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THE SIGNALLING ROLE OF TRADE CREDIT ON LOAN CONTRACTS: EVIDENCE FROM A COUNTERFACTUAL ANALYSIS

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The Signalling Role of Trade Credit on Loan Contracts: Evidence from a Counterfactual Analysis

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Abstract

We study the role of trade credit in reducing the information asymmetries between firms and banks. According to the Biais and Gollier's (1997) model trade credit is a complement to bank credit as it is used to convey information to the bank about firm quality, thereby alleviating bank credit rationing. By employing a switching regression approach and taking into account the endogeneity arising from the simultaneous decisions of the bank to extend credit and the firm to use trade credit, we find that (i) the firm decision to use trade credit is a self-selection mechanism; (ii) any firm that chooses to use trade credit would benefit from a reduction in the cost of credit, with this reduction greater for firms that actually use trade credit; (iii) firms that use trade credit have a higher probability of obtaining financing. Thus, using a methodology that allows us to account for the role of private information in the firm-bank relationship, our results provide support to the signalling role of trade credit.

Keywords: Trade credit, Asymmetric Information, Signalling, Bank Credit, Endogenous Switching Regression
Jel Classification: C21, D82, G32.

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1 Introduction

It is well documented that trade credit is widely used as source of financing and it represents the most important source of short-term external finance. For instance, Elliehausen and Wolken (1993) report that in 1987 trade credit accounted for about 15% of the liabilities of non-farm non-financial businesses in the United States, and for small businesses this percentage was about 20% of their liabilities. Rajan and Zingales (1995), report that in 1991 trade credit (estimated using accounts payable) amounted to 15% of total assets for a large sample of non-financial US firms. In the sample used by Aktas, De Bodt, Lobez, and Statnik (2012), which contains non-financial, US, listed firms between 1992 and 2007, trade credit represents an average of 8.22% of total assets. Mian and Smith Jr (1994) report that trade credit comprised 26% of the total debts of non financial firms listed on the NASDAQ at the end of 1992. The importance of trade credit as a financing source also applies outside of the US. For instnace, Marotta (2005) shows that trade credit finances on average 38.1% of the input purchases of non-rationed Italian firms and 37.5% of rationed ones. Using a survey that covers 48 countries, Beck, Demirgüç-Kunt, and Maksimovic (2008) find that on average trade credit accounts for 19.7% of all external finance used to finance investments. They also find that in most countries trade credit is the second most important source of external finance. This large use of trade credit is surprising if we compare its cost with other short-term financial resources. For instance, the equivalent one-year interest rate of a "two part" contract is about 44% (Cuñat, 2007; Ng, Smith, and Smith, 1999)[1].

Firms decision on the use of trade credit has been extensively investigated.[2] The existing literature can be divided into financial and non-financial theories. In this paper we focus on the use of trade credit as a financing source, thereby contributing to the financial theories of the use of trade credit. The main discussion among the financial

[1] A common two-part contract is one that offers the client a discount of 2 per cent if they pay within 10 days of delivery, otherwise they are expected to pay the full amount due by the 30th day, which, according to Ng, Smith, and Smith (1999) is the most common deal used in the US. Other common deals such as "8-30 net 50" imply even higher implicit interest rates (Cuñat, 2007).

[2] See Cuñat and Garcia-Appendini (2012) for an extensive review on the role of trade credit in entrepreneurial finance.

theories is whether trade credit is a substitute or a complement of bank credit and both theories are supported by a rich empirical evidence. Along this strand of literature, in this paper we analyze empirically the relationship between trade credit and bank credit. In particular, we test the signalling role hypothesis resulting from the Biais and Gollier (1997) model, hereafter BG model, according to which, in an environment characterized by asymmetric information, a firm decides whether to use trade credit or not depending on the outcome it expects to get in the bank credit market and the bank decides whether to extend credit depending on what it observes in the trade credit market. Thus, a bank extends a loan to an opaque firm if it observes that the firm has been extended trade credit and a firm decides to use trade credit if it expects to get a loan at better conditions than not using trade credit.[3]

Under this framework, we test whether firms decide to use trade credit to convey private information (in the seller hands) to the bank. Following the empirical implication of the BG model we test whether this decision affects firm's cost of credit as well as firm's probability to obtain financing. In particular, we assume that the firm decision to use trade credit and the bank decision about the contractual terms are taken simultaneously; that is, the firm expects its decision to affect ex-post outcomes in the credit market, i.e. interest rate and probability to obtain financing. In order to accounts for these interdependent decisions we use an endogenous switching regression approach. Specifically, the estimation strategy is the following. Firms that suffer from asymmetric information, the opaque firms, decide to use trade credit to get a lower interest rate and to increase their probability to obtain financing. On the other hand, firms that do not suffer from asymmetric information, the transparent firms, do not find beneficial to use trade credit. We model this process assuming that firms belonging to the former group self select into the trade credit (TC) regime while those that belong to the latter group self-select into the no trade credit (NTC) regime. Once we have accounted for the self-selection, we estimate the interest rate and the probability to obtain financing in the two regimes; we also compute the expected actual and counterfactual outcomes and thus the effect of the treatment on the treated.

[3]We will make clear this mechanism in paragraph 3 where we discuss the implication of the BG model.

Our estimates confirm that firms self-select into their preferred regime to convey information about their credit worthiness to the bank. Moreover, any firm who chooses the TC regime would obtain a lower cost of credit than it would by choosing the other regime. However, the cost of credit differential between the two regimes is larger for firms that actually decide to use trade credit. In addition, we find that conditional on the same decision on the use of trade credit, firms belonging to the NTC regime get an interest rate always lower than firms belonging to the TC regime. This result corroborates the assumption that firms in the NTC regime are less opaque and therefore, anything else equal, they carry on less uncertainty at the eyes of the bank. Finally, concerning the probability to obtain financing, we find a positive effect of the treatment on the treated, that is a higher probability to obtain financing for firms that actually select the TC regime than for firms in the other regime had they decided to use trade credit.

These results contribute to the literature on the role of trade credit as a complementary source of financing, providing evidence of the signalling role of trade credit in improving small firms cost of and access to credit. Our results are in line with the finding of Giannetti, Burkart, and Ellingsen (2011) which investigate whether firms' extension of trade credit from their supplier embeds informational advantage over banks and therefore constituting a credible signal of firms' creditworthiness. In addition, this paper complements the theoretical model of Biais and Gollier (1997) as it is the first that test both some of the assumptions and equilibrium properties of the BG model, accounting for the endogeneity arising from the simultaneous decisions of the bank and the firm.

