

EUROPEAN UNIVERSITY INSTITUTE
DEPARTMENT OF ECONOMICS

EUI Working Paper **ECO** No. 2003/3

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An Investigation into the Determinants
of UK Manufacturing Firms' Access to Trade Credit

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Published in Italy in March 2003
European University Institute
Badia Fiesolana
I-50016 San Domenico (FI)
Italy

Trade Credit and Bank Lending: An Investigation into the Determinants of UK Manufacturing Firms' Access to Trade Credit

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October 2002

Abstract

Trade credit is an important source of finance for firms, but it has typically been excluded from the analysis of the credit channel. In this paper we examine a panel of 16,000 manufacturing firm records for the years 1990 through 1999. We show that the uptake of trade credit varies with the monetary cycle, increasing when interest rates are high and falling when rates fall; this offers indirect evidence in support of the bank lending channel. We discover that suppliers evaluate the creditworthiness of firms on much the same basis as banks, with solvency, credit risk and age all improving the access to trade credit. We conclude that trade credit is taken up by firms as a substitute for bank finance at the margin when they are credit constrained.

¹ The first author acknowledges the financial support from Experian plc through the Experian Centre for Economic Modelling while a visiting scholar at the University of Nottingham. The second author is Deputy Director of the Experian Centre and is currently Jean Monnet Fellow at the European University Institute, Florence. We acknowledge beneficial comments from Frank Hahn, Giuseppe Bertola, Ayi Ayayi, Gabriella Chiesa, Piercarlo Zanchettin, participants at the Scottish Economic Society Conference 2002, and the Portuguese Financial Network 2002. Any remaining errors are our own.

1. Introduction

The monetary transmission mechanism has traditionally referred to money, on the *liabilities* side of the banking sector's balance sheet, rather than credit; yet the *asset* side of banks' balance sheets relating to the credit channel has now received a considerable amount of support (see Bernanke and Blinder (1988), Bernanke and Gertler (1989), Romer and Romer (1990), Friedman and Kuttner (1993), Gertler and Gilchrist (1994) and Oliner and Rudebush (1996)). It is a feature of these papers, and the theoretical models behind them, that they tend to consider market finance and bank finance as the two options available to the firm. For example, Besanko and Kanatas (1993), Bolton and Freixas (2000), Diamond (1991), Holmstrom and Tirole (1997), Repullo and Suarez (2000) and Hoshi *et al.* (1993)) allow capital market imperfections to create bank dependence for firms that cannot access capital markets, but trade credit does not receive any attention in these papers.

This is surprising since trade credit is widespread. According to a Federal Reserve Board Study by Elliehausen and Wolken (1993) trade credit represented about 20% of non-bank non-farm businesses' liabilities, and up to 35% of their total assets. Rajan and Zingales (1995) calculated that trade credit represented 17.8% of total assets for all American firms in 1991, and in European countries such as Germany, France and Italy, trade credit represents more than a quarter of total corporate assets. For the United Kingdom, Kohler *et al.* (2000) estimate that 70 per cent of total short term debits (credit extended) and 55 per cent of total credit received by firms is comprised of trade credit. Eighty per cent of all firms use trade credit according to a review by Atanasova and Wilson (2002), and the scale of trade credit usage is much increased during periods of monetary contractions. Nilsen (2002) reports different sources that suggest that greater priority should be placed on studies of trade credit.

These facts suggest that Meltzer (1960) was right to propose that trade credit should be considered a substitute for bank lending. Yet only a small empirical literature attempts to address this question (cf. Nilsen, 2002 and Kohler *et al.*, 2000) and these papers are concerned mainly with the direction of change in trade credit when business conditions become adverse. In this paper we intend to compare tight monetary conditions with more benign periods, but also to assess whether firms offering trade credit discriminate between borrowers on the basis of firm-specific characteristics as do banks. We are also interested in whether the evidence that large firms offer trade credit during tight periods is in fact indirect evidence for the bank lending channel, since trade credit is lower in the pecking order than bank finance.

In this paper we make use of the interchange between Kashyap, Stein and Wilcox (1993) (hereafter KSW) and Oliner and Rudebusch (1996), since the improvements in our understanding of external finance (especially bank lending) over the monetary cycle that were derived from these papers have not been carried over to trade credit. The KSW approach isolates the influence of monetary policy contractions on bank lending by measuring the *relative* changes to bank lending compared to non-bank sources of funds by constructing a ‘mix’ variable defined as the ratio of bank lending to total external finance (bank lending plus commercial paper). The subsequent work by Oliner and Rudebusch (1996) widens the range of alternative sources of finance (although it does not include trade credit), and accounts for differential effects on small as opposed to large firms.

We take on board the KSW approach while also accounting for firm-specific characteristics highlighted by Oliner and Rudebusch (1996)². Recent evidence suggests that financially weak firms have difficulties in accessing relatively low external premium funds during tight money periods and thus they tend to substitute more costly funds to finance their projects (Nilsen, 2002; Valderrama, 2001). Anecdotal supports this view by implying that credit-constrained firms rely proportionally more heavily on trade credit relative to other sources of external finance in periods of monetary tightening. Although we expect to find that bank borrowing diminishes and that trade credit increases in absolute terms and relative to bank borrowing, we assess this claim when we condition for other influential factors over the uptake of external finance.

The rest of the paper is organised as follows. Section 2 asks the primitive question ‘why do firms offer or receive credit?’. The following sections then report our data sources, methodology, and the results. Section 6 concludes.

