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The mission of the EIB's Economics Department is to provide economic analyses and studies to support the Bank in its operations and in its positioning, strategy and policy. The Department, a team of 30 staff, is headed by Debora Revoltella, Director of Economics.

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Abstract

We study the relationship between net trade credit and firms' investment levels, focusing on financially distressed firms. First, we introduce a theoretical model to predict the role played by net trade credit as a coordination device differentiating firms by their degree of financial distress. Then, we test these predictions by using a large panel of more than 10 million firms in 23 EU countries over the period 2004–2014. Our main result is that, whereby net trade credit has an overall negative impact on capital formation due to liquidity effects, the effect is less pronounced for firms that are in financial difficulties. The main explanation is that through capital expenditures distressed companies try to maintain vital business relations with their customers in order to participate in the final profits via trade credit repayments.

JEL classification: E22, G20, G30,

Keywords: trade credit, investment, financial constraints, distressed firms

Introduction

Trade credit is an important financial instrument for European enterprises. Its role is twofold depending on its characteristics as an asset or a liability. For debtors, trade credit provides an alternative source of financing for trading partners and it allows the possibility to use an asset as input before it has been paid. For creditors, trade credit serves as a guarantee against the quality of goods exchanged, and it offers a price discrimination mechanism between customers (Dass, Kale, & Nanda, 2015).

Most trade credit theories relate the use of trade credit to the presence of information asymmetries and the monitoring advantages that suppliers have over banks. They mainly consider the liability side, that is, the role played by accounts payable. However, a growing strand of the literature has been focusing on the importance of trade credit as a liquidity management tool looking at the asset side of the balance sheet accounts, that is, mainly to accounts receivable (see Ferrando & Mulier (2013) for a review of the literature).

This paper contributes to the literature by considering the two dimensions together by focusing on net trade credit, i.e. the difference between accounts receivables and accounts payables, and its link with investment.

Despite the wide body of literature on the topic, the evidence of the impact of net trade credit on investment is inconclusive. Coricelli & Frigerio (2016) argue that net trade credit is liquidity-absorbing and therefore has a negative impact on investment. By using a large sample of European companies in the period 2004-2013, the authors suggest that during the financial crisis firms were affected by a strong increase in net trade credit, which drained liquid resources that could have been otherwise invested or used to support current production. Furthermore, such a liquidity squeeze was particularly strong for small and medium-sized enterprises (SMEs).

On the other hand, Dass, Kale, & Nanda (2015) provide theoretical and empirical evidence that the provision of trade credit to business partners can serve as a commitment device for making relationship-specific investments. In an environment with incomplete contracts and bargaining power, they argue that trade credit naturally emerges as a quality guarantee mechanism when the downstream company is uncertain about the quality of acquired goods. This quality can be enhanced by extra investment efforts of the upstream company. Their empirical investigation confirms the theoretical predictions by signalling that trade credit, in the form of accounts receivable, is positively related to relationship-specific investments. The reverse effects, that is the impact of trade credit on investment, are largely left unadressed.

In our framework a company has a portion of outstanding trade credit on the books before the investment decision takes place, highlighting the roll-over nature of trade credit. Contrary to the timing suggested by Dass, Kale, & Nanda (2015), we consider that a company first makes the relationship-specific investment to be further supported by trade credit in case of incomplete contracts or uncertainty behind the upstream production quality. The role of trade credit in boths setups is investment-supportive under increased uncertainty, but whereas Dass, Kale, & Nanda (2015) suggest an ex-ante commitment channel of trade credit, in our setup it is more of an ex-post coordination device. We argue that if a company is in distress it may keep on investing to support the vital business lines, which are exemplified by outstanding trade credit.

Our paper aims to contribute to the discussion on the relationship between trade credit and firms' investment levels in two main directions. First, we capitalize on the theoretical framework proposed by Dass, Kale, & Nanda (2015) and we introduce a model to set down the predictions on the impact of trade credit on investment in distressed and non-distressed firms. Second, we test those predictions by using a large panel of non-financial corporations in 23 EU countries. Our sample comprises more than 10 million companies over the period 2004–2014.

Our main results is that, whereby net trade credit has an overall negative impact on capital formation due to liquidity effects, the negative effect is less pronounced for distressed firms (marginally profitable and financially constrained firms). We argue that, through capital expenditures, distressed companies try to maintain vital business relations with their customers in order to participate in the final profits via trade credit repayments. We also confirm that financial distress overall is investment-negative.

The remainder of the paper is organised as follows. In Section 2 we briefly review the related literature. Section 3 lays out a model to explain the trade credit support device. Section 4 describes the data and the definitions used to classify firms in financial distress. In Section 5 we present the main empirical methodology and the estimated results. Section 6 presents some additional analysis using several robustness checks. Section 7 concludes.

1. Literature overview

The paper draws upon the rapidly evolving literature on trade credit, and its potential role as a financing and liquidity management tool. In particular, we contribute both to the theoretical and empirical strands, and offer a potentially new link between trade credit and investments in financially distressed firms.

Original theories on trade credit focus on the role it plays among financially constrained buyers which, due to insufficient funds at hand, cannot afford to immediately pay for

production inputs. Therefore, such firms open a credit line with their suppliers, which allows them to postpone the payments. Such trade financing offers clear efficiency gains in environments with information asymmetry between customer and supplier (Smith, 1987), adverse selection due inability to differentiate between customer credit risk (Brennan, Maksimovic, & Zechner, 1988), or lack of direct relationships between corporates and banks (Biais & Gollier (1997), Petersen & Rajan (1994)). Although the above-mentioned theories picture trade credit as a remedy for potential market failures, they refer to it as a costly alternative to other sources of finance, in particular, to bank loans. By contrast, the more recent empirical evidence, relaying on richer and more granular databases, points out that trade credit should not be perceived as inferior to bank finance. For instance, Marotta (2005) finds no evidence that trade credit financing is more expensive than standard loans for a sample of Italian firms. In a more recent study, Ellingsen , Jacobson , & von Schedvin (2016) study more than 50 million trade credit contracts provided by the Swedish credit bureau and find that trade credit is very often the preferred source of finance when compared to bank instruments.

Our theoretical framework largely corresponds to the body of literature where trade credit is a way of doing business, rather than a purely financing instrument. Long, Malitz, & Ravid (1993) argue that trade credit can be used as a warranty device, confirming the quality of delivered goods. Antràs & Foley (2015) provide evidence that the choice of trade credit terms is influenced by a possibility that upstream company could not deliver goods as specified in the contract. In fact, we use this line of reasoning as a starting point in our stylized setup.

Having pointed this out, the role that trade credit plays for asset management has been largely left unexplored until recently. On one hand, Coricelli & Frigerio (2016) suggest that the provision of trade credit can be liquidity absorbing and therefore it can drain funds from productive investments. Using a sample of European companies the authors confirm that net trade credit - the difference between accounts receivable and accounts payable-, is investment negative. On the other hand, Dass, Kale, & Nanda (2015) argue that trade credit commits the upstream company to make relationship-specific investments. These effects should be less significant in case of lower uncertainty behind the upstream company. In this sense, our results are largely complementary to the ones of Dass, Kale, & Nanda (2015), as one can argue that financial distress is accompanied by elevated uncertainty.

Going forward, Belghitar, Mateus, & Moro (2016) focus on a large set of small and medium-sized enterprises in Europe between 2003 and 2013. They find that the use of trade credit is country-specific, and depends on a number of cultural and institutional characteristics. In our empirical assessment we control for such influences by saturating the regressions with a number of unobserved fixed effects at the country, sector and year levels and corresponding interactions.

2. Theoretical justification

To explain the mechanism at work, we develop a modified version of the model proposed by Dass, Kale, & Nanda (2015). For expositional reasons, let us consider a simple two period setup ($t = 1,2$) with two companies A and B. The former is a downstream (customer) and the latter is an upstream firm (supplier), so that A has a direct interest in non-differentiated intermediate goods produced by B. The intermediate goods are transacted in exchange for a trade credit contract, which is standardized to be free of charge and in settled in the first period.

