ iss)_{i,t}$	$(debt\ rep)_{i,t}$	$(debt\ cha)_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Instrument^{2,msa}_{i,t}$	0.012***	0.006**	0.009***	0.029***	0.022	0.038**	-0.000
	(0.003)	(0.003)	(0.003)	(0.009)	(0.032)	(0.017)	(0.016)
$size_{i,t-1}$	0.046***	0.032***	0.022***	0.007	-0.002	0.034***	-0.022
	(0.004)	(0.003)	(0.004)	(0.009)	(0.027)	(0.012)	(0.014)
$cash_{i,t-1}$	-0.008	-0.003	0.018**	-0.072***	-0.046	-0.008	-0.000
	(0.008)	(0.007)	(0.008)	(0.027)	(0.072)	(0.039)	(0.035)
$debt_{i,t-1}$	0.007	-0.004	-0.006	0.017	-0.067	0.389***	-0.216***
	(0.008)	(0.007)	(0.009)	(0.024)	(0.089)	(0.051)	(0.046)
$inventories_{i,t-1}$	0.043**	0.064***	-0.006	0.276***	0.814***	0.098	0.139
	(0.018)	(0.017)	(0.019)	(0.068)	(0.193)	(0.099)	(0.091)
$old_{i,t}$	0.023	-0.012	-0.047*	0.048	-0.234	-0.133	-0.040
	(0.039)	(0.039)	(0.026)	(0.061)	(0.209)	(0.091)	(0.107)
Fixed-effects							
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,039	11,061	11,039	11,054	10,310	10,653	10,022
Adjusted R^2	0.529	0.605	0.619	0.517	0.259	0.389	0.0797
Firms	1,480	1,480	1,480	1,473	1,467	1,477	1,461

[a] Standard errors are reported in parenthesis, clustered at the MSA-year level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported.

Table 10: Pooled OLS using the sample of firms operating in the manufacturing sector (1993-2018)[a].

	$(ar/sales)_{i,t}$	$(ap/costs)_{i,t}$	$(nar/sales)_{i,t}$	$(notes\ pay)_{i,t}$	$(debt\ iss)_{i,t}$	$(debt\ rep)_{i,t}$	$(debt\ cha)_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$RE^{state}_{i,t}$	0.010***	0.004*	0.010***	0.017***	0.036*	0.039***	0.002
	(0.002)	(0.002)	(0.002)	(0.006)	(0.021)	(0.012)	(0.012)
$size_{i,t-1}$	0.045***	0.027***	0.028***	-0.003	0.003	0.033***	-0.025**
	(0.004)	(0.003)	(0.004)	(0.009)	(0.022)	(0.011)	(0.011)
$cash_{i,t-1}$	-0.014*	-0.005	0.024***	-0.084***	-0.068	-0.044	0.007
	(0.007)	(0.007)	(0.008)	(0.027)	(0.063)	(0.039)	(0.031)
$debt_{i,t-1}$	-0.001	-0.008	0.001	0.032	-0.068	0.313***	-0.180***
	(0.007)	(0.007)	(0.008)	(0.025)	(0.091)	(0.045)	(0.052)
$inventories_{i,t-1}$	0.030**	0.073***	0.015	0.220***	0.369**	-0.034	0.088
	(0.015)	(0.016)	(0.017)	(0.056)	(0.161)	(0.085)	(0.084)
$old_{i,t}$	0.056	0.016	-0.067**	0.064	-0.136	-0.131	0.008
	(0.039)	(0.038)	(0.030)	(0.063)	(0.304)	(0.095)	(0.134)
Fixed-effects							
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,507	12,527	12,506	12,543	11,679	12,059	11,359
Adjusted R^2	0.517	0.633	0.626	0.595	0.348	0.450	0.196
Firms	1,503	1,503	1,503	1,504	1,481	1,487	1,467

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported. Following Mian and Sufi (2014), the manufacturing sector serves as a proxy of tradable output. Manufacturing industries have SIC2 codes in the range of codes 20 and 39.

Table 11: Pooled OLS using the sample of small firms with headquarters located in large MSA (1993-2018)[a].

	$(ar/sales)_{i,t}$	$(ap/costs)_{i,t}$	$(nar/sales)_{i,t}$	$(notes\ pay)_{i,t}$	$(debt\ iss)_{i,t}$	$(debt\ rep)_{i,t}$	$(debt\ cha)_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$RE_{i,t}^{state}$	0.028***	0.013*	-0.003	0.058***	-0.007	0.043	-0.033
	(0.006)	(0.007)	(0.006)	(0.021)	(0.057)	(0.035)	(0.032)
$size_{i,t-1}$	0.049***	0.031***	0.027***	0.020	0.033	0.046***	-0.009
	(0.006)	(0.005)	(0.005)	(0.014)	(0.043)	(0.016)	(0.020)
$cash_{i,t-1}$	0.003	0.022*	0.010	-0.109***	-0.216**	-0.048	-0.065
	(0.010)	(0.011)	(0.010)	(0.039)	(0.110)	(0.066)	(0.047)
$debt_{i,t-1}$	0.001	-0.022*	-0.002	0.027	0.093	0.436***	-0.146**
	(0.012)	(0.011)	(0.014)	(0.037)	(0.139)	(0.077)	(0.072)
$inventories_{i,t-1}$	0.069**	0.067**	-0.003	0.177*	0.847***	-0.017	0.182
	(0.027)	(0.028)	(0.029)	(0.102)	(0.323)	(0.155)	(0.156)
$old_{i,t}$	0.101	0.046	-0.121**	0.063	-0.398	-0.179	-0.177
	(0.064)	(0.068)	(0.050)	(0.098)	(0.383)	(0.179)	(0.173)
Fixed-effects							
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,205	4,212	4,205	4,219	3,919	4,022	3,787
Adjusted R^2	0.545	0.617	0.674	0.601	0.420	0.506	0.273
Firms	718	718	718	717	695	700	687

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported. Small firms are those in the bottom three quartiles of firms' total assets distribution. A large MSA is defined as anyone on the top 20 largest MSAs in terms of population size, according to the 2000 Census.

Table 12: Pooled OLS using samples from three different sub-periods[a].