2. Why do firms offer or receive trade credit?

It is reasonable to ask the question ‘why do firms offer trade credit and why do others take it up?’, since the incentives on either side are not obvious. Firms that *offer* trade credit must administer the account of a firm to which they extend trade credit and this can create a substantial burden of responsibility. Summers and Wilson (1996) document that the process involves assessing the risk of the customer and determining the terms of the credit account. If the customer is ‘good’ the firm must monitor the payments and ensure compliance with

² The variety of micro data on other aspects of the firm besides their size, allows us to assess the influence of factors such as their balance sheet, real assets, perceived riskiness and indebtedness on access to trade credit and bank lending.

the agreed terms, but if the firm is 'bad' then the costs of collecting the receivable debts and bearing the risk of default or bad debt must also be incurred, or outsourced to a factoring company at an additional cost. On the receiving side, on the other hand, it is evident that trade credit is low in the pecking order of finance and usually incurs pecuniary and non-pecuniary terms that are unfavourable compared with other forms of finance. So why do firms offer trade credit and why do firms take it up?

At least four motives can be identified for a firm to offer trade credit to one of its customers. First, firms can price discriminate through trade credit since trade credit reduces the effective price offered to low quality buyers; firms with a high margin between sales and variable costs have a strong incentive to make additional sales without cutting the price to existing customers (see Petersen and Rajan, 1994, 1997). If anti-trust laws prevent direct price discrimination, high priced trade credit may be a subsidy targeted towards risky clients; alternatively lower prices offered through these means may ensure the long-run survival of customers at risk of failure. In the case of the latter the supplier takes into account the present value of the profit margins on future sales.

Second, there is a transactions motive. The extension of trade credit reduces the costs of paying and administering invoices between suppliers and buyers, who undertake regular exchanges of goods or services, and trade credit can be a useful cash management tool (Ferris, 1981, Ng *et al.*, 1999, Nilsen, 2002). By delaying the payment for purchases, a firm may be able to better match the timing of cash receipts from sales with the cash outlays for the costs of the goods purchased. An implication of this approach is that large firms with greater financial expertise should be better than smaller ones at exploiting economies of scale in managing trade credit and at implementing an integrated investment approach into current assets (especially net trade credit and inventories).

Third, there is a financing motive (Ng *et al.*, 1999, and Nilsen, 2002). The supplier can have a threefold advantage over other credit providers in extending credit to a buyer, since they are able to assess the creditworthiness of a buyer during the normal course of business. They are able to gather information that is only available to a financial institution with a lag and possibly with a monitoring cost. The supplier is also more likely to be able to enforce repayment since there is a credible threat to cut off future supplies; but if the buyer does default, the supplier has the advantage of an available network for reselling any repossessed goods.

Lastly, there is a sales motive since a 'quality guarantee' can be reinforced by offering trade credit to finance goods until the buyer can ascertain the product quality,

(Deloof and Jegers, 1995). Wilson and Summers (2002), find that trade credit can also be used as a signalling tool by smaller and growing firms who offer more trade credit in an attempt to encourage more frequent custom with an eye towards developing a long-term relationship.

The reasons for the uptake of trade credit are more straightforward. First, the most obvious case is made by Petersen and Rajan (1997) who find evidence that firms use trade credit when credit from financial institutions is not available. Trade credit comes lower down in the pecking ordering than borrowing from financial institutions because it is a more expensive form of credit, therefore, trade credit is typically relied on by firms that are credit constrained by their institutional lenders. Trade credit is at least partially the result of credit rationing even when a distinction is made between firms that rely on trade credit and firms that rely on other sources of funds (Danielson and Scott, 2000). Most firms, including those that rank trade credit as an important source of external finance, try to take advantage of trade credit discounts.

Second trade credit reflects arbitrage. When borrowing and lending rates on offer to firms differ by a margin, trade credit can serve to arbitrage the difference (Emery, 1984). Firms may take up trade credit in order to mitigate credit rationing. For example Biais and Gollier (1997) indicate that the seller's provision of trade credit provides a valuable signal to the banker that the buyer is worthy of credit. Thus firms that take it up may find that the price and quantity effects of credit rationing are eroded as they build reputation. Evidence suggests that firms may use both trade credit and bank credit even when banks are assumed to be relatively more competitive lenders than suppliers (Cunat, 2001).

The evidence suggests, as Meltzer (1960) proposed, the *trade credit channel* might be a substitute for the *bank lending channel*. Recent evidence in the UK implies that the broad credit channel can be offset by the trade credit channel (Kohler, *et al.* 2000), since firms with direct access to capital markets help out bank-dependent firms by extending more trade credit when times are hard, both in gross and net terms. This is also the case in the US where firms believed to be credit constrained (small firms) receive greater amounts of trade credit during periods of monetary tightening, implying that their demand for trade credit remains steady (Nilsen, 2002). These papers resolve some important issues but there are further unanswered questions to address.

In this paper we return to the issue of whether the credit channel – operating through the broad credit channel and the bank lending channel – is offset by trade credit. The first aspect of this issue is whether the *provision* of trade credit does indeed increase when

monetary policy tightens. If it does, this supports the view that trade credit is more readily available when conditions become adverse, but it also provides evidence that there is a bank lending channel. The willingness to *offer* trade credit is only one side of the story: its counterpart in the willingness to *take it up* demonstrates that firms do not have other external funds higher up the pecking order to rely upon. If there is more trade credit offered and firms are making use of it, it is because bank lending is constrained. The second part of the issue is to determine who is offered trade credit. The previous literature has assumed that all bank constrained firms are eligible for trade credit, and if there is one-for-one substitution of trade credit for bank lending, then the credit channel would be attenuated. In this paper we seek to determine whether firms that offer trade credit discriminate between their customers according to firm-specific characteristics in the same way that banks discriminate between safe and risky borrowers. If they do so then provision of trade credit may only offset the credit channel for specific classes of firms. Some firms may have characteristics that leave them constrained in terms of all forms of external finance including trade credit. These firms are unlikely to find any viable alternatives when monetary conditions become tight, and they are likely to fail.

