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Full Length Article

Corporate growth – Trade credit relationship: Evidence from a panel of countries

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Abstract

This paper examines how a borrower's growth affects trade credit decisions. An analysis of publicly traded firm data from nine developed economies indicates that trade credit increases with growth. In some cases, this increase is driven by conditions related to liquidity. Exploring the relationship under macroeconomic conditions reveals evidence of an increase in trade credit financing in slow-moving economies and in times of adverse borrowing conditions. The findings indicate strong support from suppliers under circumstances that can be explained by informational symmetry and the increasing market power of growing firms.

JEL classification: G01; G30; G32

Keywords: Trade credit; Corporate growth; Working capital management; Alternative financing; Signaling

1. Introduction

Many important aspects of trade credit have been the subject of academic research. One important element, however, has not received sufficient attention: its relation to growth in business capacity. Expansion in a borrower's business will also be reflected in the supplier's business in that the sales of the two parties are connected, so the growing firm will become an important business partner by buying and selling more of the supplier's product. The current study seeks answers to several important questions: how trade credit (TC) supply to a borrower changes as that borrower grows, how a borrower's short-term liquidity fits into this context, whether cyclicality in the economy influences the decisions, and how the borrower adjusts their own TC supply policy in line with the policy of suppliers.

Previous studies have considered sales growth,[1] but investment in physical and nonphysical assets, which would actually enhance business capacity, can provide firsthand concrete evidence of the relationship. Hence, for the empirical part of this study, investment is used as a measure of growth. TC supply to growing firms, the main focus of the study, is measured both as the portion of total assets and the portion of total liabilities. The supply policy and the net TC balance (TC demand minus supply) of growing firms are also examined because findings related to their supply decision can provide valuable insights that can be useful in interpreting the evidence and therefore contribute to drawing reliable conclusions.

One of the strengths of the present study is the sample data, which encompasses publicly traded firms from nine countries. The large number of firms from different sectors with different TC policies that are shaped by the culture (Ghoul & Zheng,

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[1] Fabbri and Menichini (2010); Fabbri and Klapper (2016).

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2016), as well as the legal and financial structure in each country (Demirgüç-Kunt & Maksimovic, 2001), makes the sample richer and increases the generalizability of the results in comparison to single-country studies.

The analysis reveals a number of intriguing results. First, growth appears to be significantly effective in shaping TC contracts, resulting in an increase in the amount of TC supplied to growing firms and revealing the seller's commitment to the partnership. Informational efficiency on the part of each party, which is likely to extend to existing growth opportunities, might be driving the results. Economically motivated suppliers can judge a borrower by the smoothness of its business operations and its steadily rising purchase orders, indicators that the business is growing and that the future is promising. They can thus reliably determine which customers have the potential to generate a larger portion of their revenues in the future. If suppliers aspire to be a part of that promising future, they might be motivated to restructure their TC policy to accommodate that growing firm. Hence, potential growth in the business capacity of a firm may encourage its suppliers to strengthen the partnership and to be a part of a long-term commitment.

The rising market power of growing firms is also one of the likely drivers of the findings. Expanding operations naturally increases borrowers' bargaining power and may enable them to draw up a contract with favorable terms that will be accepted by the supplier. The role of competitive power in affecting TC contracts has been documented in previous studies (see Fabbri & Klapper, 2016 and; Demir & Javorcik, 2018). The findings of the present study are complementary to those of the abovementioned studies; by investing, firms can actually add to their existing market power and negotiate for better terms.

Another interesting result is that growing firms increase the supply of TC. This might seem surprising at first, but it is normal when one considers that growing firms will want to liquidate the borrowed inventory as quickly as possible to avoid the costs associated with holding on to it (Bougheas, Mateut, & Mizen, 2008). TC supply policies may also be adjusted in accordance with the growth objectives, which create a positive correlation between TC offerings and the growth rate (Niskanen & Niskanen, 2006). Promoting new sales and expanding market share subsequent to growth may require an increase in the supply. Thus, growth enables borrowers to acquire and use TC both as a source of liquidity and as an instrument for promoting sales. Another valid explanation for the increase in supply is the product quality verification argument discussed by Long, Malitz, & Ravid, (1993) and Deloof and Jegers (1996). Information about changes in product lines and the customer base of growing firms is not available, but it is plausible that any new product and/or new customers that come with expansion may require TC for quality verification purposes.

Once a set of reliable evidence on the growth-TC relationship is obtained, the next question is what drives it. For example, do liquidity-related issues play any role, as reported in early studies by Deloof and Jegers (1996) and Garcia-Appendini and Montroil-Garriga (2013)? Exploring the motivation behind the increase produces evidence that a shortage of liquidity is relevant. This conclusion is based on several findings. First, there is direct evidence that the financial conditions of growing firms—conditions such as a lack of liquidity—drive TC financing decisions. Analyses conducted with alternative measures of liquidity provide robustness to this conclusion. Second, an analysis of TC borrowed as a portion of liabilities and the evidence related to TC supply decisions also lends credibility to this verdict. Third, ceteris paribus, growth causes supply to increase more than demand unless growing firms operate with a shortage of liquidity. Hence, a lack of short-term liquidity in growing firms plays a significant role in the increase in TC received from suppliers.

Although it is not formally tested here, gross profit margin seems to account for a significant portion of the increase of TC in favor of supply. The median value for the margin in growing firms is about 45%, which is high enough to explain some portion TC provided due to growth. Thus, for every unit that is bought and sold, such a markup results in more TC supplied in percentage terms.[2]

In contractionary periods, when access to conventional financing is reduced, TC becomes a substitute for bank loans, and there may be a significant increase in the use of TC (Mateut, Bougheas, & Mizen, 2006). With this in mind, this study investigates the effect of adverse economic/credit conditions on the attitude of suppliers toward growing firms. The findings are contrary to the observational conclusion of Ferrando and Mulier (2013), and the empirical findings of Demirgüç-Kunt and Maksimovic (2001); both of these studies indicate that the aggregate pattern in TC is pro-cyclical, i.e., it increases and decreases with economic activity, whereas the findings of this study suggest that suppliers continue to support growing firms, even in a slow economy, which emphasizes the strength of commitment to the partnership. On the other hand, the evidence on the effect of credit conditions is not as strong. A scrutiny of a three-year period during which the smallest annual growth[3] in bank lending to the corporate sector was realized reveals that growing firms received more TC than the rest of the sample in those years, indicating the availability of a source of liquidity in times of need.

[2] Average gross profit margin is around 50% and the median is 43% for all firms and the average for growing firms is 45%. An investing firm is probably not offering the inventory to which its own cash is tied up. What is offered is the inventory borrowed from the suppliers, which may or may not goes through manufacturing process but leaves the company with a price up by 45%, and is likely to explain the rise. Consider a firm with total assets of 100$ and the product, borrowed from suppliers, worth of 10$. In the case of no other inventory and no other TC, accounts payable would be 10% of total assets of that firm. If the firm offers this inventory to a buyer via TC, assuming a 50% of gross profit margin, then TC offered would be 15$ and the firm would have receivables, amounting to 15% of total assets. The net TC would be negative 5% due to the profit margin. Hence, for every extra unit bought and sold after the growth the firm will naturally be offering more TC in percentage terms unless some changes are made.

[3] In the mentioned period, roughly half of the values are positive, so it is called a small growth period instead of a contraction.