Company B has its overall investment portfolio consisting of two types of investment books. The first kind are the investments corresponding to the general business expenditures, and are denoted by $I_{BE} \geq 0$. The second type are the relationship investments, which sustain the trade credit relations, and are denoted by $I_{TC} \geq 0$. It follows that the aggregate investment level of company B is given by $I = I_{BE} + I_{TC}$. Both investment types are financed with some sort of external finance $F_E \geq 0$ and it is possible that the company makes use of trade credit arrangements. The relation between accounts receivable and accounts payable, i.e. net trade credit, is captured by variable G_{TC}. For simplicity we take that $I_{BE} + I_{TC} = F_E - G_{TC} + K$, where K is the level of own funds or equity. To streamline the discussion, in the model we further assume that company B can only control the trade-credit related investments I_{TC} and other variables are given exogenously, and predetermined at time $t = 1$.

Trade credit is a trade-support device which would not occur without a physical delivery of goods or services at some point in time. Having pointed this out, the casual effects of trade credit on investment can materialize only if the trade credit relation is established before the physical trade, so that the supplier can improve good quality by extra investments. This can happen under two scenarios. First, the companies could agree on a physical delivery in the future but trade credit, or an advance on trade credit, happens today. Nevertheless, given the short-term nature of trade credit contracts, it is unlikely that this channel would provide long-term investment incentives. Second, an alternative explanation can be given in the case of long-term trading partners with large turnover in trading volumes. The trade credit roll-over risks could therefore motivate a supplier to invest and to maintain (or improve) product quality, turning the trade credit wheel. Once the quality deteriorates, customers would close the trade credit lines and the supplier will be left with overdue trade credit. In this example, trade credit serves as a reputational, or coordination, device and providing incentives for investment efforts.

The intermediate good is an input to produce the final good and it can be either of high or low quality, depending on the financial conditions of company B, which we discuss later.

Importantly, the quality of the intermediate good is passed onto the quality of the final good and consequently affects profits of company A. If the final good quality is low, the firm's A can sell it at value $\underline{V}$, which is lower than it would be in case of high quality value $\overline{V}$ with $\underline{V} < \overline{V}$. The final value is then shared between both companies, depending on the bargaining power of company A, denoted by $\beta \in [0,1]$, similar to Dass, Kale, & Nanda (2015).

Trade credit is a tool for company B to participate in the final profits. We assume that company A always initiates the trade credit contract, that is, first it receives the goods with a payment notice which is converted into trade credit liability, and then, if the quality of goods delivered is high, it pays the outstanding amount back. However, in case of poor quality of traded goods and consequently lower realized profits for company A, there are legal mechanisms in the contract which allow company A to decide whether to pay the trade credit back or not or, in other words, whether to share the final profits with the upstream company. In case of a trade credit default, however, company A would have to pay the quadratic search cost, proportional to the value of the trade credit contract. Such costs represent a monetary equivalent of an extra effort necessary to settle future trading relations (see, for instance, De Walque, Pierrard, & Rouabah (2010)).

Company B can decide whether to invest in the trade credit business line. Investment increases the quality of the intermediate good, which further cascades into the final good quality. Due to market final demand we assume that the final good cannot be sold at the price higher than $\overline{V}$. Corresponding investment comes at a fixed cost $c > 0$. For simplicity of exposition we assume that any variable cost of investment is booked in the net value of the investment project.

The timing is as follows. In the first period, company B has to decide whether to invest to support relation with company A or not. This decision cannot be observed by company A. In the second period company A observes the final profits and decides whether to pay back trade credit or not.

If company B is non-distressed, it can easily finance the overall investments and deliver the high quality good. In the case of extra trade credit investment efforts, its payoff is reduced by the fixed cost of investment. Otherwise it is equal to $(1-\beta)\overline{V}$ and it conditional on the profit sharing by company A in the second period, in which case company A receives $\beta\overline{V}$. In the case when company A decides not to pay back the outstanding trade credit, its profit is equal to $\overline{V} - \alpha\overline{V}^2$, with $\alpha > 0$ describing the search cost sensitivity.

To streamline the discussion around the relevant criteria, we skip the equivalence conditions which may result in multiple possible equilibria. We solve the sequential game by backward induction. The corresponding equilibrium structure for the non-distressed scenario is described in Proposition 1.

Proposition 1. Under the non-distressed scenario the equilibrium structure of the system is characterized by

- $\overline{V} > (1-\beta)/\alpha$: one Nash equilibrium (not invest & Trade Credit (TC) repayment),
- $\overline{V} < (1-\beta)/\alpha$: one Nash equilibrium (not invest & TC default).

Under the non-distressed scenario, company B never invests to sustain trade credit relation. At the same time, the final profit is shared between company A and B only if it is larger than the costs of finding a new trading partner. In case the final value is too low, in equilibrium the supplier would never receive back the trade credit.

Distressed companies face some sort of financial shock which limits their ability to fund investment projects with external finance, $F_E^* < F_E$. Consequently, the overall investment levels are lower than under the non-distressed scenario, *ceteris paribus*, and hence company B is unable to deliver high-quality goods. This can be seen through a prism of lack of funds to maintain sufficient capital or labour expenditures, or even by compromised relations with storage or transport counterparts. As a result distressed firms may find it difficult to compete under standard market conditions. Customers do not usually observe such problems directly, which, however, affect the value of the final good, $\underline{V}$. In addition, switching to another supplier would be costly due to the already established trade credit relation. Such costs could include potential additional costs of delivery or extra legal costs. They could also be related to technological changes necessary to adjust the production structure to the goods delivered by a new supplier.

Distressed suppliers can decide whether to improve the quality of the intermediate good through an investment effort I_{TC}, contributing in this way to the value of the final good by $V(I_{TC})$. This value is net of the corresponding variable costs of investment efforts. We assume that an investment effort always improves the value of the input but it cannot go beyond the maximal intrinsic value and it has a decreasing marginal effectiveness, i.e. $\overline{V} > V(I_{TC}) > \underline{V}$ and $\frac{\partial V(I_{TC})}{\partial I_{TC}} > 0, \frac{\partial^2 V(I_{TC})}{\partial^2 I_{TC}} < 0$. Such extra relationship investments are necessary to address the company distress but they do not affect the overall technological stance, making it comparable with the non-distressed case.

If the company does not invest, the final good value is equal to $\underline{V}$ and, depending on the profit sharing of company A, the profits of company B are either $(1-\beta)\underline{V}$ or 0. Company A would, respectively, cash the profit of $\beta\underline{V}$ or $\underline{V} - \alpha\underline{V}^2$. If company B invests, the profits are reduced by the fixed investment cost.

The corresponding equilibria are summarized in Proposition 2. Again, for presentational reasons we skip the equivalence conditions which result in multiple equilibria.

Proposition 2. Under the distressed scenario the equilibrium structure of the system is characterized by

- $V(I_{TC}) > \underline{V} > (1-\beta)/\alpha$
  - $V(I_{TC}) > c/(1-\beta)$: one Nash equilibrium (invest & TC repayment),
  - $V(I_{TC}) < c/(1-\beta)$: one Nash equilibrium (not invest & TC repayment),
- $V(I_{TC}) > (1-\beta)/\alpha > \underline{V}$: one Nash equilibrium (invest & TC repayment),
- $(1-\beta)/\alpha > V(I_{TC}) > \underline{V}$: one Nash equilibrium (not invest & TC default).

Consequently, if a customer finds it costly to change the supplier, as long as the company investment efforts are large enough, i.e. $(I_{TC}) > \underline{V} > (1-\beta)/\alpha$ and $V(I_{TC}) > c/(1-\beta)$, in equilibrium the distressed company will invest and it will be paid back the outstanding trade credit. On the other hand, if the cost of investments are too burdensome or the bargaining power of company B is low, i.e. $c/(1-\beta) > V(I_{TC})$, company B will not pursue an investment strategy but it will be paid back the share of the lower profits $\underline{V}$.

If a customer considers the no-investment quality of delivered goods as too low compared to the relative cost of switching the supplier, i.e. $\underline{V} < (1-\beta)/\alpha < V(I_{TC})$, but company B still enjoys satisfactory bargaining power, it will engage in the investment efforts and still participate in the final profits. This profit participation can be viewed as sustaining vital business lines, and, in fact, the only way of having non-zero profits for company B is to invest. Therefore, we argue that the investment serves a coordination device for company B to be repaid on the trade credit.

The last outcome predicted by the model results from highly unbalanced powers between companies A and B. In the case when profit participation does not cover the investment efforts of company B, in equilibrium company B will not invest and it will not be paid back the trade credit.