We answer these questions by examining trade credit and bank lending in absolute and relative terms during tight and benign periods of monetary policy. We will also assess how the ratio of trade credit to other finance such as bank lending varies with firm characteristics such as firm size, age, riskiness, access to credit markets and indebtedness.

3. Data

3.1. Data sources and definitions

The FAME database covers all UK registered companies including those that have recently formed and up to 10 years of detailed information (modified accounts) for about 1.3 million companies plus summarised information for a further 1 million companies. Large firms provide balance sheets, profit-loss accounts and some important ratios based on firms' accounting thresholds refereed in the section 248 of the UK Companies Act 1985. Small and medium enterprises (SMEs), have some advantages relative to large companies because they need not prepare detailed accounts. For medium-sized companies there is no requirement to disclose turnover details, while for small-sized companies only an abridged balance sheet is required.

We construct a sample from the FAME Database that allows us some flexibility in analysing the monetary transmission mechanism and corporate sector finance. The sample is extracted from the FAME Database based on the following criteria:

- Firms whose primary activity is classified as manufacturing industry according to 1992 UK SIC Code in England, Scotland, Wales and Northern Ireland³.
- Firms established prior to 1989 and still reporting for the years 1999 and 2000⁴.

There are 16,354 firms that satisfy the above criteria⁵. The dataset presents some characteristics that make it extremely useful for our purposes. Firstly, it contains data on whether firms are quoted or not. Unlike in the US, where only quoted firms are required to file their quarterly or annual accounts, UK firms have to disclose their accounts even if they are not traded on the stock market. Secondly, it offers a large number of observations, which make it ideal for testing the implications of a monetary tightening on different categories of firms.

The data has an exemption structure that allows some missing observations in company's accounts held on the FAME Database, and these are prevalent in the first couple of years of the sample period. This means that the sample is not a balanced panel, since firms whose turnover is under the threshold are not observed (the threshold on turnover is £90,000).

3.2 Firm specific characteristics

There are several ways of identifying firms that are likely to be discriminated against by credit providers. In the literature the identification of these firms that are likely to be financially constrained is based on criteria such as the *dividend payout ratio* (Fazzari et al, 1988); *size and age* (Devereux and Schiantarelli, 1990, Carpenter et al, 1994, Gertler and Gilchrist, 1994); *bond rating* (Whited, 1992); *bank dependency* (Bernanke et al, 1996); *affiliation to industrial groups or banks* (Hoshi et al., 1991); and the *coverage ratio* (Milne 1991, Guariglia, 1999). In this paper we isolate several firm-specific criteria to determine

³ The software included 940 firms (5.7 percent of total sample) whose secondary activity is classified in the manufacturing sector rather than primary activity.

⁴ In fact, only 3 percent of the firms in the manufacturing industry stopped reporting during the period of 1990-1999. This may stem from either failure of company or getting into exemption threshold.

⁵ It is important to mention that the sample was downloaded in October and November 2001. Its size, based on these downloading criteria, is likely to be different at a different downloading date due to monthly revision of firm accounts.

whether trade credit offers differ systematically with size, age, credit risk, coverage ratio and whether the receiving firm is quoted or not.

In determining the size of the firm we follow the criteria used by the Companies Act. It seems reasonable to do this since these are the criteria used in data disclosure. Firms are classified as small or medium if they satisfy two out of the following three criteria:

	Small	Medium
Turnover	Max £2.8 mil	Max £11.2 mil
Balance sheet	Max £1.4 mil	Max £5.6 mil
Employees	Max 50	Max 250

Small and medium size firms are expected to be the main receivers of trade credit, while large firms have better access to capital markets, better collateral and longer relationship with banks.

Suppliers offer more trade credit to their established customers (Cunat, 2001), hence it is likely that age of the firm as a proxy for the time it takes to develop a regular business relationship will be an important determinant of trade credit provision. Our dataset includes information about the year of the incorporation of the firm, and firms are classified as ‘young’ if they were incorporated after 1975, otherwise they are considered to be ‘old’. Our sample includes only firms established before the end of December 1989 and there are no new entrants on the market.

Information relevant to the perceived riskiness of firms allows us to distinguish between secure and risky firms. Secure firms have better chances of getting bank loans or issuing commercial paper. We expect risky firms to rely more heavily on trade credit since they have little access to bank loans or capital market⁶. We define secure and risky firms using a Quiscore indicator produced by Qui Credit Assessment Ltd, which measures the likelihood of company failure in the twelve months following the date of calculation⁷. Monetary policy changing will affect prevalently risky firms, which will demand relatively more trade credit from their suppliers.

We use the interest cover ratio defined as total profits before tax and before interest divided by total interest payments to determine whether a firm is financially constrained or

⁶ Junk bonds are used in UK less than in US.

⁷ Quiscore is given as a number in the range from 0 to 100. For ease of interpretation we distinguish among five distinct bands: band one includes firms with credit scores 81-100, band two includes firms with credit scores in the interval 61-80, and so on. Firms in bands one and two are considered secure, while firms in bands four and five constitute the group of risky firms.

not. Following Milne (1991) and Guariglia (1999), a ratio of less than 5 denotes that the firm is credit constrained. Credit constrained firms will have larger amounts of trade credit in their balance sheets. A monetary tightening worsens the situation of constrained firms who are forced to demand even more trade credit.

