

# The Determinants of Trade Credit: A Study of Portuguese Industrial Companies

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## Abstract

Despite the relevance of trade credit as a source of business financing, the topic is far from being considered exhausted, especially because there is no general and integrated theory explaining the causes and consequences of trade credit.

Our research aims to contribute towards the literature that studies the determinants for granting and receiving trade credit. In this sequence, the present study seeks to empirically test some theories about the reasons why companies grant and receive commercial credit. For this purpose we apply a fixed effect model to a panel of 11 040 Portuguese industrial companies, of which 360 are large companies and the majority 10 680 are Small and Medium Enterprises (SME) for the period between 2003 and 2009.

We conclude that large companies (with greater access to credit market) serve as financial intermediaries to their clients with less access to finance. In addition, it was observed that the supplier companies use trade credit as a legal means of price discrimination. Finally, financially constrained enterprises, especially in times of financial crisis, use commercial credit as an alternative source of funding, endorsing the hypothesis of substitution between trade credit and bank credit.

**Keywords:** trade credit, financing, financial crisis

## 1. Introduction

Companies cannot live without capital funding which is used to finance several needs as investment, notably in buildings, machinery and stocks. As stated by Brennan, Maksimovic & Zechner (1988), in addition to financing obtained through financial institutions, trade credit may also be a source of funding, particularly for those companies with limited access to bank credits.

The literature offers several theories to explain the use of trade credit based on advantages for both “suppliers” and “customers”; such advantages rely on financial, operational and commercial points of view. Firstly, companies with better access to the formal credit market and with lower production cost can act as financial intermediaries for other companies, their customers, which face difficulties of access to credit (Schwartz, 1974; Emery, 1984). At the same time, the use of trade credit can help companies to obtain bank financing, since this alternative source of funding generates information about the credit quality of firms receiving trade credit and this information can be useful to financial institutions (Biais & Gollier, 1997).

Secondly, and from an operational perspective, trade credit allows suppliers to create operational efficiencies and to reduce costs of transport and of storage, improving stock management which can be used as a mechanism of reduction of global transaction costs (Ferris, 1981). In addition, it promotes greater flexibility and security to suppliers allowing them to deal with variations in demand but also allowing customers to get greater control of their payments, to the extent that these may be made periodically instead of several times and whenever there is a commercial transaction (Nilsen, 2002 or Rodríguez-Rodríguez, 2008).

Thirdly, for commercial reasons, on the one hand, trade credit can stimulate sales by allowing buyers to lengthen payment periods; on the other hand and, to the extent that the payment policies allow you to change the price of

goods sold (where the supplier charges higher prices to customers who are delaying payment periods and practice discounts to customers who do cash payments), it works as a form of price discrimination (Mian & Smith, 1992).

Nevertheless, there is no general and complete theory about trade credit, given that the work carried out, as some of the above mentioned, analyzed essentially the characteristics of such credit, focusing on the practical reasons that lead companies to grant or to resort to commercial credit. Additionally, most studies on trade credit are focused in Anglo-Saxon countries like the United States of America (USA) or the United Kingdom (in particular, Meltzer, 1960; Petersen & Rajan, 1997; Danielson & Scott, 2000; Nilsen, 2002; Cuñat, 2007, Bougheas, Mateut & Mizen, 2009; Yang, 2011). Moreover, trade credit also implies long-term credit exposures accumulating contagion risks due to increased lending in the context of national and international trade relationship (Deutsche Bank, 2012)

The discussion of trade credit has not been developed for Portuguese firms (with the exception of Oliveira, 2011) and thus it justifies the need for further analysis in the Portuguese market, especially given the known difficulties the majority of Portuguese firms have experienced in obtaining formal credit. In this context, we intend to analyse the determinants for trade credit granted and received in the Portuguese industrial companies, testing some theoretical propositions for the period between 2003 and 2009 and based on a sample of 11 040 companies, of which 10 680 are small and medium-sized enterprises (SME) and 360 are large enterprises (LE). As far as we know it is the first time, for Portuguese firms, that the determinants of both granting and receiving trade credit are studied and discussed allowing a global analysis of such phenomenon in which, for several occasions, the same firm grants and receives trade credit which advises the study of trade credit determinants to include both the position of granting and receiving (which is neglected in many studies).

The main results of the study allow us to conclude that LE receive more trade credit than SME, even if the former have an easier access to the formal credit market. Moreover, we also find evidence capable of supporting the possibility of substitution between trade credit and bank credit, i.e. businesses without access to external sources of financing (such as bank lending) seek trade credit as an alternative source of funding, especially in times of financial contraction, when institutions credit offer is further reduced. Additionally, we found evidence supporting the theory that trade credit is used as a way of price discrimination by suppliers.