The reminder of the paper is organized as follows. Section 2 reviews the related literature, and Section 3 discuss the signalling role hypothesis stemming from the BG model. Section 4 describes the data and and the empirical setting. In particular, Section 4.1 develops the research hypotheses and Sections 4.2 and 4.3 describe the model specification. Section 5 reports the estimation procedure and the results, and Section 6 concludes.

2 Related literature

From a theoretical perspective, Biais and Gollier (1997) argue that trade credit is used to reduce the information asymmetry between firms and bank, thus acting as a complementary financing source. They show that with asymmetric information and without the possibility of financing through trade credit firms are not able to receive credit. Therefore trade credit acts as channel for good opaque firms to signal their quality to the bank. This is possible thanks to the fact that firms that extend trade credit - the sellers - to firms with which they have commercial relationships - the buyers - have superior information about the quality of these firms than the banks. Therefore firms that find difficult to obtain financing from the bank, can relax the credit constraints they face by using trade credit so to pass the information in the sellers' hands to the bank. The signalling role hypothesis of trade credit has been also studied theoretically and empirically by Engemann, Eck, and Schnitzer (2014) for firms that are active in the international trade. They find that while in general trade credit and bank credit are substitutes, the use of trade credit enables a firm that cannot afford to export if only pure bank financing is available, to obtain additional bank credit. Burkart and Ellingsen (2004), with a model that contemplates a moral hazard problem, argue that both complementary and substitution effect are inside the use of trade credit depending on the firms' aggregate debt capacity. They find that trade credit and bank credit are substitutes for firms with unconstrained access to external finance, whereas firms that do not receive sufficient bank funding use bank and trade credit in a complementary way. Our paper is closely related to the theoretical paper of Biais and Gollier (1997), as we test the empirical implication of their model.

From an empirical perspective, the literature that investigates the financial motives of the use of trade credit, focuses on the relationship between trade credit and bank loans availability, particularly for small-medium firms for which the existence of credit market imperfections is relevant. The existing literature provides contradictory evidence. Some studies support the substitution role of trade credit with respect to bank credit, while others support their complementarity. The role of trade credit as a substitute of bank credit is supported by the evidence that firms use trade credit if they struggle to obtain

bank loans (Petersen and Rajan, 1997; Danielson and Scott, 2004; Demiroglu, James, and Kizilaslan, 2012; Casey and O'Toole, 2014) and of an increase in the use of trade credit during periods of monetary contractions (Choi and Kim, 2005; Nilsen, 2002; Atanasova and Wilson, 2004; Atanasova, 2007; Mateut, Bougheas, and Mizen, 2006) and financial crisis (Palacín-Sánchez, Canto-Cuevas, and Di-Pietro, 2019). Using survey data on U.S. small businesses, Danielson and Scott (2004) investigate whether credit availability affects firms' trade credit demand; they find that when credit constraints is imposed by banks, firms are likely to use trade credit as financing source. Similarly, Casey and O'Toole (2014), using European data on small and medium-sized enterprises during the 2009-2011 financial crisis, show that firm's demand of trade credit as an alternative financing source increases when they are financially constrained by the bank. In particular they find that credit rationed firms are more likely to use trade credit than self-rationed borrowers, i.e. those that do not apply due to high cost of lending, thereby confirming the role of trade credit as a substitute for bank credit.

However, other empirical studies find support to the hypothesis of the complementarity between trade credit and bank loan (Elliehausen and Wolken, 1993; Tsuruta, 2015; Andrieu, Staglianò, and Van Der Zwan, 2018). For example, Elliehausen and Wolken (1993), using the NSSBF dataset, find that firms that use relatively large amount of short-term institutional credit are also the largest users of trade credit. Using a different wave of the NSSBF, Giannetti, Burkart, and Ellingsen (2011) find that trade credit seems to facilitate financing by uninformed lenders. Moreover, these firms are offered better deals from the banks. Consistently with the positive signalling effect of trade credit on bank credit, Engemann, Eck, and Schnitzer (2014), in a sample of Germany manufacturing firms for the period 1994-2009, find that the inverse relationship between trade credit and bank credit, which holds for the whole sample of firms, is attenuated for financially constrained exporters.

Other studies report that there is not a clear cut evidence of the role of trade credit as substitute or complement for bank credit, as it depends on the different monetary episodes firms face. Trade credit is an alternative source of bank financing during periods

of monetary tightness, while during looser monetary episodes the extension of trade credit by suppliers to a firm can reveal information on the firm creditworthiness, thus acting as a complement to bank loans (Yang, 2011).

Differently from the above mentioned papers, our analysis does not question whether trade credit is a substitute or complement for bank credit, rather we focus on the signalling role of trade credit that emerges from the BG model. However, we are not the first to test the signalling role hypothesis contemplated by BG. For instance, Giannetti, Burkart, and Ellingsen (2011) using a dummy variable about the use of trade credit, find that firms that use trade credit have on average shorter relations with their banks, relay more on distant lenders, borrow from a larger number of banks but pay a lower fees for obtaining a bank loan. According to them all these findings are consistent with the notion that trade credit reveals favorable information to other lenders. Agostino and Trivieri (2014), using micro-data on Italian SMEs in the years 1998-2006, find that bank funding tends to increase as trade credit increases. They use the strength of bank-firm relationships as an identification strategy for the signalling role of trade credit. They find that the positive impact of trade credit on bank funding appears to be greater when lending relationships are shorter. Differently from Agostino and Trivieri (2014), we test the signalling role of trade credit by taking into account the endogeneity between the firm decision to use trade credit and the ex-post outcome in the bank credit market in terms of probability to obtain a loan and cost of credit. Moreover, our methodology allows to test directly whether the firm decision process conveys private information to the bank. Similarly to us, Del Gaudio, Sampagnaro, Porzio, and Verdoliva (2021), using confidential data at the bank-firm loan-level of small-medium Italian firms examine the role of trade credit, measured as amount of accounts payable, on the loan approval process. They find that trade credit increases the probability of a borrower receiving a positive response to a loan request. However, our approach is new as we study the relationship between trade credit and access to bank credit, as well as cost of credit, using an identification strategy that provides a test of the empirical implications stemming from the BG model. In particular, the methodology we use takes into account the endogeneity stemming from the BG model and allows to

measure the relevance and the extent of the signal embedded in the decision to use trade credit as a source of financing.