The database allows us to identify quoted firms and unquoted firms. We can also distinguish between those quoted on the main list, and those quoted on the Alternative Investment Market (AIM) and on the OFEX (“Off-exchange”) market. We define a public quoted firm as one that is on the main list, and a quoted firm as one on the main list or AIM/OFEX markets. Whether a firm belongs to the quoted group or the ‘not-quoted’ group is fixed over the entire sample period since there is evidence that only a small number of firms were “promoted” to a better capital market during the sample period⁸. Therefore, we can assess the influence of being quoted on the main list, or being quoted on the alternative markets, or not at all.

4. Methodology

Our paper seeks to determine whether firms with different size, age and financial positions have different reactions to the monetary policy stance once we have conditioned for the firm’s type. Our approach is to explain the mixture of liabilities that a firm draws upon over the cycle with a combination of environmental (monetary policy determined) conditions and firm specific characteristics. Our measure of the liabilities that firms choose is based on four ratios. The ratio of trade credit received in total liabilities, the ratio of bank lending in total liabilities, the ratio of trade credit received in total short term debt (trade credit received plus bank loans), and the ratio of net trade credit (trade credit received minus trade credit extended) in total liabilities.

We divided the sample into two different time periods corresponding to tight and benign monetary policy. The first period of tight policy relates to the period when monetary policy in the UK was dedicated towards maintaining the exchange rate within its target zone in the Exchange Rate Mechanism during 1990-1992. This required high rates of interest to match those in Germany after reunification and to offset the perceived weakness of sterling, which was at the bottom of its permitted range in the target zone for much of the period.

⁸ We classify firms as “quoted” in the period 1990-1995 even though the AIM and the OFEX market were not established until 1995. We do this because firms that had not performed well for the 1990-95 period would not have been admitted on these markets later on.

The period also coincided with a recession and therefore represented a harsh period for existing and new corporate borrowers. The second period 1993-1999 following the recession witnessed a period of sustained economic growth, falling unemployment and inflation, and interest rates at low levels. The corporate sector experienced an improvement in net worth and borrowing conditions and was less constrained than in the earlier period. In this study we measure the monetary stance using the level of base rates.

We categorise firms and run regressions based on the firm specific effects defined above. We expect solvency (the ratio of shareholders' equity to total assets) and risk to be important factors influencing the mix of external funds. Firms experiencing solvency problems should use their suppliers as lenders of last resort and higher risk customers are more likely to be refused credit by banks. We also expect constrained firms to use more trade credit and those that are not quoted on the stock exchange, since their alternative sources of funds are limited. We can determine how these explanatory variables influence the mix under periods when monetary policy was tight compared to when it was benign.

We estimate the relationship between the financial choices of firms and their specific characteristics using a standard panel model written in the following form:

$$y_{it} = \alpha_i + X_{it}\beta + \varepsilon_{it}$$

where $i = 1, 2, \dots, N$ refers to a cross section unit (firms in this study), $t = 1, 2, \dots, T$ refers to time period. y_{it} and X_{it} are the dependent variable and the vector of non-stochastic explanatory variables for firm i and year t , respectively. ε_{it} is the error term, α_i captures firm-specific effects. We take a random effects approach, which treats α_i as a firm-specific disturbance. The nature of the data, which is drawn from a large population, makes the random effects model the most suitable approach for estimation, because it is more likely that firm specific constant terms are distributed randomly across cross-sectional units, that is, there is no correlation between firm specific constant terms and explanatory variables⁹.

More specifically we can write the random effects model as follows:

$$y_{it} = X_{it}\beta + \varepsilon_{it}, \quad \varepsilon_{it} = \alpha_i + e_{it}$$

where ε_{it} , the disturbance term, is made up of α_i representing an individual disturbance which is fixed over time and assumed to be uncorrected with explanatory variables and e_{it} ,

⁹ We rejected the hypothesis of no systematic difference between coefficients obtained from the random effects and fixed effects models by using Hausman test, therefore, the random effects model is justified.

an idiosyncratic disturbance. The estimation process involved unbalanced panel data techniques to test our hypothesis.

5. Results

5.1 Does trade credit received by firms vary with the monetary cycle?

The results we report refer to the responses of each ratio in a period of monetary tightening 1990-1992 versus a period of monetary loosening 1993-1999. Table 1 reports the response of gross trade credit relative to total liabilities, while in contrast Table 2 reports the ratio of bank lending to liabilities. Table 3 reports the ratio of gross trade credit to the total short-term debt (the sum of trade credit and bank lending) and last of all, Table 4 reports net trade credit to total liabilities. All the response coefficients are reported in percentage terms.

Row one of Table 1 shows that when monetary policy is tight all types of firms rely more heavily on trade credit (the coefficients are positive and significant), but there is some differentiation in the degree to which firms increase the ratio according to their type. The coefficients associated with the monetary stance are greater for smaller and younger firms, as expected. There is also more trade credit taken up by secure firms than by risky firms, which reflects the fact that risky firms usually have larger liabilities as well as fewer offers of trade credit from their suppliers. Unconstrained firms have more trade credit than constrained firms, but public quoted firms take up far less than either quoted or not-quoted firms, since they have alternative sources of funds higher up the pecking order of finance. When we compare this row with the same row in the second panel, we see that the scale of the coefficients is at least an order of magnitude larger in the first panel than in the second. Thus the response to monetary loosening generates a very small reduction in the ratio.

An almost identical pattern, but with the signs reversed is observed in Table 2: bank lending is reduced in times of tightening monetary policy for all types of firms but especially for the smaller, younger and more risky types. This provides strong evidence in favour of a bank lending channel; the evidence comes directly through Table 2, and indirectly from Table 1 as firms take up more trade credit, which is lower down the pecking order. It is small firms that tend to experience the greatest decline in bank lending and who take up the most trade credit when monetary policy tightens, while risky firms experience a decline in bank lending and do not receive a compensating increase in trade credit. The risky firms are the ones that are most likely to fail when monetary policy tightens.