The present study satisfies the need for an investigation of the effect of growth on TC policies and adds a new element to the literature that focuses on firm-specific determinants of TC policy. Empirical evidence overwhelmingly suggests that a borrower's growth prospects encourage its supplier(s) to make a commitment and provide favorable treatment, which underlines the importance of including growth in future analyses. In this vein, the present study is related to the literature that includes international data and examines the effect of general economic conditions. Empirical results provided by Demirgüç-Kunt and Maksimovic (2001) indicate that GDP growth and TC activity are positively correlated. Ghoul and Zheng (2016), however, report a negative correlation. Huang, Shi, & Zhang, (2011) focus on the TC and bank-financing relationship and examine how that relationship changes in accordance with growth in GDP. They conclude that the substitution effect between TC and bank financing is countercyclical. The evidence obtained here indicates that growing firms demand more TC in a slow economy, and the advantage of growth that the borrower holds is not considered in the above studies and likely to be the cause of differing findings.

The present study also concerns optimal managerial decisions that involve investment and following short-term liquidity management, thus documenting that growth attracts alternative financing when needed. Moreover, the study is related to signaling theory promoted by Biais and Gollier (1997) and Agostino and Trivieri (2014), who argue that business partners, unlike financial intermediaries who rely on financial reports, have more reliable knowledge about their partners' businesses. Since the partners that operate in the same industry are likely to be aware of business opportunities, the seller knows about the return on its partner's investment and, therefore, is willing to offer more credit and take a risk. This also implies that third parties such as banks and investors can consider that a significant increase in TC might be associated with growth in business operations; therefore, the findings offer informational advantages and clarity in assessing firms. Another branch of the literature that focuses on TC financing and stock performance explains how this advantage comes into effect. Aktas, Bodt, Lobez, & Statnik, (2012), for example, report that the TC level is related to a firm's performance. Similarly, Goto, Xiao, & Xu, (2015), relying on the informational content of suppliers' financing, argue that TC is a strong predictor of the stock return of borrowing firms. Although they make a convincing case for TC as an indicator of the performance of borrowers, they do not go beyond that to investigate what the content of that valuable information might be. Corporate growth through investment can lead to an increase both in TC and in the mentioned performance measures. Hence, another contribution of this study is the finding that introduces a new dimension to the ongoing discussion, implying that the missing link between TC and firm performance may have been the growth in business capacity. TC is able to communicate valuable and favorable information to outsiders because it is a leading indicator of the future value creation process.

The remainder of this study is structured as follows. Section 2 presents the hypotheses. Data and methodology are given in Section 3, empirical findings are presented in Section 4, and in Section 5, a brief conclusion is offered.

2. Hypothesis development

The place of TC in corporate financing has been the subject of a large number of studies. Two opposing views in particular have found significant support in the academic community.

The first view argues that TC is an alternative financing source in the sense that firms turn to their suppliers for financing when the credit supply from traditional financial intermediaries declines, i.e., it is a substitute for bank financing (see, for example, Mateut et al., 2006; Nilsen, 2002).

The second view posits that TC is *complementary* to bank financing, citing empirical evidence on a simultaneous increase in both components. This idea is based on disproportionate access by financial intermediaries and business partners to information on borrowers. Suppliers have reliable information on their partners because they can simply monitor the frequency and volume of the orders placed by customers (Petersen & Rajan, 1997). A seller can also gain informational advantage by paying frequent visits to its partners (Mian & Smith, 1992) to observe the progress on site. Banks suffering from informational asymmetry can consider TC an indicator of a borrower's quality and rely on suppliers' judgment (Burkart & Ellingsen, 2004; Agostino & Trivieri, 2014). Informational transparency between business partners is fed primarily by business transactions. For example, regularly placed orders and growth in the volume of the orders might suggest that a buyer's business is thriving. This information can help the seller judge the partner's business and decide if it is worthy of credit (Agostino & Trivieri, 2014; Biais & Gollier, 1997; Petersen & Rajan, 1997). A logical implication of this argument is that suppliers have the necessary knowledge about the opportunity set their partners have, and they can reposition themselves accordingly to take advantage of it. Hence, firms with better growth opportunities may receive favorable treatment.

H1. *Growing firms receive more TC.*

The first hypothesis targets the central goal of this study, which is to collect empirical evidence on whether growth in the business of a borrower leads to an increase in TC supplied to that borrower, with the aim of casting light on how a borrower's growth prospects affect sellers' supply decisions.

For a borrowing firm, growth means a capacity increase, more production, and more sales; to a supplier, it means more business with the buyer in the future. In times of difficulty or temporary liquidity-related shocks, firms may simply find it less costly to delay payment and/or borrow more from suppliers than renegotiate with a bank (Danielson & Scott, 2004), and suppliers can, by offering TC on acceptable terms, create a win-win situation for the future. Clearly, offering TC in such times—with the goal of expanding their business and

profitability by capitalizing on the partner's market share growth—is a strategic decision for suppliers. The incentive for the seller to increase the supply is strong. This discussion leads to the question of whether suppliers increase TC supply to growing firms that experience a lack of liquidity**.**

H2. *Growing firms receive more TC when they experience a shortage of liquidity.*

H3. *Growing firms receive more TC under adverse macroeconomic conditions*.

Hypotheses 2 and 3 are designed to reveal the supplier's level of commitment to its partnership with a growing firm. If the supplier continues to support its partner under these conditions—for example, when a borrower suffers from a lack of short-term liquidity or during an economic period when its ability to obtain external capital is hammered—it would indicate the seller's commitment to the partnership. The second part of the analysis therefore broadens the first part, with the goal of documenting the extent of the relationship between the partners.

3. Data and methodology

Data on nonfinancial publicly traded firms from the 9 largest developed economies (see the supplementary material available online for the list of countries) are retrieved from Datastream. Annual corporate data cover the period of 2000–2014. The reasons for studying this specific sample are as follows. The first is that including firms from multiple countries increases the generalizability and reliability of the results. The fact that publicly traded firms have received relatively less attention than SMEs in the existing literature motivated the current sampling. Identifying how TC policies of these firms evolve under specific circumstances can offer deeper insights into the role of TC; unlike SMEs, they have stronger access to external financing sources, and in addition, they are based in countries where the financial system offers resources to satisfy their financing needs. For the period, the early and late 2000s were less stable in comparison to 2015–2019 as far as the macro variables used in this study are concerned. For example, in 2003, the German economy grew by approximately negative 1%; in 2012, Italy grew by negative 2.8%; and in 2011, Japan grew by negative 0.7%. Most countries closed 2008 and 2009 with negative growth: virtually all countries were affected, to varying degrees, by the 2008 global financial crisis. However, in the late 2000s, the aforementioned countries, with the exception of Italy, achieved strong growth. This variation in growth rates presents an opportunity to test the hypotheses on a period that covers both high and low growth, which is particularly important, given the nature of TC. Additionally, the existence of sharp changes in the macroeconomic environment, such as sizeable contractions in lending to the real sector, can cause specific patterns to emerge in aggregate TC. For example, in 2000, the ratio of corporate borrowing to GDP in Korea declined more than 10%, but in 2008, it rose approximately 13%. Another example is the U.K., where according to IMF data, the ratio increased by more than 8% in 2005 but decreased by approximately 8% in 2014. The period in hand exhibits drastic fluctuations in GDP growth and borrowing rates and therefore offers an ideal setting for studying the hypotheses stated earlier.