This paper is organised as follows: in Section 2 we present a brief review of the literature that addresses the main theories of trade credit and also of empirical studies on this subject; also in this chapter, the hypotheses to be tested (in the following chapters) are presented. In Section 3 we describe the sample we use and the econometric methodology adopted for the empirical treatment. In Section 4 the main empirical results are discussed and several hypotheses tested. Finally, we conclude in Section 5.

## **2. Literature Review and Formulation of the Working Hypotheses**

### *2.1 Financial Theory*

The first works undertaken on trade credit describe it as a mean of financial intermediation between the supplier and its customers, in which the supplier companies (with greater access to credit market) act as financial intermediaries to their clients through the deferral of payment of debts (Schwartz, 1974).

According to Biais and Gollier (1997) suppliers often show larger capacity than the banks to investigate the solvency of the customers and generally possess more knowledge about the industry where both belong to. In this way, the suppliers have an advantage, when compared with banks, in information about their customers and they also get it at lower cost. Besides, suppliers benefit from greater monitoring capacity which means they may threaten customers with a supply suspension if they do not pay (Cuñat, 2007). Due to these advantages, the suppliers are more able to reduce credit risk and thus can extend trade credit to their customers as banks face high costs and risks when granting credits.

### *2.2 Theory of Transaction Costs (Note 1)*

This theory considers that suppliers and customers can reduce transaction costs through trade credit. Ferris (1981) shows that trade credit allows buyers of goods and services the information about future working capital needs in that they may decide to accumulate debt and pay only monthly or quarterly instead of paying on each delivery of goods; this means lower intermediation costs (Note 2). In fact, by separating the time of the exchange of goods of the time of their payment, trade credit reduces transaction costs as customers can aggregate multiple payments into one. On the other hand, from the point of view of suppliers, when granting trade credit, they can predict more accurately their future incoming receipts, thus reducing risks.

### *2.3 Trade Credit and Inventory Management*

Emery (1984) states that there are valid reasons for a company to provide trade credit, namely because it means the opportunity to change the credit attitudes, enabling the suppliers with a mechanism to respond to fluctuations in demand, i.e. they offer better credit conditions (lower prices) to increase sales when demand is low.

Trade credit may be used as an instrument of trade policy of the supplier, leading to a better management of inventories, which can be very useful, especially for businesses with seasonal activity while maintaining smoother production cycles and smaller stocks (Bougheas et al., 2009). In this respect, Bahillo (2000) tells us that suppliers must have the means to cope with deviations in demand; thus having the options of changing the price of products temporarily, increasing stocks or granting commercial credit, they prefer to adopt the latter, to the extent that the others can mean higher costs. In this context, the first hypothesis to test is now formulated:

*H<sub>1</sub>: supplier companies use trade credit as a tool for inventory management.*

#### *2.4 Theory of Price Discrimination*

Another theory that justifies the use of trade credit, assumes trade credit is a form of price discrimination by suppliers when they cannot legally establish a pricing system. According to Mian and Smith (1992) this discrimination occurs when suppliers grant payment discounts to immediate payments, thus demanding “higher prices” to clients who defer the payment deadline. This theory also assumes that companies that have higher gross margins have a higher propensity to grant commercial credit. In this respect, it should be also referred that unlike financial institutions (where benefits are obtained only by the granting of credit and the consequent interests charged), suppliers, obtain their main benefits by enhancing the sales of products and/or services. Moreover, suppliers are thus able to maintain long-term business relationships with their clients which implies they grant commercial credit to their customers, especially when clients do not have access to other alternative sources of financing (Bahillo, 2000). In this context, the following hypothesis has been formulated to be tested:

*H<sub>2</sub>: Companies with higher gross margin grant more commercial credit.*

#### *2.5 Trade Credit and Information Asymmetry*

The theory of asymmetric information is a critical piece to understand the existence of trade credit as a substitute and/or complement to the financial system (Stiglitz and Weiss, 1981).

Petersen and Rajan (1997) consider that trade credit should be seen as a solution to the problems of information asymmetry on the quality of the borrower. The supplier has in this aspect, a clear advantage in relation to financial institutions, to the extent that the supplier manages to gather customer information faster and cheaper. Biais and Gollier (1997) state that companies unrelated to banking institutions are turning more to trade credit given that sellers obtain information that banks do not own which helps to minimize the problems of information asymmetry.

Furthermore, Cuñat (2007) suggests that being involved in trade credit stimulates companies to improve their information standards which also benefits the access to bank credit given it allows banks to update their data and opinions about the quality of companies and thus facilitates bank credit granting; in this line, we can assume the existence of a certain complementarity between these two sources of external financing. In fact Agostino and Trivieri (2014) in a study for SME also found that banks seem to consider suppliers a reliable source of information on firms' financial conditions even after several years of lending relationships with such clients. In this context, the following hypothesis has been formulated to be tested.