3 The signalling role hypothesis of trade credit

According to Biais and Gollier (1997) trade credit is used to facilitate firms with valuable project to obtain financing and thus it reduces credit rationing in a context with adverse selection. Differently from Stiglitz and Weiss (1981), in the BG framework credit rationing occurs because at the equilibrium interest rate charged by the bank, firms whose project net present value is positive are not willing to borrow. Hence, in this context credit rationed firms are those with valuable projects whose cost of credit would exceed the cash flow generated by the project. Such a situation arises when asymmetric information does not allow the bank to identify between good and bad firms and (i) there is a large fraction of lemons in the firms population, or (ii) the bank receives a imprecise signal about firms quality. However, if firms are able to finance a fraction of their investment through trade credit, the asymmetric information between banks and firms can be reduced by means of trade credit, which would convey to the bank the private information held by the sellers, thereby reducing credit rationing. If that is the case, then the extensive use of trade credit by firms is justified despite its high cost. In the following we briefly discuss some of the results stemming from the BG model, which we use to derive some testable hypothesis.

1. **Decision to use trade credit.** Trade credit is used as a form of short-term financing when the presence of asymmetric information causes good firms to be credit rationed. Good firms that do not suffer from credit rationing do not use trade credit, while good firms that experience credit rationing respond by using trade credit. When delayed payments are extended by the seller to the buyer, firms finance part of their investment through trade credit, while the rest is financed by bank credit. Accordingly we can classify firms that suffer from relevant asymmetric information as opaque and as transparent those whose quality and characteristics are perfectly observed by the bank. Thus, opaque firms would use trade credit in conjunction with bank credit to finance their project while good transparent firm

would use only bank credit.

2. **Cost of credit.** The loan interest rate the bank charges to firms that use trade credit results to be lower than the pooling interest rate charged to the firms if bank credit were the only source of financing. Indeed, good opaque firms would not be able to signal their quality if they cannot use trade credit. In that case, the pooling interest rate would take into account the fraction of bad firms that the bank is not able to identify. Clearly, without asymmetric information a good firm would have the same cost of bank credit regardless it uses trade credit or not. This interest rate is lower than that charged to a good firm that needs to signal its quality by using trade credit.

3. **Probability to obtain financing.** Firms that suffer from asymmetric information use costly trade credit to obtain bank credit which otherwise would not be granted; moreover it is necessary a certain amount of trade credit in order to be financed. Therefore, for an opaque firm there exist an implicit probability to be financed, which depends both on the decision to use trade credit and on the amount of trade credit extended. Conversely, for transparent firms, the probability to obtain financing is 1 for good firms and zero for bad ones. Thus, provided that a sufficient amount of trade credit has been extended, for these firms the probability to receive bank credit is 1, while for all the others this probability is less than 1. The explanation is the following: firms for which the bank observes that trade credit has been extended, the opaque ones, always receive bank financing, as they are able to signal themselves as good. On the contrary, transparent firms, which do not use trade credit, are either good and bad. Their quality can be identified by the bank and thus their probability to be financed is less than one.

4 Data and empirical setting

We use the 2003 NSSBF (National Survey of Small Businesses Finances) dataset conducted by the Board of Governors of the Federal Reserve System. The dataset provides

information on a sample of 4240 firms, selected from the target population of all for-profit, non-financial, non-farm, non-subsidiary business enterprises that had fewer than 500 employees and were in operation as of year-end 2003 and on the date of the interview. Information on the availability and use of credit and other financial services, demographic characteristics for up to three of the individual owners, other firm's characteristics such as number of workers, organizational form, location, credit history, income statement and balance sheet is available.

The survey contains a section about the use of trade credit by firms. We use this information together with the information on bank financing to study the relationship between trade credit and bank credit. In particular we use the information whether the firm used trade credit or not during the last year, whether the firm has been financed by the bank in the last three years and, if any, on the interest rate charged by the bank. We assume that firms that use trade credit are those that suffer from relevant information asymmetries and thus, are those that experience credit rationing. These firms then, might use trade credit in order to have a better access to bank loan. On the contrary, firms whose characteristics are fully observed by the bank do not need to use trade credit to obtain financing. Our aim is to test whether the use of trade credit has an impact on the contractual terms between the bank and the firm. In particular we test whether there is a relationship between the decision to use trade credit and the interest rate charged by the bank (cost of credit) as well as the probability to obtain financing. Following the theoretical literature (Biais and Gollier, 1997), we argue that there is endogeneity between the decision on the use of trade credit and the expected outcomes in terms of access to and cost of credit. Accordingly, we consider a framework with two regimes; in the NTC, i.e. no trade credit, regime firms do not need to signal their quality to the bank; in the TC, i.e trade credit, firms convey some private information through the use of trade credit. Firms that belong to the first regime are the transparent ones, while those that belong to the latter regime are identified as opaque firms.

4.1 Empirical Hypotheses

In this section we describe the identification strategy and the hypotheses that we are going to test.

1. **Decision to use trade credit**

   We model firms decision to use trade credit in the following way. Opaque firms are more likely to use trade credit than transparent firms. Thus, a firm choosing the NTC regime is one whose characteristics and creditworthiness are fully observed by the bank. On the contrary, a firm choosing the TC regime is one whose characteristics and creditworthiness are not fully observed by the bank.

   > **Hypothesis 1.a:** The firm decision to use trade credit conveys private information to the credit market.
   >
   > **Hypothesis 1.b:** The firm decision to use trade credit is driven by its expected outcome in the credit market.

   Hypothesis 1.a comes from the fact that good opaque firms need to use trade credit in order to signal their quality and obtain a bank loan, which otherwise would not be granted. Therefore a firm decision to use trade credit works as an information channel. However, the decision to use trade credit is not costless; usually the use of trade credit is associated to a higher cost of funds than the interest rate charged by the bank[4]. Therefore, trade credit is used by those firms that expect to have a better outcome in terms of access to and cost of bank credit (Hypothesis 1.b).

2. **Cost of credit**

   Following the implications of the BG model, good transparent firms will be financed without using trade credit, while good opaque ones use trade credit to obtain a loan. These latter, by using trade credit get a lower interest rate than that charged without trade credit. Hence, this argument leads to formulate the following hypothesis.

[4]This higher cost of trade credit is documented in Cuñat (2007) and Ng, Smith, and Smith (1999).

Hypothesis 2: Firms that use trade credit pay a lower bank interest rate than the one they would have paid had they not used trade credit.

This hypothesis follows from the fact that without trade credit opaque firms would be financed at the pooling interest rate, which corresponds to the highest rate in the market. Clearly, in the data we do not observe the pooling interest rate because at this rate no exchange takes place. With some non very restrictive assumptions we are able to construct this counterfactual by implementing a switching regression model, as it will be explained in the section 4.2.

3. **Probability to obtain financing.** Opaque firms signal their quality through trade credit in order to obtain a bank loan, otherwise they would not be financed. Thus, we expect trade credit to play a role in the probability of firms to access credit market.

   Hypothesis 3.a: The probability to obtain financing and the decision on the use of trade credit are endogenously determined.

   Hypothesis 3.b: Firms that use trade credit have a higher probability to be financed than firms that do not use it.