The original data included 449,263 firm-year observations with a large number of empty cells. First, the extreme values were removed—the top and bottom 2% of each key variable (trade payable, trade receivable, net trade credit, capex and growth in fixed assets). Second, balance sheet variables (e.g., accounts receivable/payable, cash balance, tangible assets, financial debt after being scaled to total assets) were kept within the lower bounds of zero and upper bounds of one. Third, negative assets and firms with fewer than four observations were dropped (for a similar procedure, see Huang et al., 2011). To avoid selection bias, no adjustments were made regarding firm entry and exit, so at the end of the data cleaning process, the sample is unbalanced panel data of 8063 firms and 71,326 observations[4] (the detailed steps of the data cleaning process are provided in Table S3, available online).

Descriptive statistics of the variables are presented in Tables S2 and S3 (see the supplementary material available online), and related variables are scaled by size variable.[5] The average ratio of trade payables to total assets is approximately 12%, whereas the average trade credit supplied is approximately 19%. Clearly, publicly listed firms supply more than they receive. The firms that supplied the highest TC are in France, Italy and Japan, in descending order. The net TC balance, on the other hand, varies from country to country, and the highest net TC suppliers are in France, Italy and Korea. Despite the existence of similarities across countries in legal and financial structures, TC activity shows heterogeneity both across and within countries. For example, the U.S. has the lowest average borrowed TC—8% of total assets; in Italy, it is twice that figure, 16%. One can observe similar variation in TC supply. As mentioned earlier, short-term liquidity, namely, cash balance, is an important determinant of TC policy, and on average, firms seem to follow different cash holding policies both within and across groups. The average cash balance of Japanese firms is twice that of Korean and Italian firms. Wide variations in the cash balance of firms are also observable within groups. With respect to size and age, firms vary within groups, but similar properties exist across countries. Thus, within-country and cross-country variation in key variables constitutes a heterogeneous sample.

Regression equations and the variables are presented below. The methodology is built upon a reasonable assumption that short-term variables—for example, the amount of trade credit

[4] This process automatically removes "NA" filled cells.

[5] To deal with endogeneity, the Arellano-Bond system GMM is used, which requires finding proper instruments produced by the lags and/or difference of explanatory variables. Debt is subtracted from total assets and size became: $Size_{ijt} = (total\ assets - debt)_{ijt}$, to help find exogenous instruments.

Table 1
Variable descriptions.

Dependent variables		
TC_{ijt}^{D*}	Accounts payable	Accounts payable$_{ijt}/Size_{ijt-1}$
TC_{ijt}^{S}	Accounts receivable	Accounts receivable$_{ijt}/Size_{ijt-1}$
TC_{ijt}^{NET}	Accounts payable minus accounts receivable	(Accounts payable − accounts receivable)$_{ijt}$ $/Size_{ijt-1}$
Explanatory variables		
Cash[a]	Cash	$Cash_{ijt}/Size_{ijt-1}$
Tangible assets[a]	Plant property and equipment (PPE)	$PPE_{ijt}/Size_{ijt-1}$
Growth[a]	Growth in tangible assets and capital expenditure	$(GFA_{ijt} - GFA_{ijt-1})/Size_{ijt-1}$; $Capex_{ijt}/Size_{ijt-1}$
Positive Growth[a]	If annual change in gross fixed assets is positive, then it takes the value of the change; otherwise, it is zero	If $GFA_{ijt} - GFA_{ijt-1} > 0$; then $Positive\ growth = \frac{GFA_{ijt} - GFA_{ijt-1}}{Size_{ijt-1}}$; otherwise, it is 0
D_{cash}	Dummy for a lack of liquidity measured by the level of cash stock	$D_{cash} = 1\ if \frac{cash_{ijt}}{current\ assets_{ijt}} < 0.17\ otherwise\ D_{cash} = 0$
Low Cash	Dummy variable is interacted with positive growth	$Low\ Cash = Positive\ growth{*}D_{cash}$
$D_{cashlike}$	Dummy for a lack of liquidity measured by the level of cash and cash like assets	$D_{cash} = 1\ if \frac{cashlike\ assets_{ijt}}{current\ assets_{ijt}} < 0.25\ otherwise\ D_{cashlike} = 0$
Low Cashlike*	Dummy variable is interacted with positive growth	$Low\ Cashlike = Positive\ growth{*}D_{cashlike}$
$D_{LowGrowth}$	Three years of lowest growth in GDP of each nation	$D_{LowGrowth} = 1$ if a year is one of the three years of lowest growth, otherwise it is 0.
Low Growth[a]	Low growth dummy variable is interacted with positive growth and capex	$Positive\ growth{*}D_{LowGrowth}$, $capex{*}D_{LowGrowth}$
$D_{contract}$	Three years of lowest growth in corporate debt/GDP of each nation	$D_{contract} = 1$ if a year is one of the three years of lowest growth, otherwise it is 0.
Contraction[a]	Low growth dummy variable is interacted with positive growth and capex	$Positive\ growth{*}D_{contract}$, $capex{*}D_{contract}$
Debt	Bank loans and debt securities	$Debt_{ijt}/Size_{ijt-1}$
Size	Total assets minus bank loans and debt securities	$\log(total\ assets - debt)_{ijt-1}$
Financial Slack	Current assets in logarithmic form, minus short-term liabilities in logarithmic form, excluding TCs	$log(Curr.\ assets - acc.\ receivable)_{ijt} - \log(short\ term\ liabilities - acc.\ payable)_{ijt}$

[a] This variable is also scaled by total liabilities.

to demand and supply—are driven by long-term objectives such as investment. In accordance with the hypotheses presented in Section 2, the equation is designed to document changes in TC policies subsequent to growth in business capacity.

$$TC_{ijt} = \alpha_i + TC_{ijt-1} + \beta_1 growth_{ijt} + \beta_n X_{ijt} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

In Eq. (1), TC_{ijt} represents one of the TC measures, namely, borrowed TC, supplied TC, and their difference, scaled by size variable. Given the high correlation between the demand for TC and the supply of TC, employing both TCs and their difference is necessary for a comprehensive approach. Ferrando and Mulier (2013) argue that firms use borrowed TC to finance TC supply. Accordingly, any change in 1 TC as a result of growth is likely to arise in the other TC as well. Including net TC as a dependent variable therefore provides an opportunity to isolate the net effect. Borrowed TC is also included as a portion of external funds, in other words, accounts payable scaled by liabilities. Goto et al. (2015) use the ratio of TC to liabilities to account for the supplier's informational advantage on the borrower's business and argue that it reflects the supplier's level of confidence. On the other hand, Mateut et al. (2006) use the same ratio to represent the role of TC as a source of funding, claiming that when some firms' access to traditional financing is weakened by macroeconomic conditions, they increase TC financing, which would be reflected in this ratio. Therefore, including TC as a portion of liabilities in the analysis as a dependent variable can provide robustness to the findings.

The other key variable, growth, is measured via investments in tangible assets, namely, gross fixed assets (GFA). Gross assets include the amount of depreciation for the fiscal year and reflect the replacement value of the investment. The second measure of growth is annual capital expenditure (capex). In recent decades, the nature of corporate investment has gone beyond the acquisition of long-term physical assets and now encompasses intangible capital in accordance with the rising importance of such assets in achieving long-term objectives

Table 2
System GMM analysis: Growth and TC.