*H<sub>3</sub>: Trade credit is complementary to bank credit.*

On the other hand, given that the issues of asymmetry of information and bank credit rationing favour big companies, Meltzer (1960) supported the idea that companies with higher liquid cash-flows have higher capacity to offer commercial credit, especially during monetary contractions and then only companies in financial difficulties and with no regular access to other sources of funding, would use this alternative source. In fact, Meltzer finds, during monetary contractions, that the bank credit channel weakens and the trade credit appears as a clear substitute for poorer firms. In this respect, De Blasio (2005) using Italian data shows some evidence in favour of the hypothesis of trade credit being a substitute to bank credit, to the extent that, companies with difficulties in resorting to bank credit opt for trade credit. In this context, the following hypothesis will be assessed:

*H<sub>4</sub>: Trade credit is substitute to bank credit from the viewpoint of the credit user.*

#### *2.6 Trade Credit and Financial Crisis*

Nilsen (2002) found that when banks decrease the supply of loans they trigger a monetary shock and trade credit may increase. This same author finds evidence that in times of financial contraction, small industrial enterprises use more trade credit than larger firms, insofar as, they are unable to obtain another type of funding. In this context, the following hypothesis must be tested:

*H<sub>5</sub>: SME rely more on trade credit than larger companies.*

Other studies, like Choi and Kim (2005), consider that, as the tightening of monetary policy raises the prize of external financing, companies are increasing the demand for trade credit as a substitute for bank loans and

commercial paper; thus, as a result, the inter-company liquidity will become more active; in this way, trade credit could become more expensive or less available, depending on firms' market power and how deserving are companies to get funding through this source.

This phenomenon is also studied by Love, Preve Lorenzo & Sarria-Allende (2007). The authors argue that trade credit in periods of monetary contraction, works as an alternative, given the shortage of supply of credit on the part of financial institutions. In the same direction points a research by Bastos and Pindado (2013) after studying firms of countries that have undergone financial crisis. However, by virtue of this higher demand, they verify that the amount of trade credit available decreases after such contractionary monetary shocks. This evidence shows that suppliers have a restricted ability to offer trade credit. In this context, we have created our sixth hypothesis to test:

*H<sub>6</sub>: During the financial crisis, client companies are turning more to trade credit and suppliers grant less trade credit.*

Even after formulating the previous hypothesis we do not ignore the fact that suppliers with a weak bargaining position may then find it difficult to reduce their provision of trade credit during a recession despite the need to do so (Tsuruta, 2013).

### 3. Sample, Variables and Methodology

#### 3.1 Database and Sample Selection

Our sample consists of a balanced panel of economic and financial data (for the period 2003 to 2009 (Note 3)) of 11 040 non-financial Portuguese companies of the secondary sector (including extractive industry, manufacturing and construction); 10 680 are SME and 360 are large companies. The information was collected in the database of the Iberian Balance Analysis System (SABI), developed by Bureau van Dijk and containing information on public and private companies from Spain and Portugal. To classify a company as SME or large company, we used the criteria established by the European Union in the Commission Recommendation 2003/EC No. 6 may. Thus, a company is considered SME if, cumulatively, the following parameters are fulfilled: Hire more than 10 and less than 250 employees (so as to exclude micro-enterprises); Do not exceed the 50 million euros of turnover; Submit a total balance sheet not exceeding 43 million euro. Additionally the following filters were applied to the database in order to expunge senseless economic observations: total assets, total liabilities, current assets, the debt to third parties, accounts receivable and interest incurred must be all positive and turnover cannot be zero. State owned-companies were excluded.

#### 3.2 Variables

Based on the theoretical analysis presented we intend to examine whether the characteristics of the Portuguese industrial enterprises as dimension, seniority, formal debt cost, growth of revenue, gross margin, cash flow, type of industry, current situation and the region of location can explain both the demand and the supply of trade credit. To do this, we built the following variables:

#### 3.3 Dependent Variables

The dependent variables were constructed following the methodology of García-Teruel and Martínez-Solano (2010). So, the dependent variable **Trade Credit Received** by companies (CC RECE) is determined by the ratio of short-term accounts payable over turnover. The dependent variable **Trade Credit Granted** by suppliers to their customers (CC GRAN), is defined as the ratio of short-term accounts receivable over total assets. These two variables allow us to know what is the importance of trade credit in business financing (Petersen & Rajan, 1997).

#### 3.4 General Independent Variables

Given the several explanatory factors that may influence trade credit received and trade credit granted, our empirical approach uses the common following ones: a dimension variable (TAM), a seniority variable (AGE), a cost of debt variable (COST DEB), a turnover growth variable (GRO), a cash flow variable (CF).