	Share of accounts receivable				Share of accounts payable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$RE^{state}_{i,t}$	0.011***	0.001	0.011***	0.011***	0.007**	-0.004	0.007***	0.006***
	(0.002)	(0.006)	(0.002)	(0.002)	(0.003)	(0.006)	(0.002)	(0.002)
$size_{i,t-1}$	0.066***	0.073***	0.050***	0.047***	0.050***	0.026**	0.036***	0.034***
	(0.007)	(0.015)	(0.005)	(0.003)	(0.006)	(0.018)	(0.005)	(0.003)
$cash_{i,t-1}$	-0.010	0.040**	-0.004	-0.008	-0.009	0.022	0.003	-0.001
	(0.005)	(0.014)	(0.003)	(0.006)	(0.004)	(0.011)	(0.003)	(0.006)
$debt_{i,t-1}$	0.011	0.020	0.004	0.000	0.011	-0.023	0.002	-0.002
	(0.007)	(0.018)	(0.007)	(0.005)	(0.008)	(0.015)	(0.007)	(0.005)
$inventories_{i,t-1}$	0.039*	-0.031	0.026	0.036***	0.078***	0.028	0.059***	0.071***
	(0.008)	(0.013)	(0.006)	(0.014)	(0.007)	(0.019)	(0.006)	(0.013)
$old_{i,t}$	0.002	0.002	-0.004	0.049	0.006	0.006	0.003	0.006
	(0.006)	(0.006)	(0.005)	(0.038)	(0.004)	(0.004)	(0.004)	(0.038)
Fixed-effects								
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,667	3,320	16,030	20,369	12,686	3,327	16,056	20,401
Adjusted R^2	0.589	0.667	0.576	0.569	0.633	0.754	0.632	0.617
Firms	2,109	780	2,384	2,824	2,110	781	2,385	2,824
Years	(1997-2007)	(2009-2018)	(1997-2018)	(1993-2018)	(1997-2007)	(2009-2018)	(1997-2018)	(1993-2018)

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported.

Table 13: Pooled OLS with samples of constrained and unconstrained firms, first definition (1993-2018)[a].

	Share of accounts receivable $(ar/sales)_{i,t}$				Share of accounts payable $(ap/costs)_{i,t}$			
	Unconstrained (1)	Constrained (2)	Unconstrained (3)	Constrained (4)	Unconstrained (5)	Constrained (6)	Unconstrained (7)	Constrained (8)
$RE^{state}_{i,t}$	0.010***	0.013**			0.003	0.018***		
	(0.002)	(0.005)			(0.002)	(0.006)		
$RE^{msa}_{i,t}$			0.012***	0.029***			0.003	0.037***
			(0.003)	(0.010)			(0.003)	(0.009)
$size_{i,t-1}$	0.042***	0.102***	0.045***	0.098***	0.026***	0.081***	0.028***	0.093***
	(0.004)	(0.010)	(0.004)	(0.016)	(0.003)	(0.010)	(0.004)	(0.011)
$cash_{i,t-1}$	-0.021**	-0.002	-0.020**	-0.003	-0.003	-0.019	-0.001	-0.019
	(0.009)	(0.013)	(0.010)	(0.018)	(0.009)	(0.014)	(0.010)	(0.020)
$debt_{i,t-1}$	0.007	0.022*	0.013	0.025	-0.000	0.020*	0.003	0.008
	(0.007)	(0.012)	(0.009)	(0.021)	(0.006)	(0.012)	(0.008)	(0.019)
$inventories_{i,t-1}$	0.032	0.030	0.047**	0.038	0.067***	0.082**	0.066***	0.104
	(0.019)	(0.043)	(0.024)	(0.069)	(0.017)	(0.041)	(0.020)	(0.066)
$old_{i,t}$	0.012		0.015		-0.008		0.002	
	(0.026)		(0.026)		(0.026)		(0.028)	
Fixed-effects								
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,909	3,933	8,323	1,320	11,933	3,939	8,337	1,324
Pseudo R^2	0.623	0.611	0.601	0.496	0.650	0.624	0.638	0.620
Firms	1,722	1,171	1,357	405	1,723	1,172	1,359	406

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported. According to the first definition of ex-ante credit constraint, unconstrained firms have outstanding long-term debt and bonds rated by Standard and Poor's company. Constrained firms are those without a bond rating.

Table 14: Pooled OLS with samples of constrained and unconstrained firms, second definition (1993-2018)[a].

	Share of accounts receivable $(ar/sales)_{i,t}$				Share of accounts payable $(ap/costs)_{i,t}$			
	Unconstrained (1)	Constrained (2)	Unconstrained (3)	Constrained (4)	Unconstrained (5)	Constrained (6)	Unconstrained (7)	Constrained (8)
$RE^{state}_{i,t}$	0.014***	0.012***			0.001	0.012***		
	(0.003)	(0.004)			(0.003)	(0.004)		
$RE^{msa}_{i,t}$			0.013***	0.015***			-0.002	0.013***
			(0.004)	(0.005)			(0.005)	(0.005)
$size_{i,t-1}$	0.055***	0.054***	0.061***	0.052***	0.034***	0.041***	0.033***	0.037***
	(0.006)	(0.005)	(0.007)	(0.005)	(0.004)	(0.004)	(0.006)	(0.005)
$cash_{i,t-1}$	0.001	-0.017**	-0.011	-0.006	-0.021	0.001	-0.027	0.000
	(0.014)	(0.008)	(0.017)	(0.009)	(0.017)	(0.008)	(0.020)	(0.009)
$debt_{i,t-1}$	0.016	0.006	0.013	0.019*	-0.007	0.004	-0.008	-0.000
	(0.011)	(0.008)	(0.012)	(0.011)	(0.013)	(0.007)	(0.019)	(0.010)
$inventories_{i,t-1}$	0.038	0.025	0.050	0.047*	0.046*	0.077***	0.064*	0.066***
	(0.028)	(0.021)	(0.034)	(0.025)	(0.028)	(0.018)	(0.035)	(0.023)
$old_{i,t}$	-0.003	0.095	0.007	0.099	-0.033	0.113	-0.022	0.126
	(0.016)	(0.074)	(0.015)	(0.071)	(0.022)	(0.081)	(0.028)	(0.077)
Fixed-effects								
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,405	7,932	4,546	5,204	7,416	7,942	4,551	5,212
Pseudo R^2	0.689	0.477	0.668	0.446	0.700	0.562	0.701	0.562
Firms	1,796	1,823	1,125	1,086	1,794	1,825	1,124	1,086

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported. According to the second definition of ex-ante credit constraint, constrained firms are those in the bottom three deciles of the dividend payout distribution every year. Unconstrained firms are those in the top three deciles of the dividend payout distribution for every year.

Table 15: Pooled OLS with samples of constrained and unconstrained firms, third definition (1993-2018)[a].