Dependent variable	TC^{D}_{ijt}		TC^{S}_{ijt}		TC^{NET}_{ijt}		TC^{D*}_{ijt}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged dependent variable	.586***	.490***	.176***	.536***	.004	.004	–.005	–.003
	(.116)	(.111)	(.050)	(.084)	(.004)	(.023)	(.000)	(.003)
Growth	.095***	.495***	.198***	.633***	–.151***	–.136***	.051***	.182***
	(.027)	(.193)	(.053)	(.239)	(.048)	(.040)	(.017)	(.045)
Tangible assets	–.109***	–.136***	–.253***	–.130***	.147***	.137***	.015**	–.008
	(.038)	(.022)	(.033)	(.033)	(.015)	(.020)	(.007)	(.005)
Debt	.114**	.091***	.170***	.046***	–.054**	–.070***		
	(.049)	(.011)	(.039)	(.015)	(.020)	(.024)		
Size	–.011*	–.002	–.011	–.004**	.012***	.009***	–.008***	–.017***
	(.006)	(.001)	(.005)	(.001)	(.003)	(.003)	(.002)	(.004)
Cash	–.235	–.160***	–.378*	.271***	–.135***	–.169**	.098***	.056***
	(.169)	(.059)	(.318)	(.087)	(.033)	(.067)	(.013)	(.009)
Financial slack	.013	–.001	–.048***	–.038***	.060***	.061***	.029***	–.032***
	(.009)	(.007)	(.015)	(.005)	(.003)	(.007)	(.005)	(.003)
ROA	.252	–.145	–.270	.107***	–.151***	–.091***	–.041***	.005
	(.227)	(.128)	(.160)	(.041)	(.030)	(.029)	(.011)	(.028)
AR (1)	.000	.000	.000	.000	.000	.000	.000	.000
AR (2)	.182	.790	.535	.301	.107	.248	.516	.845
Hansen	.118	.521	.103	.416	.787	.161	.131	.121
# obs	33,527	21,823	26,473	31,078	46,610	25,229	37,659	46,744

Robust standard errors are in parentheses and ***, **, * denote significance levels at 1%, 5%, and 10%, respectively. All specifications are estimated with a constant, time, industry and country dummies. AR(2) represents the P-values for the second order serial correlation in the residuals, with the null of no correlation. P values of Hansen test with the null of instrument validity are presented. TC^{D}_{ijt} is trade credit received from suppliers; TC^{S}_{ijt} is trade credit supplied to buyers; TC^{NET}_{ijt} is the difference between received and extended trade credit; and TC^{D*}_{ijt} is trade credit received from suppliers as portion of liabilities. Growth is growth in tangible assets (capex) in columns 1, 3, 5, 7 (2, 4, 6, 8); debt represents interest bearing debt; size is logarithm of total assets minus debt; cash is cash stock; and financial slack is the logarithmic difference between short-term assets and short-term liabilities, excluding TCs. ROA is operating profit scaled by size.

(OECD, 2007; Zéghal & Maaloul, 2011).[6] Thomson Reuters (2015) defines the annual capex as the sum of the purchase of fixed assets, the purchase/acquisition of intangibles, and software development costs, i.e., the expenditures necessary for maintaining the existing production capacity in premium conditions and noncompulsory expenditures for growth. Hence, capex is used as an alternative measure of growth that, along with former growth measures, also provides robustness to the findings. X_{ijt} represents the rest of the explanatory variables, which are found to be relevant in previous studies, such as those by Deloof and Jegers (1996), Garcia-Appendini and Montoriol-Garriga (2013), and Nilsen (2002). Detailed descriptions are presented in Table 1.

An endogeneity problem arises when explanatory variables are correlated with error terms. A practical and efficient way to control for this problem is to use instruments, which are correlated with the original variables and uncorrelated with error terms, produced from the lags and lagged differences of endogen variables (Arellano & Bond, 1991). A system GMM panel data analysis is chosen as the main methodology because it allows addressing this problem using lagged level and lagged differences of explanatory variables as instruments. Both of the growth variables and the first lag of the dependent variables are treated as potentially endogenous. In addition, cash stock and profitability are assumed to have violated the exogeneity condition (see, for example, Kling et al., 2014). The rest of the regressors are used in levels as instruments to themselves.

GMM estimation requires that the test for second-order serial correlation, AR (2), not be rejected because the existence of serial correlation causes inconsistent coefficients. It is also necessary that the instruments are not correlated with the error term, i.e., they are jointly exogenous, which is tested by the Hansen test (see, for example, Roodman, 2009). Since the choice of lags, particularly the number of lags and the type of equation—difference or level—can directly affect both tests' results, the goal is to choose the best lag structure that satisfies these conditions. While doing so, one must try to minimize the number of instruments and choose from the closest lags (for example, if t-2 and t-3 are both available and both satisfy the above conditions, then t-2 is preferred, since it is more likely to have a stronger correlation with the original variable). However, the lag structure that satisfies the aforementioned conditions in the case of TC^{D}_{ijt}, for example, may not work in the case of TC^{S}_{ijt}, so both the equation and/or the lag numbers for instruments may change. Similarly, adding liquidity and positive growth variables later in the analysis results in the use of different sets of instruments.

For this reason, the instruments include further lagged levels and lagged differences of these variables, starting from the first and second lag and in some cases (particularly in the

[6] I am grateful to an anonymous reviewer for bringing this point to my attention.

Table 3
System GMM analysis: Growth, trade credit and the lack of liquidity.

Dependent variable	TC^{D}_{ijt}		TC^{S}_{ijt}		TC^{NET}_{ijt}		TC^{D*}_{ijt}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged dependent variable	.284***	.178**	.356***	.335**	−.031	.007	−.005	−.001
	(.079)	(.081)	(.115)	(.156)	(.035)	(.008)	(.000)	(.001)
Growth	.058***	.743***	.108***	145	−.082***	−.462***	.036***	.213***
	(.019)	(.284)	(.037)	(.251)	(.024)	(.125)	(.017)	(.063)
Low cash	.085***	.327	.355***	.434*	−.225**	.653***	.140***	.029
	(.020)	(.294)	(.098)	(.261)	(.105)	(.241)	(.044)	(.078)
Tangible assets	−.100***	−.136***	−.180***	−.174***	.185***	.112***	−.045****	−.015**
	(.013)	(.030)	(.031)	(.033)	(.013)	(.016)	(.009)	(.006)
Debt	.061***	.044***	.108***	.067***	-.088***	-.076***		
	(.012)	(.015)	(.028)	(.021)	(.016)	(.017)		
Size	−.007**	.006	−.007	−.007**	.007***	.009***	−.003	−.019***
	(.004)	(.004)	(.007)	(.003)	(.002)	(.003)	(.003)	(.003)
Cash	.011	-.013	.327	.285**	−.147***	−.057*	.203***	.047
	(.035)	(.059)	(.203)	(.141)	(.040)	(.038)	(.044)	(.035)
Financial slack	−.005*	−.021***	−.028***	−.049***	.058***	.049***	−.004	.032***
	(.004)	(.005)	(.009)	(.012)	(.004)	(.003)	(.013)	(.009)
ROA	.293*	−.388**	−.235	.229**	−.020	−.056	−.027**	.012
	(.158)	(.195)	(.185)	(.092)	(.086)	(.066)	(.011)	(.016)
AR (1)	.000	.000	.000	.000	.000	.000	.001	.000
AR (2)	.436	.263	.234	.089	.171	.247	.770	.247
Hansen	.124	.152	.118	.143	.120	.389	.194	.389
# obs	31,127	44,968	44,968	45,141	19,635	46,779	30,222	46,744