Overall, Proposition 2 opens up a possibility that financial distress may result in higher relationship-specific investments, as opposed to Proposition 1. It does not give a precise answer on how such investments will be financed, however. Usually firms have some degree of flexibility to realign their balance sheet structure to meet the new investment incentives, even under distress, provided that the incentives are sufficiently strong. In the case of model investment-finance constraint, we assume that firms need to draw on their own funds to finance the relationship-specific investments. The exact mechanism is, however, beyond the scope of the proposed setup. Secondly, the model outcomes depend on the exact cost parametrization and does not result in an imminent investment expansion under financial distress. Therefore, to verify this possibility, we take the theoretical ambiguity to the data in Sections 4 and 5.

In practice, an upstream company can be in the middle of the supply chain so it can be both the trade credit provider (accounts receivable) and recipient (accounts payable). The balance between the variables is captured by the variable G_{TC}. Since trade credit as a liability can be used as a source of investment finance, it can serve as a buffer in the case of an external finance shock.

2.1 Our theoretical predictions suggest that companies which, on **average**, have a positive net trade credit exposure, i.e. $G_{TC} > 0$, are more likely to reduce their investment efforts in the case of lack of external funding, *ceteris paribus*. They are more of finance suppliers in the trade credit market in our stylized example above, drawing on resources which potentially could have been invested otherwise. This corresponds to the liquidity absorption mechanism proposed by Coricelli & Frigerio (2016). To put it differently, the larger the relative share of accounts payables vis-a-vis receivables, the lower the finance support for investments.

Similarly, as the level of net trade credit is becoming smaller, less incentives are related to the trade credit channel described above, as such a company is more a trade customer rather than a trade supplier, and potentially its investment decisions can be driven by other firm-specific incentives. Therefore, it is common in the trade credit literature to treat the net trade credit exposure as the main variable of interest to differentiate between trade credit suppliers and customers (Coricelli & Frigerio, 2016).

To sum up, the proposed model predicts three main outcomes. Firstly, distressed firms, due to problems with investment finance, decrease their overall investment levels. Secondly, firms with higher net trade credit balance invest overall less than otherwise identical firms with lower trade credit exposure due to liquidity absorption of trade credit receivables. Thirdly, and most importantly, it is possible that the two effects jointly have a lower impact than when considered separately. In other words, it may be that financially distressed firms with large net trade credit exposure are incentivised to expand their relationship investments, somehow mitigating the effects of the financial distress itself and of the finance-absorptive nature of net trade credit.

3. Data and empirical strategy

To test the theoretical predictions discussed in the previous section, we use firm-level information included in the ORBIS database provided by Bureau van Dijk (BvD). The database contains firm-level financial statements and ownership data, gathered and standardized to the so-called 'global format', being comparable across jurisdictions. Our database updates come semi-annually in vintages, where each vintage is cleaned up from companies which haven't reported any information for 10 years or more. Therefore, to correct for the survivorship bias, we aggregate the data for all the vintages to obtain a sample covering 11 years, from 2004 until 2014.

Our study focuses on the EU28 countries and we consider unconsolidated accounts. To avoid potential idiosyncratic errors we exclude country-specific sectors, such as agriculture and mining, sectors highly susceptible to governmental intervention or with high

governmental ownership, like energy or public administration sectors, and heavily regulated sectors, such as financial sector. Consequently, looking at the NACE Rev. 2 classification we look into 8 broad non-financial sectors: (C) Manufacturing, (F) Construction, (G) Wholesale and Retail Trade, (H) Transportation and Storage, (I) Accommodation and Food Service Activities, (J) Information and Communications, (M) Professional, Scientific and Technical Activities, (N) Administrative and Support Service Activities, as in Coricelli & Frigerio (2016).[1] At this point our sample covers almost 70 million firm-year observations with geographical coverage presented in Table A1 in the annex.

We further clean up the data by excluding countries with poor country-wide coverage. We benchmark the number of companies in each country and in each relevant sector against the official numbers reported by Eurostat or OECD.[2] Due to data availability we consider the average country-sector representation in years 2008-2014, and drop the countries with coverage below 10%, i.e. Cyprus, Greece, Lithuania, Malta and Poland. The average coverage of the remaining sample is around 44% with 67,924,497 company-year observations in 23 EU countries. The detailed coverage numbers are presented in Table A2 in the annex .

We further exclude observations with odd or inconsistent values in the spirit of Kalemli-Özcan, Laeven, & Moreno (2015). We drop firm-year observations in which total assets, fixed assets, intangible fixed assets, sales, long-term debt, loans, creditors, debtors, other current liabilities, or total shareholder funds and liabilities have negative values. On top of that we check for the reporting consistency and drop the firm-year financial statements which violate the basic balance-sheet equivalences by more than 10%, as in Gopinath, Kalemli-Özcan, Karabarbounis, & Villegas-Sanchez (2017). Furthermore, we impose that (i) total asset match total liabilities, (ii) total assets match the sum of fixed assets and current assets, and (iii) current liabilities match the sum of loans, trade credit and other current liabilities.

We also deflate variables using the country-specific Harmonised Index of Consumer Prices (HICP) deflators. At this point the dataset contains nearly 61 million firm-year observations, covering 10,775,304 unique companies.

3.1 Main variables

Table 1 reports the basic descriptive statistics of our main variables at firm and bank levels. All variables are winsorized at the 1% level at the country-year reference cut. Starting with the dependent variable of the regression analysis, net investment is defined as the annual change in a firm's tangible fixed assets over total fixed assets of the previous period. On

[1] Coricelli & Frigerio (2016) consider also sector L (Real Estate Activities), which we exclude due to possible volatility in certain countries over the considered time span.

[2] The Eurostat numbers are not available for Greece, for which we use the OECD tables. Since the OECD data use ISIC 4 sectoral classification, we match the numbers to NACE Rev. 2 using the correspondence tables provided by the United Nations Statistics Division.

average, total net investment covers 32% of capital, whereas most is attributable to fixed tangible investments (21%). The net trade credit variable, which is scaled by sales, is on average equal to 7%. We consider also a proxy for the potential growth of firms based on the actual amount of sales over total assets. Also in this case the variability is quite high across firms and time. Most firms in the sample are able to generate internal funds as indicated by the cash flow variable which is on average equal to around 5% of total assets. Financial debt, which is the sum of loans up to one year and long-term debt over total assets, is about 18%. Finally, we include in our analysis the logarithm of total assets as a measure of size. (See table 1 in appendix)

Table 1 presents also a set of indicators of the degree of financial distress of firms as well as a set of variables related to banks which are managing the bank loans of those firms reporting it in the ORBIS database.

3.2 Indicators of (financially) distressed firms

In order to identify distressed firms we consider three distinct classifications. The first is a novel financial distress index derived from the EIB Investment Survey (EIBIS) index of financial constraints; the second classification is derived from the definition proposed by the OECD and the third one is based on the classification proposed by the Bank of England. We use the first classification to derive the baseline results, whereas the last two indices are used for robustness checks to streamline the discussion and to make the empirical analysis more transparent.

i) Financial constraints index (EIB index)

The novel financial distress index is calculated using the information derived from the EIB Group Survey on Investment and Investment Finance (EIBIS). EIBIS is an EU-wide survey that gathers qualitative and quantitative information on investment activities by both SMEs and larger corporates, their financing requirements and the difficulties they face. Using a stratified sampling methodology, EIBIS is representative across all 28 Member States of the EU and applies to four firm size classes (micro, small, medium and large) and four sector groupings (manufacturing, services, construction and infrastructure) within countries. It is designed to build a panel of observations over time, and is set up in such a way that survey data can be linked to firms' reported balance sheet and profit and loss data. The first wave of the survey took place between July and November 2016 (2016 vintage), and the second one between April and August 2017 (2017 vintage). The technical details behind the survey are described by Brutscher & Ferrando (2016).

