

Trade Credit in Small and Medium Size Firms: An Application of the System Estimator With Panel Data*

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ABSTRACT. Financing through suppliers is a subject that has been little studied in the economic literature in general and in corporate finance in particular. Although several hypotheses have been put forward to explain the different reasons behind this phenomenon, trade credit is not based on a general theory.

This study provides empirical evidence about factors determining the use of trade credit for a sample of small and medium size firms, which are potentially the firms that would follow this financing route, since they are more rationed in credit markets. Using a panel of Canary-Island firms from 1990 to 1996, and by means of specifications with the system estimator, results reveal that trade credit leads to a reduction in asymmetric information between firms and their financial backers, as well as in transaction costs. Furthermore, we confirm the theory that companies with easier access to institutional finance act as a credit channel for those with greater difficulties to obtain external funds.

KEYWORDS: asymmetric information, panel data, system estimator, trade credit, transaction costs

JEL: D920, G30, M130

1. Introduction

In traditional Microeconomics, it is assumed that when a transaction is made in the goods market, payment takes place at the time of the operation itself. However, this payment is made at a later date in most transactions between firms. Therefore, this financial component should be taken into account in the sale of goods with deferred payment, in that the extension and

acceptance of trade credit play an important role for firms' organisation and decision-making.

The primary objective of this work is precisely to analyse the factors that determine trade credit use by a sample of Canary-Island firms in the period 1990–1996. This, in turn, enables us to test several theories about trade credit provided by the literature. Hence, this research is novel, since there is no known study that analyses this aspect of the Canary-Island corporate sector.

Trade credit for the time span analysed has resulted in an important source of finance for firms in the province of Santa Cruz de Tenerife and provided them with almost 50% of short-term external resources. Such high dependence on this type of funds makes it extremely interesting to analyse the motives that lead firms to such an intensive use of this form of finance. Furthermore, the fact that firms included in the database of the *Central de Balances de La Universidad de La Laguna* (Commercial Performance Information Bureau of the University of La Laguna) (from hereon CPIBULL) are mostly small and medium size makes the base especially attractive for studying this type of credit, generally used by institutional finance constrained firms.

It is also interesting to compare the results obtained for this data sample with those found for Spanish firms on the whole, when determining whether Canary-Island firms behave in a particular way regarding financing through suppliers. This comparison forms the second objective of this study.

This paper is structured in the following manner: in the next section reference is made to the most relevant works about trade credit in the literature. Section 3 shows the empirical model to be estimated. The sample of firms and

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methodology used are described in Section 4, while Section 5 reports the results. The main conclusions of the study are presented in the final section.

2. Theoretical and empirical references

The first studies on trade credit related this type of credit with monetary policies and their effects on economic activity in general, highlighting the research by Meltzer (1960), Brechling and Lipsey (1963) and Nadiri (1969), though, more recently, studies by Ramey (1992), Norrbin and Reffett (1995) and Nilsen (2002) also emphasise this perspective.

Bearing financial motives in mind, trade credit has been considered a financial disintermediation device in that it enables firms experiencing difficulties to access institutional finance to obtain funds through commercial relations with others who find it easier to participate in credit markets. Research made by Schwartz (1974) and Emery (1984) reports this reason for using trade credit. Furthermore, one of the most significant advantages for the commercial debtor is a reduction in transaction costs incurred with a system of immediate payment on delivery of merchandise, as argued by Nadiri (1969), Ferris (1981) and Emery (1987).

Trade credit use has also been analysed as an effective means of discriminating prices for firms through prompt payment discounts. Several studies, such as those by Schwartz and Whitcomb (1979), Brennan et al. (1988), Mian and Smith (1992) and Petersen and Rajan (1994) justified this role of trade credit.

Trade credit has also been considered a way of smoothing asymmetric information problems between firms and financial backers. From this perspective, firms' suppliers may have an advantage over banks, when assessing the credit risk and when clearing merchandise in the event of non-payment of debt. Likewise, this type of credit would lead to a reduction in asymmetric information related to product quality. The theoretical basis for relations between trade credit and asymmetric information have been put forward in studies by Smith (1987), Lee and Stowe (1993), Long et al. (1993), Freixas (1993), Biais et al. (1994), Biais and Golier (1997) and

Burkart and Ellingsen (2004). For their part, the empirical evidence in the research carried out by Deloof and Jegers (1996), Petersen and Rajan (1997) and Ng et al. (1999) has also resulted in important contributions to the literature linking trade credit with asymmetric information.

The most recent studies on trade credit, especially those by Frank and Maksimovic (1998), Wilner (2000) and Cuñat (2002), found links with firms' liquidation and bankruptcy and, therefore, with debt rescheduling. These models explained the high cost of trade credit due to the risk of non-payment involved and to the fact that, in the event of firms' financial problems, suppliers would find themselves obliged to lend assistance. Likewise, these studies link the use of trade credit to the degree of supplier dependency on clients.

From an empirical perspective, several works contribute evidence on different policies and terms of trade credit in various time spans, industries and countries, featuring the following most recent research by Perotti (1998), McMillan and Woodruff (1999), Fafchamps (1997, 2000), Fafchamps and Minten (1999), Denisova (2000), Hege and Ambrus-Lakatos (2000),¹ Fisman (1999; 2001), Van der Wijst and Hol (2002), Summers and Wilson (2002; 2003), Cheng and Pike (2003) and Berlin (2003).

Studies carried out on trade credit in Spanish firms feature those by Chuliá (1991; 1992; 1993), García-Vaquero and Maza (1996), Martínez de Guereñu (1996), and Hernández de Cos and Hernando (1999). These studies revealed the existence of a size effect, by pointing out that the smallest firms most recur to supplier finance. Likewise, these inter-enterprise financial flows were analysed for their implications for the economic system and the restrictive measures of monetary policies.

3. Empirical model

The model presented in the paper identifies the determining factors of trade credit received for the sample selected and enables us to test some of the theories offered by the literature on trade credit.

The dependent variable TRADECRED1 is defined by the ratio accounts payable on current

liabilities. TRADECRED2 is also used, which is defined as the ratio defined by accounts payable on total liabilities.² The consideration of this alternative dependent variable would provide a solid grounding for the results from using TRADECRED1. Thus, if for any reason firms transform part of their short term bank debt into long term bank debt, this might mean that the ratio of accounts payable on total short term debt increases for reasons other than those being tested in this study. Therefore, a proxy variable regarding firms' total debt could guarantee more robust results.³

Figure 1 shows the evolution of the trade credit received along the 7 years of the sample (1990–1996). This graph indicates that both measures of the trade credit received – TRADECRED1 and TRADECRED2 – follow the same growing tendency along time.

Explanatory variables are included through economic and financial ratios essentially according to the following criteria: profitability, liquidity, size, debt cost, firm activity and investment. Moreover, most of these ratios have been used in the relevant literature on trade credit.

In general terms, and in accordance with the majority of theoretical and empirical studies on trade credit presented in Section 2, firms with ready access to credit markets are expected to resort less to financing through suppliers, as this form of finance is more expensive than the more

immediate alternative: bank credit. Firms that readily obtain institutional finance are generally the most profitable, the most solvent and the largest, since these features provide them with credit quality, thereby facilitating access to financing in more favourable conditions than firms with economic and financial problems.

Bearing the above in mind, the variable PROFIT has been included as a profitability measure. In this respect, the less profitable a firm the more likely it is to resort to supplier finance, since higher chances of bankruptcy or non-payment result in institutional finance constraints. As a matter of fact, profitability is usually considered as an indicator of firms' economic risk. The ratio operating profit on turnover is used as a profitability indicator. This measure of firms' profitability has been chosen over other alternatives as the most suitable for the current analysis, since the operating profit does not include firms' financial results, as trade credit is linked to purely commercial activity and trading. This reason and the fact that every work on trade credit uses a different ratio from the many available to proxy the firm's profitability justify the choice of the variable PROFIT. Anyway, most papers use the variable profitability (independently of the ratio utilised) to proxy the firm's access to external financing.

The chance of sufficient liquidity to meet short-term payments enables firms to reduce accounts payable. Current assets on current

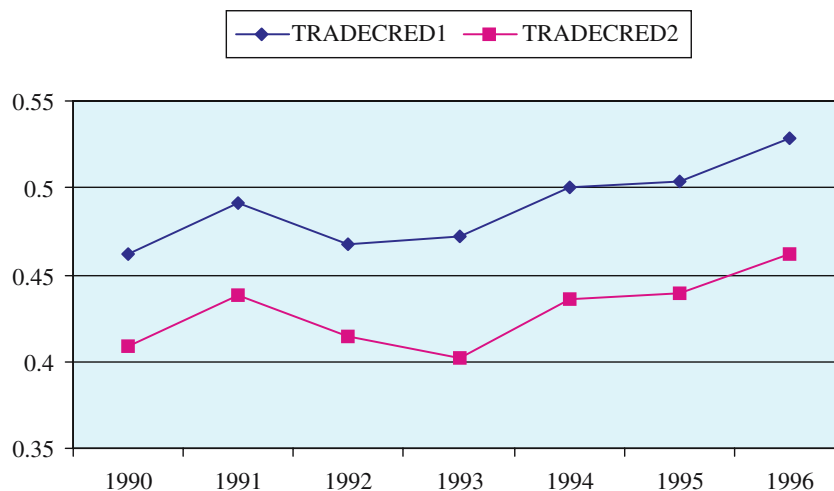


Figure 1. Trade credit received (annual means).

liabilities is the ratio used for showing liquidity (LIQ variable). This indicator also appears as a means of solvency as it reveals the working capital available to firms. In this way, companies with more liquidity are expected to have fewer problems when seeking banking finance. Several theoretical (Perotti, 1998; Hege and Ambrus-Lakatus, 2000; Burkart and Ellingsen, 2004; etc.) and empirical (Elliehausen and Wolken, 1993; Hernández de Cos and Hernando, 1999; Bahillo, 2000; etc.) works include liquidity as a determining factor of trade credit. Moreover, the ratio used in those empirical works coincides with the one included in the paper (LIQ), what validates the measure.