Robust standard errors are in parentheses and ***, **, * denote significance levels at 1%, 5%, and 10%, respectively. All specifications are estimated with a constant, time, industry and country dummies. AR(2) represents the P-values for the second order serial correlation in the residuals, with the null of no correlation. P values of Hansen test with the null of instrument validity are presented. TC^{D}_{ijt} is trade credit received from suppliers, $TC^{S}_{ijt}$is trade credit supplied to buyers, $TC^{NET}_{ijt}$is the difference between the received and the supplied trade credit, TC^{D*}_{ijt} is trade credit received from suppliers as portion of liabilities. Growth in columns 1,3,5,7 is growth in tangible assets, *l*ow cash = $positivegrowth*D_{cash}$ where D_{cash} represents firms with cash stock below 0.17 (median value for cash/current assets), and $positive\ growth = \frac{GFA_{ijt} - GFA_{ijt-1}}{Size_{ijt-1}}$ if $\frac{GFA_{ijt} - GFA_{ijt-1}}{Size_{ijt-1}} > 0$; otherwise it is 0. Growth in columns 2,4,6,8 is capex, and *l*ow cash = $capex* D_{cash}$, debt represents interest bearing debt, size is a logarithm of total assets minus debt, cash is cash stock, financial slack is the logarithmic difference between short-term assets and short-term liabilities, excluding TCs. ROA is operating profit scaled by size.

case of the lagged dependent variable) up to the tenth lag.[7] Instrument selection is determined by the orthogonality condition, which is tested by the Hansen test, and by the information driven from the serial correlation (AR (1) and AR (2)) tests. The test results provide feedback on the validity of the instruments and provide guidance on finding appropriate lag structures while documenting statistical and economic relationships among the variables.

4. Empirical findings

4.1. Growth and trade credit

The first set of analyses reveals how TC changes subsequent to growth. In the absence of a significant relationship, the analysis should yield an insignificant coefficient for growth, or any relation should be absorbed by the control variables. Throughout the analysis, robust standard errors are reported in parentheses. Columns 1 through 4 of Table 3 show the effect of growth on TC financing. In columns 1 and 2, the dependent variables are TC demand and supply, respectively; in column 3, it is net TC, and in column 4, borrowed TC is a portion of liabilities. The coefficients for both growth measures in columns 1 and 2 are positive and significant; the more investment firms make, the more TC they receive.

Similarly, growing firms increase the portion of TC in total external capital, as shown in columns 7 and 8, confirming the positive association between growth and TC financing. As explained earlier, suppliers' knowledge about their clients' future potential in terms of growth in sales and profitability is likely to be driving this result. A similar positive association was also reported in early studies. Petersen and Rajan (1997), for example, find that positive growth results in more TC supplied to growing firms. Werner and Nielen (2011) examine the effect of innovation on TC financing and find that innovative firms receive more TC because their business partners are incentivized by the innovative activities of the buyer, which is likely to spur growth in sales; thus, they are willing to increase the supply. Furthermore, Love and Zaidi (2010) argue that firms' need for external financing may fluctuate in accordance with growth opportunities, suggesting that higher growth may result in demand for more TC. The present study reaches a conclusion that is similar to those in the aforementioned studies, but it also differs significantly. For example, I

[7] This is the reason for the difference between the size of the sample in the tables of results and the size of the full sample.

use investment activity as representative of growth, whereas Petersen and Rajan (1997) use sales growth; Werner and Nielen (2011) use product innovation; and Love and Zaidi (2010) use export ratio in times of currency devaluation.

An increase in the volume and frequency of orders can also add to the bargaining power of a growing firm, making it a leverage factor for obtaining more TC. In a setting where partners' revenues are connected, growing firms will generate a larger portion of suppliers' sales, so growing firms may impose certain conditions for their own advantage. This argument has found empirical support from Fabbri and Klapper (2016) and Demir and Javorcik (2018). The findings of the present study are closely comparable to theirs with regard to the idea that growth through capacity expansion contributes to market power, making it possible for firms to use their growth in negotiating for better terms in their contract. For economic magnitude, while a one-unit increase in growth in tangible assets creates a 10% increase in the amount of TC received, the increase is 50% in the case of the capex. Clearly, capex-oriented growth attracts more TC.

If, around the time of investment, TC comes at a cost that is favorable, then an increase in the ratio of TC to total liabilities may reveal firms' preferences. The results presented in columns 7 and 8 of Table 2 (where the dependent variable is TC scaled by liabilities) indicate that a one-unit increase in tangible assets and capex leads to increases of 5% and 20%, respectively. This finding implies that TC may be supplied to growing firms at considerably favorable terms because it would be more reasonable to observe an increase in financial debt coinciding with investment (DeAngelo, DeAngelo, & Whited, 2011; Denis & McKeon, 2012), which would push the portion of TC down. Therefore, a likely interpretation is that the prospects of a growing partner constitute a strong motivation for suppliers to extend TC with acceptable terms.

On the other hand, the findings in columns 3 and 4 indicate that the TC supply from growing firms increases. It is likely that these firms extend more TC to promote sales with growth, which is compatible with the findings of Petersen and Rajan (1997) and Garcia-Appendini, & Montroel-Garriga (2013), who conclude that firms use TC to increase sales. Niskanen and Niskanen (2006) claim that firms adjust their TC supply policy in accordance with growth objectives and indicate the existence of a positive correlation between growth and TC supply. Similar arguments have been put forth by Ferrando and Mulier (2013). While these findings are consistent with existing studies, none of them consider investment as a measure of growth; the present study is thus complementary to theirs.

Furthermore, net TC balance is used as a dependent variable, and corresponding changes provide robustness to early findings. A positive (negative) result indicates that growing firms receive (supply) more than they supply (receive). The results in columns 5 and 6 indicate that growth causes the net TC balance to increase in favor of supply. A likely interpretation of this finding is that firms increase supply to avoid the dead weight of inventory, as proposed by Bougheas et al. (2008). It is understandable that they would liquidate the borrowed inventory that came with growth by extending more TC. As explained in the introduction, a gross profit margin of approximately 50% is also likely to be responsible for the increase in net TC. As the margin goes up, borrowed inventory—in case it is being bought and sold on credit—will drive the balance of receivables higher, causing supply to increase more than demand for every unit of growth.

When growth is measured by tangible assets, one unit in growth causes a 20% increase in the supply, which becomes 63% when growth is proxied by capex. The coefficients obtained by the net TC analysis are similar and suggest that one unit in growth causes growing firms to increase the supply approximately 15% more than the amount they receive. This finding is comparable to the results of Niskanen and Niskanen (2006), who obtain a 5% increase in TC supply as a result of a one-unit increase in growth. Petersen and Rajan (1997) obtain a marginal effect of −1% in supply and 1% in demand for TC. The difference between the results of both studies and those in the present study may be attributable to several factors. The data used here, for example, belong to public firms, which are financially more flexible and self-sufficient, whereas they use data on SMEs, which are more likely to be dependent on external financing (Karakoc, 2020). More importantly, they use different measures of growth.[8] Nevertheless, the direction of the relation is the same and suggests that growth leads to an increase in TC supply.