	Share of accounts receivable $(ar/sales)_{i,t}$				Share of accounts payable $(ap/costs)_{i,t}$			
	Unconstrained (1)	Constrained (2)	Unconstrained (3)	Constrained (4)	Unconstrained (5)	Constrained (6)	Unconstrained (7)	Constrained (8)
$RE^{state}_{i,t}$	0.009***	0.007			0.004	0.011*		
	(0.003)	(0.005)			(0.003)	(0.006)		
$RE^{msa}_{i,t}$			0.010***	0.016***			0.004	0.009
			(0.003)	(0.006)			(0.005)	(0.007)
$size_{i,t-1}$	0.053***	0.050***	0.061***	0.047***	0.044***	0.040***	0.042***	0.033***
	(0.005)	(0.005)	(0.007)	(0.006)	(0.007)	(0.004)	(0.009)	(0.005)
$cash_{i,t-1}$	-0.007	-0.004	0.004	0.001	-0.057***	0.022***	-0.040*	0.012
	(0.013)	(0.008)	(0.018)	(0.009)	(0.016)	(0.008)	(0.023)	(0.009)
$debt_{i,t-1}$	-0.001	-0.000	0.005	0.003	0.001	-0.017*	-0.011	-0.026**
	(0.008)	(0.009)	(0.011)	(0.012)	(0.007)	(0.010)	(0.011)	(0.012)
$inventories_{i,t-1}$	0.007	0.032	-0.028	0.036	0.075***	0.081***	0.046	0.073***
	(0.023)	(0.023)	(0.026)	(0.025)	(0.022)	(0.020)	(0.031)	(0.026)
$old_{i,t}$	0.063	0.277***	0.060	0.221**	0.022	0.097	0.034	0.088
	(0.066)	(0.091)	(0.066)	(0.090)	(0.071)	(0.095)	(0.079)	(0.099)
Fixed-effects								
- firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- industry ## year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Init. controls # R.E. prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,625	5,161	3,471	3,665	6,642	5,168	3,478	3,674
Pseudo R^2	0.782	0.361	0.782	0.385	0.753	0.557	0.761	0.563
Firms	1,428	1,065	812	686	1,429	1,066	813	686

[a] Standard errors are reported in parenthesis, clustered at the state-year level when state-level prices are used to construct the main independent variable and at the MSA-year level when MSA-level prices are used to construct the main independent variable. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Fixed effects, real estate prices, the lagged value of the dependent variable, and the interaction between initial controls and real estate prices are included but not reported. According to the third definition of ex-ante credit constraint, constrained firms are those in the bottom three deciles of the total assets' distribution for every year. Unconstrained firms are those in the top three deciles of total assets distribution for every year.

Appendix B

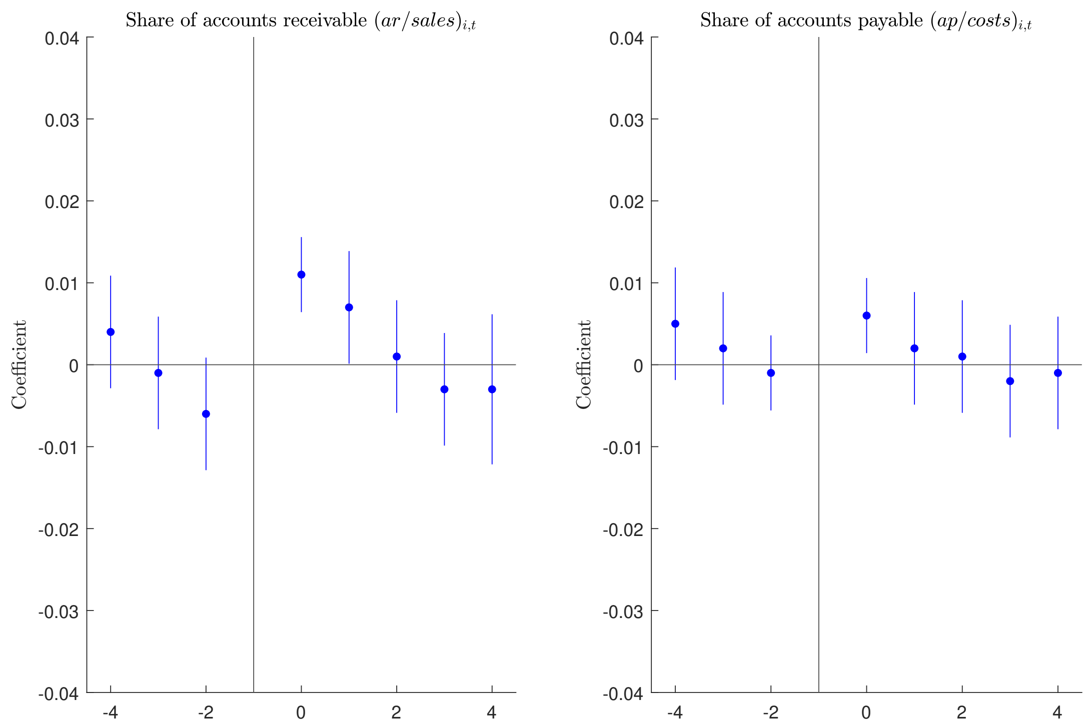

Figure 1: Estimated β coefficient using different lagged and forward values of the dependent variable with prices representative at state-level.

Appendix C

Table 16: Description of variables and sources

Variable	*Definition*	*Source*
Accounts receivable ($ar_{i,t}$)	Accounts receivable of firm i in period t represents the amount of open accounts, net of applicable reserves, owed by customers for goods and services sold in the ordinary course of business. Figures are presented annually and measured in millions of current USD.	Variable "RECTR" or item No. 151 of Compustat, Fundamentals, Balance Sheet category.
Accounts payable ($ap_{i,t}$)	Accounts payable of firm i in period t represents trade obligations due within one year or the normal operating cycle of the company. Figures are presented annually and measured in millions of current USD.	Variable "AP" or item No. 70 of Compustat, Fundamentals, Balance Sheet category.
Net accounts receivable ($nar_{i,t}$)	Net accounts receivable of firm i in period t is computed as the difference between accounts receivable ($ar_{i,t}$) and accounts payable ($ap_{i,t}$) of the same firm. Figures are presented annually and measured in millions of current USD.	Accounts receivable correspond to the variable "RECTR" or item No. 151 of Compustat, Fundamentals, Balance Sheet category. Accounts payable correspond to the variable "AP" or item No. 70 of Compustat, Fundamentals, Balance Sheet category.
Share of accounts receivable ($(ar/sales)_{i,t}$)	The share of accounts receivable of firm i in period t measures the fraction of the firm's total sales that has been made on a trade credit basis. It is computed after scaling the accounts receivable of the firm ($ar_{i,t}$) by its total net sales.	Net sales correspond to the variable "SALE" or item No. 12 of Compustat, Fundamentals, Income Statement category.