In some extent, the variable liquidity can also be considered a measure of the firm's access to external financing. Nevertheless, this variable has some further discussion for which it is separately analysed in Section 5.3.

The capacity to generate funds internally – variable GENFUND – enables a firm to meet payments deriving from purchases from suppliers, benefiting from discounts given for prompt payment. Thus, a negative effect on trade credit received is expected for this variable. Moreover, this internal generation of funds can also be seen as a positive factor in order to access external financing, as it is pointed out in Hernández de Cos and Hernando (1999). The ratio of cash flow on turnover has been calculated as an approach to the internal capacity for fund generation.

Generally speaking, and following the same line of argument than above, larger firms are expected to require less trade credit to cover their short term financial needs, since they potentially have more access to external funding sources. The majority of works on trade credit have considered the firm's size when explaining the factors that influence trade credit (Martínez de Guereño, 1996; Hernández de Cos and Hernando, 1999; Elliehausen and Wolken, 1993; and Petersen and Rajan, 1997; among others). The size variable in this paper – TURNOVER – has been defined by the volume of turnover (series deflated by using Canary-Island Price Index with base year December 1992). The lack of information available about the number of

employees has hindered its consideration as a proxy variable for firm size. Likewise, usage of the total assets volume provided results somewhat similar to those found for turnover, though in this case they provided a slightly clearer explanation for trade credit, since the parameter estimates were more significant. Turnover is frequently used as a measure of firm's size in economics works in general and in trade credit literature in particular.

The cost of external financing (expressed in the variable DEBT COST) may also be considered as a measure of firms' capacity of access. Hence, and following Hernández de Cos and Hernando (1999) and Marotta (2001) the more expensive external resource funding the more firms will need to seek alternative finance, including trade credit. Therefore, a positive coefficient accompanying DEBT COST variable is expected.

The ratio of financing charges on total liabilities minus accounts payable has been used to proxy debt cost.⁴ Debt cost has been considered without distinguishing terms, since the intention with this variable is to express the cost to firms of accessing external financing.

Investment is another feature that related to firms' capacity for accessing credit markets. In this respect, firms' investment may influence its image vis-à-vis financial institutions. Thus, the fact that a firm reveals a solid investment structure could be seen by banks as a positive sign when it comes to granting the funding (cheaper than trade credit), thereby anticipating a negative effect on deferred payment to suppliers.

The investment measurement used in this study (INVEST variable) is given by the ratio of annual allowance for amortisation on net fixed assets. In this respect, it is more to do with maintenance investment or reinvestment than with an increase in real assets.

The introduction of the INVEST variable as one of the determining factors of trade credit is novel, since none of the studies dealing with this issue have included it as such. Furthermore, as will be seen in the estimates presented, this variable emerges as one of the most influential in determining deferred to suppliers as a means of short term funding for firms.

The volume of turnover generated by a firm in relation to its total assets (TURASSET variable) is an indicator of firms' activity, as well as a measurement of the degree of income generation. In this way, both the transaction and solvency motives indicated in the literature could provide a reasonable explanation for the relationship between this variable and trade credit. Bearing in mind the financial motives, the larger the TURASSET the smaller the need to delay payment to suppliers, as a greater income-generating capacity would enable firms to benefit from prompt payment discounts. Transaction motives are argued by pointing out that trade credit usage increases commercial exchange flows, since there is a reduction in costs inherent to cash payment and in the uncertainty of the transactions, namely liquidation costs, storage costs, etc. Following the theory behind the transaction motives, the more active firms use more trade credit as a way of financing.

The literature contains theoretical and empirical studies arguing either motive. On the one hand, a positive relation between trade credit and firms' activity for transaction motives is considered to be more justified by some authors (Martínez de Guereñu, 1996; Frank and Maksimovic, 1998; Cuñat, 2002; among others). However, these motives have also been argued to explain just the opposite sign of the relation provided by empirical evidence (Hernández de Cos and Hernando, 1999). On the other hand, other research resorts to solvency motives in order to explain a negative relation between TURASSET and trade credit use (Bahillo, 2000).

In addition to the previous variables, short term bank financing and the granting of trade credit have been included as regressors in the

model. Studies into this type of credit often include these variables as important factors in the decision to obtain funding through suppliers.

In general terms, bank credit has also been used in works such as those by Elliehausen and Wolken (1993), Martínez de Guereñu (1996), McMillan and Woodruff (1999), Bahillo (2000) and Fisman (2001). The ratio short term bank debt on current liabilities – BANKCRED variable – can be considered as a proxy of the firm's likelihood of accessing sources of short term institutional finance.⁵ Table I shows that trade creditors and bank credits make up between 67 and 75% of current liabilities throughout the period. Nevertheless, the remaining items also represent a significant proportion and reveal certain variability. Furthermore, the concepts that constitute these items might not necessarily be considered exogenous, in the sense that, for example, debts with the administration also reflect firms' commercial activity to some extent. For these reasons, it can be argued that the incorporation of two types of short term funding (trade credit and bank credit) in the model specifications presented is devoid of tautology.

The variable CREDGRANT expresses the granting of trade credit by firms to their clients and it is defined by accounts receivable on current assets ratio. Two reasons could be distinguished to explain why firms allow deferred payment. On the one hand, the voluntary deferment of payment by clients would be justified by the company enjoying sufficient liquidity to be able to extend collection periods. This situation would then have a negative effect on its need to be funded by suppliers. On the other hand, the positive effect of CREDGRANT on TRADECRED could be explained

TABLE I
Average percentage of the components of short term debt by years

Type of short term debt	1990	1991	1992	1993	1994	1995	1996
Trade credit received	46.2	49.1	46.7	47.2	50.0	50.4	52.8
Bank credit	21.7	24.0	26.0	27.3	23.0	21.6	22.3
Debts with the group and affiliated companies	4.2	4.6	5.2	2.9	7.0	5.7	3.6
Non-commercial debt	27.1	21.6	21.6	21.9	19.2	21.4	20.4
Other debts	0.8	0.7	0.5	0.7	0.8	0.9	0.9

Source: CPIBULL and own preparation.

by the involuntary nature of trade credit to be collected. In this respect, a delay in collection on the part of the firm would lead to longer payment periods to suppliers.

Previous works on trade credit received (Martínez de Guereñu, 1996, among others) have also included the extension of trade credit as a variable influencing the trade credit received by firms. Nevertheless, there are not uniform criteria in defining it.

The literature on trade credit contains several explanations for the sectorial effect on this type of credit. The more recent works connect this effect to the advantage in salvaging value from existing assets. This advantage comes from the fact that suppliers can claim back supplied intermediate goods in case of customer default and have the distribution channels to re-sell them. In this sense, Petersen and Rajan (1997, pp. 63–64) argue that “the advantage of suppliers over financial institutions will vary cross-sectionally depending upon the type of goods the supplier is selling and how much the customer transform them. The less the goods are transformed by the buyer, the greater the advantage the supplier will have over financial institutions in finding an alternative buyer”.

Some other studies consider that firms purchasing highly specific merchandise from suppliers tend to benefit from longer periods of deferred payment (see Cuñat, 2002). The justification put forward is that the more specific the merchandise involved in transactions between supplier and client, the greater the dependence of the former on the latter, as operating income is linked to the business undertaken with these specific clients and with the clients’ future.⁶ Additionally, in the event of non-payment by the client firm, one of the implications of the theories that have linked trade credit to the likelihood of the recovery and resale of merchandise by the supplier is based on the fact that the more durable the goods supplied, the better collateral they provide and the greater the credit the supplier can provide (see Mian and Smith, 1992).

Information about firms’ activity sectors has been considered in all the specifications by using dummy variables. The aggregated sectors created were as follows: 1. COMMERCE;

2. INDUSTRY; 3. CONSTRUCTION; 4. HOSPITALITY SECTOR; and 5. OTHER SERVICES.⁷ The activity excluded from the dummy variables corresponds to the COMMERCE sector.⁸ The parameters corresponding to these industry variables have only been set out and discussed in the specification with the system estimator in Section 5.2.