The support we find for the credit channel is reinforced by the ratio of gross trade credit to total short-term debt. This variable increases for all types of firms as monetary policy tightens and declines slightly during loosening, although the decline is not significant for small firms. The responses of medium and large firms is almost identical, but the increase in trade credit dependence as interest rates rise is four times higher for small firms than for medium-large firms.

Table 4 shows that the results obtained by Kohler *et al.* (2000) can be confirmed for our data. Net trade credit increases during monetary tightening, since firms in the manufacturing sector receive more credit than they give out. The scale of the response is twice as large for small firms as for medium-large firms and almost twice as large for young compared with older firms and for risky versus secure firms. The response of net trade credit in a period of benign monetary policy was insignificantly different from zero.

The answer to our first question is that firms do receive less bank lending and they substitute more trade credit (gross) when monetary policy tightens. Firms also receive more net trade credit when interest rates rise. Our results confirm the bank lending channel, as suggested by Kashyap *et al.* (1993), but smaller, younger and more risky firms *are* relatively more affected by higher interest rates as suggested by Oliner and Rudebush (1996). Our finding also implies that the substitution of trade credit for bank lending will mean that the bank lending channel does not choke off funds altogether. Rather it will shift the balance of funding away from financial institutions and towards suppliers and thereby increase the marginal cost of external finance.

5.2 Does trade credit depend on firm-specific factors?

Our next question relates to the wider credit channel view which advocates that firms with weaker balance sheets are likely to be most affected by a monetary tightening since they face greater difficulties in finding external finance of all types.

In the first row of the Tables, which we evaluated in the previous section, we found that differentiating among firms with regard to their riskiness and degree of indebtedness, showed the smaller, younger and more risky firms to be more vulnerable to monetary tightening than larger and more secure firms. In this section we assess whether solvency, riskiness, interest cover, age and size (sales) influence the extent of trade credit relative to other sources of funds by reading down the remaining rows of each of the Tables for the firms of given types, recorded in the columns.

Firm solvency is an important explanatory variable in both panel periods. The coefficients are positive and significant at the one percent confidence level in almost all regressions. The exceptions are small and risky firms when the monetary policy is tight – these firms are not helped by their solvency, since they do not receive more trade credit even if they are solvent. Solvency also allows firms to receive more bank lending than they would otherwise do on the basis of their type, according to Table 2, and Table 3 reveals that solvency tends to shift a firm towards bank finance rather than trade credit. In other words solvency allows a firm to access finance higher up the pecking order than it would otherwise be able to do. The coefficients are generally smaller in times of a monetary contraction, suggesting that solvency influences relatively less the shift in the composition of firm finance when interest rates are high than when the economy is in recovery.

The perceived riskiness of the firms seems to be another important factor in explaining the change in the composition of firms' funding, and again the coefficients are almost always strongly significant. The exceptions are large firms, old firms and firms quoted on the stock exchange, which are unaffected by the risk measures and in any case have access to alternative sources of funds. Otherwise, perceived riskiness has opposite effects on the ratio in the case of constrained firms when money is tight and when money is loose. Thus, a better credit rating increases the proportion of trade credit received when money is tight, but it does not influence bank lending as much. Hence, firms tend to find that they can access more trade credit on the basis of better credit ratings, but they cannot obtain more bank lending. In benign periods firms can access other sources of funding and try to reduce their use of supplier credit.

The degree of indebtedness measured by the interest cover (profit before tax before interest/interest payments) is influential when the ratio of trade credit to liabilities is growing. Here greater interest cover allows firms to use more trade credit, but this variable is only marginally important for bank lending relative to total liabilities, however, and only affects risky and constrained firms. One reason for this finding may be the fact that bank lending appears higher in the pecking order than trade credit, hence firms resort to bank lending first, and they do so when they have relatively few outstanding debts. But when the firm seeks additional funding from banks, or seeks credit from suppliers, it may already have obligations from banks and therefore the interest coverage becomes an important consideration.

The age of the firm appears to be an important variable. Table 1 shows that the older the firm the lower the ratio of trade credit in total liabilities in both types of monetary

regime, which implies that relationships with banks increases with age (Sharpe, 1990 and Rajan, 1992). As firms become more established they build relationships with their lenders that allow them to overcome periods of financial distress without resorting to trade credit to the same degree. From Table 2 we can reconfirm this, since an increase in the age of the firm has a positive effect on the amount of bank loans received, and the relative movement is towards bank lending and away from trade credit as age increases according to Table 3.

The volume of sales appears to be a significant variable only for access to bank lending. The size of the coefficients suggests that the volume of sales is more important in the case of small and medium-size firms, of young, risky, constrained, and firms not quoted. This implies that overall size of the firm based on sales can offset some other unfavourable characteristics.

We conclude that firm specific characteristics that lie behind the idea of a ‘balance sheet channel’ in the credit channel literature can also be found to be influential over the extension of trade credit. Factors such as solvency, credit score and age tend to allow a firm greater access to both bank lending and trade credit, while greater interest cover tends to allow more trade credit but not more bank lending. We conclude that firms that are small, risky, and young that also have unfavourable characteristics in relation to solvency and credit risk, will not obtain either bank lending or trade credit.

6. Conclusions

Our study complements the work that has been done in recent years to evaluate the existence of a credit channel (Kohler *et al.* 2000, and Nilsen, 2002). Just as the evidence for the bank lending channel and the balance sheet channel has improved our understanding of the monetary transmission mechanism, this paper helps to evaluate the finance available from suppliers when a firm is credit constrained by banks. We have shown that trade credit represents an important source of external finance for firms, and that although it is lower down the pecking order of finance for firms it is taken up when offered by suppliers in order to bridge the financing gap.