continues in next page

Table 16 – continued from previous page

Variable	*Definition*	*Source*
Share of accounts payable $((ar/costs)_{i,t})$	The share of accounts payable of firm i in period t measures the fraction of the firm's total costs that has been covered on a trade credit basis. It is computed after scaling the accounts payable of the firm $(ap_{i,t})$ by the total cost of the goods sold. The total cost of the goods sold represents all costs directly allocated by the firm to production, including raw materials, intermediate inputs, and labor.	Total cost of the goods sold correspond to the variable "COGS" or item No. 12 of Compustat, Fundamentals, Income Statement category.
Share of net accounts receivable $((nar/sales)_{i,t})$	The share of net accounts receivable of firm i in period t correspond to the firm's net accounts receivable $(nar_{i,t})$ scaled by its net total sales.	Net sales correspond to the variable "SALE" or item No. 12 of Compustat, Fundamentals, Income Statement category.
Log of total adjusted assets $(assets_{i,t})$	Log of total adjusted assets of firm i in period t is constructed after applying log to the total assets of the company minus its accounts receivable $(ar_{i,t})$. Figures are presented annually and measured in logs of millions of current USD.	Total assets correspond to the variable "AT" or item No. 6 of Compustat, Fundamentals, Balance Sheet category.

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Table 16 – continued from previous page

Variable	*Definition*	*Source*
Cash flow from operations ($cash_{i,t}$)	Cash fow from operations of firm i in period t is computed following Chaney et al. (2012), and it is calculated after scaling the summation of income before extraordinary items and depreciation and amortization by total adjusted assets. Income before extraordinary items correspond to the income of the company after all expenses, including special items, income taxes, and minority interest, but before provisions for common and/or preferred dividends. Depreciation is concerned with spreading the actual cost or other basic value of tangible capital assets over their estimated useful life, and amortization is the process of cost allocation for intangible assets. Figures are presented annually and measured in millions of current USD.	Income before extraordinary items correspond to the variable "IB" or item No. 18 of Compustat, Fundamentals, Income Statement category. Depreciation and amortization correspond to the variable "DP" or item No. 14 of Compustat, Fundamentals, Income Statement category.
Log of net sales ($size_{i,t}$)	Log of net sales of firm i in period t represents gross sales reduced by cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers. Gross sales correspond to the amount of actual billings to customers for regular sales completed during the period. Figures are presented annually and measured in millions of current USD.	Net sales correspond to the variable "SALE" or item No. 12 of Compustat, Fundamentals, Income Statement category.
Adjusted total long-term debt ($debt_{i,t}$)	The adjusted debt level of firm i in period t is measured following Costello (2019), and it is computed after scaling the total long-term debt of this firm by its total adjusted assets. Total long-term debt represents debt obligations due more than one year from the company's balance sheet date. Figures are presented annually and measured in millions of current USD.	Total long-term debt correspond to the variable "DLTT" or item No. 9 of Compustat, Fundamentals, Balance Sheet category.

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Table 16 – continued from previous page

Variable	*Definition*	*Source*
Adjusted total inventories ($inventories_{i,t}$)	Adjusted total inventories of firm i in period t is computed after scaling total inventories of this firm by its total adjusted assets. Inventories correspond to merchandise bought for resale and materials and supplies purchased for use in production of revenue. It includes finished goods, raw materials, work in progress, among others. Figures are presented annually and measured in millions of current USD.	Total inventories correspond to the variable "INVT" or item No. 3 of Compustat, Fundamentals, Balance Sheet category.
Old firm ($old_{i,t}$)	Dummy variable that takes the value of one if the firm i in period t is old, and zero otherwise. The firm is classified as old, if the age of the firm is higher or equal to the median value observed in the sample. The age the firm is measured as the number of years since the IPO date. The IPO date is the date of a company's initial public stock offering. If the date of a company's initial public stock offering is not available, the first trading date in the major exchange is used.	The IPO date correspond to the variable "IPODATE" of Compustat.

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Table 16 – continued from previous page

Variable	*Definition*	*Source*
Market to book ratio ($market/book_{i,t}$)	The market to book ratio of firm i in period t is computed following Chaney et al. (2012), and it is defined as the market value of assets scaled by its book value. Market value is computed as the summation of total assets and the value of total common shares outstanding, minus the value of total common/ordinary equity and deferred taxes. Total common shares outstanding are computed by multiplying the net number of all common shares outstanding at year-end, excluding treasury shares and scrip, with the close market price at the calendar year-end. Deferred taxes represent the accumulated tax deferrals due to timing differences between the reporting of revenues and expenses for financial reporting and tax purposes. Figures are presented annually and measured in millions of current USD.	The number of common shares outstanding correspond to the variable "CSHO" or item No. 24 of Compustat, Fundamentals, Balance Sheet category. The close market price is the variable "PRCC_C" or item No. 14 of Compustat, Fundamentals, Balance Sheet category. Total common/ordinary equity correspond to the variable "CEQ" or item No. 60 of Compustat, Fundamentals, Balance Sheet category. Deferred taxes correspond to the variable "TXDB" or item No. 74 of Compustat, Fundamentals, Balance Sheet category.
Local housing supply elasticity (($supply\ elasticity)_l$)	The local housing supply elasticity in location l is computed in Saiz (2010), and it is estimated from a nonlinear model based on physical and regulatory constraints, including processing satellite-generated data on elevation and the presence of water bodies, and predetermined population levels in the year 2000. Figures are presented for 95 different MSAs and capture the amount of developable land in each of these MSAs.	Local elasticity of land supply is obtained from Saiz (2010).
Long-term interest rate (r_t)	The long-term interest rate in period t corresponds to the contract rate on 30-years conventional home mortgage. Figures are presented monthly and measured in percent. Annual values are obtained as a simple average of monthly values.	The interest rate correspond to the variable "30-Year Conventional Mortgage Rate" published by the Board of Governors of the Federal Reserve System.