The survey considers companies as financially constrained when they are dissatisfied with the amount of finance obtained (received less), or they sought external finance but did not receive it (rejected) and they did not seek external finance because they thought borrowing costs would be too high (too expensive) or they thought they would be turned down

(discouraged). The probability of being constrained for firms in EIBIS is regressed on a set of indicators of their financial situation (profitability, growth opportunities, financial leverage and cash holding) as well as on sector and country dummies. In the procedure we use the 2016 and 2017 EIBIS vintages. The estimated coefficients are then fit to our sample of European firms[3]. The resulting score is used to rank the firms according to their probability of being credit constrained or not. For each year, financially constrained firms are finally identified as those with a value of the score greater than a country threshold, which is directly derived from the survey. On average, 7.2% of firms are financially constrained in our sample. Figure 1 displays the trend of net trade credit ratio between financially constrained and not- constrained firms over time. Interestingly after having declined from the beginning of our sample until the burst of the financial crisis, net trade credit has started to increase since then. For financially constrained firms net trade credit is lower than for those firms that are not financially constrained.

ii) Distressed firms (OECD definition)

The second classification of distressed companies is derived from the definition proposed by the OECD (McGowan, Millot, & Andrews, 2017). Distressed companies are firms older than 10 years with negative profit or interest coverage less than 1 over 3 consecutive years. In this case, the indicator points to a higher percentage of firms with a distressed situation, almost one fifth of firms in the sample. Figure 2 shows a similar dynamics of net trade credit over time but we observe that the use of net trade credit becomes higher for distressed firms since 2010.

iii) Distressed firms (Bank of England definition)

Lastly, a very broad definition of financially distressed companies proposed by the Bank of England (2013) selects companies with negative profits for three consecutive years. The average percentage is 13.3% and the dynamics of net trade credit resembles the first indicator (Figure 3 in appendix).

3.3 Banking variables

To enhance the inference on the data set, and in particular to make use of the instrumental variables technique, we merge the company-specific data with the corresponding banking information. We exploit the fact that for a subset of companies, we may get a list of banks managing their loan books. This information is available from ORBIS through the dataset of Kompass , and it displays the name of the banks with which the firm has a relationship. Following Kalemli-Özcan, Laeven, & Moreno (2015) we use OpenRefine and Reconcile-CSV to match the reported bank names to the identification numbers of banks from a sample of European banks available in Bankscope, and we subsequently match these bank names with

[3] The methodology is similar to the one used by Ferrando, et al. (2015) based on the Survey in the Access to Finance of Enterprises (SAFE) conducted by the European Central bank and the European Commission.

bank information on equity ratio, NPL ratio, returns on average assets and total assets from Bankscope. If a firm reports more than one bank, we choose the largest bank, in terms of total asset value. For consistency with the firm-level ORBIS sample, we drop observations with negative equity, NPLs or total assets.

We recognise that the matching procedure is based on a fuzzy-matching algorithm, and therefore does not guarantee absolute accuracy. To limit he potential biases from spurious firm-bank relation, we take only the links with more than 50% accuracy of the matching score, delivered by the matching software. In this way we keep only the banks for which the evidence of having a relation with a given company is higher than a coin toss probability.

It should be pointed out that the proportion of companies reporting a link to at least one bank is small and it can vary by jurisdiction. Overall, we are able to match 3,151,817 bank-year observations to the ORBIS sample. After cleaning, this drops marginally to 3,149,486 bank-year observations and further decreases to 2,578,303 if we include only banks with higher than 50% accuracy of matching. This covers 556,708 companies and 2,372 banks. On average, banks have 7.3% of equity ratio and the return on average assets is 5%. The NPL ratio is relatively low at around 6%.

The corresponding country coverage of bank-firm observations is presented in the annex in Table A2 by the residence country of banks (note that a bank can offer cross-border lending). Because of low coverage figures we decided to use the matched data set only for robustness check, to address some of the potential biases that might be present in the main model specification.

4. Identification strategy and main results

The main identification strategy is based on the following specification:

$$\frac{I_{icst}}{K_{icst-1}} = \beta_1 NTCS_{icst} \times FD_{icst} + \beta_2 NTCS_{icst} + \beta_3 FD_{icst} + \beta_4 X_{icst-1} + \nu_i + \mu_{cst} + \varepsilon_{icst}, \quad (1)$$

where I corresponds to the actual investment levels, taken as the year-on-year change in tangible capital stock, K is the tangible capital level, $NTCS$ is the net trade credit variable in relation to gross sales, FD denotes the financial distress index discussed before (EIB index, FD OECD or FD BoE), and X is a vector of control variables, including the sales to asset ratio,

the ratio of cash flow to total assets and the logarithm of total assets. The model is saturated by the company-specific fixed effects v_i, and a vector of country-sector-year fixed effects μ_{cst}, with sectors characterized at the 4-digit level of the NACE Rev. 2 classification. Error terms are represented by ε_{icst} where subscripts i, c, s and t correspond to the firm, country, sector and time dimensions, respectively.

We additionally run the model with lagged FD index, addressing the potential endogeneity bias stemming from this variable. $NTCS$ variable is taken at time t rather than $t-1$ to mimic the short-term nature of trade credit contracts (usually less than one year[4]). However, we recognize that it can be potentially susceptible to reverse causality bias and therefore run several robustness checks to address this problem in Section 6.

The main results are presented in Table 2 in the annex.

We find that, whereas net trade credit has overall a negative impact on capital formation due to liquidity effects (Coricelli & Frigerio, 2016), the effect is less pronounced for firms that are in financial difficulties compared to the ones which are not (specified through the interaction term). The results confirm our theoretical prediction that through capital expenditures distressed companies try to maintain vital business relations with their customers in order to participate in the final profits through the trade credit repayments.

The order of magnitude is quite substantial. For instance, looking at the specification in column (4) of Table 2, an increase in net trade credit by one standard deviation would decrease the overall investment rate by nearly 4.5 pp. However, the overall impact is less pronounced when we consider financially distressed companies. Applying the same calculation, a one standard deviation increase in net trade credit reduces the investment rate by around 4pp, half percentage point less.

5. Robustness checks

To ensure the stability of the results, we carry out several robustness exercises. In particular, we look at the different specifications of company distress, we include extra controlling variables both at the micro and macro levels, and we verify whether the results are affected by the sample selection. Finally, we address the potential reverse causality issue between

[4] To confirm the predictions, we re-estimate the regression on the subset of companies with trade credit payable and receivable days shorter than 360. We observe that the interaction coefficient at time t becomes not statistically significant, whereas the one at time $t-1$ preserves significance and it becomes larger in magnitude. It signals that the effect of the trade credit channel described above may materialize with a lag, and it is passed on in time through the trade credit duration. For brevity, we do not report the results, which are available upon request.

trade credit and investment levels which, due to the short-term nature of trade credit, cannot be addressed directly through time differential.

5.1 Alternative specifications of distressed companies

As discussed above, we investigate the investment cycle of companies which are classified as distressed using two alternative methodologies, i.e. the OECD and Bank of England (see McGowan, Millot, & Andrews (2017) and Bank of England (2013) for details). Both comprise broader definitions of firm-specific distress, fosusing on interest coverage ratio and profitability.

Despite the fact that the distress metrics assume different underlying sources of problems for the companies, they show a high degree of commonalities with respect to the trend of net trade credit. For the classification based on the BoE definition, the net trade credit ratio is always positive and higher for non-distressed companies. In the case of the OECD classification, distressed companies increased more their use of net trade credit after the financial crisis.

The results for two alternative distress metrics are given in Table 3 and Table 4.

The signs and statistical significance of all the estimates are preserved, when using the two different definitions of financial distress. Net trade credit drains still liquidity from productive investments, however, less so for distressed companies. In terms of the magnitudes, the size of coefficients is largely preserved in the new specifications for the contemporary distress variables, and it is around double the original size with lagged distress variables. We speculate that the OECD and BoE distress indicators actually describe more severe firm-specific turbulences than the financial constraints index, and therefore for such companies the relationship-specific investments may be more vital to sustain their participation in the final profits via the trade credit exposure.

Importantly, despite the differences in the evolution of the distress indices over time and their relation with trade credit, the results seem to be robust to the choice of the definition of distress.

5.2 Additional controls

To control for possible influence from extra firm-specific or country-specific shocks, we augment the main model specification by additional balance sheet and aggregate demand variables. In particular, to distinguish between high- and low-capital-intensive companies, we include the measure of tangibility, expressed as a ratio between tangible fixed assets to total assets. We further control for the overall financial leverage, expressed as the ratio of loans and long-term debt to total assets. It should be pointed out that financial leverage is one of the components used to calculate the financial constraints index and therefore there might be potential collinearity in the regression. Nevertheless, we consider it as an

interesting additional variable which may capture leverage effects beyond the levels captured in the distress indicator.