Our paper analyses a panel of more than 16,000 British firms for the period 1990-1999, and draws two main conclusions. The first is that trade credit increases, while bank lending decreases, in absolute and relative terms with a monetary tightening. This provides indirect evidence that there is a bank lending channel but also shows that the effects of monetary tightening are ameliorated to a degree by trade credit. Thus the bank lending channel does not choke off funds altogether, even for those firms that receive less funding

from bank sources, such as small, young and risky firms. Rather it alters the balance of funding away from financial institutions and towards suppliers, increasing the marginal cost of external finance for these types of firms.

Our second main finding is that the measures of financial health that are used by banks to assess creditworthiness are used by suppliers for the same purpose with respect to trade credit such as size, age, solvency, credit rating, level of indebtedness, and quotation on the market. Thus firm-specific characteristics go a long way towards explaining whether firms receive trade credit or not. There are some firms that are adversely affected by their creditworthiness and these firms do not receive any trade credit.

We conclude that trade credit is an important short-term source of funds for small, young and risky firms and is more readily offered to firms that have greater solvency, credit scores and interest cover. It is used extensively to cover short-term financing constraints and can substitute for the effects of a decline in bank lending in some cases. Given that it has a role as a substitute, and that this role varies according to the type of firm, we argue that trade credit deserves more consideration than it has so far received in the credit literature.

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Table 1. Panel 1990-1992

Dependent variable: trade creditors / total liabilities

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	3.137*** (0.158)	1.494*** (0.080)	1.475*** (0.052)	1.896*** (0.088)	1.681*** (0.059)	2.068*** (0.086)	1.581*** (0.099)	1.665*** (0.063)	1.922*** (0.086)	1.501*** (0.186)	1.767*** (0.050)	0.587*** (0.179)
solvency	-0.010 (0.025)	0.113*** (0.018)	0.269*** (0.015)	0.046*** (0.017)	0.188*** (0.014)	0.424*** (0.020)	-0.034** (0.016)	0.085*** (0.013)	0.279*** (0.020)	0.154*** (0.045)	0.121*** (0.011)	0.324*** (0.055)
quiscore	0.155*** (0.028)	0.110*** (0.019)	0.002 (0.014)	0.132*** (0.018)	0.048*** (0.015)	-0.265*** (0.027)	0.432*** (0.029)	0.136*** (0.015)	-0.161*** (0.023)	-0.024 (0.043)	0.094*** (0.012)	-0.207*** (0.050)
interest cover	-0.003 (0.004)	-0.000 (0.002)	0.001 (0.002)	0.001 (0.003)	-0.001 (0.002)	0.006*** (0.002)	-0.026*** (0.007)	-0.131*** (0.025)	0.000 (0.002)	-0.006 (0.007)	-0.000 (0.002)	-0.003 (0.008)
age	-0.111*** (0.027)	-0.025* (0.013)	-0.021** (0.010)	0.047 (0.075)	-0.052*** (0.011)	-0.028** (0.012)	-0.048*** (0.015)	-0.031*** (0.010)	-0.053*** (0.012)	-0.042* (0.025)	-0.044*** (0.009)	0.006 (0.027)
logsales	8.119*** (0.639)	-0.094 (0.542)	-0.853*** (0.220)	-0.731*** (0.206)	-0.409*** (0.152)	0.079 (0.177)	-1.657*** (0.209)	-0.980*** (0.149)	-0.209 (0.183)	-0.334 (0.357)	-0.711*** (0.131)	-1.069** (0.484)
No. of obs.	4155	7636	7790	7853	12089	7041	5621	12208	7734	1198	18744	651
Chi-square	622.76	645.28	1495.82	672.01	1370.41	973.29	572.53	1171.29	715.18	86.17	1902.31	58.57

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 1 (cont.). Panel 1993-1999

Dependent variable: trade creditors / total liabilities

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	-0.187 (0.170)	-0.276*** (0.098)	-0.079 (0.082)	-0.123 (0.095)	-0.182** (0.079)	-0.221** (0.100)	0.017 (0.123)	0.029 (0.082)	-0.366*** (0.093)	-0.311 (0.241)	-0.186*** (0.063)	-0.753*** (0.283)
solvency	0.149*** (0.011)	0.221*** (0.008)	0.216*** (0.007)	0.173*** (0.007)	0.212*** (0.006)	0.340*** (0.008)	0.087*** (0.008)	0.163*** (0.006)	0.251*** (0.008)	0.181*** (0.019)	0.189*** (0.005)	0.263*** (0.025)
quiscore	-0.061*** (0.012)	-0.043*** (0.008)	-0.013** (0.006)	-0.033*** (0.007)	-0.028*** (0.006)	-0.219*** (0.010)	0.195*** (0.012)	-0.027*** (0.006)	-0.156*** (0.008)	-0.008 (0.017)	-0.030*** (0.005)	-0.010 (0.020)
interest cover	0.001 (0.001)	0.003*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.003*** (0.001)	0.004*** (0.001)	-0.006*** (0.002)	-0.007 (0.008)	0.002*** (0.001)	-0.000 (0.003)	0.003*** (0.001)	-0.001 (0.003)
age	-0.147*** (0.017)	-0.087*** (0.010)	-0.072*** (0.008)	-0.307*** (0.028)	-0.117*** (0.008)	-0.070*** (0.008)	-0.097*** (0.010)	-0.091*** (0.007)	-0.099*** (0.007)	-0.114*** (0.019)	-0.122*** (0.006)	-0.047** (0.022)
logsales	5.028*** (0.292)	2.544*** (0.259)	-0.201 (0.136)	0.981*** (0.114)	1.147*** (0.096)	0.951*** (0.101)	-0.783*** (0.123)	0.490*** (0.092)	0.198** (0.099)	0.194 (0.235)	1.090*** (0.078)	-1.820*** (0.363)
No. of obs.	11568	22451	23436	27847	31526	22240	14489	29352	30021	3497	55876	1718
Chi-square	551.50	1281.87	2095.83	1075.45	2074.33	1698.87	851.01	1181.14	1273.20	189.48	2812.39	272.52