The variable **Dimension** is defined as the logarithm of the total assets while the **Seniority** variable is defined as the logarithm of (1 + age) (Note 4), in which the age is the number of years of the company since its establishment. To control for the cost of bank financing, we use the variable **Cost of Debt** (COST DEB) defined as the ratio between financial charges over total liabilities minus short-term payables (in order to exclude from the liabilities the trade credit use). To capture the possible effects that variations in turnover can have on accounts receivable, we built the variable **Growth** (GRO). The variable is calculated as percentage changes in each firms' turnover in consecutive years. To measure the ability of companies to generate internal financial resources, we create the variable **Cash Flow**

(symbolized by CF), calculated as the ratio between the sum of net result for the period with depreciation over sales. Finally, we create the variable **Stocks** (STOCK) which is calculated as the ratio of stocks over sales.

### 3.5 Specific Independent Variables for Trade Credit Received and Trade Credit Granted

The variable **Banking Debt** (BANK DEB) is calculated through the ratio bank debt over total assets as a way to test the hypothesis of substitution between trade credit and bank credit. The **Negotiating Gross Margin** variable (GM), is determined by the difference between the revenue and the cost of goods sold and materials consumed (CMVMC), divided by the turnover. It will allow the assessment of the influence of price discrimination in a company's decision to grant trade credit to its customers. The variable **Trade Credit Received** (CC RECV) besides being itself a dependent variable, will also be used also as explanatory variable for trade credit granted; in fact, companies that receive more trade credit tend to have better conditions to offer more trade credit to their customers.

### 3.6 Additional Variables

In order to "control" the statistical analysis to present in the following section it becomes necessary to study other driver factors of both explained variables; for this purpose we will use the variables: Current Situation, Region, Sector and Difficult Year. The variable **Current Situation** (CURR SIT) is a dummy variable (assuming the value "1" for companies involved in a process of insolvency, and "0" for enterprises in regular activity) that links trade credit to companies in financial difficulties, in particular in cases of insolvency. The variable **Region** (REGION) relates trade credit with the specific location of the headquarters of the firm and then we shall test separately the importance of different explanatory variables in the universe of Portuguese "richer region" and "poorer region". The "richer region" is the administrative region of Lisbon, which is the region that has the highest per capita gross domestic Product (Note 5) (GDP pc) and the "poorer region" is the northern region that has the lowest GDP pc, according to the Portuguese statistical organization. Our choice of signalling only these two regions derives from the fact that the headquarters of 77% of all Portuguese companies is located in one of those two regions. The variable **Difficult Year** (YEAR DIFIC) is a dummy variable that represents the years of 2008 and 2009 (Note 6) as symbols of the years, in our sample, with the highest financial bottlenecks on the Portuguese economy. We created this variable YEAR DIFIC to control for the effect of macroeconomic issues on trade credit. Finally, the variable **Industry** (SECTOR) will be a dummy variable representing the two-digit level industry classification. This variable allows us to help determine the relationship between the level of trade credit granted and received and the specific sector of activity the firms belongs to.

### 3.7 General Descriptive Statistics

Table 1a. Summary statistics of independent variables

Variable	Mean	Standard deviation	Max	Min
TAM	7.36	1.42	13.74	0
GRO	5.39	8.24	194	-1
DEBT COST	0.11	5.14	214	-775
STOCK	7.22	10.1	17704	0
GM	0.32	1.89	1	-304
CASH FLOW	2.67	51.5	9549	-2144
BANK DEBT	0.25	0.16	2.92	0

Table 1b. Correlations between independent variables

	TAM	GRO	DEBT COST	STOCK	GM	CASH FLOW	BANK DEBT
TAM	-						
GRO	0.08	-					
DEBT COST	-0.01	0.01	-				
STOCK	0.06	0.01	0.01	-			
GM	-0.04	-0.01	-0.02	-0.18	-		
CASH FLOW	0.04	0.02	0.01	0.79	0.01	-	
BANK DEBT	0.19	-0.01	-0.02	0.03	-0.05	-0.04	-

In Table 1a general statistics are provided for independent variables and in Table 1b correlations between independent variables are shown; there is no evidence of multicollinearity problems among independent variables

### 3.8 Econometric Methodology Adopted

Data were analysed through the methodology of panel data, given that the same company is observed in several years; so there is a temporal variable (year of observation) and a panel variable (company). This is the most appropriate methodology, given the data available, to test the relationship between the variables defined. Several authors have also used this methodology: Petersen and Rajan (1997), Cufiat (2007), García-Teruel and Martínez-Solano (2010), Martínez-Sola, García-Teruel and Martínez-Solano (2014).

To apply the methodology of panel data, we will initially assess which specific panel data model to use: the pooled least squares model (PLSQ), the fixed effects model (FEM) or the random effects model (REM). For the selection of the most appropriate model we use the F statistic and the test of Hausman (1978). Using the F test, we have rejected the null hypothesis of equality to a level of significance of 1%, thus suggesting the existence of significant individual effects, namely, invalidating the pooled model estimates. Later, by using the Hausman's test, the hypothesis of correlation of individual effects with the explanatory variables was tested. To a level of significance of 1% the null hypothesis was rejected because the unobservable effects were not correlated with independent variables. Thus, we concluded that the most appropriate methodology to the analysis of the relationship between trade credit received and trade credit granted with independent variables is the FEM.