On the aggregate side, we include GDP growth, unemployment rate and the yield on 10-year government bonds. Macro controls come both in levels and interactions with the main variables of interest.

The identification strategy, augmented for the presence of extra variables, is the following

$$\frac{I_{icst}}{K_{icst-1}} = \beta_1 NTCS_{icst} \times FD_{icst-1} + \beta_2 NTCS_{icst} + \beta_3 FD_{icst-1} + \beta_4\, NTCS_{icst} \times FD_{icst-1} \times AGG_{ct-1} + \beta_5 NTCS_{icst} \times AGG_{ct-1} + \beta_6 FD_{icst-1} \times AGG_{ct-1} + \beta_7 X_{icst-1} + \nu_i + \mu_{cst} + \varepsilon_{icst}, \quad (2)$$

where now X_{icst} includes the measures of tangibility and financial leverage, and AGG_{ct} is the macro variable. Note that we do not add the macro variables in levels alone as the dynamics is already spanned by a set of country-year fixed effects. We follow a two-step approach. Firstly, we assess the robustness of the results in the presence of extra firm-specific controls only through the lens of Model 1. Secondly, we include macro controls one-by-one and all-at-once in the full horse-run specification. The results are presented in Table 5 and Table 6.

Controlling for additional firm-specific characteristics does not alter the model dynamics. All the coefficients have the same signs and statistical significance as in the baseline regression. The coefficients on interaction terms are modestly lower, confirming that a small share of the original effects may be spanned by firm-specific composition of assets or financial leverage. The effects of the sales to asset ratio are somehow counterintuitively negative in some setups, but this might be the effect of collinearity and potential substitutability between the set of control variables. This is also the reason why we use less control variables in the baseline regression. In terms of the two new controls, their coefficients are both negative and statistically significant, being fully in line with Coricelli & Frigerio (2016)'s findings. All else equal, higher shares of tangible assets may suggest that investment decisions have already taken place and no new capital expenditures are foreseen beyond the level of capital depreciation. The results also re-affirm the debt-overhand problem, whereby the leveraged companies have less investment incentives as the proceeds from new projects would go largely to debt rather than equity holders (Kalemli-Özcan, Laeven, & Moreno (2015), Barbiero, Brutscher, Kolev, Popov, & Wolski (2018)).

The results are largely preserved when we control for aggregate demand effects, both in levels and in the interaction terms. There are two remarks to be pointed out at this stage. First, when we control for unemployment dynamics, the coefficient of the interaction is not

significant and the financial constraints coefficient switches the sign. This can be driven by the relatively lower volatility of the unemployment variable throughout the cycle, which would eventually provide less additional explanatory power beyond the country-year fixed effects. The results are fully preserved when we control for all three macro-economic variables, however. Second, in the horse-race specification, the financial constraints indicator becomes insignificant. This may suggest that the effects of financial constraints on investment are catalysed by aggregate demand. The interaction term is however positive and significant highlighting that the investment-incentivising role of trade credit in distressed companies is not demand-dependent.

5.3 Influence of the banking crisis

One can argue that the trade credit-investment mechanism described above can be distorted during abnormal functioning of the financial system, like for instance, during a banking crisis. We test by comparing the responsiveness of distress companies to changes in net trade credit during crisis and non-crisis times. For the exact classification of country-specific crisis periods, we follow the methodology developed by Laeven & Valencia (2013). The baseline regression specification is given by

$$\frac{I_{icst}}{K_{icst-1}} = \beta_1\, NTCS_{icst} \times FD_{icst} \times BC_{ct-1} + \beta_2 NTCS_{icst} \times FD_{icts} + \beta_3 NTCS_{icst} \times BC_{ct-1} + \beta_4 FD_{icts} \times BC_{ct-1} + \beta_5 NTCS_{icst} + \beta_6 FD_{icst} + \beta_7 X_{icst-1} + \nu_i + \mu_{cst} + \varepsilon_{icst}, \quad (3)$$

where BC_{ct} denotes the crisis dummy. The coefficient of interest, depicting whether the crisis times can be characterized by different investment responsiveness to TC, is given by β_1. The results are presented in Table 7.

There are several interesting finding from the banking crisis exercise. Firstly, the results differ depending on a set of applied fixed effects. It suggests that the banking crisis propagated through the EU economy with a great heterogeneity between countries and sectors. Let us consider the estimates for the full set of fixed effects, spanning through the country, sector and year dimensions, as being our preferred specification. It appears that the trade credit channel of investment support for distressed companies does not differ between crisis and non-crisis times. The effect itself is still preserved for the contemporaneous distress specification (column 2) but the statistical significance dilutes once the lagged specification is chosen (column 4). This can be partially explained by the fact that although the financial constraints are overall investment-negative, they are even more so during the banking crisis times, potentially offsetting the trade credit relationship. Interestingly, the liquidity drain from the net trade credit is of lower magnitude during the

crisis times. This could be driven by the fact that the short-term trade credit constraints have a lower priority when the entire balance sheet is under pressure.

5.4 Addressing endogeneity bias

Last but not least, we try to address the potential endogeneity problems resulting from the simultaneous specification of the trade credit variable and investment. As argued above, simple time differential may oversee the real trade credit effects due to their short-term nature, falling below the 12 month maturity threshold.

We employ therefore a two-stage instrumental variable technique. We use the Model (1) as the benchmark regression, where the net trade credit variable is instrumented by a set of bank-specific variables. To maximize the explanatory power of the instruments, we take the financial distress index with a lag, alleviating some of the potential exclusion restrictions, and we instrument only the net trade credit variable. Exogenous variations in the bank financial health are then assumed to affect the corporate balance sheet through the trade credit rebalancing, and not directly through the financial constraints index.

We follow the argument that the situation of a financing bank should be unrelated to company's investment prospects, and consequently to its investment levels, but may affect the degree of on-balance trade credit in the corporate sector. For instance, weak banks may be unable to provide sufficient funding for corporates to finance the investment projects. To put it differently, the variation in investment levels explained by the corresponding bank-specific situation materializes through the funding structure of a corporate, which is related to the use of trade credit.

Our instruments include the equity ratio, the non-performing loan (NPL) ratio, returns on average assets and bank size, expressed as a log of total assets. It largely follows the strategy of defining bank-specific stress conditions suggested by Storz, Koetter, Setzer, & Westphal (2017), however, due to data unavailability we do not include maturity mismatch and bank-specific z-scores.

We use bank-related variables as exogenous instruments for the net trade credit, to be further regressed against the corporate investment. It should be recognized that due to the fact that only a fraction of companies in ORBIS report to which banks they have the relations with, the sample size drops substantially. Given the number of fixed effects we include in the model we use the small sample correction on the estimates. The standard errors are clustered at the company and bank levels. The results are given in Table 8.

One can readily observe that the size of the coefficient of the interaction term is preserved and it is statistically significant. Although the overall significance of the model somehow

dilutes when controlling for different groups of fixed effects, the general findings of the paper still hold at the 10% significance level. All the models also pass the identification tests.

6. Conclusions

This paper investigates how the trade credit channel could affect investment decisions in distressed companies. In general, financially distressed firms invest less as a result of inability to fund new investment projects. Similarly, positive net trade credit balances may drain the investment-supportive liquidity. However, we provide a theoretical explanation that the two factors can be mutually mitigating under certain conditions. We argue that financially distressed firms with outstanding net trade credit may lose business customers, and therefore a part of profits, because they are unable to sustain the quality of produced goods and compete under normal market conditions. As a reaction, such firms may feel incentivized to improve the quality of their products through additional investments to sustain their business relation and to be paid back the trade credit. Our theoretical model predicts that companies with large shares of net trade credit will actually invest more, or reduce investment by less, in case of a distress event.

To verify this theoretical possibility empirically, we investigate an EU-wide sample of corporate balance-sheets available in ORBIS database in years 2004-2014. We construct a variable on the net trade exposure, correcting for a potential trade credit asset-liability mismatch and the position of companies in the supply chain. In a number of regressions, we address potential data and model-specification shortcomings, including omitted variable bias, sample selection problems and endogeneity issues.