Research on business financing includes the relationships between firms and financial institutions as an important issue to be considered.⁹ The study of the main characteristics of lending relationships reveals the existence of problems of asymmetric information in these relationships, and which in turn lead to credit rationing. More specifically, the duration of lending relationships has been one of the variables used in those works. The results offered by most of the studies show that longer banking relationships increase the availability of credit.¹⁰

The length of time that a company has been operating in the market is an indication of its survival, in addition to a way of measuring the extent of its relationship with its financial backers. In this respect, it is to be expected that younger firms experience most difficulty when attempting to access bank funding, since they generally involve a higher level of credit risk for banks. In others words, it is expected that younger firms are more credit rationed by asymmetric information problems between them and banks. However, these firms could finance with trade credits because the suppliers will be more disposed to allowing them deferred payment, since achieving (and keeping) a new client is important for maintaining future sales flow, especially where growth opportunities for the newly established firm are concerned. Thus, the age of the firm can be used as a proxy to capture the way in which trade credit can reduce the problems of asymmetric information between the customer firm and financial institutions.

In the extension of the model that figures in Section 5.4, a dummy variable is introduced for the age of the firm (variable AGE), which takes the value 1 in cases where the firm has been in existence for a maximum of 10 years.

The inclusion in this study of firms’ age among the determinants of trade credit is novel as regards studies of this kind for Spanish firms,

since no research undertaken has included it as such when using national firm data. Nevertheless, this variable has been considered an important factor influencing trade credit in studies with other databases relating to other countries (Elliehausen and Wolken, 1993; Berger and Udell, 1998; Petersen and Rajan, 1997; Marotta, 2001; Fisman and Love, 2001; Cuñat, 2002; among others).

Table II shows the main descriptive statistics of the variables (ratios and variables used in computing the ratios) included in the analysis. In the sample as a whole, trade credit received represents almost 50% of current liabilities and over 42% of total debt, which once again justifies

studying this type of financing. Additional information on annual means of all the variables and ratios is displayed in Table B4 in Appendix B.

Bearing in mind the empirical model developed in this section, the following testing hypotheses could be considered in this work:

Hypothesis 1: firms experiencing difficulties for accessing institutional funding generally resort to financing through suppliers.

Hypothesis 2: the most active firms receive finance through trade credit, which leads to a reduction in transaction costs.

Hypothesis 3: trade credit leads to a reduction in asymmetric information between firms and financial backers.

TABLE II
Descriptive statistics of variables (ratios and variables used in computing the ratios)

Variables	Mean	Standard deviation	Minimum	Maximum
TRADECRED1	0.48990	0.22953	0.00000	1.00000
APayable	259,410.90	315,752.95	0.00000	2,048,837.00
CurLiabil	683,348.40	1,466,720.52	20,361.33	18,133,752.07
TRADECRED2	0.42833	0.23098	0.00000	0.97908
APayable	259,410.90	315,752.95	0.00000	2,048,837.00
TotLiabil	795,453.79	1,550,594.98	35,371.38	18,133,752.07
PROFIT	0.06702	0.07356	-0.27992	0.38110
OperProfit	178,061.45	645,832.48	-443,785.09	7,686,263.00
Turnover	1,768,028.70	2,727,175.70	191,029.27	24,188,973.00
LIQ	2.14997	2.00863	0.14246	15.72354
CurAssets	1,094,875.32	2,196,032.55	13,405.00	18,048,638.00
CurLiabil	683,348.40	1,466,720.52	20,361.33	18,133,752.07
GENFUND	0.08004	0.08834	-0.10955	0.75417
CashFlow	185,539.17	617,317.23	-642,767.06	6,026,984.17
Turnover	1,768,028.70	2,727,175.70	191,029.27	24,188,973.00
TURNOVER				
Turnover	1,768,028.70	2,727,175.70	191,029.27	24,188,973.00
DEBTCOST	0.19225	0.32370	0.00000	4.83827
FinCharges	56,783.35	82,968.27	0.00000	593,170.59
TotLiabil-AP	536,042.88	1,434,314.89	6,767.04	18,119,563.95
INVEST	0.08935	0.08154	0.00462	0.47176
AAA	35,263.68	70,967.62	888.87	715,086.00
NFAssets	593,772.76	903,899.37	3,822.97	7,512,762.82
TURASSET	1.32977	0.78580	0.11764	5.63968
Turnover	1,768,028.70	2,727,175.70	191,029.27	24,188,973.00
TotAssets	1,699,509.56	2,782,551.31	137,019.07	23,590,715.56
BANKCRED	0.24309	0.21444	0.00000	1.00000
STBanCred	154,940.61	312,771.11	0.00000	2,961,482.04
CurLiabil	683,348.40	1,466,720.52	20,361.33	18,133,752.07
CREDGRANT	0.41097	0.24115	0.00000	1.08993
AReivable	306,670.70	396,719.92	0.00000	3,423,914.00
CurAssets	1,094,875.32	2,196,032.55	13,405.00	18,048,638.00

All variables used in computing the ratios are in thousands. The original data have been deflated by using Canary-Island Price Index with base year December 1992.

Source: CPIBULL and own preparation.

The three hypotheses are tested in Sections 5.1 and 5.2 through panel data methodology, while third hypothesis is also studied in Section 5.4 using the same kind of econometric model as in Section 5.2, once the statistical tests pointed it out as the best specification for the model.

4. Methodology and data

The data used in this study constitute an unbalanced micro-economic panel containing economic and financial features from 71 non-financial Canary-Island firms audited during 1990–1996, which is the longest period of information available at the CIBULL.¹¹ The companies included in this data set respond to the fundamental profile of Canarian business, which is characterised by small firms and the predominance of the service sector.¹²

The selection of the sample was as follows: firstly, from a total population of firms in the CIBULL, only those that used an external auditing process were selected (378 firms) in order to reach a quality minimum level in the accounting information.¹³ Secondly, some filters, which are given in Appendix A, were applied to keep minimum criteria for accounting coherence. Finally, in order to guarantee some temporal variability of the regressors used, only firms with at least five correlative annual observations were included.¹⁴

As a result of this screening process, 71 firms constitute the final sample. The suitability of this database for undertaking studies on trade credit is worth pointing out, given that these are small and medium size firms.

The combination of a cross-section of information of N individuals (firms) with time series of each of them present in the data sample requires the panel data methodology to adequately express the non-observable heterogeneity of the individuals.¹⁵ The benefits of using panel data instead of cross-section or time series methodology in such as database are widely known. Hsiao (1985), Klevermarken (1989), and Solon (1989) list the following advantages of using it (cited in Baltagi, 1995):

- Controlling for individual heterogeneity: times series and cross-section studies which do not

control for this heterogeneity run the risk of obtaining biased results, e.g. see Moulton (1986, 1987).

- Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. Times-series studies are plagued with multicollinearity and the cross-section dimension adds a lot of variability, adding more informative data on regressors. With additional, more informative data one can produce more reliable parameter estimates.
- Panel data are more appropriate to study the dynamics of adjustment. Cross-sectional distributions that look relatively stable, hide a multitude of changes.
- Panel data are better able to identify and measure effects that are simply undetectable in pure cross-section or pure time-series data.
- Panel data models allow us to construct and test more complicated behavioural models than purely cross-section or time-series data. Also, fewer restrictions can be imposed in panel on a distributed lag model than in a purely time-series study.
- Panel data are usually gathered on micro units (like individual or firms) and biases resulting from aggregation are eliminated.¹⁶

The general specification of a panel data econometric model with individual effects is the following:

$$y_{it} = x'_{it}\beta + \delta_t + \eta_i + v_{it} \quad i = 1, \dots, N; \quad (1)$$

$$t = 1, \dots, T_i,$$

where y_{it} is the dependent variables vector, being i and t the economic agent and the corresponding period of time, respectively. δ_t (time specific effects) is a vector of temporal variables with the same influence on all the individuals and allows the aggregate variables in the model to be controlled. Likewise, η_i (invariant with time) is the specific individual effects, which may or may not be correlated with the explanatory variables. The vector x_{it} includes the explanatory variables that may or may not be correlated with the individuals effects η_i , and for each of these cases they may be strictly exogenous,

predetermined (namely, $E[x_{it}v_{is}] = 0$ only if $s \geq t$) or endogenous variables with respect to v_{it} .

When the explanatory variables are uncorrelated with the individual effects the model is efficiently estimated by Generalised Least Squares – GLS – (Balestra-Nerlove estimator). This is the well-known random effects model where individual effects are part of the error term. In this case, the error term includes two components: the white noise random term and the individual effects. This specified model is the one-way error component regression model. When time specific effects are included in the error term we have the two-way error component regression model.

In the fixed effects model, the individual effects are considered as a set of N coefficients to be jointly estimated with β . The model is then consistently estimated using different transformations of the initial variables in order to eliminate the individual effects. The particular transformation to be applied depends on the correlation between the explanatory variables and the error term. Moreover, the estimation method used depends on this correlation.