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2. Panel 1990-1992

Dependent variable: BANK / total liabilities

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	-2.430*** (0.119)	-0.281*** (0.067)	0.121** (0.056)	-0.736*** (0.075)	-0.309*** (0.052)	-0.350*** (0.067)	-0.881*** (0.102)	-0.516*** (0.057)	-0.621*** (0.068)	-0.398*** (0.153)	-0.508*** (0.044)	0.041 (0.165)
solvency	0.328*** (0.020)	0.357*** (0.017)	0.347*** (0.016)	0.343*** (0.016)	0.323*** (0.013)	0.233*** (0.017)	0.326*** (0.018)	0.378*** (0.013)	0.291*** (0.018)	0.223*** (0.039)	0.347*** (0.011)	0.144*** (0.050)
quiscore	-0.748*** (0.022)	-0.799*** (0.017)	-0.804*** (0.016)	-0.771*** (0.016)	-0.786*** (0.013)	-0.591*** (0.022)	-0.859*** (0.031)	-0.857*** (0.014)	-0.770*** (0.020)	-0.566*** (0.037)	-0.791*** (0.011)	-0.466*** (0.046)
interest cover	0.005 (0.003)	0.003 (0.002)	0.002 (0.002)	0.002 (0.003)	0.004** (0.002)	-0.002 (0.001)	0.047*** (0.008)	0.331*** (0.024)	0.000 (0.001)	0.010 (0.006)	0.003** (0.001)	-0.009 (0.008)
age	0.070*** (0.022)	0.033** (0.014)	0.022* (0.012)	0.430*** (0.073)	-0.019 (0.012)	-0.001 (0.010)	0.068*** (0.018)	0.042*** (0.011)	0.036*** (0.012)	0.075*** (0.022)	0.034*** (0.009)	0.049** (0.024)
logsales	-1.734*** (0.515)	3.328*** (0.530)	-0.202 (0.259)	0.966*** (0.199)	0.903*** (0.155)	0.258* (0.155)	1.831*** (0.244)	1.023*** (0.154)	0.550*** (0.173)	-0.052 (0.318)	1.094*** (0.131)	-0.365 (0.436)
No. of obs.	4155	7636	7790	7853	12089	7041	5621	12208	7734	1198	18744	651
Chi-square	1660.60	2636.93	3165.73	2669.52	4325.71	813.78	930.23	4133.83	2056.98	352.76	6514.16	176.64

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2 (cont.). Panel 1993-1999

Dependent variable: BANK / total liabilities

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	0.290 (0.192)	0.511*** (0.120)	0.739*** (0.122)	0.469*** (0.116)	0.671*** (0.110)	0.451*** (0.121)	0.644*** (0.179)	0.827*** (0.114)	0.478*** (0.109)	0.712** (0.283)	0.642*** (0.083)	0.246 (0.301)
solvency	0.177*** (0.012)	0.283*** (0.010)	0.280*** (0.010)	0.253*** (0.008)	0.231*** (0.008)	0.184*** (0.010)	0.238*** (0.011)	0.326*** (0.008)	0.199*** (0.009)	0.160*** (0.021)	0.257*** (0.006)	0.112*** (0.025)
quiscore	-0.558*** (0.013)	-0.716*** (0.010)	-0.725*** (0.009)	-0.668*** (0.008)	-0.665*** (0.008)	-0.543*** (0.012)	-0.695*** (0.018)	-0.774*** (0.009)	-0.653*** (0.009)	-0.456*** (0.020)	-0.683*** (0.006)	-0.403*** (0.021)
interest cover	-0.001 (0.002)	0.002* (0.001)	0.001 (0.001)	0.000 (0.001)	0.002* (0.001)	-0.003*** (0.001)	0.026*** (0.003)	0.224*** (0.010)	-0.001* (0.001)	-0.006** (0.003)	0.001* (0.001)	-0.010*** (0.003)
age	0.095*** (0.019)	0.040*** (0.011)	0.030*** (0.010)	0.477*** (0.033)	0.037*** (0.010)	0.026*** (0.008)	0.039*** (0.013)	0.030*** (0.009)	0.073*** (0.008)	0.064*** (0.019)	0.069*** (0.007)	0.023 (0.017)
logsales	-1.235*** (0.330)	0.054 (0.307)	-0.959*** (0.185)	-0.317** (0.131)	-0.939*** (0.119)	-1.050*** (0.111)	1.142*** (0.171)	-0.151 (0.117)	-0.655*** (0.112)	-2.196*** (0.247)	-0.356*** (0.093)	-0.511* (0.305)
No. of obs.	11568	22451	23436	27847	31526	22240	14489	29352	30021	3497	55876	1718
Chi-square	2508.43	7311.30	8268.66	8156.05	9262.90	2363.34	1612.15	8398.76	6828.15	843.47	16408.71	553.18

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3. Panel 1990-1992

Dependent variable: trade creditors / (trade creditors + bank loans)