We find an investment-negative effect of financial distress. We also confirm the negative impact of net trade credit on investment in non-distressed companies, confirming the liquidity-drain channel presented by Coricelli & Frigerio (2016). Interestingly, this effect is, however, less pronounced during the banking crisis times, when controlling for country, sector and time specific unobserved fixed effects. We suggest that the trade credit drain on potential investment liquidity is of less importance during systemic events, when the entire firms' balance sheet and cash flow is under pressure. Similarly, distressed companies invest less, on average, than non-distressed companies, and this effect is exacerbated during crisis times. However, we find that given that a company is under distress, the negative effect of net trade credit is less severe, or it may even turn positive when controlling for demand dynamics.

The results hold across a range of model specifications, including the instrumental variable approach In particular, we exploit the firm-bank relations to proxy for the supply-side

financing conditions. We use a set of bank-level characteristics as exogenous instruments for the net trade credit variable, arguing that the use of trade credit has been a substitute to bank finance throughout our sample time span, and, at the same time, bank-specific conditions should not influence the related corporate investment as given a good project a company can always switch between banks. Our theoretical predictions on the role of trade credit in financially distressed firms are fully confirmed, even in such a sophisticated model setup.

Interestingly, our results suggest that whereas the impact of financial constraints on investments is catalysed by aggregate demand, the trade credit role in stimulating investment in distressed firms' appears not to be demand-driven.

It appears that the mechanisms behind trade credit are more nuanced for distressed firms. Troubled companies operate in a difficult market environment, often under a stigma, mistrust and in isolation. For those companies, established corporate relations, often supported with trade credit, appear to be a vital source of revenues. In this framework, capital expenditures sustain, if not improve, the quality of produced goods, allowing those companies to keep their business relations and participate in the final profits through the trade credit repayment. Consequently, trade credit is important for the investment decisions of distressed firms, supporting their role throughout the supply chain. However, to establish the macroeconomic impact of the survival of distressed companies is something that goes beyond the present analysis.

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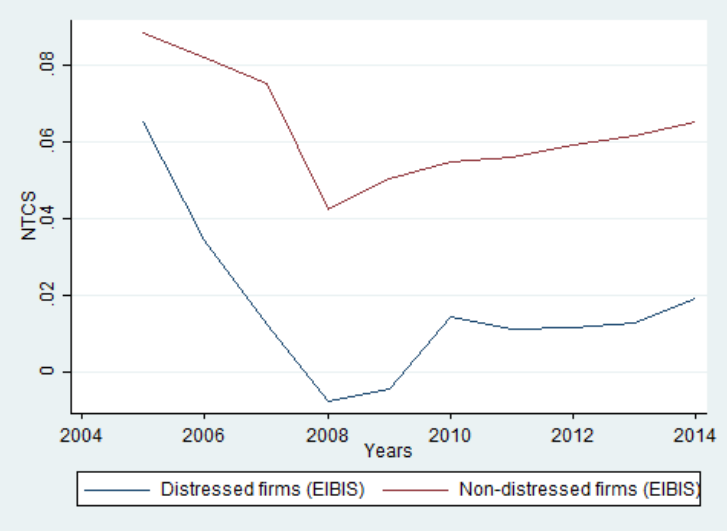
Annexes

Table 1 Descriptive statistics.

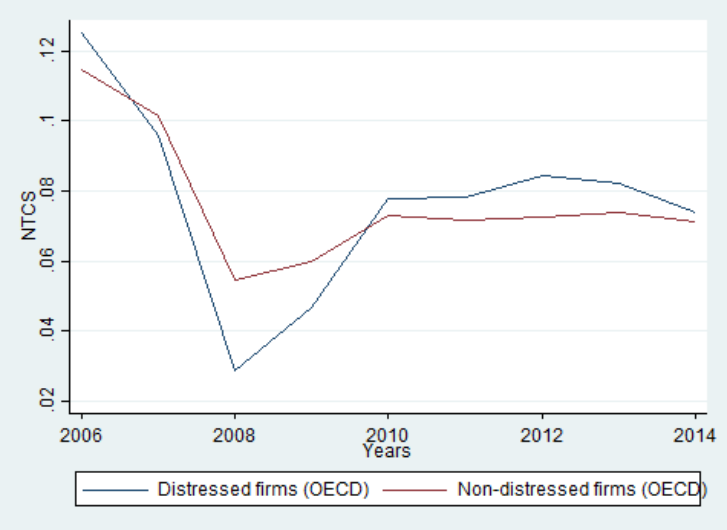
Indicator class	Variable	Obs.	Mean	Sd	Min	Max
Firm-level	Investment/Capital	37,599,861	0.326	2.184	-1	16.954
	NTCS	29,937,987	0.067	0.516	-2.417	2.898
	Sales/Assets	37,534,868	1.843	2.089	0	13.408
	Cash flow/Assets	35,238,338	0.047	0.323	-1.83	0.963
	Total Assets (log)	60,884,232	11.526	2.597	1.031	16.844
	Tangible assets / Assets	53,864,805	0.21	0.257	0	0.975
	Fin. Leverage	37,084,404	0.175	0.277	0	1.464
Distress index	Financial constraints index	19,804,065	0.072	0.259	0	1
	Distressed firms index (OECD)	12,828,419	0.196	0.397	0	1
	Distressed firms index (BoE)	26,621,016	0.133	0.34	0	1
Bank-level	Equity ratio	2,569,920	7.338	6.453	0	100
	NPL ratio	863,978	6.149	6.24	0	67.71
	ROAA	2,533,456	0.439	0.915	-36.07	28.28
	Total Assets (log)	2,436,784	8.504	1.901	2.89	13.893

Figure 1 EIB index: net trade credit among financially constrained and not-financially constrained firms.



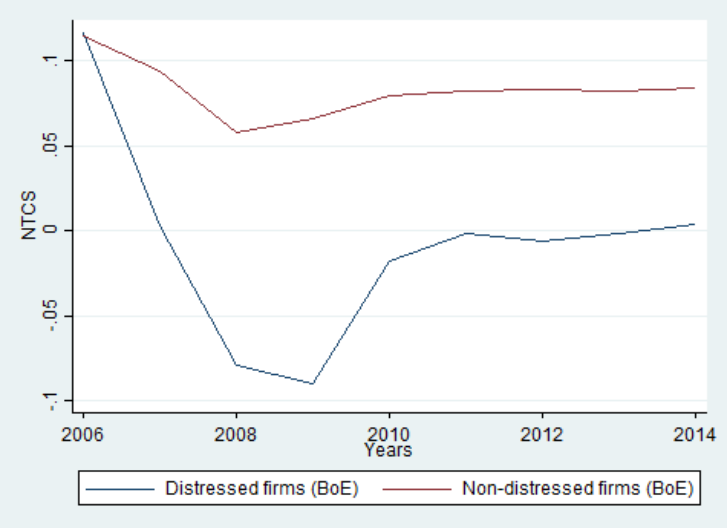
Source: Authors' calculations based on EIBIS 2016 and 2017 and the Bureau van Dijk ORBIS database.

Figure 2 OECD index: net trade credit among distressed and not- distressed firms.



Source: Authors' calculations based on the Bureau van Dijk ORBIS database.

Figure 3 Bank of England index: net trade credit among distressed and not-disressed firms.



Source: Authors' calculations based on the Bureau van Dijk ORBIS database.

Table 2 Impact of trade credit on investment for financially constrained companies.

	(1) Investment/Capital	(2) Investment/Capital	(3) Investment/Capital	(4) Investment/Capital
NTCS x FIN_CONS	0.055***	0.048***		
	-0.005	-0.005		
NTCS x FIN_CONS (lag)			0.023***	0.020***
			-0.006	-0.007
FIN_CONS	-0.213***	-0.214***		
	-0.004	-0.004		
FIN_CONS (lag)			-0.090***	-0.079***
			-0.004	-0.004
NTCS	-0.130***	-0.113***	-0.114***	-0.100***
	-0.002	-0.002	-0.002	-0.003
CASH FLOW / ASSETS (lag)	0.437***	0.357***	0.520***	0.440***
	-0.005	-0.006	-0.006	-0.006
SALES / ASSETS (lag)	0.033***	0.012***	0.074***	0.045***
	-0.001	-0.001	-0.001	-0.002
LOG ASSETS (lag)	-0.761***	-0.749***	-0.593***	-0.607***
	-0.003	-0.003	-0.003	-0.004
Company FE	YES	YES	YES	YES
Country x Sector x Year FE	NO	YES	NO	YES
Firm-level clustering of SE	YES	YES	YES	YES
N	15,138,499	13,481,857	11,930,793	10,598,616
R-sq	0.214	0.219	0.202	0.207
adj. R-sq	0.037	0.041	0.013	0.017

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the EIB Investment Survey methodology. Standard errors are clustered at the company level and they are reported in parentheses, where $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3 Impact of trade credit on investment for distressed companies characterized by OECD specification.