The most common transformations are deviations from individual means, first differences and orthogonal deviations.¹⁷ The first one requires the x_{it} to be strictly exogenous with respect to the error term for consistency. Strict exogeneity of regressors is not required when first differences or orthogonal deviations transformations are carried out. They allow for the elimination of the individual effects from the transformed error term without introducing all its lags. This fact allows the use of lags of the endogenous and predetermined variables as suitable instruments when an instrumental variables method is required.¹⁸

The well-known within estimator arises from the estimation of the transformed model using deviations from individual means. If we use Ordinary Least Squares (OLS) as the applied estimation method then the fixed effects model results.

The first differences transformation consists of taking temporal differences in equation (1), resulting the new specification of the model as follows¹⁹:

$$\Delta y_{it} = (\Delta x_{it})' \beta + \Delta v_{it}, \quad i = 1, \dots, N; \quad t = 1, \dots, T_i, \quad (2)$$

The transformation in first differences is more suitable than the within estimator in cases where the length of T is short in panel data (Anderson and Hsiao, 1981).

Orthogonal deviations, as proposed by Arellano (1988) and Arellano and Bover (1995), is an alternative transformation to first differences. Moreover, the orthogonal deviations are useful in linear models with predetermined variables. This transformation expresses each observation as the deviation from the average of future observations in the sample for the same individual, and weights each deviation to standardise the variance. The expression is as follows:

$$x_{it}^* = \left(x_{it} - \frac{x_{i(t+1)} + \dots + x_{iT}}{T-t} \right) \left(\frac{T-t}{T-t+1} \right)^{1/2} \quad t = 1, \dots, T_i - 1 \quad (3)$$

One of the characteristics of orthogonal deviations is that if the original errors are serially uncorrelated and homoskedastic, the transformed errors will also be serially uncorrelated and homoskedastic. In fact, the estimation using a transformation in orthogonal deviations is equivalent to estimating a model in first differences, eliminating the individual effects, and then estimating by GLS in order to avoid serial correlation introduced by first differences.

The OLS estimations of models transformed with first differences or orthogonal deviations allow the unobservable heterogeneity in a panel data to be controlled. Nevertheless, these estimations will be biased in case of endogenous regressors, where an instrumental variables method is required for consistency. Thus, the Generalised Method of Moments (GMM) allows the use of all moments restrictions and requires orthogonal conditions in instrumental variables for both first differences and orthogonal deviations. The choice of suitable instruments will then permit consistent estimators.

The instruments have to be uncorrelated with the error term in the population to be valid. Thus, it is necessary to obtain the vector of coefficients, β , that minimises the sample correlations between instruments and residuals. The GMM estimator is based on this requirement.

The previous estimators refer to either models with all regressors uncorrelated with individual effects (random effect models) and models with all regressors correlated with individual effects (fixed effects models). The system estimator (SYS) is an intermediate estimator and it is very useful in cases of lack of variability in some regressors as indicated in Blundell and Bond (1998). With a view to obtaining an efficient GMM estimator, it would be necessary to define a set of restrictions of moments referring to the equations in first differences, and a set of restrictions of moments referring to the equations in levels, and they need to be combined. Arellano and Bover (1995) propose using the first differences of the variables as instruments for the equations in levels, in addition to the instruments in levels for the equations in first differences. Blundell and Bond (1998; 2000) show how the SYS estimator is more efficient than the First Difference estimator if the panel is short in time and if it includes persistent time series. An additional advantage of using the GMM-SYS estimator is that it exploits all information in the level and difference equations.

The estimation process performed in the paper involves, first of all, carrying out estimations of the model specified in levels, in first differences and in orthogonal deviations, using a procedure of instrumental variables. Consequently, the Generalised Method of Moments controls an anticipated correlation of individual effects and regressors, in addition to their foreseeable endogeneity. Secondly, the system estimator is applied with a view to avoiding problems deriving from some regressors lack of variability and to the possibility that some of them may not be correlated with the individual effects. Gains in efficiency arising from the incorporation of information in levels through the SYS estimator identify it as the

most appropriate specification for explaining trade credit received by firms in the sample.

5. Results

5.1. *Estimations by the generalised method of moments*

The first part of the estimation process consists of estimating the specifications in first differences and in orthogonal deviations through GMM in order to control for the correlation between individual effects and regressors, as well as their foreseeable endogeneity. Table III shows the results obtained using lagged regressors as instruments, since no external instruments were available. As a MA(1) structure is introduced with the transformation in first differences and given the foreseeable endogeneity of the regressors, two and three lags of the explanatory variables are used as valid instruments for estimations in first differences.²⁰ Additionally, despite being biased, the estimations of the model in levels for the two dependent variables have been included, with a view to making comparisons.

All Sargan tests reported in Table III are based on the two-step estimator obtained by the GMM, since this is how consistency to heteroskedasticity is achieved (Arellano and Bond, 1991; 1998). The values of these tests mean that the validity of the instruments used cannot be rejected.²¹ The *P*-values corresponding to the statistics M1 and M2 in first differences and orthogonal deviations specifications also support the consistency of these specifications.²²

In Table III, columns 4 to 7, corresponding to the specifications in first differences and in orthogonal deviations, show that most parameters are significant and with the expected signs. Likewise, the results are quite similar for the two dependent variables used, especially those corresponding to the specifications in first differences.

The statistical significance and the negative sign of the BANKCRED variable reveal that a reduction in firms' short term bank credit causes an increase in both the ratio of trade credit on current liabilities and the ratio of

TABLE III
GMM estimations of the determinants of trade credit received

Regressors	Levels ^{a,b}		First differences ^{a,c}		Orthogonal deviations ^{a,d}	
	(1)	(2)	(1)	(2)	(1)	(2)
BANKCRED	-0.410*** (-12.02)	-0.391*** (-12.03)	-0.468*** (-22.30)	-0.399*** (-20.53)	-0.533*** (-19.79)	-0.493*** (-16.50)
CREDGRANT	0.128*** (3.41)	0.130*** (3.14)	-0.165*** (-3.04)	-0.287*** (-7.30)	-0.080* (-1.72)	-0.110** (-2.13)
TURASSET	0.023(1.58)	0.044*** (3.60)	-0.098*** (-4.68)	-0.053* (-3.59)	-0.033* (-1.71)	-0.001(-0.06)
DEBTCOST	0.214*** (9.87)	0.240*** (13.79)	0.073*** (4.46)	0.098*** (8.46)	0.093*** (15.91)	0.107*** (19.54)
PROFIT	0.070(0.47)	0.020(0.17)	-0.123(-1.36)	0.010(0.10)	-0.124(-1.62)	-0.106(-1.14)
LIQ	-0.030*** (-9.88)	-0.021*** (-6.87)	-0.005* (-2.03)	-0.014* (-3.39)	0.001(0.23)	-0.011* (-4.17)
GENFUND	-0.214(-1.42)	-0.146(-0.99)	0.009(0.12)	0.059(1.03)	-0.053(-0.87)	0.070(1.04)
INVEST	-0.172(-1.48)	-0.190* (-1.90)	-0.373*** (-3.65)	-0.352*** (-3.98)	-0.583*** (-4.08)	-0.438*** (-3.95)
TURNOVER ^e	-0.016* (-1.72)	-0.017* (-1.91)	-0.061* (-1.94)	-0.087* (-4.58)	-0.027(-1.01)	0.004(0.11)
No. observations	362	362	291	291	291	291
Sargan tests	0.998	0.997	0.928	0.931	0.992	0.991
M1	0.000	0.000	0.001	0.001	0.001	0.000
M2	0.000	0.000	0.902	0.217	0.760	0.342

(1) Estimations with the dependent variable TRADECREDD1 = accounts payable/current liabilities.

(2) Estimations with the dependent variable TRADECREDD2 = accounts payable/total liabilities.

^aEstimations through the two-step Generalised Method of Moments.

^b1 and 2 lagged values of regressors have been used as instruments for estimations in levels.

^c2 and 3 lagged values of regressors have been used as instruments for estimations in first differences.

^d1 and 2 lagged values of regressors have been used as instruments for estimations in orthogonal deviations.

^eThe proxy variable for firm size is expressed in logarithms throughout the analysis.

T statistics are given in brackets: *** significant at 99%; ** significant at 95%; * significant at 90%.

In all the regressions, dummy variables have been included for temporal and sectorial effects, whose values are not shown in the Table.

M1 and M2 show the *P*-values corresponding to first and second order serial correlation tests, respectively.

All estimations have been obtained by using the DPD98 programme by Arellano and Bond.

Source: own preparation.

trade credit on firms' total debt. This might indicate that both banking and trade credit are substitutable to a certain extent. In this respect, we may conclude that firms experiencing short term bank finance constraints are more likely to use trade credit. The information motive to explain this type of credit, which is more expensive than bank credit, may justify this effect, as deferred payment may be seen as a way of mitigating asymmetric information problems between applicants and grantors. The study by Martínez de Guereñu (1996) follows along these lines, where bank finance for firms, expressed as an aggregate variable, reduces the use of trade credit.²³

The previous result is strengthened by the fact that most of the variables indicating firms' capacity to access external finance are significant and show the expected signs, thereby confirming hypotheses 1 and 3 of this study. Thus, small firms experience more credit constraints and consequently resort to finance through suppliers. Furthermore, these firms are likely to have a closer relationship with their suppliers, thereby encouraging longer periods of payment and/or an increase in deferred payment volumes. This size effect gave a significant result in the study by Martínez de Guereñu (1996). In the research by Hernández de Cos and Hernando (1999), however, size was not detected as influencing the portion of purchases financed by suppliers.