However, in FE estimation the unobservable heterogeneity term is correlated with the regressors and, as point out by Cameron and Triverdi (2009:231), this allows a limited form of endogeneity, while continuing to assume that the regressors are uncorrelated with the disturbance term. According to García-Teruel and Martínez-Solano (2007) and Baños-Caballero, García-Teruel & Martínez-Solano (2010), if results of regression analysis are affected by endogeneity it could be possible that independent variables in the estimation are being affected by the dependent variable and not vice-versa. This suggests that we need a method to determine whether a particular regressor must be treated as endogenous. In order to test and to deal with endogeneity problems, we use panel instrumental variables (IV) methodology. Cameron and Triverdi (2009:281) point out that the IV methodology provides a consistent estimation by assuming the existence of valid instruments. According to them, an instrumental variable must satisfy two requirements: instruments must be correlated with the endogenous independent variable but under the exogeneity assumption that they are uncorrelated with the disturbance term. Given the fact that, in FE estimations, it may be reasonable to assume that observations on the same firm (cluster) in two different time periods are correlated, but observations on two different firms are not, it is also reasonable to assume that valid instruments are the endogenous independent variables lagged one or more periods. In order to confirm the use of IV methodology, it must be conducted a test to provide evidence that the regressors are endogenous. The most appropriate test is the Davidson- MacKinnon test, under the null hypothesis that regressors are exogenous. If the null hypothesis is rejected, so we may conclude that independent variables are endogenous, thus requiring and confirming the need for the use of IV estimations.

To sum up this point, it is well known that corporate finance literature has pointed out the potential endogeneity problems in financial decisions. So we used the Hausman test to compare the estimation's coefficients made by instrumental variables (first lag of the independent variable as instrument) and by ordinary least squares, under the null hypothesis of exogeneity of the explanatory variables. Given the fact that we rejected the null hypotheses, then we decided also to perform estimations using instrumental variables. In a second phase, the estimations obtained were corrected for heteroscedasticity by using the method of White (1980).

The equations to estimate are for dependent variable CC RECV and for dependent variable CC GRAN, respectively:

$$CC\ RECV_{i,t} = \alpha_{i,t} + \beta_1 TAM_{i,t} + \beta_2 AGE_{i,t} + \beta_3 DEB\ COST_{i,t} + \beta_4 GRO_{i,t} + \beta_5 CF_{i,t} + \beta_6 STOCK_{i,t} + \beta_7 BANK\ DEB_{i,t} + \beta_8 SECTOR_{i,t} + \beta_9 CURR\ SIT_{i,t} + \beta_{10} REGION_{i,t} + \beta_{11} YEAR\ DIFIC_{i,t} + \epsilon_{i,t} \quad (1)$$

$$CC\ GRAN_{i,t} = \alpha_{i,t} + \beta_1 TAM_{i,t} + \beta_2 AGE_{i,t} + \beta_3 DEB\ COST_{i,t} + \beta_4 GRO_{i,t} + \beta_5 CF_{i,t} + \beta_6 STOCK_{i,t} + \beta_7 GM_{i,t} + \beta_8 CC\ RECV_{i,t} + \beta_9 SECTOR_{i,t} + \beta_{10} CURR\ SIT_{i,t} + \beta_{11} REGION_{i,t} + \beta_{12} YEAR\ DIFIC_{i,t} + \epsilon_{i,t} \quad (2)$$

As a result of what has already been explained, CC RECV measures trade credit received by a company and CC GRAN represents trade credit granted by a company. TAM and AGE represent the size and age of the company. The variable DEB COST measures the cost of bank debt; GRO represents the growth of turnover over the year  $t-1$ ; CF measures the ability of companies to generate internal financial resources; STOCK represents the weight of the stocks over the total active; BANK DEB is the Bank financing obtained in percentage of total assets; MB represents the company's gross margin in% of turnover; CC GRAN is a variable that acts as a proxy for trade credit granted; (GM) means the gross margin obtained by the firma as percentage of turnover; SECTOR is a dummy variable that represents the sector of which the company belongs; CURRENT SIT is a dummy variable showing if companies are

involved in insolvency/restructuring processes; REGION represents the location of the companies; YEAR DIFIC represents the macroeconomic aspects not found in the other variables. Finally,  $\alpha_{i,t}$  represents the individual fixed effects and  $\epsilon_{i,t}$  is the term of the individual error.