   In order to obtain consistent estimates of the probability of being financed we employ a maximum likelihood estimation of a joint model of the probability to be financed and the switching decision to use trade credit, as detailed in section 4.3.

4.2 Model specification: trade credit and cost of credit

We assume that firms decide whether to use trade credit or not depending on the expected outcome in the bank credit market. At the same time, banks decide whether to extend credit and at what price, taking into account what they observe in the trade credit market. Therefore, the estimation methodology should take into account the interdependence of these two simultaneous decisions. In order to test whether the decision to enter the trade credit regime (TC) affects the bank interest rate we cannot use a direct method, because we do not observe the interest rate that would have been charged if firms had chosen not

to enter the trade credit regime (NTC). In this situation the errors of the trade credit equation and those of the interest rate equation are correlated. According to Kai and Prabhala (2007) such a situation is a problem of self-selection, in which the decision on the use of trade credit captures some unobserved heterogeneity of firm quality, and hence creditworthiness, bringing to light information on creditworthiness privately held by the firms. Moreover, the self-selection is not the only reason why it is important to consider the firm decision on the use of trade credit. If trade credit conveys some information in the hands of trade credit supplier to the bank about the quality of the firm, the bank would apply different interest rate, depending on whether they observe selection into trade credit or not.

We model the decision to use trade credit as follow:

$$TC_i^* = Z_i\gamma + v_i \tag{1}$$

where TC represents the value from using trade credit, Z is a set of trade credit determinants, γ is a vector of parameters and v is the error term. TC^* is a latent variable with the following index function:

$$TC_i = \begin{cases} 1 & if \;\; Z_i\gamma + v_i > 0 \\ 0 & if \;\; Z_i\gamma + v_i \leq 0 \end{cases} \tag{2}$$

We model the cost of bank credit (R) separately for the two cases as a function of a set of loan rate determinants X:

$$R_{TC,i} = X_i\beta_{TC} + u_{TC,i} \tag{3}$$

$$R_{NTC,i} = X_i\beta_{NTC} + u_{NTC,i} \tag{4}$$

where β are vectors of parameters, and u are the error terms. We observe R_{TC} when $TC = 1$, but in this case R_{NTC} is not observed, latent or missing. Similarly, we observe R_{NTC} when $TC = 0$, in which case R_{TC} is not observed. We assume that there is

interchangeability across states.

The model consisting of equations (2)-(4) cannot be estimated directly because the observed interest rates are conditional outcomes and depend on the chosen alternative, but we can estimate it by using a switching regression approach. Because of the failure to observe R_{TC} when $TC = 0$ and R_{NTC} when $TC = 1$ we need to define the expected loan rate for a firm using trade credit who self-selects into trade credit. Assuming that u and v are bivariate normal we have:

$$\begin{aligned} E(R_{TC,i}|TC = 1) &= E(R_{TC,i}|TC^* > 0) \\ &= E(R_{TC,i}|v_i > -Z_i\gamma) \\ &= X_i\beta_{TC} + E(u_{TC}|v_i < Zi\gamma) \\ &= X_i\beta_{TC} + \sigma_{TC,v}\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)} \end{aligned} \tag{5}$$

where ϕ is the pdf of the standard normal distribution and Φ is the cumulative density function. The results follow due to the truncation of the distribution of R_{TC} from below. Similarly, the expected cost of credit for firms not using trade credit is:

$$\begin{aligned} E(R_{NTC,i}|TC = 0) &= E(R_{NTC,i}|TC^* \leq 0) \\ &= E(R_{NTC,i}|v_i \leq -Z_i\gamma) \\ &= X_i\beta_{NTC} + E(u_{NTC}|v_i \geq Z_i\gamma) \\ &= X_i\beta_{NTC} - \sigma_{NTC,v}\frac{\phi(Z_i\gamma)}{1 - \Phi(Z_i\gamma)}, \end{aligned} \tag{6}$$

which follows from the truncation of R_{NTC} from above. The functions $\lambda_{TC,i} = \frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ and $\lambda_{NTC,i} = -\frac{\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}$ are the inverse Mills's ratio, and they represent the conditional expectation of v given the selection into trade credit or not respectively.

The procedure is to estimate in the first stage the following equation:

$$TC_i = Z_i\gamma + v_i. \tag{7}$$

From equation (7) we obtain the linear predictions, $Z_i\widehat{\gamma}$ which are used to calculate λ_{TC}

and λ_{NTC}. By employing this switching model we control for self-selection and obtain consistent estimates of β_{TC} and β_{NTC} by estimating equations (5) and (6) with OLS. The strength of this model is that it allows for a clear interpretation of the sign of the inverse Mills's ratio, as it tells us the direction of the selection and most importantly, we are able to verify Hypothesis 1.a as follows

1. the variables λ_{TC} and λ_{NTC} are an estimate of the private information underlying the firm decision about the TC regime, and

2. the test of the significance of the coefficients associated to the inverse Mills' ratios is a test of whether private information possessed by the firm explains ex-post results, i.e. cost of bank credit (Kai and Prabhala, 2007)

However, according to our hypothesis, if the choice of using trade credit conveys information about the quality of the firm, then the decision to use trade credit depends on the expected outcome in terms of cost of credit. Therefore, in order to address the endogeneity between trade credit and the cost of credit we employ the endogenous switching approach (Lee and Trost (1978), Maddala (1986)). The endogenous switching model can be fitted one equation at a time using the two steps estimation proposed by Maddala (1986), pp. 223-228, or by maximum likelihood. We rely on full-information ML method proposed by Lokshin and Sajaia (2004) which yields consistent standard errors.

Consider the model represented by equations (1)-(4). Assume that v_i, $u_{TC,i}$ and $u_{NTC,i}$ have a trivariate normal distribution, with mean vector zero and covariance matrix

$$\Omega = \begin{bmatrix} \sigma_v^2 & \sigma_{u_{TC},v} & \sigma_{u_{NTC},v} \\ \sigma_{u_{TC},v} & \sigma_{u_{TC}}^2 & . \\ \sigma_{u_{NTC},v} & . & \sigma_{u_{NTC}}^2 \end{bmatrix}$$

where σ_v^2 is the variance of the error term in the trade credit selection equation, and $\sigma_{u_{TC}}^2$ and $\sigma_{u_{NTC}}^2$ are the variances of the error terms in the cost of credit equations. $\sigma_{u_{TC},v}$ is the covariance of v_i and $u_{TC,i}$, and $\sigma_{u_{NTC},v}$ is the covariance of v_i and $u_{NTC,i}$. The model is identified through non linearities. Nevertheless, as explained in section 4.3, we include