The estimates in Table III show that firms facing high financing expenses for their debt tend to use deferred payment to suppliers as an alternative means of short term financing. This result coincides with that obtained by Hernández de Cos and Hernando (1999).²⁴ This positive and significant relation between cost of debt and trade credit is robust to change in the dependent variable used. Moreover, the coefficient of the parameter is greater and more significant in the specification with TRADECRED2 than in the specification with TRADECRED1.

The reverse relation between profitability and trade credit shown in the results when TRADECRED1 is used is consistent with the evidence presented in the work by Martínez de Guereñu (1996). However, it is not significant

when TRADECRED2 is considered as the dependent variable.

Firms with high levels of liquidity have fewer problems meeting payments for goods purchase. This explains the sign of the variable LIQ in practically all the estimations in Table III. In the estimation in first differences with TRADECRED1, the effect of the LIQ variable is not very high according to the indications of the accompanying parameter coefficient.²⁵ Nevertheless, this effect is greater and more significant when TRADECRED2 is used as the dependent variable.

The GENFUND variable is not significant for trade credit use. Furthermore, it gives the opposite sign to what was expected in the specifications in first differences. This result follows along the lines of that obtained by Hernández de Cos and Hernando (1999).

Firms' investment has a negative and significant influence on financing via suppliers, thereby confirming the effect expected. When TRADECRED1 is used as the dependent variable in the specification in orthogonal deviations, the INVEST effect is second in importance and is only exceeded by the effect corresponding to the BANKCRED variable. In the estimation in orthogonal deviations for TRADECRED2, the explanatory variable INVEST takes third place between the regressors with most influence on trade credit, after BANKCRED and CREDGRANT.

The above result is an important conclusion that can be derived from this work, since this is the first research to include investment as a determinant for trade credit received, and it also shows that INVEST is one of the most explanatory variables.

The most commercially active firms do not need to resort so much to suppliers in order to obtain funding, as shown by the TURASSET variable coefficient. The study by Hernández de Cos and Hernando (1999) also gives this negative relation between turnover on total assets ratio and trade credit, though they argued this result through transaction motives, as reported in Section 3.

The negative sign of the parameter corresponding to CREDGRANT variable confirms that granting trade credit is voluntary. Firms

with sufficient liquidity to allow their clients to defer commercial debt payments finance themselves less frequently through suppliers, since, in all likelihood, they experience fewer bank funding constraints.

5.2. Estimations with the system estimator

The empirical evidence obtained in several works, such as those by Blundell and Bond (1998), highlights the fact that, in panels where T is small, estimations by GMM of the specification in first differences usually show a downward bias in autoregressive models. Moreover, where there are instruments available uncorrelated with the individual effects, these variables can be used as instruments for the equations in levels. In this

case, and following Arellano and Bover (1995) estimations with the system estimator are carried out, using first differences of variables as instruments for the equations in levels, in addition to the instruments in levels for the equations in first differences. Particularly, given the endogeneity of the regressors, the first differences lagged one period have been used as instruments for the equations in levels.²⁶ Likewise, as in the GMM first differences estimations, two and three lags of the explanatory variables are used as valid instruments for estimations in first differences.

Table IV gives the results from using SYS estimator. Most of the parameters in the estimations (I) are significant and present the expected signs, though those corresponding to

TABLE IV
System estimations of the determinants of trade credit received

First differences + levels ^{a,b}				
Regressors	(I)		(II)	
	TRADECRED1	TRADECRED2	TRADECRED1	TRADECRED2
CONSTANT	1.410(5.26)***	1.428(4.36)***	1.471(8.86)***	1.067(5.92)***
CREDBANK	-0.278(-6.24)***	-0.248(-5.75)***	-0.270(-6.97)***	-0.327(-9.70)***
CREDGRANT	0.045(0.67)	-0.091(-1.08)	—	—
TURASSET	0.069(3.39)***	0.074(3.28)***	0.090(4.69)***	0.083(4.94)***
DEBTCOST	0.217(9.78)***	0.230(8.87)***	0.203(9.54)***	0.217(10.39)***
PROFIT	0.060(0.37)	0.009(0.05)	—	—
LIQ	-0.017(-3.08)***	-0.010(-2.08)**	-0.013(-3.11)***	-0.006(-1.66)*
GENFUND	-0.252(-2.23)**	-0.044(-0.28)	-0.077(-0.90)	-0.017(-0.14)
INVEST	-0.806(-5.61)***	-0.687(-4.46)***	-0.834(-5.55)***	-0.691(-5.61)***
TURNOVER ^c	-0.062(-3.57)***	-0.067(-2.90)***	-0.069(-6.04)***	-0.044(-3.42)***
INDUSTRY	0.084(2.88)***	0.091(2.47)**	0.082(4.83)***	0.076(2.92)***
CONSTRUCTION	0.112(3.42)***	0.109(2.64)***	0.127(4.39)***	0.104(2.93)***
HOSPITALITY SECTOR	0.001(0.03)	-0.055(-1.01)	-0.048(-1.73)*	-0.123(-3.51)***
OTHER SERVICES	-0.207(-4.37)***	-0.156(-3.61)***	-0.131(-3.14)***	-0.151(-4.45)***
No. observations	362	362	362	362
Sargan tests	1.000	1.000	0.999	1.000
M1	0.003	0.005	0.005	0.006
M2	0.762	0.125	0.669	0.140

Dependent variable TRADECRED1 = accounts payable/current liabilities.

Dependent variable TRADECRED2 = accounts payable/total liabilities.

^aEstimations through the two-step Generalised Method of Moments.

^b2 and 3 lagged values of regressors have been used as instruments for the equations in first differences and the first differences lagged one period have been used as instruments for the equations in levels.

^cThe proxy variable for firm size is expressed in logarithms throughout the analysis.

T statistics are given in brackets: *** significant at 99%; ** significant at 95%; * significant at 90%.

In all the regressions, dummy variables have been included for temporal effects, whose values are not shown in the Table.

M1 and M2 show the P -values corresponding to first and second order serial correlation tests, respectively.

All estimations have been obtained by using the DPD98 programme by Arellano and bond.

Source: own preparation.

the variables CREDGRANT and PROFIT are no longer significant when they certainly were in the first differences model.²⁷

The variable TURASSET, which is significant, now shows a positive sign, what means that firms generating a greater sales volume per unit of assets receive most finance through suppliers. This result confirms the second hypothesis in this study, according to which trade credit enabled a reduction in transaction costs deriving from cash payment, by increasing commercial exchange flows. Likewise, this result coincides with that obtained in the study by Martínez de Guereñu (1996).

Tables III and IV reveal that, in all the estimations incorporating information in levels, the parameter that accompanies TURASSET is positive and significant in most of them. However, in the estimations in first differences and in orthogonal deviations, this variable appears as significant and with a negative sign in most cases with at least 95% of confidence. This ambiguity in the sign of the parameter accompanying the variable TURASSET as it incorporates information in levels or otherwise persists when TRADECRED1 and TRADECRED2 are defined as the dependent variables.²⁸

With the aim of comparing and attempting to improve results, the specifications (II) in Table IV show the SYS estimations once the non-significant variables in the specifications (I) have been eliminated: variables CREDGRANT and PROFIT.²⁹ The results show that all the parameters appear as significant and with the expected signs, save the parameter corresponding to the variable GENFUND, which loses significance in relation to specification (I) with TRADECRED1, although it maintains the expected sign. This result is coherent with that obtained in the GMM estimations. Likewise, it coincides with the aforementioned results obtained by Hernández de Cos and Hernando (1999).

Sargan tests of overidentifying restrictions for estimations in Table IV do not permit a rejection of the null hypothesis of the validity of the instruments used. Furthermore, Hausman-type specification tests were performed, in order to test whether the additional instruments corresponding to the equations in levels are valid or

not. For this, a vector of zeroes replaced the observations in first differences, in the regressor matrix in the specification of the system in first differences plus levels. Thus, this statistical test becomes a Wald test for the joint significance of these additional regressors. The results facilitate a rejection of the null hypothesis of the non-significance of these variables in all the specifications of the transformed model.³⁰

Table IV shows that in all the estimations performed, firms in the OTHER SERVICES sector, in comparison with the COMMERCE sector, significantly defer payment to suppliers to a lesser extent. This same result also seems true for the HOSPITALITY branch of activity in estimations (II) in Table IV.

The additional information contributed to the model by the parameter values corresponding to INDUSTRY and CONSTRUCTION branches of activity indicates that firms classified in these sectors make most use of trade credit. This result coincides with Chuliá (1991), where it was argued that the highest levels of trade credit were concentrated in firms in the primary and secondary sectors.

The results obtained in this study from branch of activity analysis contrast with those presented by Martínez de Guereñu (1996), where this sectorial effect was not found. Moreover, Hernández de Cos and Hernando (1999) made no reference to the results obtained for branches of activity, although sectorial dummy variables were included among the regressors and the set of instruments in most of the regressions estimated.