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Table 16 – continued from previous page

Variable	*Definition*	*Source*
Property price index ($P^j_{l,t}$)	The residential property price index of location l in period t is computed using CPI information before the year 1975, and local residential real estate prices after 1975. The index is computed both at state and MSA level, i.e. $j = \{state, msa\}$.	The CPI information is obtained from the U.S. Bureau of Labor Statistics. The residential property price information comes from "The FHFA House Price Index" database available trough the Federal Housing Finance Agency.
Adjusted notes payable ($(notes\ pay)_{i,t}$)	Adjusted notes payable of firm i in period t is computed as total notes payable scaled by the total net value of property, plant and equipment of the firm. Notes payable correspond to the short-term borrowing, and it is a component of the debt in current liabilities. It includes bank acceptances, bank overdrafts, and loans payable to stockholders, among others. Figures are presented annually and measured in millions of current USD.	Notes payable correspond to the variable "NP" or item No. 206 of Compustat, Fundamentals, Balance Sheet category.
Adjusted long-term debt issuance ($(debt\ iss)_{i,t}$)	Adjusted long-term debt issuance of firm i in period t is computed following Chaney et al. (2012), and it is defined as the total long-term debt issuance of the firm scaled by its total net value of property, plant and equipment. Figures are presented annually and measured in millions of current USD.	Long-term debt correspond to the variable "DLTIS" or item No. 111 of Compustat, Fundamentals, Cash Flow category.

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Table 16 – continued from previous page

Variable	*Definition*	*Source*
Adjusted long-term debt repayment $((debt\ rep)_{i,t})$	Adjusted long-term debt repayment of firm i in period t is computed following Chaney et al. (2012), and it is defined as the total long-term debt reduction of the firm scaled by its total net value of property, plant and equipment. This item represents a reduction in long-term debt as a consequence of long-term maturing, payments of long-term debt, and the conversion of debt to stock. Figures are presented annually and measured in millions of current USD.	Long-term debt reduction correspond to the variable "DLTR" or item No. 114 of Compustat, Fundamentals, Cash Flow category.
Adjusted long-term debt net change $(debt\ cha)_{i,t}$	Adjusted long-term debt net change of firm i in period t is computed following Chaney et al. (2012), and it is defined as the difference between total long-term debt issuance and total long-term debt reduction, scaled by the total net value of property, plant and equipment. Figures are presented annually and measured in millions of current USD.	Long-term debt issuance correspond to the variable "DLTIS" or item No. 111 of Compustat, Fundamentals, Cash Flow category. Long-term debt reduction correspond to the variable "DLTR" or item No. 114 of Compustat, Fundamentals, Cash Flow category.
Adjusted current debt change $(cur\ debt\ cha)_{i,t}$	Adjusted current debt change of firm i in period t is computed following Chaney et al. (2012), and it is defined as the net change in short-term borrowings and current maturities of long-term debt, scaled by the total net value of property, plant and equipment. Figures are presented annually and measured in millions of current USD.	Current debt change correspond to the variable "DLCCH" or item No. 301 of Compustat, Fundamentals, Cash Flow category.

Appendix D

Model setup: This section proposes a straightforward toy theoretical model that helps to rationalize some of the results obtained in the empirical section of this document. The economy is closed and composed of a finite number of sectors S, each composed by a continuum of firms with a unit mass and indexed by $\omega \in \Omega^T$. For simplicity, each economic sector is located in a particular country region. Therefore, we have a one-to-one mapping between industries and locations. Firms require intermediate inputs to produce without having any internal funds for their acquisition. Firms decide whether to acquire these inputs using financing from the banking sector or to take some of the trade credit offered by each of the different suppliers in other sectors of the economy. Each option charges its own interest rate. Finally, the inputs offered by these sectors are perfect substitutes for the firm, and the price charged for them is the same across inputs. Therefore, when acquiring intermediate inputs, firms only care about the relative value of the different interest rate options.

The banking sector: There is a continuum of banks with a unit mass and indexed by $\varphi \in \Omega^B$. Regarding the different financing sources of a firm, $BC_j(\varphi)$ will denote the bank credit borrowed by the representative firm of sector $j \in S$ from bank $\varphi \in \Omega^B$. I assume that this firm will repay its debt in full with exogenous probability p_1 at the beginning of the next period, but it will default with the remaining probability $(1 - p_1)$. Moreover, this firm j holds an amount of real estate k_j that depreciates at an exogenous rate δ. Given the procedure employed to compute firms' real estate market value in the empirical section of this document, I assume that affirms cannot acquire new real estate. Therefore, if the current amount of real estate is k_j, the next-period amount of this asset corresponds to $k'_j = (1-\delta)k_j$. For simplicity, I assume that every firm in sector $j \in S$ holds the same level of real estate. Moreover, I assume that this real estate can be pledged as collateral and transferred to the lender in case of default. The current market value of one unit of real estate held by this firm j, located in $l(j)$, is denoted as $q_{l(j)}$. Therefore, the current market value of total real estate held by firm j corresponds to $q_{l(j)}k_j$. I assume that in case of default, the bank receives a fraction $\eta_j^B \in [0, 1]$ of the market value of the collateral. In other words, what a bank receives by firm j in case of default corresponds to $\eta_j^B q'_{l(j)} k'_j$. I assume that banks are risk-neutral, the risk-free interest rate is zero, and loans are competitively priced. Therefore, the interest rate $(1 + r_j^B(\varphi))$ charged by bank $\varphi \in \Omega^B$ solves the following equation:

$$p_1(1 + r_j^B(\varphi))BC_j(\varphi) + (1 - p_1)\eta_j^B q'_{l(j)} k'_j \quad = \quad BC_j(\varphi) \qquad \text{with} \qquad k'_j \quad = \quad (1 - \delta)k_j \quad (3)$$

Moreover, firms face a borrowing constraint on the size of the bank loan they can obtain. As it is usual in the banking literature, I assume that bank credit to firm j is bounded from above by a fraction $\theta_j^B \in [0, 1]$ of the current market value of its real estate. Therefore, we must have the following:

$$BC_j(\varphi) \quad \leq \quad \theta_j^B q_{l(j)} k_j$$

Notice that I can define the tightness of the previous borrowing constraint as $\phi_j^B(\varphi) \in [0, 1]$, where $\phi_j^B(\varphi) = 1$ correspond to the case where the previous equation is satisfied with strict equality and the constraint is binding. Therefore, I can establish the following:

$$\frac{BC_j(\varphi)}{\theta_j^B q_{l(j)} k_j} \quad = \quad \phi_j^B(\varphi) \quad \in \quad [0, 1]$$

Replacing the definitions of the parameters k'_j and ϕ_j^B into equation (3), I conclude that the following expression gives the optimal interest rate charged by banks:

$$(1 + r_j^B(\varphi)) \quad = \quad \frac{1 - (1 - p_1)(1 - \delta)\eta_j^B q'_{l(j)} / (q_{l(j)} \phi_j^B(\varphi) \theta_j^B)}{p_1} \tag{4}$$