as exclusion restriction a variable that affects the decision to use trade credit but not the cost of credit. The logarithmic likelihood function for the equations (1)-(4) is

$$lnL_i = \sum_{i=1}^{N} \left\{ TC_i \left[ln\phi(\frac{u_{TC,i}}{\sigma_{TC}}) - ln\sigma_{TC} + ln\Phi(\eta_{TC,i}) \right] + \right.$$
$$\left. + (1 + TC_i) \left[ln\phi(\frac{u_{NTC,i}}{\sigma_{NTC}}) - \sigma_{NTC} + ln\left(1 - \Phi(\eta_{NTC,i})\right) \right] \right\}$$

where $\eta_{j,i} = \frac{Z_i\gamma + \rho_j u_{j,i}/\sigma_j}{\sqrt{1-\rho_j^2}} \frac{1}{2}$ with $j = \{TC, NTC\}$. The endogenous switching regression model can be used to compute the observed cost of credit for TC and NTC users and the counterfactual hypothetical cost of credit, i.e. the cost of credit for trade credit users had they not used it, and the cost of credit for non-trade credit user had they used it. The conditional expectations for the cost of credit in the four cases are defined as follows

$$E(R_{TC,i}|TC = 1) = X_i\beta_{TC} + \sigma_{TC,v}\lambda_{TC,i} \tag{8}$$

$$E(R_{NTC,i}|TC = 0) = X_i\beta_{NTC} + \sigma_{NTC,v}\lambda_{NTC,i} \tag{9}$$

$$E(R_{NTC,i}|TC = 1) = X_i\beta_{NTC} + \sigma_{NTC,v}\lambda_{TC,i} \tag{10}$$

$$E(R_{TC,i}|TC = 0) = X_i\beta_{TC} + \sigma_{TC,v}\lambda_{NTC,i} \tag{11}$$

Equation (8) is the expected cost of bank credit for a firm in the TC regime conditional it used trade credit, equation (9) is the expected cost of bank credit of a firm in the NTC regime conditional it did not use trade credit. Equation (10) denotes the expected cost of bank credit of a firm in the NTC regime conditional it used trade credit. Finally, equation (11) is the expected cost of bank credit of a firm in the TC regime conditional it did not use trade credit. Cases (8) and (9) are the actual expectation observed in the sample. Cases (10) and (11) represents the counterfactual outcomes. We compare the expected cost of bank credit in the four cases to test Hypotheses 1.b and 2.[5]

[5]The estimation is carried out employing the Stata command `movestay` (Lokshin and Sajaia, 2004).

4.3 Model specification: trade credit and probability to obtain financing

According to Hypotheses 3.a and 3.b there exists endogeneity between the decision to use trade credit and the decision of the bank to extend credit. In particular, a firm that suffers from asymmetric information decides to use trade credit to increase its chance to obtain a bank loan and the bank is willing to finance an opaque firm if it observes that that firm has been extended trade credit. In order to consistently estimate the probability to obtain bank credit, we account for this simultaneity in the following way.

Let π_i^* the latent process that guides the bank decision to finance firm i

$$\pi_i^* = W_i\theta + TC_i\alpha + \epsilon_i, \tag{12}$$

Variable π_i^* is unobservable. We observe the variable π_i according to the following index function

$$\pi_i = \begin{cases} 1 & if \;\; W_i\theta + TC_i\alpha + \epsilon_i > 0 \\ 0 & otherwise \end{cases} \tag{13}$$

W_i is a set of determinants of bank credit, θ and α are vectors of parameters and ϵ is the error term. This model is often referred as "multivariate probit model with a structural shift" (Heckman, 1978) or "dummy endogenous variable model" (Maddala, 1986). If $\epsilon_i|W_i, TC_i \sim N(0,1)$ it would be possible to estimate model (13) by standard probit. However, assuming trade credit decision is endogenous, and given that the variable is a binary indicator its distribution is not normal, and hence such nonlinear models cannot be estimated using a two-stage method (Carrasco, 2001).

In order to account for this endogeneity problem, we formulate this decision process as a system of two equations for two latent responses. The decision to use trade credit is modeled as in equations (1) and (2), which we report here below for exposition purposes

$$TC_i^* = Z_i\gamma + v_i, \tag{14}$$

where TC^* is a latent variable with the following index function

$$TC = \begin{cases} 1 & if \;\; Z_i\gamma + v_i > 0 \\ 0 & otherwise. \end{cases} \tag{15}$$

We use the procedure proposed by Lokshin and Sajaia (2011) which employ a ML estimator of the binary choice model with endogenous regressors. Although the model is identified by non linearities, we also include an exclusion restriction variable. This procedure allows us to (i) test the endogeneity hypothesis between trade credit and probability of being financed, via the significance of the correlation coefficients (hypothesis 3.a) and (ii) the treatment effect for the treated, which corresponds to our hypothesis 3.b[6].

The treatment effect for the treated is calculated using the following equation

$$TT = Pr(\pi_{TC} = 1|TC = 1) - Pr(\pi_{NTC} = 1|TC = 1).$$

5 Estimation procedure and results

5.1 Cost of credit: the switching model

We start estimating the standard switching model of equations (7), (5)-(6). We first estimate the firm decision to use trade credit, i.e. equation (7), using the following set of Z variables. The dependent variable is a dichotomous indicator equal one if the firm made purchases of good and services on account rather than paying at the time of delivery. Notice that we use the same set of Z variables whenever we have to estimate the firm decision to use trade credit. Among the explanatory variables we include *liquidity on total asset* and the *growth of sales* as measures that account for the transaction use of trade credit. We expect that the higher is the share of liquid asset the less likely the firm uses trade credit. Conversely, when sales are growing we expect that the likelihood of observing trade credit also increases. As argued by Petersen and Rajan (1997), for small firms *firm age* is a proxy for experience in the business. Some projects may be feasible after an

[6]The estimation is carried out employing the Stata command `switch_probit` (Lokshin and Sajaia, 2011)

adequate level of experience is achieved. However, for larger firms investment opportunities may decline in firm age (Petersen and Rajan, 1997). Given the above arguments, it is difficult to identify how firm age affects the use of trade credit. *Inventories* are a proxy of working capital needs that positively influence the decision to use trade credit. Finally we include the *ratio of loans on total asset* in order to account for firm capital structure. We also include some variables proxy for the quality of the firm-bank relationship. *Length of relationship* between the firm and its principal financial institution is a proxy measure of the tacit soft information the lender has obtained through time about the quality of the borrower, and hence a measure of firm informational opacity. Another measure of firm informational opacity is given by the dummy *financial statement for internal use only*, which should be positively correlated to trade credit use. Longer distances between the firm and its principal financing institution are proxy of the application cost of obtaining a loan. We expect a positive correlation between the variable measuring the *distance* in miles from the bank and the use of trade credit. Finally, we include the *amount of unused credit lines* as an exclusion restriction; this variable affects the firm decision on the use of trade credit but it should not influence the cost of bank credit. The choice of this variable as an exclusion restriction is appropriate because the firm proximity to its credit line limits proxies tightness in the use of short-term funds and it is likely to affects the decision on the use of trade credit. Conversely, the amount of unused line of credit should not affect the interest rate charged by the bank on the most recent loan. We report the results of the estimation of equation (7) in table 1.