5.3. *Analysis of interaction between liquidity and solvency*

The liquidity measurement used in this study, LIQ variable, has been defined as the current assets/current liabilities ratio. The result found, which coincides with the majority of theoretical and empirical studies undertaken, facilitates the argument that firms with most liquid assets resort less to financing through suppliers. However, this measure is controversial in the sense that, for many authors, firms expecting to have liquidity constraints tend to accumulate liquid assets, but tend to reduce them when they

consider that external funding sources are relatively constraint-free. For this reason, a more detailed analysis of the relation between trade credit and firms' liquidity was undertaken by conditioning through solvency measures. However, the high correlation between liquidity and solvency variables somewhat limits the conclusions reached. Hence, only partial results have been obtained, owing to a lack of observation for several groups formed through variable interaction.

Figure 2 shows the evolution of liquidity and solvency variables along the sample period (in annual means). The correlation between both variables can be seen in this graph, where both series follow the same increasing tendency. Descriptive statistics of variable solvency are shown in Table B5 in Appendix B.

The following variables have been defined to show the interaction between liquidity and solvency: SOLV = a firm's solvency, measured by total assets/total liabilities; L&SQ1 = value of the LIQ variable for firms belonging to the lowest quartile of the liquidity and solvency variables; L&SQ2 = value of the LIQ variable for firms belonging to the lowest quartile of the liquidity variable and to the highest quartile of the solvency variable; L&SQ3 = value of the LIQ variable for firms belonging to the highest quartile of the liquidity variable and to the lowest of the solvency variable; L&SQ4 = value of the variable LIQ for firms belonging to the

highest quartile of both the liquidity and solvency variables.³¹

However, from these four cases there are two principal types of firms (L&SQ1 and L&SQ4), while observations for the other two are practically non-existent. As a consequence, the inclusion of the four variables alongside the LIQ variable, which shows the central quartiles of the distribution, presents estimation problems. For this reason, estimations have been made by using the variables LIQ, L&SQ1 and L&SQ4.³²

The results are shown in Table V and, generally speaking, follow the same direction as the previous ones. Furthermore, we can observe that, for the specification with TRADECRED2, firms with low liquidity and solvency respond more than the rest to an increase in liquidity, as far as trade credit is concerned. However, conclusions for the central quartiles of the distribution when TRADECRED1 is used as the dependent variable do not follow the criteria found in the estimations with TRADECRED2.

It can, therefore, be concluded from the liquidity analysis that the negative relation between liquidity and trade credit found in the literature is confirmed even when it is conditioned by solvency measures. Nevertheless, the degree of negative response in trade credit to an increase in liquidity might depend on the amount of liquid resources available to a firm. Furthermore, the fact that the measure used to show liquidity also reflects firms' solvency

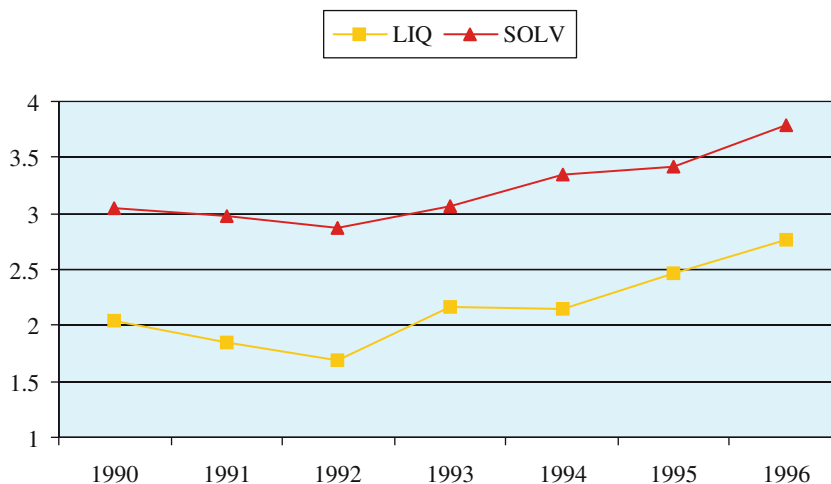


Figure 2. Evolution of liquidity and solvency variables (annual means).

TABLE V
System estimations of trade credit received incorporating the interaction between liquidity and solvency

First differences + levels ^{a,b}				
Regressors	TRADECRED1		TRADECRED2	
	Coefficient	T-Statistic	Coefficient	T-Statistic
CONSTANT	1.507	5.60***	1.070	4.54***
BANKCRED	-0.310	-6.39***	-0.354	-7.03***
TURASSET	0.089	3.12***	0.073	2.59***
DEBTCOST	0.213	5.47***	0.203	6.73***
LIQ	0.031	2.10**	-0.013	-0.94
L&SQ1	-0.084	-2.82***	-0.081	-2.54**
L&SQ4	-0.048	-3.50***	0.002	0.21
GENFUND	-0.171	-1.26	-0.110	-0.80
INVEST	-0.634	-3.76***	-0.715	-4.12***
TURNOVER ^c	-0.075	-3.84***	-0.041	-2.55**
INDUSTRY	0.106	4.11***	0.076	1.92*
CONSTRUCTION	0.164	4.74***	0.155	3.42***
HOSPITALITY SECTOR	-0.008	-0.18	-0.114	-2.21**
OTHER SERVICES	-0.149	-2.65***	-0.103	-2.21**
No. observations	362		362	
Sargan tests	1.000		1.000	
M1	0.001		0.002	
M2	0.618		0.130	

See footnotes from Table IV.

somewhat limits the analysis of the interaction between these two variables, especially for the central quartiles of the distribution.

5.4. *An extension of the model: analysis of firms' age*

Firms' age is incorporated into the model through a dummy variable which takes the value 1 in cases where firms have been in existence for a maximum of 10 years.³³ Columns 2 and 3 of Table VI give the results of the TRADECRED1 estimation corresponding to the specification (II) in Table IV, incorporating firms' age. Similarly, columns 4–7 show the results corresponding to the estimations of the two dependent variables, including the detailed analysis of liquidity and firms' age.

Table VI shows the robustness of the estimations to the variation in the specification of the model to be included in firms' age. Additionally, younger firms are seen to resort more to financing through suppliers than firms with a history in the market, thereby confirming the expected result.³⁴ Thus, evidence is provided in

favour of hypothesis 3 considered in this study, according to which trade credit use leads to a reduction in informational asymmetries between firms and financial backers.

The conclusions arising from the interaction between liquidity and solvency follow the same direction as those indicated for the specifications that excluded age. Nevertheless, the results obtained for more liquid and more solvent firms and for firms in the central quartiles of the liquidity and solvency variables are not so clear, as the estimations are not robust to change in the specification of the dependent variable.

6. Conclusions

This work is the first to analyse the determinants of trade credit for a sample of Canary-Island firms. The results confirm the hypotheses arose in this research and are congruent with the majority of studies about this type of credit. Furthermore, new results are obtained through the incorporation of several additional explanatory variables, which have turned out to be significant. Likewise, this study is comparable

TABLE VI
System estimations of trade credit received including firms' age and the interaction between liquidity and solvency

First differences + levels ^{a,b}						
Regressors	TRADECRED1		TRADECRED1		TRADECRED2	
	Coeffic.	T-Statistic	Coeffic.	T-Statistic	Coeffic.	T-Statistic
CONSTANT	1.388	8.66***	1.598	4.96***	1.044	4.32***
BANKCRED	-0.237	-5.48***	-0.310	-5.99***	-0.339	-6.04***
TURASSET	0.091	5.40***	0.094	3.59***	0.075	2.74***
DEBTCOST	0.216	11.20***	0.202	5.86***	0.193	6.39***
LIQ	-0.013	-3.01***	0.035	2.24**	-0.006	-0.48
L&SQ1	—	—	-0.071	-1.94*	-0.095	-2.89**
L&SQ4	—	—	-0.055	-3.69***	-0.006	-0.46
GENFUND	-0.150	-1.35	-0.079	-0.58	-0.026	-0.19
INVEST	-0.875	-6.99***	-0.805	-4.93***	-0.720	-4.26***
TURNOVER ^c	-0.064	-5.75***	-0.083	-3.54***	-0.041	-2.42**
AGE ^d	0.057	2.87***	0.074	3.42***	0.077	3.46***
INDUSTRY	0.115	5.46***	0.120	4.36***	0.072	1.88*
CONSTRUCTION	0.155	4.54***	0.194	5.05***	0.174	3.79***
HOSPITALITY SECTOR	-0.048	-1.96**	0.026	0.53	-0.091	-1.65*
OTHER SERVICES	-0.167	-4.55***	-0.165	-3.40***	-0.143	-3.68***
No. observations	362		362		362	
Sargan tests	0.999		1.000		1.000	
M1	0.003		0.000		0.001	
M2	0.689		0.619		0.150	

See footnotes from Table IV.