#### 4. Results and Discussion

Tables 2 and 3 report the results obtained from the estimates of equations 1 and 2 respectively. In the following lines we have omitted to interpret the results of many variables given our main purpose is the discussion of the key variables of the models.

For each equation we perform six estimations; the first five using fixed effects model and one using instrumental variables. There is a general estimation, an estimation just for companies in insolvency proceedings, an estimation only for rich region companies, an estimation just for firms located in a poor region, an estimation only for younger and a global regression with instrumental variables.

Table 2. Determinants of trade credit received

VARIABLES	I(FE)	II(FE)	III(FE)	IV(FE)	V(FE)	VI Instr.Var
<b>CONST</b>	-72.76*** (510.88)	-206.38* (206.38)	-24.094 (30.982)	-95.96*** (602.03)	-66* (26.91)	
<b>TAM</b>	191.61*** (133.75)	552.23* (99.690)	7.2623 (9.2837)	253.01*** (159.12)	0.2582 (1.936)	264.60* (3.91)
<b>TAM<sup>2</sup></b>	-10.772*** (7.549)	-30.993* (5.6729)	-0.3901 (0.5857)	-14.351*** (9.063)	-0.0359 (0.1281)	-14.639* (0.255)
<b>CF</b>	-0.0055*** (0.0676)	-0.0322* (0.0138)	-0.001 (0.0012)	-0.0236 (0.2194)	-0.0130 (0.0101)	-0.0049 (0.0066)
<b>GRO</b>	-0.7471* (0.3710)	-4.069* (1.744)	-0.6573* (0.2275)	-0.7284** (0.4296)	0.1172 (0.1030)	-1.361* (0.662)
<b>DEBT COST</b>	1.080 (1.004)	3.64 (4.24)	0.9666* (0.4798)	3.399 (2.751)	0.519* (0.2509)	1.981*** (1.311)
<b>YEAR DIFIC</b>	2.32*** (1.46)	10.44* (2.738)	0.464 (0.200)*	3.09** (1.86)	0.334* (0.1330)	1.32 (1.221)
<b>STOCK</b>	0.1716* (0.098)	0.1971 (0.3744)	0.175 (0.0168)	0.1665* (0.0067)	1.375* (0.4894)	0.1781* (0.099)
<b>BANK DEBT</b>	-10.92 (8.27)	-33.528* (13.269)	1.427 (1.290)	-15.40*** (11.06)	-1.294*** (0.8945)	-16.461* (2.091)
<b>AGE</b>	-15.50*** (10.14)	-104.15* (28.497)	-2.599 (2.051)	-40.139** (24.408)	-3.017* (1.217)	-4.122 (10.23)
<b>R-SQUARED</b>	0.018	0.033	0.084	0.096	0.098	
<b>F-Test</b>	0.000	0.000	0.000	0.000	0.000	0.000
<b>Observations</b>	16 792	1639	2622	9686	2899	9219

Note: (I) General regression; (II) just regression with companies in insolvency proceedings; (III) rich region companies only regression (Lisbon); (IV) just regression to enterprises in the poor region (North); (V) only regression with young companies (<15 years); results obtained using the fixed effects model (FE). For Regression (VI) instrumental variables are used. Values in brackets refer to standard deviations.

\* Statistically significant at the 5% level; \*\* statistically significant at the 10% level; \*\*\* statistically significant at the 15% level. F test is the p-value of the F statistic. The null hypothesis of constant terms are identical is not rejected. The regression's standard error obtained is controlled in view of the possible existence of heteroscedasticity.

About the results of Table 2 we notice firstly that the variable TAM is statistically significant in the regressions I, II, IV and VI revealing to be an important factor for trade credit received. Nevertheless and contrary to expectations, the variable has a positive sign, indicating that as the dimension of enterprises increases, *ceteris paribus*, so does trade credit received but only up to a certain point, as explained in the next paragraph. In this regard, Petersen and Rajan (1997) or García-Teruel and Martínez-Solano (2010) found similar results in their estimates. A possible explanation for this result is that large companies are unable to obtain total financing they need through financial institutions and therefore resort to trade credit.

To test whether the relationship between this variable and the dependent variable trade credit received is linear and directly proportional, we have used the square of the logarithm of the total assets. Since the variable TAM<sup>2</sup> presents a negative sign and statistically significant in the regressions I, II, IV and VI we conclude that the relationship between the variables is not linear and there is a maximum; this means that larger firms benefit from that fact of receiving more trade credit, but this relationship has a threshold from which the increased dimension does lower the level of trade credit received (probably because from that limit this type of companies do not have effective need of such credit and seeks it less).

All that said we cannot confirm hypothesis 5 because we do not observe any evidence that SME use more trade credit than large firms.