I assume that the price of real estate $(q_{l(j)})$ is a random variable that is drawn independently and with identical distribution in each location. More specifically, I assume that the future value of real estate prices ($q'_{l(j)}$) follows a Fréchet distribution as the one presented below, where the parameter $P_{l(j)} > 0$ correspond to a measure of aggregate real estate prices in location $l(j)$.

$$Pr\left(q'_{l(j)} < q\right) \;=\; F^q_j(q) \;=\; \exp\left(-P_{l(j)} q^{-\theta}\right) \quad \text{for} \quad q \;>\; 0$$

Notice that the fact that the real estate price is a random variable implies that the interest rate charged by banks is also a random variable. The distribution of the banking interest rate is defined according to the optimal interest rate charged by banks and presented in equation (4). Considering the parameter $\Phi^B_j = P_{l(j)}\left[(1-p_1)(1-\delta)\eta^B_j\right]^{\theta}\left[q_{l(j)}\phi^B_j(\varphi)\theta^B_j\right]^{-\theta}$, the distribution of the interest rate charged banks is given by:

$$Pr\left(1 + r^B_j(\varphi) < R\right) \;=\; H^B_j(R) \;=\; 1 - \exp\left(-\Phi^B_j(1-p_1R)^{-\theta}\right) \quad \text{for} \quad R \;\in\; (-\infty, 1/p_1)$$

Firm's suppliers: Regarding a firm's other possible financing source, the setup is very similar to the one presented for the banking sector. In this case, $AP_{ji}(\omega)$ will denote the trade credit obtained by the representative firm of sector $j \in S$ from firm $\omega \in \Omega^T$ in the industry $i \in S_{-j}$. Again, the firm repays its debt in full with exogenous probability p_1 at the beginning of the next period, but it defaults with a probability $(1-p_1)$. I assume that the real estate held by this firm can be pledged as collateral and transferred to the lender in case of default. Therefore, in case of default, the industry $i \in S_{-j}$ receives a fraction $\eta^T_{ji} \in [0,1]$ of the market value of the collateral. I assume that suppliers have a substantial comparative advantage. For these firms, the borrower's collateral has an internal value. The supplier can produce using the real estate acquired through the borrower's default. Therefore, when the supplier evaluates the interest rate it would charge, this firm compares the internal and external value of the collateral pledged. I assume that the internal value of the asset is evaluated according to its productivity z_i for a firm in the sector $i \in S$. More specifically, I assume that the future value of this productivity (z_i') follows a Fréchet distribution as the one presented below, where the parameter $T_i > 0$ correspond to a measure of the aggregate real estate productivity in the industry $i \in S$.

$$Pr\left(z_i' < z\right) = F_j^z(z) = \exp\left(-T_i z^{-\theta}\right) \quad \text{for} \quad z > 0$$

Therefore, the actual value of the collateral perceived by the supplier corresponds to $p_{ji} = \max\{q_{l(j)}, z_i\}$. Given the distribution of both random variables involved in the $\max\{\cdot\}$ function, I conclude that the random variable p_{ji}' follows a Fréchet distribution too. Given the parameter $P_{ji} = P_{l(j)} + T_i$, this distribution correspond to:

$$Pr\left(p_{ji}' < p\right) = F_{ji}^p(p) = \exp\left(-P_{ji} p^{-\theta}\right) \quad \text{for} \quad p > 0$$

One important assumption I make is that the banking sector has an important comparative advantage compared with suppliers. In this model, suppliers face a cost when issuing trade credit, while banks can raise funds for free. I assume this cost is decreasing in the current market value of the collateral they own but increasing in the amount of trade credit they supply. Therefore, I define this cost function as $\xi(q_{l(i)}k_i, AP_{ji}(\omega))$, such that $\xi_1(\cdot) < 0$ and $\xi_2(\cdot) > 0$. Moreover, I assume that this function is linear in its second argument since I can prove $AP_{ji}(\omega) \propto \eta_{ji}^T p_{ji}' k_j'$, I conclude $\xi(q_{l(i)}k_i, AP_{ji}(\omega)) = c(q_{l(i)}k_i)\eta_{ji}^T p_{ji}' k_j'$[32]. Considering all the information presented above, the interest rate $(1 + r_{ji}^T(\omega))$ charged by the supplier $\omega \in \Omega^T$ from sector $i \in S_{-j}$ to the representative firm of sector $j \in S$, must solve the following equation:

[32] An assumption that I make at this point is that $0 \leq c(q_{l(i)}k_i) \leq (1 - p_1)$ for every possible value of the argument $q_{l(i)}k_i$.

$$p_1(1 + r^T_{ji}(\omega))AP_{ji}(\omega) + (1 - p_1)\eta^T_{ji}p'_{ji}k'_j - \xi(q_{l(i)}k_i, AP_{ji}(\omega)) \;\; = \;\; AP_{ji}(\omega)$$

where $p'_{ji} = \max\{q'_{l(j)}, z'_i\}$. Given the set of assumptions made on the cost function $\xi(\cdot)$, and considering the new function $\left[1 - \tilde{p}_1(q_{l(i)}k_i)\right] = (1 - p_1) - c(q_{l(i)}k_i)$, the optimal interest rate $(1 + r^T_{ji}(\omega))$ solves:

$$p_1(1 + r^T_{ji}(\omega))AP_{ji}(\omega) + \left[1 - \tilde{p}_1(q_{l(i)}k_i)\right]\eta^T_{ji}p'_{ji}k'_j \;\; = \;\; AP_{ji}(\omega) \tag{5}$$

As in the banking case, firms face a borrowing constraint on the size of the trade credit they can obtain. More specifically, I assume that the level of trade credit coming from firm $\omega \in \Omega^T$ in sector $i \in S_{-j}$ to firm j is bounded from above by a fraction $\theta^T_{ji} \in [0, 1]$ of the current market value of its real estate. Therefore, we must have the following:

$$AP_{ji}(\omega) \;\; \leq \;\; \theta^T_{ji}q_{l(j)}k_j \quad \Rightarrow \quad \frac{AP_{ji}(\omega)}{\theta^T_{ji}q_{l(j)}k_j} \;\; = \;\; \phi^T_{ji}(\omega) \;\; \in \;\; [0, 1]$$