To estimate the loan rate equation we use a set of X variables that includes the following regressors. The dataset contains specific information about the most recent approved loan, which we consider in our estimation. We consider the *amount granted of the loan on total amount applied*, *the amount of the loan on total firm asset* and a dummy equal one if firm post *collateral*. Given that it is likely that a fixed interest rate is associated with a higher cost of credit, we include also a dummy equal one for *fixed interest rate*, that we expect to affect positively the cost of credit. We also include the dummy equal one if the loan is a *mortgage*. To account for differences in the monitoring

costs of the bank we include the *distance* in miles of the firm from the bank. A measure of the impact of firm financial structure on the cost of credit is included using the ratio of *debt on total asset*. Morevoer, *credit score* is included to control for firm quality observed by the bank, which may have an effect on interest rate. To measure this effect we include a dummy equal one if firm credit score is in the top 25% of the distribution. Market characteristics may also affect the loan rate. To consider possible bank local market power we include a dummy equal one if the *Herfindahl-Hirschman bank deposit index* of local banking market concentration is greater than 1800 (i.e. highly concentrated). Finally, we consider a set of variables that account for heterogeneity of borrowers. As documented in the literature entrepreneur experience contributes positively to firm profit. To catch the managing experience effect we include the number of *years of the principal owner's managing experience*. We expect the interest rate to be decreasing in the years of managing experience as a greater experience is positively correlated to higher profit and hence it generates a higher probability of success for the firm. The literature reports evidence that entrepreneurs that belong to a minority group rely more heavily on their own funds to finance a start up. We include two dummies: the first is equal one if the *principal owner is black*, the other is equal one if the owner belongs to *other minority groups* (asian, hispanic, asian pacific, native american). Firm's proprietorship characteristics may have some effect on credit availability and loan contract as family and non-family owned firms may exhibit different agency costs. To control for proprietorship effects we include a dummy equal one if firm is *family owned*.

From the estimation of equation (7) we obtain the inverse Mills' ratio λ_{TC} and λ_{NTC}. Then we estimate the two equations of the cost of credit (3) and (4) augmented with the inverse Mills' ratios. Results are reported in tables 1-3. In the standard switching model a positive sign of the coefficient of λ_{TC} means that there is a positive correlation between the unexplained factors that affect the cost of credit and those that affect the decision to use trade credit. In both loan rate equations (tables 2 and 3) the inverse Mills' ratios are positive and statistically significant. We can therefore confirm Hypothesis 1.a about the role of trade credit in conveying private information from the buyer-seller relationship to

the loan market. In addition, the significance of the inverse Mill's ratios confirms that there is a selection effect in the use of trade credit. Among the various regressors that explain the loan rate equation, notice that the coefficient estimate of the dummy *collateral* is not significant for firms in the NTC regime while it is positive and statistically significant for firms in the TC regime. This result is in line with the conclusions of Bellucci, Borisov, Giombini, and Zazzaro (2021) according to who the effect of collateral on cost of credit is positive whenever one does not account for the endogeneity between these two contractual terms.[7]

5.2 Cost of credit: the endogenous switching model

We now test Hypothesis 1.b (the endogeneity hypothesis), according to which firms decide whether to use trade credit anticipating the ex-post results about the cost of bank credit. To this purpose we estimate the endogenous switching model described in section 4.2. The sets of X and Z variables are those already described in the previous section. Results are displayed in table 4. The results of the switching equation, the trade credit decision, are displayed in the bottom panel of table 4.[8] The variable *amount of unused credit lines*, our exclusion restriction, is negative and significant. Our proxy for firm information opacity, *financial or accounting statements only for internal use*, is positive and highly significant. This finding supports the assumption that opaque firms rely more on trade credit.

The correlation parameters ρ_{TC} and ρ_{NTC} are both positive and significant, thus confirming Hypothesis 1.b of firm self-selecting into one of the two regimes. With regard to the dummy *collateral*, in this regression the coefficient of this regressor is negative and significant in the cost of credit equation in both regimes, and positive and significant in the switching equation. A positive correlation between the decision to use trade credit and the dummy collateral can be explained by the fact that firms that use trade credit are generally more opaque, and as such these firms are also the ones most likely to be asked

[7] Bellucci, Borisov, Giombini, and Zazzaro (2021) show that when accounting for the endogeneity the effect of collateral on the interest rate appears to be weaker or not significant. Notice that we obtain a result similar to theirs, when we run the endogenous switching regression in section 5.2; in fact we find that effect of collateral on the interest rate differs from what we obtain in the standard switching regression.

[8] Notice that the endogenous switching method implies that the switching equation for the decision to use trade credit is augmented with all the variables that we consider in the loan rate equation.

to provide collateral by the bank. However, once we account for the endogeneity of the decision to use trade credit, posting collateral always reduces the cost of credit. The effect of posting collateral is stronger for firm in the NTC regime: cost of credit is reduced by 0.77 percentage points versus a reduction of 0.47 percentage points for firms in the TC regime.

The estimation in table 4 is used to compute the conditional expected cost of bank credit, which are reported in table 5. The first column reports the value $E(R_{TC}|TC = 1) = 5.45$, which is the predicted cost of bank credit for a firm in the TC regime currently using trade credit. This value is nearly 2.5 percentage points below the counterfactual cost of credit for a firm in TC regime had it not used trade credit, see column 2 of table 5. However, firms selecting the TC regime do worse than firms who currently are in the NTC regime had they decided to use trade credit. This confirms our Hypothesis 2, according to which there is a benefit in terms of lower cost of credit for any firm that chooses to use trade credit. Moreover, by comparing the first column with the last column, and the second column with the third one of table 5, we find that conditional on the same decision on the use of trade credit, firms belonging to the NTC regime get an interest rate always lower than firms belonging to the TC regime. This result supports the assumption that firms in the NTC regime are the transparent ones and therefore, anything else equal, they carry on less uncertainty at the eyes of the bank.