^dVariable AGE takes the value 1 in cases where firms have been in existence for a maximum of 10 years and takes the value 0 otherwise.

with the results obtained in research done in a national context, which enables us to establish comparisons between Canary-Island firms and Spanish firms in general, where the use of trade credit is concerned. Moreover, research has been done for a sample in which small and medium size firms are well represented.

The incorporation of information in levels, through the system estimator, enhances the efficiency of the estimations obtained in specifications in first differences and in orthogonal deviations through GMM and highlights it as the most appropriate way of explaining the determinants of trade credit received for firms in the sample.

The results confirm the size effect, by indicating that the smallest firms mostly seek short term finance through suppliers. The explanatory variables used to approximate firms' capacity to access external funding support the explanation that trade credit is used as a means of mitigating asymmetric information problems between firms'

and financial backers. Furthermore, evidence is provided that favours the theory of transaction cost reduction through trade credit use.

By the same token, our results appear to support the existence of a sectorial effect, according to which, and always in connection with the COMMERCE branch of activity, industrial firms most resort to deferred payment to suppliers.

The negative relation between trade credit and liquidity found in the literature is confirmed even when conditioned by solvency. Although the difficulty of separating information related to liquidity and solvency limits the analysis somewhat, the degree of negative response in trade credit to an increase in liquidity is greater for firms with fewer liquid resources.

Firms' age analysis confirms the information motive, which has already been pointed out in previous studies and which explains trade credit. In this way, young firms most look to commercial suppliers for short term financing.

Notes

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¹ The work by Buduru and Colonescu (2002) stood out from a theoretical approach by modelling the role of delayed payment as an incentive to the collusive behaviour of firms in transition economies.

² Table A1 reports the definition of all the ratios and variables used in computing the ratios.

³ The ratio TRADECRED1 has been used in several studies, such as Martínez de Guereñu (1996). Likewise, TRADECRED2 is the dependent variable defined in works such as those by Martínez de Guereñu (1996), Van der Wijst and Hol (2002), and Cuñat (2002), among others.

⁴ Hernández de Cos and Hernando (1999) also use the same ratio to proxy the cost of external financing for the Spanish firms.

⁵ Most firms link the periods of maturity of their assets and liabilities. In this regard, it is reasonable to consider that purchases made from suppliers are financed with short term bank credits and/or via trade credit. On the contrary, investments in fixed assets are usually financed with medium and long term funds (in Diamond, 1991 a model was provided for the choice of due date of the debt when there is a liquidity risk).

⁶ The model by Frank and Maksimovic (1998) predicts the opposite relationship: lower levels of trade credit when inputs are buyer specific.

⁷ From the six aggregated sectors initially created, activities corresponding to AGRICULTURE were eliminated, since only one firm in the final sample figured in this group. Subsequently, only five branches of activity were considered in the sectorial analysis.

⁸ Table B1 in Appendix B shows the distribution of firms in the sample according to branches of activity. This table reveals that the majority of firms are involved in the COMMERCE sector.

⁹ Pioneering research on the study of lending relationships has been carried out by Petersen and Rajan (1994, 1995, 2002) and Berger and Udell (1995).

¹⁰ See Hernández (2004) for a sample of Spanish SMEs firms.

¹¹ The CPIBULL was formally constituted on 13th June 1994. Its main objective was to create a database including all non-financial firms in the province of Santa Cruz de Tenerife. The information was taken from the annual accounts presented at the Companies Registration Office in this province. For more knowledge of its characteristics, methodology and results, please consult the Spanish Society of Registrars of Deeds and Companies (1996).

¹² All the companies that fulfilled the precept established in Act 19/1989 of 25th July, presenting the annual accounts at the Companies Registration Office are grouped in a two-digit classification in CPIBULL, according to the National Classification of Economic Activities (NCEA) of 1993.

¹³ It is important to bear in mind that almost 72% of the Canarian business is composed of entrepreneurs and natural persons exempt from the obligation of presenting the annual accounts at the Companies Registration Office.

¹⁴ Appendix B contains Tables B2 and B3 which provide additional information about the sample of firms used.

¹⁵ An exhaustive development of Panel Data Econometrics can be found in Arellano (2003), Wooldridge (2002), Greene (2002) and Baltagi (1995). Similarly, a review of recent advances in this field appears in Arellano and Honoré (2000).

¹⁶ Baltagi (1995) lists the main limitations of panel data, including design and data collection problems, distortion of measurement errors and short time-series dimension. The advantages and limitations from using panel data are also described in Arellano and Bover (1990).

¹⁷ The between groups transformation includes the temporal means of each individual as transformed variables. The estimation of such transformed model by Ordinary Least Squares is the between estimator. Uncorrelation of individual effects and explanatory variables is required for consistency since individual effects do not disappear with this particular transformation.

¹⁸ Arellano and Bover (1995) indicate other kinds of transformations with the same properties.

¹⁹ The transformation in first differences introduces a MA(1) form in the transformed error term, under the assumption that the error is white noise in the original model.

²⁰ The use of different instruments depends on the assumption made on variables being endogenous, predetermined or exogenous.

²¹ The Sargan test is asymptotically distributed as a chi-squared with as many degrees of freedom as overidentifying restrictions, under the null hypothesis of the validity of the instruments.

²² The assumption of no serial correlation in the error term is essential for the consistency of the estimators such as those considered in the text. Thus, DPD98 reports M1 and M2 tests for the absence of first-order and second-order serial correlation in the first-differenced residuals (or in the level residuals for the specification in levels). If the disturbances v_{it} are not serially correlated, there should be evidence of significant negative first-order serial correlation in differenced residuals, and no evidence of second-order serial correlation in the differenced residuals. These tests are based on the standardised average residual autocovariances which are asymptotically $N(0,1)$ variables under the null hypothesis of no autocorrelation. The tests reported are based on estimates of the residuals in first differences, even when the estimator is obtained using orthogonal deviations. Even if the validity of orthogonal conditions is not affected, the transformation in orthogonal deviations can introduce serial correlation in the transformed error term if the v_{it} are serially uncorrelated but heteroskedastic.

²³ Bahillo (2000) also found a negative relation between the demand for trade credit and the ratio of bank credit on short-term debt in a sample of North American firms.

²⁴ Marotta (2001) found this same relation for a sample of Italian manufacturing firms.

²⁵ In order to determine the effect of each parameter on the dependent variable, the elasticities of this variable were calculated in relation to each of the regressors. They were obtained specifically in the mean points, namely, by multiplying the parameters estimated by the quotient of the mean of each explanatory variable on the endogenous variable. Table C1 in Appendix C shows the values of these elasticities for the estimations in Table III corresponding to the specifications with TRADECRED1 as the dependent variable. For the case of elasticity in relation to TURNOVER, the fact that the parameter estimated for the firm size variable is a semi-elasticity was taken into account, since it was measured in logarithms in the estimations. Table C2 in Appendix C displays the elasticities for TRADECRED2 as the dependent variable.

²⁶ The use of further lags than one as instruments in the levels equations can be shown to be redundant, given the moment conditions exploited in the equation in first differences.

²⁷ The variable used by Hernández de Cos and Hernando (1999) to proxy the firm's profitability was not significant among the determining factors of trade credit received. Likewise, the clients on sales ratio, which is equivalent to the variable CREDGRANT, was not included as a regressor in the aforementioned work, as it was not accepted among the set of instruments.

²⁸ Estimations have been performed by changing the variable TURASSET for other measurements of firms' activity, without being able to eliminate this ambiguity from the results. This was specifically tested with value added/total assets and (stocks + debtors)/operating assets ratios.

²⁹ When TRADECRED2 is used as the dependent variable, the regressor GENFUND in (I) is not significant either. Nevertheless, in specifications (II) only variables CREDGRANT and PROFIT were excluded, since they were not significant for the specification with TRADECRED1 or when TRADECRED2 was inserted as the

dependent variable.

³⁰ An interesting discussion about these tests can be found in Arellano and Bond (1991) and in Arellano (1993).

³¹ Table B6 in Appendix B shows the values corresponding to the quartiles of variables LIQ and SOLV.

³² Another way of interacting the two variables would be through their direct product. Nevertheless, given the high positive correlation between both variables (variable LIQ reflects firms' solvency to a large extent) and the fact that, of the four cases of interest in the sample, there are firms with scant liquidity and solvency on the one hand and firms with high liquidity and solvency on the other, it would appear to be more convenient to interact the variables by including LIQ, L&SQ1 and L&SQ4 in the estimations, since interpretation is more direct and both cases of interest are perfectly separated.

³³ Table B7 in Appendix B displays the relative frequencies of young and mature firms for each year of the sample.

³⁴ This result coincides with Marotta (2001), Elliehausen and Wolken (1993) and Berger and Udell (1998). However, it contrasts with results obtained by Fisman and Love (2001), where it was argued that younger firms experience more difficulties in obtaining finance through suppliers, which is consistent with reputation-based theories. Nevertheless, Petersen and Rajan (1997) and Cuiat (2002) found a non-linear relation between firms' age and trade credit.

Appendix A. Filters applied to the sample of firms and definition of variables

Filters applied to the sample of firms

- Net tangible fixed assets must be positive.
- Turnover must be positive.
- Equity must be positive.
- Long term investment cannot be negative.
- Current assets must be positive.
- Value added must be positive.