The parameter $\phi^T_{ji}(\omega) \in [0, 1]$ defines the tightness of this borrowing constraint associated with this particular trade credit option. Again, $\phi^T_{ji}(\omega) = 1$ corresponds to the case where the previous equation is satisfied with strict equality and the constraint is binding. Replacing the definitions of the parameters k'_j and ϕ^T_{ji} into equation (5), I conclude that the optimal interest rate charged by supplier $\omega \in \Omega^T$ from sector $i \in S_{-j}$ to the firm j, is given by the expression:

$$(1 + r^T_{ji}(\omega)) \;\; = \;\; \frac{1 - \left[1 - \tilde{p}_1(q_{l(i)}k_i)\right](1 - \delta)\eta^T_{ji}p'_{ji}/(q_{l(j)}\phi^T_{ji}(\omega)\theta^T_{ji})}{p_1}$$

Since the supplier perception of the collateral value is a random variable, the trade credit interest rate is a random variable too. Considering the definition of the parameter $\Phi_{ji}^T = P_{ji}\left[[1-\tilde{p}_1(q_{l(i)}k_i)](1-\delta)\eta_{ji}^T\right]^\theta (q_{l(j)}\phi_{ji}^T(\omega)\theta_{ji}^T)^{-\theta}$, the distribution of this trade credit interest rate is given by:

$$Pr\left(1+r_{ji}^T(\omega) < R\right) \;=\; H_{ji}^T(R) \;=\; 1-\exp\left(-\Phi_{ji}^T(1-p_1R)^{-\theta}\right) \qquad \text{for} \qquad R \in (-\infty, 1/p_1)$$

Optimal source of trade credit: If the representative firm of sector $j \in S$ opts for the trade credit option, it will choose to acquire the intermediate input $\omega \in \Omega^T$ from the industry that can provide it charging the lowest interest rate possible. In other words, the interest rate that this firm pays for the use of the trade credit option corresponds to the following:

$$(1+r_j^T(\omega)) \;=\; \min_{k\in S_{-j}} \left\{1+r_{jk}^T(\omega)\right\}$$

Given the definition of the parameter $\Phi_j^T = \sum_{k\in S_{-j}} \Phi_{jk}^T$, I conclude that the distribution of this lowest interest rate $(1+r_j^T(\omega))$ is given by:

$$Pr\left(1+r_j^T(\omega) < R\right) \;=\; H_j^T(R) \;=\; 1-\exp\left(-\Phi_j^T(1-p_1R)^{-\theta}\right) \qquad \text{for} \qquad R \in (-\infty, 1/p_1)$$

Comparing bank and trade credit: Finally, the firm will compare both categories of credit options and choose the one corresponding to the least-cost credit provider. Given the distributions defined for the interest rates $(1+r_j^B(\varphi))$ and $(1+r_j^T(\omega))$, I conclude that the probability of the banking sector being the least-cost provider corresponds to:

$$Pr\left(1+r_j^B(\varphi) < 1+r_j^T(\omega)\right) \;=\; \int_{-\infty}^{1/p_1} \left[1-H_j^T(R)\right] dH_j^B(R)$$

Since $dH_j^B(R) = \left[1-H_j^B(R)\right]\Phi_j^B\theta(1-p_1R)^{-(\theta+1)}p_1dR$, it is possible to solve the last equation and finally conclude:

$$Pr\left(1+r_j^B(\varphi) < 1+r_j^T(\omega)\right) \;=\; \frac{\Phi_j^B}{\Phi_j^B+\Phi_j^T}$$

Because of the continuum of firms and banks in this economy and the law of large numbers, this probability will equal the fraction of credit the banking sector provides to the representative firm of sector $j \in S$. If the notation for this fraction is π_j^B, and considering the definition of the parameter $\Phi_j^T = \sum_{k\in S_{-j}} \Phi_{jk}^T$, I conclude:

$$\pi_j^B \;=\; \frac{\Phi_j^B}{\Phi_j^B + \sum_{k\in S_{-j}} \Phi_{jk}^T}$$

Repeating the analysis, we can establish that the probability of the trade credit option being the least cost provider corresponds to the equation below for π_j^T. Again, this is the fraction of total financing required by the representative firm of sector $j \in S$ that corresponds to trade credit. Moreover, the probability that the particular industry $i \in S_{-j}$ is the least-cost provider corresponds to the definition of the variable π_{ji}^T. Then, we have:

$$\pi_{ji}^T \;=\; \frac{\Phi_{ji}^T}{\Phi_j^B + \sum_{k\in S_{-j}} \Phi_{jk}^T} \quad \text{for} \quad i \in S_{-j}, \qquad \text{and} \qquad \pi_j^T \;=\; \sum_{k\in S_{-j}} \pi_{jk}^T \;=\; \frac{\sum_{k\in S_{-j}} \Phi_{jk}^T}{\Phi_j^B + \sum_{k\in S_{-j}} \Phi_{jk}^T}$$

Total financing requirement: I assume that the total financing requirement of the representative firm in sector $j \in S$ corresponds to the amount F_j. Since firms do not have internal funds, the financing restriction of this firm corresponds to the following:

$$F_j \; = \; \int_0^1 BC_j(\varphi)d\varphi + \sum_{i\in S_{-j}} \int_0^1 AP_{ji}(\omega)d\omega \; = \; \left[\int_0^1 \frac{BC_j(\varphi)}{q_{l(j)}k_j}d\varphi + \sum_{i\in S_{-j}} \int_0^1 \frac{AP_{ji}(\omega)}{q_{l(j)}k_j}d\omega\right] q_{l(j)}k_j$$

Notice that an implicit assumption is that firms in sector $j \in S$ hold a strictly positive amount of real estate, i.e. $k_j > 0$. Because there is a borrowing constraint associated with the size of bank and trade credit that firms can obtain, and these constraints are defined according to the set of parameters $\left\{\theta_j^B, \{\theta_{ji}^T\}_{i\in S_{-j}}\right\}$, from the previous equation I conclude that the following inequality must be satisfied:

$$F_j \; \leq \; \left[\theta_j^B + \sum_{i\in S_{-j}} \theta_{ji}^T\right] q_{l(j)}k_j \; = \; \Theta_j q_{l(j)}k_j$$

This last equation corresponds to an aggregate borrowing constraint for the representative firm of sector $j \in S$. Finally, I define the parameter $\Psi_j \in [0,1]$ as the tightness of this last constraint, where $\Psi_j = 1$ corresponds to the case where the inequality is satisfied with strict equality and the constraint is binding. Therefore, we must have the following:

$$\Psi_j \; = \; \frac{F_j}{\Theta_j q_{l(j)}k_j} \; \leq \; 1 \qquad \Rightarrow \qquad F_j \; = \; \Psi_j \Theta_j q_{l(j)}k_j$$