	(1) Investment/Capital	(2) Investment/Capital	(3) Investment/Capital	(4) Investment/Capital
NTCS x DISTRESS	0.043***	0.043***		
	-0.004	-0.004		
NTCS x DISTRESS (lag)			0.042***	0.039***
			-0.004	-0.004
DISTRESS	-0.131***	-0.057***		
	-0.002	-0.002		
DISTRESS (lag)			-0.175***	-0.119***
			-0.002	-0.002
NTCS	-0.099***	-0.088***	-0.094***	-0.080***
	-0.003	-0.003	-0.003	-0.003
CASH FLOW / ASSETS (lag)	0.514***	0.410***	0.398***	0.329***
	-0.006	-0.007	-0.007	-0.008
SALES / ASSETS (lag)	0.087***	0.048***	0.087***	0.044***
	-0.002	-0.002	-0.002	-0.002
LOG ASSETS (lag)	-0.601***	-0.627***	-0.553***	-0.597***
	-0.004	-0.004	-0.004	-0.005
Company FE	YES	YES	YES	YES
Country x Sector x Year FE	NO	YES	NO	YES
Firm-level clustering of SE	YES	YES	YES	YES
N	9,995,620	8,806,021	8,078,304	7,103,737
R-sq	0.208	0.215	0.214	0.221
adj. R-sq	0.023	0.029	0.016	0.023

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the OECD methodology. Standard errors are clustered at the company level and they are reported in parentheses, where $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4 Impact of trade credit on investment for distressed companies characterized by Bank of England specification.

	(1) Investment/Capital	(2) Investment/Capital	(3) Investment/Capital	(4) Investment/Capital
NTCS x DISTRESS	0.053***	0.048***		
	-0.003	-0.003		
NTCS x DISTRESS (lag)			0.045***	0.040***
			-0.004	-0.004
DISTRESS	-0.222***	-0.166***		
	-0.003	-0.003		
DISTRESS (lag)			-0.152***	-0.115***
			-0.003	-0.003
NTCS	-0.114***	-0.101***	-0.107***	-0.093***
	-0.002	-0.002	-0.002	-0.003
CASH FLOW / ASSETS (lag)	0.430***	0.361***	0.449***	0.375***
	-0.005	-0.005	-0.005	-0.006
SALES / ASSETS (lag)	0.065***	0.036***	0.072***	0.039***
	-0.001	-0.001	-0.001	-0.002
LOG ASSETS (lag)	-0.618***	-0.632***	-0.581***	-0.618***
	-0.003	-0.003	-0.004	-0.004
Company FE	YES	YES	YES	YES
Country x Sector x Year FE	NO	YES	NO	YES
Firm-level clustering of SE	YES	YES	YES	YES
N	15,145,397	13,546,387	11,992,660	10,704,082
R-sq	0.198	0.202	0.204	0.209
adj. R-sq	0.017	0.020	0.010	0.014

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the Bank of England's methodology. Standard errors are clustered at the company level and they are reported in parentheses, where $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5 Impact of trade credit on investment for financially constrained companies – extra controls.

	(1) Investment/Capital	(2) Investment/Capital	(3) Investment/Capital	(4) Investment/Capital
NTCS x FIN_CONS	0.048***	0.039***		
	-0.005	-0.005		
NTCS x FIN_CONS (lag)			0.017***	0.013**
			-0.006	-0.006
FIN_CONS	0.039***	0.040***		
	-0.004	-0.004		
FIN_CONS (lag)			-0.010**	0.004
			-0.004	-0.004
NTCS	-0.175***	-0.151***	-0.154***	-0.136***
	-0.002	-0.002	-0.002	-0.003
CASH FLOW / ASSETS (lag)	0.312***	0.216***	0.269***	0.174***
	-0.005	-0.005	-0.006	-0.006
SALES / ASSETS (lag)	-0.019***	-0.037***	0.025***	-0.001
	-0.001	-0.001	-0.001	-0.002
LOG ASSETS (lag)	-0.759***	-0.741***	-0.590***	-0.602***
	-0.003	-0.003	-0.003	-0.003
TANGIBILITY (lag)	-5.286***	-5.417***	-5.300***	-5.412***
	-0.01	-0.01	-0.012	-0.012
FIN. LEVERAGE (lag)	-0.245***	-0.246***	-0.219***	-0.248***
	-0.005	-0.005	-0.006	-0.006
Company FE	YES	YES	YES	YES
Country x Sector x Year FE	NO	YES	NO	YES
Firm-level clustering of SE	YES	YES	YES	YES
N	15,138,499	13,481,857	11,604,426	10,303,988
R-sq	0.267	0.272	0.254	0.259
adj. R-sq	0.102	0.106	0.077	0.081

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the EIB Investment Survey methodology. Tangibility ratio is taken as the ratio of tangible fixed assets to total assets and financial leverage is the ratio of loans and long-term debt to total assets. Standard errors are clustered at the company level and they are reported in parentheses, where $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6 Impact of trade credit on investment for financially constrained companies – aggregate demand effects.

	(1)	(2)	(3)	(4)
	Investment/Capital	Investment/Capital	Investment/Capital	Investment/Capital
NTCS x FIN_CONS (lag)	0.012*	0.023	0.090***	0.083***
	-0.007	-0.016	-0.023	-0.028
FIN. CONS. (lag)	-0.015***	0.116***	-0.047***	-0.018
	-0.005	-0.01	-0.014	-0.016
NTCS	-0.132***	-0.194***	-0.196***	-0.237***
	-0.003	-0.005	-0.008	-0.009
CASH FLOW / ASSETS (lag)	0.174***	0.175***	0.175***	0.176***
	-0.006	-0.006	-0.006	-0.006
SALES / ASSETS (lag)	-0.001	-0.001	-0.003*	-0.003*
	-0.002	-0.002	-0.002	-0.002
LOG ASSETS (lag)	-0.602***	-0.602***	-0.601***	-0.601***
	-0.003	-0.003	-0.004	-0.004
TANGIBILITY (lag)	-5.412***	-5.412***	-5.448***	-5.449***
	-0.012	-0.012	-0.013	-0.013
FIN. LEVERAGE (lag)	-0.249***	-0.246***	-0.248***	-0.247***
	-0.006	-0.006	-0.006	-0.006
MACRO CONTROLS	GDP growth	Unempl. rate	Sov. yield	All
Company FE	YES	YES	YES	YES
Country x Sector x Year FE	YES	YES	YES	YES
Firm-level clustering of SE	YES	YES	YES	YES
N	10,303,988	10,303,988	10,104,122	10,104,122
R-sq	0.259	0.259	0.259	0.259
adj. R-sq	0.081	0.081	0.080	0.080

Note: The table reports estimates of Model 2 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the EIB Investment Survey methodology. Tangibility ratio is taken as the ratio of tangible fixed assets to total assets and financial leverage is the ratio of loans and long-term debt to total assets. Macro controls are added in levels and in interactions with the main variables of interest. Standard errors are clustered at the company level and they are reported in parentheses, where $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 7 Impact of trade credit on investment for financially constrained companies – banking crisis sample.