5.3 Access to credit

Our Hypothesis 3.b state that firms use trade credit, i.e. enter the TC regime, to signal themselves as good borrowers and increase the chance of being financed. The SSBF dataset provides information about the firm application to bank credit and whether a firm is always rationed, sometimes rationed or always financed by the bank. We use as dependent variable a dummy equal one if a firm is always financed. We estimate the probability to be financed, equation (13), by using some of the variables already described. We also include other covariates such as a dummy for firms with *bankruptcy* and *delinquencies* records; the *number of applications* for loans made by the firm; a dummy for *limited liability*;

a dummy indicating if the firm has been *rationed by other banks* before the application to the most recent loan. To estimate the switching equation (15), i.e. the decision to use trade credit, we use the set of Z variables already defined. We also include another variable that works as an exclusion restriction, which is a dummy indicating a firm using the owner's credit card for business expenses whose extended credit is fully payed at the end of the month. Specifically, the survey refers only to revolving credit cards that are used for business purposes. When the variable is equal to one, it means that the firm did not take advantage of an available alternative source of short term financing. Thus, we expect that this variable correlates positively with trade credit, but it should not affect the decision of the bank to extend credit. Results are reported in table 6. The coefficient of the exclusion restriction is positive and significant. Moreover, the significance of the correlation coefficients confirms Hypothesis 3.a about the endogeneity between the decision to use trade credit and the probability to obtain credit. Hypothesis 3.b is confirmed by the computation of the treatment effect on the treated, which is $TT = 0.17$, meaning that firms entering the TC regime have 17% higher probability of being financed than firms in the NTC regime.

6 Conclusions

In this paper we focused on the relationship existing between trade credit and bank loans. The literature links the financial motif of trade credit to the information asymmetries in the credit market. In such a framework, in which asymmetric information may induce banks to ration their customers, trade credit is used as a substitute or a complementary source of financing for bank credit. We test this latter hypothesis stemming from the theoretical model of Biais and Gollier (1997) according to which trade credit is used to alleviate credit rationing due to asymmetric information. In this framework, firm' decision to use trade credit has implication on the firm' financing probability and also on the interest rate charged by the bank. Inspired by the BG model, we use an estimation methodology that takes into account the endogeneity between the use of trade credit and the loan contractual terms offered by the bank in equilibrium. We then test the effect of such decision on the

probability to be financed and bank interest rate. We first employ a switching regression approach and found that the information disclosure embedded in the decision to use trade credit is statistically significant in the loan rate equation. To account for the endogeneity problem, we employ an endogenous switching approach to compute the treatment effect of trade credit both on the probability to obtain a loan and cost of credit. Concerning the probability to access credit, the positive result of the treatment effects on the treated demonstrates that firms suffering from asymmetric information benefit from the use of trade credit. In addition, we find that using trade credit generates a lower cost of credit for any firm that decide to use it. However, we observe that some firms do not use it. This could be due to the fact that for these firms, the cost of credit differential is not large enough to offset the cost of signalling through trade credit. Thus, our results provide evidence of the signalling role of trade credit in improving firm' access to and cost of credit, hence supporting and confirming the empirical predictions of the theoretical BG model.

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Table 1: Probit estimation of the decision to use trade credit. Dep = Dummy=1 if firms uses trade credit

Variable	**Coefficient**	**(Std. Err.)**
liquidity on total asset	-0.9111***	(0.1832)
dummy =1 if firms increased sales wrt three years before	0.0203	(0.0570)
inventories on total asset	0.9472***	(0.1538)
loans on capital asset	0.0012	(0.0011)
dummy=1 if financial statement for internal use only	0.5262***	(0.1167)
distance between firm and bank (miles)	0.0096***	(0.0028)
years of firm-bank relationship on firm age	0.2639	(0.3656)
firm age (years)	0.0134***	(0.0034)
length of firm-bank relationship (months)	-0.0021	(0.0039)
amount of unused credit lines on total asset	-0.0564*	(0.0330)
Sector dummies		
mining	0.7069**	(0.2957)
construction	1.4076***	(0.1268)
manufactoring	1.0268***	(0.1038)
transport	1.7143***	(0.2143)
wholesale	0.5414***	(0.1189)
retail	0.7977***	(0.1076)
services	0.4606***	(0.0831)
N	804	
Log-likelihood	-1275.8479	
$\chi^2_{(17)}$	1809.9203	

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Table 2: Cost of credit: firm using trade credit

Variable	Coefficient	(Std. Err.)
inverse Mills ratio (λ_{TC})	4.570143***	(0.238082)
dummy=1 equal one if firm post collateral	0.279549***	(0.083687)
loan amount granted on total amount applied	0.470580***	(0.046983)
loan amount applied on total asset	-0.184229***	(0.049951)
dummy=1 if fixed interest rate	1.762007***	(0.087575)
dummy=1 if firm has a mortgage	0.074491	(0.197433)
dummy=1 if Herfindahl-Hirschman bank deposit ind. $>$ 1800	0.573883***	(0.083531)
dummy=1 if firm credit score is in the top 25%	0.433314***	(0.087261)
years of managing experience of firm owner	0.046736***	(0.003527)
dummy=1 if owner is black	0.022552	(0.540130)
dummy=1 if owner belongs to other minorities	0.820344***	(0.182058)
distance between firm and bank (miles)	0.003126***	(0.000532)
debt on total asset	0.187014***	(0.030431)
dummy=1 if firm is family owned	1.478009***	(0.092655)
N	720	
R^2	0.820943	
$F_{(14,3587)}$	1174.698118	

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Table 3: Cost of credit: firm not using trade credit

Variable	Coefficient	(Std. Err.)
inverse Mills ratio (λ_{NTC})	1.758146***	(0.316523)
dummy=1 equal one if firm post collateral	-0.280575	(0.304418)
loan amount granted on total amount applied	1.115290***	(0.172601)
loan amount applied on total asset	0.048696	(0.078593)
dummy=1 if fixed interest rate	2.288044***	(0.288711)
dummy=1 if firm has a mortgage	0.135876	(0.431777)
dummy=1 if Herfindahl-Hirschman bank deposit ind. $>$ 1800	0.442467	(0.283586)
dummy=1 if firm credit score is in the top 25%	-0.465334	(0.314356)
years of managing experience of firm owner	-0.024392*	(0.013700)
dummy=1 if owner is black	2.067928**	(0.853331)
dummy=1 if owner belongs to other minorities	3.391578***	(0.659520)
distance between firm and bank (miles)	-0.027340***	(0.006252)
debt on total asset	0.071537	(0.093145)
dummy=1 if firm is family owned	1.683876***	(0.329185)
N	110	
R^2	0.79504	
$F_{(14,535)}$	148.232996	

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Table 4: Endogenous switching: trade credit decision and cost of credit