4.2. Growth, trade credit and short-term liquidity

Empirical evidence presented in Section 4.1 indicates that growth in business capacity results in attracting more TC. However, it is still unclear whether a shortage of liquidity plays any role. For example, according to Deloof and Jegers (1996), Garcia-Appendini, & Montroel-Garriga (2013), and Huang et al. (2011), the cash stock of a company, an important liquidity measure, is a significant determinant of TC policy. Low cash and low cash-like dummies, based on cash stock and short-term liquid assets, including cash, respectively, are added to the analysis to account for the effect of illiquidity. The positive changes in GFA, since it only includes growth (versus liquidations), are interacted with a low cash dummy. low cash $=$ $positivegrowth{*}D_{cash}$, where $D_{cash}=1$ $if\ \frac{cash_{ijt}}{current\ assets_{ijt}}<0.17$ $otherwise D_{cash}=0$ and $positive\ growth=\frac{GFA_{ijt}-GFA_{ijt-1}}{Size_{ijt-1}}$ if $\frac{GFA_{ijt}-GFA_{ijt-1}}{Size_{ijt-1}}>0$; otherwise, it is 0.

The low cash dummy variable also interacts with the capex; low cash $=$ $capex_{ijt}{*}D_{cash}$.

An alternative measure of liquidity, cash plush cash-like assets, i.e., short-term investments, is used as a robustness check. A liquidity dummy variable: $D_{cashlike}=1$; if $\left(\frac{\text{cashlike assets}_{ijt}}{\text{current assets}_{ijt}}\right)<0.25$ otherwise $D_{cashlike}=0$interacts with

[8] Niskanen and Niskanen (2006) and Petersen and Rajan (1997) use sales growth.

Table 4
System GMM analysis: Growth, trade credit, and the lack of liquidity.

Dependent variable	TC^{D}_{ijt}		TC^{S}_{ijt}		TC^{NET}_{ijt}		TC^{D*}_{ijt}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged dependent variable	.382***	.174**	.337***	.330*	−.039	.141*	−.001**	−.001
	(.096)	(.086)	(.129)	(.189)	(.035)	(.075)	(.000)	(.001)
Growth	.073***	861***	.106***	.327	−.096***	−.383***	.048***	.175***
	(.028)	(.282)	(.039)	(.256)	(.024)	(.112)	(.013)	(.047)
Low cash-like	.093***	.132	.278**	.258	−.183*	.507***	.205***	.328**
	(.029)	(.341)	(.115)	(.270)	(.105)	(.178)	(.038)	(.097)
Tangible assets	−.090***	−.136***	−.210***	−.196***	.188***	.112***	−.015***	−.010
	(.013)	(.029)	(.054)	(.041)	(.013)	(.017)	(.009)	(.007)
Debt	.052***	.043***	.141***	.086***	−.092***	−.046*		
	(.012)	(.015)	(.059)	(.018)	(.016)	(.024)		
Size	−.007**	.005**	−.007	−.009**	.007***	.005	−.009***	−.009***
	(.004)	(.004)	(.007)	(.004)	(.002)	(.002)	(.003)	(.002)
Cash	.003	−.027	.354	.336**	−.120***	−.181	.071	.076***
	(.035)	(.052)	(.237)	(.163)	(.040)	(.091)	(.044)	(.008)
Financial slack	−.003	−.022***	−.026***	−.051***	.058***	.056***	.040***	−.035***
	(.004)	(.007)	(.011)	(.017)	(.004)	(.006)	(.013)	(.006)
ROA	.290*	−.421***	−.252	.258**	.001	−.090***	−.052***	−.044***
	(.150)	(.207)	(.185)	(.121)	(.086)	(.034)	(.015)	(.012)
AR (1)	.000	.000	.000	.000	.000	.001	.001	.000
AR (2)	.356	.237	.294	.187	.161	.821	.746	.257
Hansen	.214	.121	.112	.116	.268	.173	.100	.092
# obs	31,127	44,968	44,968	36.491	19,635	37,700	37,788	46,576

Robust standard errors are in parentheses and ***, **, * denote significance levels at 1%, 5%, and 10%, respectively. All specifications are estimated with a constant, time, industry and country dummies. AR(2) represents the P-values for the second order serial correlation in the residuals, with the null of no correlation. P values of Hansen test with the null of instrument validity are presented. TC^{D}_{ijt} is trade credit received from suppliers, $TC^{S}_{ijt}$is trade credit supplied to buyers, $TC^{NET}_{ijt}$is the difference between the received and the supplied trade credit, TC^{D*}_{ijt} is trade credit received from suppliers as portion of liabilities. Growth in columns 1,3,5,7 is growth in tangible assets, *l*ow cash − like = $positivegrowth*D_{cashlike}$ where $D_{cashlike}$ represents firms with cash and cash equivalents below 0.25 (median value for cash plus cash-like assets/current assets) and p*ositive growth* $= \frac{GFA_{ijt} - GFA_{ijt-1}}{Size_{ijt-1}}$ if $\frac{GFA_{ijt} - GFA_{ijt-1}}{Size_{ijt-1}} > 0$; otherwise, it is 0. Growth in columns 2,4,6,8 is capex, and *l*ow cash − like = $Capex*D_{cashlike}$, debt represents interest-bearing debt; size is a logarithm of total assets minus debt; cash is cash stock; and financial slack is the logarithmic difference between short-term assets and short-term liabilities, excluding TCs. ROA is operating profit scaled by size.

positive growth, low cash-like = $D_{cashlike}$*$positive\ growth$ and with capex; low cash-like = $capex_{ijt}$*$D_{cashlike}$. Including both variables provides robustness and increases the reliability of the findings, which are presented in Tables 3 and 4. Since both analyses are very similar in nature, the results are assessed and interpreted together.

The positive coefficients of the interaction variables in columns 1 and 2 of Tables 3 and 4 suggest that liquidity-poor firms receive more TC. In times of a lack of liquidity, such firms increase the demand for suppliers' financing because it may be more convenient for a borrower to deal with a business partner than to renegotiate terms of a loan with a financial institution (Danielson & Scott, 2004).

A seller with reliable knowledge of the customer's operations (Jain, 2001; Agostino & Trivieri, 2014; Petersen & Rajan, 1997) can foresee the return on the partner's investment, and in a way, the return on the seller's investment in the partnership and in the receivables is dependent upon the profitability of the customer's physical investment. The seller's aim is to promote its business and to build a long-term relationship with the buyer because firms perceive the act of supplying TC as a form of investment in the partnership (Ng et al., 1999; Cunat, 2007). Hence, informational efficiency among partners, i.e., the supplier is fairly confident about the return on its partner's investment, paves the way for improved business relations and allows the supplier to assume credit risk (Goto et al., 2015) and offer credit when the buyer experiences a lack of liquidity.

While the effect of low liquidity on TC demand is clear, the evidence on the supply side is mixed. The interaction variables in column 3 of both Tables 3 and 4 indicate a positive and significant association with the supply. The analysis with capex, however, offers little support to the positive association between growth and TC supply, as the coefficients are either statistically insignificant (see column 4 of Table 4) or significant at only the 10% significance level (see column 4 of Table 3). This implies that growing firms that are liquidity-poor may have been passing along only some portion of the TC they received from suppliers. It is important to consider that this judgment is based on what the available data indicate; it may require more than looking at the supplier's decision to entangle the true relationship, as it is also the decision of the borrower.[9]

[9] Love and Zaidi (2010) discuss this issue, pointing out that the financial challenges of a supplier and those of receiver can affect the amount of TC supplied.