	(1) Investment/Capital	(2) Investment/Capital	(3) Investment/Capital	(4) Investment/Capital
NTCS x FIN_CONS x BC (lag)	0.077***	0.009		
	-0.011	-0.011		
NTCS x FIN_CONS (lag) x BC (lag)			0.071***	-0.002
			-0.014	-0.015
NTCS x FIN_CONS	0.008	0.039***		
	-0.01	-0.01		
NTCS x FIN_CONS (lag)			-0.024*	0.02
			-0.013	-0.013
FIN_CONS x BC (lag)	-0.280***	-0.117***		
	-0.006	-0.007		
FIN_CONS (lag) x BC (lag)			-0.201***	-0.068***
			-0.008	-0.008
FIN_CONS	-0.044***	-0.143***		
	-0.005	-0.006		
FIN_CONS (lag)			0.043***	-0.034***
			-0.007	-0.007
NTCS x BC (lag)	-0.028***	0.067***	-0.046***	0.056***
	-0.004	-0.004	-0.004	-0.005
NTCS	-0.113***	-0.155***	-0.082***	-0.138***
	-0.004	-0.004	-0.004	-0.004
CASH FLOW / ASSETS (lag)	0.439***	0.361***	0.518***	0.441***
	-0.005	-0.006	-0.006	-0.006
SALES / ASSETS (lag)	0.032***	0.012***	0.073***	0.045***
	-0.001	-0.001	-0.001	-0.002
LOG ASSETS (lag)	-0.761***	-0.750***	-0.593***	-0.608***
	-0.003	-0.003	-0.003	-0.004
Company FE	YES	YES	YES	YES
Country x Sector x Year FE	NO	YES	NO	YES
Firm-level clustering of SE	YES	YES	YES	YES
N	15,138,499	13,481,857	11,930,793	10,598,616
R-sq	0.215	0.219	0.203	0.207
adj. R-sq	0.037	0.041	0.014	0.017

Note: The table reports estimates of Model 3 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the EIB Investment Survey methodology. Variable BC denotes the banking crisis dummies, as defined by Laeven & Valencia (2013). Standard errors are clustered at the company level and they are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8 Impact of trade credit on investment for financially constrained companies – IV estimates.

	(1) Investment/Capital	(2) Investment/Capital	(3) Investment/Capital
NTCS x FIN_CONS (lag)	2.753***	1.313*	1.295*
	-0.555	-0.731	-0.778
FIN_CONS (lag)	-0.116***	-0.126***	-0.125***
	-0.031	-0.033	-0.033
NTCS	-7.323***	-4.033**	-4.025*
	-1.392	-1.961	-2.186
CASH FLOW / ASSETS (lag)	0.831***	0.686***	0.692***
	-0.063	-0.095	-0.103
SALES / ASSETS (lag)	0.023	0.019	0.02
	-0.014	-0.015	-0.015
LOG ASSETS (lag)	-0.654***	-0.630***	-0.624***
	-0.029	-0.031	-0.031
Company FE	YES	YES	YES
Country x Year FE	NO	YES	NO
Sector x Year FE	NO	YES	NO
Country x Sector x Year FE	NO	NO	YES
Firm-level clustering of SE	YES	YES	YES
Bank-level clustering of SE	YES	YES	YES
N	302,958	266,664	266,511
Sargan p-value	0.102	0.516	0.410

Note: The table reports estimates of Model 1 with NTCS variable being instrumented by bank-specific equity ratio, NPL ratio, returns on average assets and bank size. The dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. Financially constrained companies are determined by the EIB Investment Survey methodology. Sargan test of over-identifying restrictions. Standard errors are clustered at the company and bank levels and they are reported in parentheses, where $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A1 Number of firms in ORBIS Database.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	36,609	63,552	78,201	85,481	89,367	86,510	90,522	101,890	104,750	108,179	112,969
Belgium	231,020	237,587	247,498	256,801	266,787	274,875	281,866	290,256	297,322	299,012	296,254
Bulgaria	25,935	24,221	37,904	49,428	37,227	38,814	42,826	174,637	210,577	220,374	231,991
Croatia	55,895	59,257	65,125	67,816	73,527	81,748	79,666	77,864	83,090	83,799	86,083
Cyprus	99	287	301	356	409	377	333	300	502	520	186
Czech Rep.	51,834	60,728	70,202	82,832	97,040	111,052	116,650	121,098	122,275	120,972	103,675
Denmark	59,546	65,392	73,316	81,457	86,735	88,472	89,744	92,135	94,058	96,662	99,695
Estonia	24,073	27,197	31,638	36,930	40,986	44,916	51,043	57,490	65,718	70,464	72,814
Estonia	24,073	27,197	31,638	36,930	40,986	44,916	51,043	57,490	65,718	70,464	72,814
Finland	66,424	67,771	67,823	84,565	100,488	104,624	109,061	112,706	108,951	111,214	112,129
France	655,692	683,319	718,154	753,084	789,368	804,790	829,186	849,339	864,388	826,868	622,146
Germany	66,393	381,505	617,097	638,599	663,026	670,545	660,338	669,187	513,542	436,192	359,288
Greece	26,495	27,235	27,615	27,584	26,858	25,766	26,092	26,808	24,145	22,434	19,942
Greece	26,495	27,235	27,615	27,584	26,858	25,766	26,092	26,808	24,145	22,434	19,942
Hungary	205,851	222,900	63,169	148,409	164,337	268,762	261,957	282,512	314,155	324,479	318,450
Ireland	36,333	40,768	46,087	50,966	55,759	59,339	63,436	68,345	73,955	80,286	84,379
Italy	418,073	437,122	464,083	671,929	694,412	702,628	717,452	719,443	708,702	697,979	661,401
Latvia	6,387	7,036	9,833	11,343	6,760	6,326	57,020	69,376	75,048	81,024	83,184
Lithuania	3,999	4,745	5,786	5,880	4,773	4,577	8,052	9,251	8,698	9,862	7,888
Luxembourg	3,153	5,104	6,891	7,499	9,151	12,194	12,569	12,217	12,212	11,243	8,471
Malta	1,019	1,206	1,311	1,379	2,048	2,242	2,270	2,158	1,916	1,751	1,068
Netherlands	149,272	192,171	234,738	251,089	264,918	272,295	278,481	284,170	288,767	296,488	290,158
Poland	18,757	23,505	44,003	53,290	65,149	64,308	72,711	77,763	89,635	89,530	74,822
Portugal	79,882	236,876	256,262	261,782	264,054	265,499	255,741	250,097	251,756	251,892	248,611
Romania	294,881	338,545	326,316	431,896	393,382	354,558	362,292	393,963	427,331	489,671	521,416
Slovakia	10,157	21,107	28,723	33,342	33,114	85,474	97,815	109,492	120,836	130,378	141,550
Slovenia	10,290	11,096	12,206	12,019	11,288	12,844	95,918	108,085	109,289	98,354	108,453
Spain	576,419	596,389	630,780	572,563	622,693	625,620	600,956	592,867	588,601	583,450	525,191
Sweden	143,436	146,245	150,455	156,806	163,997	172,946	183,304	203,578	223,965	239,347	255,735
UK	937,944	1,018,416	1,091,041	1,135,509	1,148,608	1,156,971	1,195,949	1,257,961	1,346,119	1,447,764	1,553,897
Total	4,659,055	5,560,136	6,037,783	6,724,460	6,977,914	7,227,445	7,489,667	7,899,593	8,017,389	8,112,542	7,839,649

Notes: This table summarizes the data on the number of firms in our ORBIS database over the period 2004–2014, for all countries in the sample, and for the following NACE Rev. 2 sections: (C) Manufacturing, (F) Construction, (G) Wholesale and Retail Trade, (H) Transportation and Storage, (I) Accomodation and Food Service Activities, (J) Information and Communications, (M) Professional, Scientific and Technical Activities, (N) Administrative and Support Service Activities. Source: ORBIS database.

Table A2 Country coverage in ORBIS and Bankscope.

Country	ORBIS coverage	Number of banks
Austria	25%	226
Belgium	57%	16
Bulgaria	46%	22
Czech Republic	13%	7
Germany	22%	1601
Denmark	52%	67
Estonia	85%	3
Spain	21%	62
Finland	43%	1
France	30%	113
Croatia	60%	16
Hungary	57%	10
Ireland	37%	6
Italy	19%	39
Luxembourg	46%	19
Latvia	70%	6
Netherlands	30%	13
Portugal	32%	77
Romania	76%	3
Sweden	33%	7
Slovenia	63%	9
Slovakia	27%	1
UK	66%	33
Cyprus	1%	N/A
Greece*	3%	1
Lithuania	6%	2
Malta	7%	1
Poland	4%	11
Average	44%	88

Notes: This table summarizes the average coverage of our ORBIS dataset with respect to Eurostat Structural Business Statistics for selected NACE 2 sections (see Table A1). We compare the period 2008-2014 due to data availability issues in SBS data by sector. For Greece we take the OECD Structural and Demographic Business Statistics for selected ISIC Rev. 4 equivalents of NACE 2 sections, as the country is not represented in the Eurostat tables. Source: ORBIS database, Eurostat Business demography by size class (Table: bd_9bd_sz_cl_r2), OECD Business statistics by employment size class. Banking sector coverage is taken by residence country of a bank.

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