Variable	**Coefficient**	**(Std. Err.)**
Outcome equation 1 : R_{TC}		
dummy=1 equal one if firm post collateral	-0.473063***	(0.084529)
loan amount granted on total amount applied	0.143027***	(0.049968)
loan amount applied on total asset	-0.051696	(0.046175)
dummy=1 if fixed interest rate	1.183193***	(0.080713)
dummy=1 if firm has a mortgage	0.202815	(0.188362)
dummy=1 if Herfindahl-Hirschman bank deposit ind > 1800	0.032523	(0.077727)
dummy=1 if firm credit score is in the top 25%	0.153419*	(0.080414)
years of managing experience of firm owner	-0.016326***	(0.003904)
dummy=1 if owner is black	-0.383795	(0.477908)
dummy=1 if owner belongs to other minorities	0.129929	(0.164786)
debt on total asset	0.028495	(0.027614)
Intercept	5.285500***	(0.157680)
Outcome equation 2 : R_{NTC}		
dummy=1 equal one if firm post collateral	-0.771444***	(0.276307)
loan amount granted on total amount applied	0.553505***	(0.157203)
loan amount applied on total asset	0.143076	(0.216793)
dummy=1 if fixed interest rate	2.192810***	(0.268327)
dummy=1 if firm has a mortgage	-0.033295	(0.463657)
dummy=1 if Herfindahl-Hirschman bank deposit ind. > 1800	0.190631	(0.260927)
dummy=1 if firm credit score is in the top 25%	-0.412132	(0.288063)
years of managing experience of firm owner	-0.024019*	(0.012889)
dummy=1 if owner is black	-1.443919	(0.958925)
dummy=1 if owner belongs to other minorities	3.571031***	(0.568365)
debt on total asset	0.080127	(0.135042)
Intercept	6.975768***	(0.551460)
Switching equation : TC		
dummy=1 equal one if firm post collateral	0.191085***	(0.061568)
loan amount granted on total amount applied	-0.013229	(0.032631)
loan amount applied on total asset	0.148358***	(0.052371)
dummy=1 if fixed interest rate	-0.107774*	(0.059780)
dummy=1 if firm has a mortgage	-0.727106***	(0.107829)
dummy=1 if Herfindahl-Hirschman bank deposit ind. > 1800	-0.028651	(0.058593)
dummy=1 if firm credit score is in the top 25%	0.117101*	(0.061860)
years of managing experience of firm owner	0.001434	(0.003618)
dummy=1 if owner is black	-0.400077	(0.258958)
dummy=1 if owner belongs to other minorities	0.078061	(0.125284)
debt on total asset	-0.040857	(0.026201)
liquidity on total asset	-1.090778***	(0.202924)
dummy =1 if firms increased sales wrt three years before	0.078483	(0.058557)
inventories on total asset	0.865151***	(0.153442)
loans on capital asset	0.001682	(0.001464)
amount of unused credit lines on total asset	-0.127742**	(0.055906)
dummy=1 if financial statement for internal use only	0.353969***	(0.117792)
distance between firm and bank (miles)	0.008202***	(0.002692)
years of firm-bank relationship on firm age	0.571624	(0.398891)
length of firm-bank relationship (months)	-0.004748	(0.003926)
firm age (years)	0.012294***	(0.004092)
intercept	0.711382**	(0.303378)
ρ_{TC}	0.39***	(0.1069)
ρ_{NTC}	0.48***	(0.0965)
Sector dummies	yes	
Robust standard errors	yes	
N	783	
Log-likelihood	-9941.529887	
$\chi^2_{(11)}$	307.237948	
Significance levels : * : 10% ** : 5% *** : 1%		

Table 5: Conditional expectation of cost of credit after endogenous switching, factual and counterfactual, equations (8)-(11)

	$E(R_{TC,i}\|TC=1)$	$E(R_{TC,i}\|TC=0)$	$E(R_{NTC,i}\|TC=0)$	$E(R_{NTC,i}\|TC=1)$
N	738	738	114	114
mean	5.45	7.90	5.92	4.14
sd	0.73	1.64	1.82	0.94

Table 6: Endogenous switching: trade credit decision and probability of access to credit

Variable	**Coefficient**	**(Std. Err.)**
Switching equation : TC		
liquidity on total asset	-0.5832***	(0.1202)
dummy =1 if firms increased sales wrt three years before	0.1195***	(0.0427)
inventories on total asset	0.8642***	(0.1425)
dummy=1 if financial statement for internal use only	0.3077***	(0.0684)
dummy=1 if business expenses on owners credit card fully payed	0.0996**	(0.0410)
distance between firm and bank (miles)	0.0028***	(0.0009)
length of firm-bank relationship (months)	-0.0033	(0.0024)
years of firm-bank relationship on firm age	0.0803***	(0.0157)
firm age (years)	0.0121***	(0.0021)
Intercept	1.2554***	(0.0739)
Outcome equation 1 : π_{TC}		
dummy=1 equal one if firm post collateral	0.0029	(0.0713)
distance between firm and bank (miles)	-0.0006*	(0.0003)
dummy=1 if firm has a mortgage	-0.4809***	(0.0821)
dummy=1 if firm turned down by other banks	-1.1863***	(0.2663)
number of credit applications	-0.0859***	(0.0100)
dummy=1 if Herfindahl-Hirschman bank deposit ind. $>$ 1800	0.0336	(0.0675)
dummy=1 if firm has limited liability	0.0072	(0.0795)
dummy=1 if firm has delinquency records	-0.1237***	(0.0260)
length of firm-bank relationship (months)	0.0007	(0.0032)
credit score	0.1641***	(0.0231)
firm age (years)	0.0204***	(0.0037)
Intercept	1.4992***	(0.1420)
Outcome equation 2 : π_{NTC}		
dummy=1 equal one if firm post collateral	-0.4202***	(0.1539)
distance between firm and bank (miles)	0.0111	(0.0099)
dummy=1 if firm has a mortgage	0.0781	(0.2092)
dummy=1 if firm turned down by other banks	-7.2234***	(0.7905)
number of credit applications	-0.5053***	(0.1027)
dummy=1 if Herfindahl-Hirschman bank deposit ind. $>$ 1800	-0.2619*	(0.1433)
dummy=1 if firm has limited liability	0.6597***	(0.2284)
dummy=1 if firm has delinquency records	-0.3568***	(0.1104)
length of firm-bank relationship (months)	0.0512***	(0.0165)
credit score	0.1359**	(0.0616)
firm age (years)	0.0103	(0.0086)
Intercept	0.8820	(0.7190)
ρ_{TC}	-0.47	(0.0983)
ρ_{NTC}	-0.60	(0.3636)
Sector dummies	yes	
N	1595	
Log-likelihood	-3932.2033	
$\chi^2_{(15)}$	591.1943	

Significance levels : $*$: 10% $**$: 5% $***$: 1%

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