Including both sides' financial positions would afford better insight into firms' TC policies and improve the precision of the conclusion. In the absence of this information, the reader is advised to consider this limitation when interpreting the results.

The interaction variable in column 5 of Tables 3 and 4 has a negative coefficient, suggesting that growing firms with a lack of liquidity increase their net TC supply. On the other hand, when growth is measured by capex, the low liquidity coefficients in column 6 of the same tables are positive and highly significant, suggesting that low liquidity causes TC demand to increase more than supply. Analysis of the TC to liabilities ratio (see columns 7 and 8 of Tables 3 and 4) indicates that cash-poor firms obtain more TC from suppliers. Considering that growing business capacity grants a competitive edge to the borrower in negotiations and given that offering TC—from a seller's perspective—is an investment in a partnership and signifies a long-term commitment, it is intuitive that a growing firm's need for short-term liquidity results in more TC financing being supplied to them.

Clearly, growing firms with little liquidity borrow more TC and do not supply as much. Similarly, these firms tend to increase TC as a portion of external funding, supporting the notion that their decision is motivated by liquidity concerns. The inclusion of dummy variables for both cash and cash-like and their interactions with both growth measures increases the reliability of the results, as they both indicate that when growing firms experience a shortage of liquidity, growth leads to an 8%–9% increase in borrowed TC. In particular, the coefficient for the dependent variable—TC as portion of liabilities—sheds further light on the magnitude of the increase. In times of liquidity shortage, both growth measures result in increases ranging from 14% to 32% (see Tables 3 and 4 columns 7 and 8 for the coefficients of low cash and low cash-like). By contrast, the coefficients for supply in columns 3 and 4 are positive and insignificant. To better judge the behavior of growing firms, one looks at the net change, measured by net TC. In the case of capex, low liquidity results in an increase in favor of demand between 65% and 50% for every unit of growth for cash and cash-like, respectively. For growth by tangible assets, the economic magnitude is −2% in favor of supply in the case of low liquidity (see columns 5 and 6 of Tables 3 and 4).

Previous studies present differing findings on the effect of liquidity. For example, Bougheas et al. (2008) find the marginal effect of liquidity on receivables and payables to be −1% and 1%, respectively. Mateut et al. (2006) report the marginal effect of liquidity on receivables and payables as −3% and −4%, respectively. It is important to keep in mind that in the present study, the effect of liquidity is already accounted for by including cash variables, and different data sets are used, both of which would largely explain the differences between findings.

4.3. Growth, trade credit and economic conditions

Fluctuations in TC activity as a result of macroeconomic circumstances that are related to, for example, the level of credit supply and economic activity, have been the subject of previous studies. Huang et al. (2011), for instance, report that the substitutability of TC moves countercyclically to GDP growth. Demirguc-Kunt & Maksimovic (2001) find that TC and economic growth move in tandem. Ferrando and Mulier (2013) report similar observations. On the other hand, Ghoul and Zheng (2016) find that TC activity and GDP growth are negatively correlated. They use GDP per capita, whereas

Table 5
System GMM analysis: Low economic growth.

Dependent variable	TC^{D}_{ijt}		TC^{S}_{ijt}		TC^{NET}_{ijt}		TC^{D*}_{ijt}	
	(1)		(2)		(3)		(4)	
Growth	.144***	(.034)	.133***	(.020)	–.156***	(.045)	.056***	(.047)
Low growth (GFA)	.074***	(.022)	.157***	(.022)	.057	(.095)	.043***	(.030)
Other variables	Yes		Yes		Yes		Yes	
AR (1)	.000		.000		.000		.002	
AR (2)	.223		.221		.298		.769	
Hansen	.109		.090		.117		.182	
#obs	36,491		36,491		23,717		37,659	
Growth	.325***	(.119)	.584***	(.179)	–.234***	(.072)	.213***	(.065)
Low growth (capex)	.007	(.049)	.156	(.127)	.196***	(.068)	–.019	(.051)
Other variables	Yes		Yes		Yes		Yes	
AR (1)	.000		.000		.000		.000	
AR (2)	.070		.459		.244		.734	
Hansen	.253		.117		.123		.170	
# obs	31,078		24,519		24,140		37,814	

Robust standard errors are in parentheses and ***, **, * denote significance levels at 1%, 5%, and 10%, respectively. All specifications are estimated with a constant, time, industry and country dummies. AR(2) represents the P-values for the second order serial correlation in the residuals, with the null of no correlation. P values of Hansen test with the null of instrument validity are presented. TC^{D}_{ijt} is trade credit received from suppliers; TC^{S}_{ijt} is trade credit supplied to buyers; TC^{NET}_{ijt} is the difference between the received and the supplied trade credit; and TC^{D*}_{ijt} is trade credit received from suppliers as portion of liabilities. Growth in upper (lower) panel is growth in tangible assets (capex), low growth(GFA) = *positive growth*$*D_{LowGrowth}$ where $D_{LowGrowth} = 1$ if a year is one of the three years of lowest growth in GDP; otherwise, it is 0, The interaction variable in lower part of the table is constructed as low growth(capex) = *capex*$*D_{LowGrowth}$.

Table 6
System GMM analysis: Contractionary period.

Dependent variable	TC^{D}_{ijt}		TC^{S}_{ijt}		TC^{NET}_{ijt}		TC^{D*}_{ijt}	
	(1)		(2)		(3)		(4)	
Growth	.119***	(.034)	.085***	(.030)	−.156***	(.045)	.036**	(.018)
Contraction (GFA)	.131***	(.022)	.053	(.044)	.100**	(.043)	.210**	(.106)
Other variables	Yes		Yes		Yes		Yes	
AR (1)	.000		.001		.001		.000	
AR (2)	.382		.103		.160		.953	
Hansen	.075		.619		.719		.193	
# obs	26,473		36,491		20,905		46,744	
Growth	.192***	(.033)	.211***	(.046)	−.134***	(.042)	.252***	(.097)
Contraction (capex)	.142***	(.023)	.196***	(.030)	−.052**	(.025)	−.091	(.074)
Other variables	Yes		Yes		Yes		Yes	
AR (1)	.000		.000		.000		.000	
AR (2)	.341		.381		.102		.466	
Hansen	.000		.000		.158		.136	
# obs	36,491		26,473		37,664		46,576	

Robust standard errors are in parentheses and ***, **, * denote significance levels at 1%, 5%, and 10%, respectively. All specifications are estimated with a constant, time, industry and country dummies. AR(2) represents the P-values for the second order serial correlation in the residuals, with the null of no correlation. P values of Hansen test with the null of instrument validity, are presented. TC^{D}_{ijt} is trade credit received from suppliers; TC^{S}_{ijt} is trade credit supplied to buyers; TC^{NET}_{ijt} is the difference between the received and the supplied trade credit; and TC^{D*}_{ijt} is trade credit received from suppliers as portion of liabilities. Growth in upper (lower) panel is growth in tangible assets (capex), contraction(GFA) = *positive growth*$*D_{contract}$ where $D_{contract} = 1$ if a year is one of the three years of lowest growth in the ratio of debt to GDP; otherwise, it is 0. The interaction variable in the lower part of the table is constructed *as* contraction(capex) = *capex*$*D_{contract}$.