TABLE A1
Definition of all variables (ratios and variables used in computing the ratios)

Variables	Definition	Variables in computing the ratios
TRADECRED1	Accounts payable/current liabilities	APayable/CurLiabil
TRADECRED2	Accounts payable/total liabilities	APayable/TotLiabil
PROFIT	Operating profit/turnover	OperProfit/Turnover
LIQ	Current assets/current liabilities	CurAssets/CurLiabil
GENFUND	Cash flow/turnover	CashFlow/Turnover
TURNOVER	Volume of turnover	Turnover
DEBTCOST	Financing charges/(total liabilities – accounts payables)	FinCharges/TotLiabil-AP
INVEST	Annual allowance for amortisation/net fixed assets	AAA/NFAssets
TURASSET	Turnover/total assets	Turnover/TotAssets
BANKCRED	Short term bank debt/current liabilities	STBanCred/CurLiabil
CREDGRANT	Accounts receivable/current assets	AReivable/CurAssets
SOLV	Total assets/total liabilities	TotAssets/TotLiabil

Source: own preparation.

- Personnel expenses cannot be zero.
- Production value must be positive.
- Purchases value must be positive.

Definition of variables

Appendix B. Data description

TABLE B1
Number of firms by activity sector

Activity sector	Number of firms
COMMERCE	43
INDUSTRY	12
CONSTRUCTION	4
HOSPITALITY SECTOR	6
OTHER SERVICES	6
AGRICULTURE	1

Source: CPIBULL and own preparation.

TABLE B2
Number of observations by years

Year	Observations
1990	61
1991	64
1992	71
1993	71
1994	71
1995	50
1996	45
Total	433

Source: CPIBULL and own preparation.

TABLE B3
Number of firms by consecutive years

Consecutive years	Number of firms
5	28
6	8
7	35

Source: CPIBULL and own preparation.

TABLE B4
Annual means of variables (ratios and variables used in computing the ratios)

Variables	1990	1991	1992	1993	1994	1995	1996
TRADECRED1	0.46206	0.49077	0.46701	0.47189	0.50012	0.50406	0.52814
APayable	264,646.6	276,462.3	268,184.6	267,806.1	239,085.2	263,427.2	228,580.8
CurLiabil	631,216.2	666,347.3	702,053.3	706,649.7	735,694.8	860,601.7	432,379.9
TRADECRED2	0.40924	0.43818	0.41397	0.40233	0.43550	0.43938	0.46235
APayable	264,646.6	276,462.3	268,184.6	267,806.1	239,085.2	263,427.2	228,580.8
TotLiabil	720,216.0	806,666.3	851,408.4	828,728.6	825,996.0	958,581.6	511,269.6
PROFIT	0.09051	0.08148	0.05792	0.04872	0.06089	0.08259	0.07650
OperProfit	236,164.4	291,090.7	238,687.9	96,794.5	116,851.9	142,510.7	107,188.6
Turnover	1,863,139.9	1,939,077.0	1,944,640.9	1,699,513.9	1,705,841.6	1,679,014.6	1,422,299.3
LIQ	2.03384	1.84303	1.68688	2.16830	2.15417	2.46678	2.76841
CurAssets	1,049,412.4	1,165,460.1	1,144,257.5	1,106,489.3	986,290.0	1,436,925.1	751,145.0
CurLiabil	631,216.2	666,347.3	702,053.3	706,649.7	735,694.8	860,601.7	432,379.9
GENFUND	0.09129	0.09468	0.05535	0.05991	0.08715	0.09698	0.09224
CashFlow	213,097.2	290,758.7	206,962.0	123,935.6	146,896.7	191,336.1	116,461.2
Turnover	1,863,139.9	1,939,077.0	1,944,640.9	1,699,513.9	1,705,841.6	1,679,014.6	1,422,299.3
TURNOVER	1,863,139.9	1,939,077.0	1,944,640.9	1,699,513.9	1,705,841.6	1,679,014.6	1,422,299.3
Turnover							
DEBTCOST	0.21988	0.19027	0.17327	0.25485	0.15776	0.19825	0.17586
FinCharges	63,363.6	68,360.5	66,359.6	65,184.4	42,274.1	44,902.0	39,127.5
TotLiabil-AP	455,569.4	530,204.0	583,223.8	560,922.5	586,910.7	695,154.4	282,688.7
INVEST	0.10184	0.09017	0.08145	0.08970	0.09626	0.09090	0.07907
AAA	33,561.7	35,967.4	37,230.0	35,990.4	36,352.3	34,211.4	31,772.2
NFAssets	535,711.1	642,829.1	657,247.1	606,352.4	516,062.1	664,086.9	527,196.3
TURASSET	1.51547	1.33845	1.33174	1.28282	1.42419	1.29124	1.31812
Turnover	1,863,139.9	1,939,077.0	1,944,640.9	1,699,513.9	1,705,841.6	1,679,014.6	1,422,299.3

TABLE B4
Continued

Variables	1990	1991	1992	1993	1994	1995	1996
TotAssets	1,596,891.5	1,826,761.5	1,809,512.5	1,719,185.6	1,519,080.4	2,109,002.3	1,282,713.9
BANKCRED	0.21650	0.24015	0.26059	0.27283	0.22970	0.21613	0.22270
STBanCred	168,030.6	152,721.2	160,217.0	191,815.4	142,780.3	130,933.4	119,708.5
CurLiabil	631,216.2	666,347.3	702,053.3	706,649.7	735,694.8	860,601.7	432,379.9
CREDGRANT	0.38436	0.40044	0.39966	0.41506	0.43548	0.39962	0.42113
AReivable	257,233.7	300,712.2	303,100.1	292,965.9	330,922.3	351,551.8	321,284.5
CurAssets	1,049,412.4	1,165,460.1	1,144,257.5	1,106,489.3	986,290.0	1,436,925.1	751,145.0
SOLV	3.05497	2.98429	2.87433	3.05656	3.34938	3.41193	3.79287
TotAssets	1,596,891.5	1,826,761.5	1,809,512.5	1,719,185.6	1,519,080.4	2,109,002.3	1,282,713.9
TotLiabil	720,216.0	806,666.3	851,408.4	828,728.6	825,966.0	958,581.6	511,269.6

Variables used in computing the ratio are in thousands. The original data have been deflated by using Canary-Island Price Index with base year December 1992.

Source: CPIBULL and own preparation.

TABLE B5
Descriptive statistics of solvency variable (SOLV)

Variables	Mean	Standard deviation	Minimum	Maximum
SOLV	3.18135	3.15606	1.00930	26.49651
TotAssets	1,699,509.56	2,782,551.31	137,019.07	23,590,715.56
TotLiabil	795,453.79	1,550,594.98	35,371.38	18,133,752.07

Variables used in computing the ratio are in thousands. The original data have been deflated by using Canary-Island Price Index with base year December 1992.

Source: CPIBULL and own preparation.

TABLE B6
Quartiles of liquidity and solvency variables

Variables	Description	Quartiles 1	2	3
LIQ	Current assets/current liabilities	1.0913	1.4908	2.3369
SOLV	Total assets/total liabilities	1.4746	1.9645	3.5127

Source: CPIBULL and own preparation.

TABLE B7
Relative share according to age of firm

	1990	1991	1992	1993	1994	1995	1996
Young Firms: No. years ≤ 10	31.15	26.56	23.94	18.31	15.49	16	11.11
Mature firms: No. years > 10	68.85	73.44	76.06	81.69	84.51	84	88.89

Source: CPIBULL and own preparation.

Appendix C

TABLE C1
Elasticities corresponding to GMM estimates (Table III of the text) with the dependent variable TRADECRED1

Regressors	Levels	First differences	Orthogonal deviations
BANKCRED	-0.20344336	-0.23222315	-0.26447636
CREDGRANT	0.10737734	-0.13841611	-0.06711084
TURASSET	0.06243052	-0.26600829	-0.08957422
DEBTCOST	0.08397938	0.02864717	0.03649571
PROFIT	0.00957624	-0.01682682	-0.01696363
LIQ	-0.13165769	-0.02194295	0.00438859
GENFUND	-0.03496338	0.00147042	-0.00865915
INVEST	-0.03137008	-0.06802929	-0.10632997
TURNOVER	-0.03265973	-0.12451521	-0.05511329

Source: own preparation.

TABLE C2
Elasticities corresponding to GMM estimates (Table III of the text) with the dependent variables TRADECRED2

Regressors	Levels	First differences	Orthogonal deviations
BANKCRED	-0.22190412	-0.22644435	-0.27979215
CREDGRANT	0.12473117	-0.27536803	-0.10554176
TURASSET	0.13660000	-0.16454091	-0.00310455
DEBTCOST	0.10772068	0.04398595	0.04802547
PROFIT	0.00312936	0.00156468	-0.01658562
LIQ	-0.10540791	-0.07027194	-0.05521367
GENFUND	-0.02728233	0.01102505	0.01308057
INVEST	-0.03963416	-0.0734275	-0.09136717
TURNOVER	-0.03968902	-0.20311442	0.00933859

Source: own preparation.

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