The variable YEAR DIFIC has positive and statistically significant coefficients for the regressions I, II, IV and V, so we conclude that in times of financial contraction, companies seek more trade credit as an alternative source of funding. This finding is more relevant to companies in insolvency (regression II) or based in poor regions (regression IV), to the extent that the shortage of supply of credit by financial institutions is more distressing for this type of companies, since they are in weaker financial situations and financing alternatives are more limited. In this line, we find evidence that allow us to corroborate the hypothesis 6, i.e. in times of contraction, financial companies customers rely more on trade credit.

The variable BANK DEB has a negative relationship with the dependent variable, equal to the expected and according to the findings of authors like Petersen and Rajan (1997) and Yang (2011). This variable is statistically significant for the regressions II, IV, V and VI meaning that companies that present more access to bank credit have less need to use trade credit. For companies with low access to bank financing and especially for firms dealing with insolvency procedures in the channel of trade credit has great importance. In this way, companies with difficulties in obtaining bank financing find themselves in aggravated situations of financial crisis, to the extent that financial institutions restrict further the granting of credit; thus, they seek to finance themselves through trade credit as a way to maintain their daily activities. In the case of young companies, in addition to these restrictions, even presenting a healthy financial situation, relations with credit institutions are narrow, then, they seek to replace Bank lending by commercial credit in times of tight monetary policy.

To sum up, we find evidence that allow us to corroborate the hypothesis 4, trade credit is a substitute of bank credit.

Table 3. Determinants of granted trade credit

Variables	I(FE)	II(FE)	III(FE)	IV(FE)	V(FE)	VI Instr.Var
<b>CONST</b>	0.227*** (0.142)	-0.245 (0.2140)	0.0249 (0.2083)	0.104 (0.1813)	-16.68* (8.227)	
<b>TAM</b>	-0.00019 (0.383)	0.1388* (0.0541)	0.062 (0.0497)	0.0201 (0.0501)	0.1793* (0.0441)	-0.003 (0.003)
<b>TAM2</b>	-0.00194 (0.0023)	-0.0087* (0.0035)	-0.005** (0.0030)	-0.002 (0.0031)	-0.0128* (0.0029)	0.0035** (0.0011)
<b>CF</b>	3.41e-06 (6.48e-06)	0.0001 (0.00022)	2.80e-06 (5.46e-06)	-0.00008 (0.00006)	0.00009 (0.0001)	0.0004 (0.0003)
<b>GRO</b>	0.01512* (0.00175)	0.0169* (0.004)	0.0115* (0.0027)	0.0155* (0.0014)	0.0188* (0.002)	0.0178* (0.0012)
<b>DEB COST</b>	-0.00009 (0.00026)	-0.0003 (0.0003)	-0.0002 (0.0007)	-9.25e-06 (0.00023)	0.0005 (0.0006)	-0.00001 (0.0001)
<b>YEAR DIFIC</b>	-0.0094* (0.0014)	-0.0023*** (0.0059)	-0.0062*** (0.004)	-0.01064* (0.0021)	0.0082* (0.0041)	-0.004* (0.0005)
<b>STOCK</b>	0.0007* (0.00002)	-0.0068* (0.002)	-0.00004 (0.00003)	0.00005* (0.00002)	0.0020*** (0.0015)	0.0001* (0.000)
<b>GM</b>	3.86e-07* (1.85e-07)	1.31e-06*** (8.9e-07)	5.05e-07** (3.00e-07)	1.85e-06* (5.29e-07)	2.80e-06* (7.74e-07)	1.8e-06 * (5.2e-07)
<b>AGE</b>	0.04334* (0.00175)	0.0336 (0.004)	0.0672* (0.0027)	0.0888* (0.0014)	-0.0283 (0.002)	0.317* (0.0012)



<b>CC RECV</b>	(0.00690) -0.00039*	(0.0383) -0.0004*	(0.032) 0.0002	(0.0179) -0.0004*	(0.03043) 0.00044	(0.003) -0.0003*
<b>R-Squared</b>	(0.00019) 0.010	(0.0004) 0.015	(0.0002) 0.016	(0.0001) 0.081	(0.0008) 0.039	(0.000) 0.000
<b>F test</b>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Observation</b>	35 596	2865	6055	21202	6746	22 774

Note: see notes of Table 2

When studying trade credit granted, the variable TAM demonstrates positive sign and is statistically significant in regressions II and V; in all other regression it shows no statistical significance. In the same regressions II and V there are some evidences that the relationship between the variables is not linear and there is a maximum; this means that larger firms grant more credit than smaller ones but this relationship has a threshold from which the increased dimension does lower the level of trade credit granted. Nevertheless, we think there enough evidences to state that big companies act as informal financial intermediaries to their client businesses; larger firms grant more trade credit than SME.

The variable YEAR DIFIC presents positive sign on regression V and negative sign in all remaining regressions, which means that, in general, firms grant less trade credit in times of financial contraction, meaning the supply companies grant less commercial credit, since even themselves are faced with a shortage of funding and liquidity. These results allow us to corroborate the hypothesis 6.