Demirgüç-Kunt and Maksimovic (2001) use GDP growth as a regressor to explain TC decisions. However, none of these studies take the borrower's growth into account. The current findings address this gap and document persistent support from suppliers under adverse macroeconomic conditions. Suppliers are motivated by the growth in the business of their clients and are thus willing to offer TC under such conditions.

An examination of the changes in TC policies subsequent to borrowers' growth in difficult times would reveal their ability to obtain TC. To achieve that objective, two important macro variables—GDP growth and the ratio of corporate debt to GPD—are used. First, in a 15-year period, the three years of lowest GDP growth are determined for each nation. Approximately half of these values are realized in the 2008–2009 period, and the other half are spread over 12 years. For example, in 2003, the German economy grew by approximately negative 1%; in 2012, Italy grew by negative 2.8%; and in 2011, Japan grew by negative 0.7%. Given that the goal is to document how growth affects suppliers' attitudes in an environment where general economic activity is reduced (versus focusing on financial crises), the era in which the data cover serves the goal. A dummy variable, $D_{LowGrowth}$, which takes the value of 1 in those three years and 0 otherwise, is interacted with the positive growth variable and capex. Interaction variables are named "low growth (GFA)" and "low growth (capex)." The results are presented in the upper and lower panels of Table 5. The positive and statistically significant coefficient of low growth (GFA) indicates that growing firms are able to obtain more TC in slow economic times. Similarly, growing firms seem to increase the supply as well, highlighting a pattern revealed earlier. Column 3 of Table 5 shows the influence of corporate growth on net TC decisions. The positive coefficient suggests that growing firms increase demand more than supply, but it is statistically insignificant. Finally, column 4 of Table 5 presents the changes in the ratio of TC to total liabilities. Low growth (GFA) has a positive and significant coefficient, indicating that growing firms increase the amount of TC relative to liabilities. For the effect of the capex in low-growth times, no significant influence on the demand and supply is observed. The effect on net TC, presented in column 3 of the lower panel of Table 5, however, is positive and highly significant, i.e., capex leads demand to increase more than supply.

Although GDP growth is an important indicator of current economic activity, it is not entirely capable of reflecting prevailing credit conditions. Therefore, the ratio of corporate debt to GDP is also used. First, in the 15-year period, the three years with the smallest growth in the ratio of debt to GDP of each nation are determined. A dummy variable that takes the value of 1 in those three years and 0 otherwise interacts with the positive growth variable and capex. The interaction variables are named "contraction (GFA)" and "contraction (capex)," and the results are presented in the upper and lower panels of Table 6.

Column 1 in Table 6 shows the effect of corporate growth on TC received. When the corporate debt ratio declines, growing firms seem to boost TC from suppliers. A similar effect is observed with capex; the coefficient for contraction (capex), in the lower panel of the table, indicates a positive relationship, i.e., a 14% increase as a result of one unit of growth in such times. The TC supply decision, on the other hand, is less consistent; in the first part, the coefficient for contraction (GFA) is positive but insignificant, implying that the direction of the relationship points to an increase. The coefficient of contraction (capex), however, is positive and significant; suggesting that growing firms do not cease

supporting their business partners even in times of adverse credit conditions. This effect is also supported by the findings shown in the lower panel, in column 3 of Table 6, where net TC is the dependent variable. Contraction (capex) has a negative and significant coefficient, indicating an increase in favor of supply, whereas contraction (GFA) has a positive coefficient, suggesting that growth in physical capacity brings more TC into firms in times of contraction. Finally, column 4 of Table 6 presents the effect of growth on TC relative to liabilities. Although the coefficient for contraction (GFA) is positive and significant, the direction of the relation changes with contraction (capex). TC financing, relative to total liabilities, does not present a persistent reaction to growth in times of contraction.

Fisman and Love (2003) use the ratio of private debt to GDP to identify how the corporate sector uses TC to manage growth. Although they do not directly test the effect of the borrowing rate on TC, they investigate how TC helps firms in some countries where the financial development index, measured by the private debt ratio, is low. Ghoul and Zheng (2016), on the other hand, find a positive but insignificant connection between private debt and TC. Demirgüç-Kunt and Maksimovic (2001) report a negative and significant association between TC and the ratio of debt to GDP. Nevertheless, empirical evidence provided here suggests that growing firms increase TC activity when GDP growth and credit conditions are not at their best. Although the debt ratio is not included as one of the regressors, firms' TC balance reacts positively when aggregate borrowing declines. This may be related to several factors. First, expanding the market power of the borrower may make it difficult for suppliers to say no to the demand for more TC in contractionary times, when traditional borrowing may not be optimal. Second, growing business capacity may allow them to liquidate the inventory, so they are able to handle more inventories and more TC. Finally, undesirable economic/credit conditions may push firms toward TC financing as an alternative, which might be more accessible than bank financing. More importantly, the consistent support of suppliers is related to their borrowers' good growth prospects.

5. Conclusion

Many important aspects of TC are covered in the current literature. However, the growth of borrowers' businesses is omitted. This study addresses this gap by exploring the relationship between borrowers' growth and TC and discovers evidence that growth is a significant determinant of TC policy. A high level of informational symmetry between partners and the soaring competitive power of growing firms are likely to be the main drivers of these findings. Moreover, short-term liquidity in growing firms influences the borrowing decision. Analyses with macro variables also provide consistent results that show that growing firms receive more TC, even in an undesirable macroeconomic environment. Finally, evidence indicates a noteworthy increase in the supply of TC from growing firms in return.

The inclusion of TC on both sides of the balance sheet in the analysis provides a clearer picture of how growth creates an advantage in effectively managing TC policies. High-growth firms can obtain more TC and not only take advantage of it as a source of liquidity but also offer it to their partners as part of promoting sales and profitability. The results also have important implications for short-term liquidity management. When growing firms experience a shortage of liquidity, they are likely to be able to compensate for it with financing from their suppliers. Furthermore, in adverse macroeconomic conditions, high-growth firms continue to capitalize on their current state by obtaining more TC from their partners. The significant association between the level of TC and growth offers valuable signals to third parties, who are dependent on regularly reported financial data, that the informational content of TC may be used to judge the future prospects of a firm.

All of this notwithstanding, due to absence of data, some important aspects of the issue are still unclear. More data would greatly improve the results of the present study. For example, the product warranties argument, studied by Long et al. (1993) and Deloof and Jegers (1996), makes a strong case that might be related to the findings of the present study. The working measure of growth is investment in business capacity, and unlike other measures, it is more likely to contain the launch of a new product. As explained earlier, any new product and/or new customers that come with expansion may require TC. Since information regarding the product line of subject firms is not available, it is important not to rule out the possibility that, to some extent, the product warranty argument may be applicable to the results. The launch of a new product may lead to a significant rise in both supply and demand, for which reason this point requires further research.

In addition, an examination of contract terms (e.g. discount rate for early payment and the duration of the contract before and after the growth) would significantly improve the intuition offered in this study and open new avenues for further research.

Finally, relating TC decisions to the financial position of partners at some point requires financial information about the parties involved. As suggested in Love and Zaidi (2010), financial position and the short-term liquidity of both parties—suppliers and buyers—are likely to influence how much suppliers offer to firms and how much to demand from them.

Conflict of interest

The author have no conflict of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bir.2021.03.004.

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