Considering all the definitions made above, it is possible to conclude that the following set of equations defines each of the different credit flows in this economy:

$$AP_{ji} = \pi_{ji}^T \Psi_j \Theta_j q_{l(j)} k_j \qquad AP_j = \sum_{k \in S_{-j}} AP_{jk} = \pi_j^T \Psi_j \Theta_j q_{l(j)} k_j \qquad BC_j = \pi_j^B \Psi_j \Theta_j q_{l(j)} k_j$$

Main conclusions: The main conclusions of this model are obtained under the assumption that the representative firm of sector $j \in S$ is totally constrained. Therefore, I impose $\phi_{jk}^T(\omega) = \phi_j^B(\varphi) = \Psi_j = 1 \ \forall \ (\omega, k) \in \Omega^T \times S_{-j}$ and $\varphi \in \Omega^B$ in the model. Moreover, I consider that the set of parameters related to the different borrowing constraints, and those associated with what lenders obtain in case of borrower's default, are equal for each industry of the economy and the banking sector. In other words, I assume $\theta_{jk}^T = \theta_j^B$ and $\eta_{jk}^T = \eta_j^B$ $\forall \ k \in S$. Under this set of assumptions, each of the different probabilities can be defined as:

$$\pi_{ji}^T = \frac{\zeta_i^j (\tilde{c}_i)^\theta}{\sum\limits_{k \in S_{-j}} \zeta_k^j (\tilde{c}_k)^\theta + 1}, \qquad \pi_j^T = \frac{\sum\limits_{k \in S_{-j}} \zeta_k^j (\tilde{c}_k)^\theta}{\sum\limits_{k \in S_{-j}} \zeta_k^j (\tilde{c}_k)^\theta + 1} \qquad \text{and} \qquad \pi_j^B = \frac{1}{\sum\limits_{k \in S_{-j}} \zeta_k^j (\tilde{c}_k)^\theta + 1}$$

where the new variables correspond to:

$$\zeta_k^j = 1 + \frac{T_k}{P_{l(j)}} \qquad \text{and} \qquad \tilde{c}_k = 1 - \frac{c(q_{l(k)} k_k)}{(1 - p_1)}$$

The variable ζ_k^j measures how relevant is the comparative advantage of a particular set of suppliers in terms of the possible internal value that the pledged collateral could have. Notice that if the real estate is highly productive in sector $k \in S_{-j}$, higher is the value of the parameter T_k, and higher is this measure of the comparative advantage of industry $k \in S_{-j}$ relative to other industries and the banking sector of the economy (ζ_k^j). This would comprise a more significant fraction of credit coming from this particular sector, i.e. a higher value of the variable π_{jk}^T. In a similar way, the variable $\tilde{c}_k$ measures how easy it is for the suppliers from industry $k \in S_{-j}$ to collect funds and provide trade credit. Remember that the cost function $c(\cdot)$ is decreasing in its argument. Therefore, a higher market value of the real estate held by firms in sector $k \in S_{-j}$, i.e. a higher value of $q_{l(k)}k_k$, implies lower costs of raising funds, and higher value of this variable $\tilde{c}_k$. Again, this would comprise a more significant fraction of credit coming from sector $k \in S_{-j}$, i.e. a higher value of the fraction π^T_{jk}. Considering these new definitions, each of the different credit flows in this constrained economy is defined by the following set of equations:

$$AP_{ji} = \pi^T_{ji}\Theta_j q_{l(j)}k_j \qquad AP_j = \sum_{k\in S_{-j}} AP_{jk} = \pi^T_j \Theta_j q_{l(j)}k_j \qquad BC_j = \pi^B_j \Theta_j q_{l(j)}k_j$$

Moreover, we can define the accounts receivable of the representative firm in sector $i \in S$. This variable AR_i corresponds to:

$$AR_i = \sum_{k\in S_{-i}} AP_{ki} = \sum_{k\in S_{-i}} \pi^T_{ki}\Theta_k q_{l(k)}k_k = \sum_{k\in S_{-i}} \left(\frac{\zeta^k_i (\tilde{c}_i)^\theta}{\sum\limits_{j\in S_{-k}} \zeta^k_j (\tilde{c}_j)^\theta + 1} \right) \Theta_k q_{l(k)}k_k$$

Therefore, the set of main conclusions related to this document's empirical section are those defined by the equations presented below. The first main conclusion is contained in equation (6). This equation states that accounts receivable of the representative firm of sector $i \in S$ are an increasing function of the market value of the collateral held by this firm $(q_{l(i)}k_i)$.

$$\frac{\partial AR_i}{\partial q_{l(i)}k_i} = \sum_{k\in S_{-i}} \frac{\partial \pi^T_{ki}}{\partial q_{l(i)}k_i} \Theta_k q_{l(k)}k_k > 0 \tag{6}$$

This result is explained by the following relationships:

$$\frac{\partial \tilde{c}_i}{\partial q_{l(i)} k_i} \;>\; 0 \quad \text{and} \quad \frac{\partial c(q_{l(i)} k_i)}{\partial q_{l(i)} k_i} \;<\; 0$$

Intuitively, this firm's higher real estate market value implies a lower cost of raising funds and providing trade credit. Therefore, the fraction of credit coming from this sector to all the other different sectors $k \in S_{-i}$ increases, i.e. the variable π^T_{ki} increases $\forall\ k \in S_{-i}$. The final effect is that the accounts receivable of this representative firm are higher. Similarly, equation (7) states that accounts payable of the representative firm in sector $j \in S$ are an increasing function of its real estate market value $(q_{l(j)} k_j)$.

$$\frac{\partial AP_j}{\partial q_{l(j)} k_j} \;=\; \pi^T_j \Theta_j \;>\; 0 \tag{7}$$

Given the exogenous increase in the market value of the real estate that this firm holds, its aggregate borrowing constraint relaxes, and the amount of total financing that this firm can acquire increases. The fraction of this total extra-financing corresponding to the trade credit option is given by the variable π^T_j. Finally, equation (8) concludes that the level of bank credit that this firm will acquire is an increasing function of its real estate market value $(q_{l(k)} k_j)$. The explanation is identical to the trade credit case, but now the fraction of extra-financing that will correspond to the bank credit option is given by the fraction π^B_j.

$$\frac{\partial BC_j}{\partial q_{l(j)} k_j} \;=\; \pi^B_j \Theta_j \;>\; 0 \tag{8}$$