In the case of regression V, a possible explanation for the results is the fact that the suppliers grant commercial credit due to the technological intensity of their industry (Cuñat, 2007); young companies or newly born, with technologically complex products, tend to create business relationships with potential customers before the so-called "formal relationship", given that these companies need specific products. In times of crisis, the suppliers grant commercial credit to their customers who find their sources of funding reduced or cut off, since these have no possibility of easily finding customers that use products with as high technology base. In short, the technological complexity can increase the level of commercial lending.

With regard to variable STOCK, it is statistically significant in all the regressions except regression III. In the regressions I, IV and V, the sign is positive, so we conclude that the management of stocks is crucial for suppliers to grant trade credit. In the case of regression II, the observed negative sign, shows that possibly the supplier companies in insolvency proceedings, do not use trade credit as a way to minimize costs by stock management and increase sales, given that they require financial liquidity to meet short-term obligations. In short, we find evidence to corroborate the hypothesis 1.

The variable GM shows a positive sign in all the regressions, as verified by Petersen and Rajan, 1997; García-Teruel and Martínez-Solano, 2010. This means that supplier companies use trade credit as a way to practice a policy of price discrimination. Therefore, when granting trade credit, they may maintain lasting relationships with their customers and gain a financial return, since charging higher prices to customers who extend payment periods and providing discounts to customers who pay in cash. These results allow us to corroborate the hypothesis 2, which demonstrates the reasons for price discrimination as an explanation for the use of trade credit as a form of short-term financing.

## 5. Conclusion

Trade credit is an important tool in corporate financing, especially for those firms with limited access to the banking market. Despite its relevance for financial management, there isn't a general theory about trade credit and the works published undertake an analysis mainly about the trade credit characteristics, focusing on the reasons that lead companies to receive or to grant commercial credit.

The results obtained in the present research allowed us to corroborate some of the starting hypothesis of our study, namely that companies with higher gross margins provide more commercial credit to their customers so that they can pursue a legal price discrimination and then take advantage, for a longer period, of trade relations with their customers. We also found evidence that allowed us to support other hypotheses; on the one hand, we were able to corroborate the notion that in times of financial contraction, companies without access to other sources of funding (including the bank credit), given its weak financial conditions and policies of tighter credit, seek trade credit as a source of alternative financing, thus showing an exchange effect between bank lending and trade credit. On the other hand, we found evidence that allow us to conclude that suppliers provide trade credit as a way of reducing the costs

of transaction, that is, as a way to reduce storage costs and inventories, thus functioning as a tool of stock management.

Unlike expected, we did not find evidence to support the hypothesis of SME to use more trade credit than large companies. It seems that firms with large capacity in obtaining resources on capital markets and those who obtain it cheaper, finance their own customers, unlike SME who need all the funding they get, for their day-to-day. This result appears to support the theory that explains trade credit based on the advantages of suppliers when they act as financial intermediaries. Similarly we've found no evidence that would allow us to conclude that trade credit is complementary to bank credit. Finally, we notice that the results obtained enabled us to corroborate the hypothesis according to which, in times of financial contraction, the firms' clients rely more on trade credit, but the suppliers grant less credit, insofar as these are, too, financially constrained. These results show that suppliers have a limited capacity to offer credit.

In terms of overall sample analysis, we found evidence that dimension, bank debt, the growth of turnover, financial crises, the weight of the stocks and the seniority of the company are clearly factors that influence the level of trade credit received. On the other hand, we found evidence that the growth in turnover, the financial crisis, the level of stocks, the gross margin, the seniority of the company and trade credit received are characteristics that influence the level of trade credit granted.

In short, we conclude that the asymmetry of information, the price discrimination, the transaction costs and the relationship between trade credit and financial crises, are determinants that influence the supply and demand for this type of funding source in the Portuguese industrial enterprises for the period 2003-2009.

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## Notes

Note 1. Transaction costs are costs of controlling and monitoring a particular transaction and to ensure that the objectives set are met, as well as the costs associated with the transport of goods, inventory and storage costs.

Note 2. Cost of intermediation includes expenditure on the compensation of depositors, administrative costs, i.e. operating costs not related to interest the institution incurs to release the funds, the costs of risk of default on the part of the customer, the taxes and the profit margin of the institution.

Note 3. This time period was chosen because it is the latest and most complete information on the SABI database available.

Note 4. Some authors such as Petersen and Rajan (1997) and García-Teruel and Martínez-Solano (2010) include the square of the logarithm of the age of company in their studies because the simple use of the logarithm of the age is not sufficient to permit study of non-linearity between the Seniority variable and dependent variables.

Note 5. Information obtained for the year 2012.

Note 6. This dummy variable takes the values "1" for the years 2008 and 2009 and "0" for the remaining years.