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	3.710*** (0.173)	1.268*** (0.094)	0.922*** (0.074)	1.848*** (0.105)	1.366*** (0.071)	1.610*** (0.108)	1.896*** (0.120)	1.658*** (0.077)	1.617*** (0.101)	1.105*** (0.225)	1.600*** (0.060)	0.296 (0.244)
solvency	-0.273*** (0.028)	-0.246*** (0.023)	-0.148*** (0.021)	-0.257*** (0.021)	-0.171*** (0.018)	0.008 (0.027)	-0.262*** (0.020)	-0.259*** (0.016)	-0.136*** (0.025)	-0.145** (0.057)	-0.220*** (0.014)	-0.004 (0.075)
quiscore	0.714*** (0.032)	0.765*** (0.023)	0.716*** (0.020)	0.733*** (0.023)	0.717*** (0.018)	0.465*** (0.035)	0.860*** (0.036)	0.779*** (0.018)	0.656*** (0.029)	0.616*** (0.053)	0.730*** (0.015)	0.435*** (0.068)
interest cover	0.001 (0.005)	0.000 (0.003)	0.001 (0.003)	0.004 (0.004)	-0.001 (0.002)	0.009*** (0.002)	-0.046*** (0.009)	-0.378*** (0.031)	0.003 (0.002)	-0.015 (0.009)	0.002 (0.002)	0.009 (0.011)
age	-0.140*** (0.031)	-0.040** (0.017)	-0.026* (0.015)	-0.367*** (0.096)	-0.011 (0.015)	-0.017 (0.016)	-0.084*** (0.019)	-0.057*** (0.013)	-0.058*** (0.016)	-0.103*** (0.032)	-0.052*** (0.012)	-0.068* (0.036)
logsales	7.805*** (0.737)	-1.855*** (0.692)	-0.340 (0.322)	-0.484* (0.262)	-0.344* (0.203)	0.676*** (0.242)	-1.881*** (0.268)	-0.643*** (0.192)	-0.046 (0.242)	0.076 (0.454)	-0.606*** (0.171)	-0.272 (0.661)
No. of obs.	4118	7606	7770	7817	12022	6989	5605	12160	7679	1197	18642	651
Chi-square	1158.28	1761.90	2192.46	1709.14	2911.92	510.41	875.47	2676.25	1160.97	262.85	4264.73	98.48

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3 (cont.) Panel 1993-1999

Dependent variable: trade creditors / (trade creditors + bank loans)

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	-0.182 (0.254)	-0.630*** (0.155)	-0.672*** (0.148)	-0.512*** (0.148)	-0.715*** (0.136)	-0.594*** (0.180)	-0.454** (0.184)	-0.696*** (0.132)	-0.616*** (0.152)	-0.920** (0.408)	-0.672*** (0.103)	-0.806 (0.522)
solvency	-0.053*** (0.016)	-0.101*** (0.013)	-0.110*** (0.012)	-0.115*** (0.011)	-0.050*** (0.011)	0.077*** (0.015)	-0.130*** (0.011)	-0.159*** (0.010)	-0.017 (0.012)	0.004 (0.032)	-0.097*** (0.008)	0.003 (0.045)
quiscore	0.412*** (0.017)	0.596*** (0.012)	0.627*** (0.011)	0.556*** (0.011)	0.537*** (0.010)	0.398*** (0.018)	0.611*** (0.019)	0.591*** (0.010)	0.492*** (0.013)	0.455*** (0.029)	0.555*** (0.008)	0.516*** (0.037)
interest cover	0.007*** (0.002)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.010*** (0.001)	-0.024*** (0.003)	-0.199*** (0.012)	0.007*** (0.001)	0.023*** (0.004)	0.005*** (0.001)	0.029*** (0.006)
age	-0.173*** (0.025)	-0.073*** (0.014)	-0.068*** (0.013)	-0.523*** (0.043)	-0.104*** (0.013)	-0.080*** (0.013)	-0.092*** (0.014)	-0.088*** (0.011)	-0.120*** (0.012)	-0.129*** (0.029)	-0.135*** (0.010)	-0.060* (0.033)
logsales	5.937*** (0.444)	2.031*** (0.399)	0.289 (0.234)	1.543*** (0.173)	1.968*** (0.156)	2.352*** (0.173)	-1.282*** (0.180)	1.040*** (0.143)	0.965*** (0.157)	2.174*** (0.371)	1.554*** (0.122)	-1.277** (0.572)
No. of obs.	11353	22190	23213	27474	31133	21853	14387	28975	29632	3466	55141	1717
Chi-square	1261.98	4311.81	5474.36	4453.36	5664.13	1295.41	1236.76	4184.57	3191.21	611.04	9341.47	448.06

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4. Panel 1990-1992

Dependent variable: net TC / total liabilities

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	2.233*** (0.227)	0.626*** (0.099)	0.502*** (0.067)	1.020*** (0.118)	0.627*** (0.083)	0.495*** (0.134)	0.933*** (0.107)	0.800*** (0.079)	0.696*** (0.137)	1.041*** (0.246)	0.777*** (0.069)	0.522** (0.245)
solvency	-0.529*** (0.038)	-0.530*** (0.028)	-0.248*** (0.019)	-0.457*** (0.025)	-0.440*** (0.022)	-0.874*** (0.040)	-0.197*** (0.018)	-0.368*** (0.019)	-0.526*** (0.031)	-0.316*** (0.064)	-0.461*** (0.017)	-0.030 (0.076)
quiscore	-0.082* (0.042)	0.005 (0.027)	-0.075*** (0.019)	-0.006 (0.026)	-0.051** (0.022)	-0.051 (0.048)	0.072** (0.032)	-0.012 (0.020)	-0.095*** (0.036)	-0.213*** (0.059)	-0.021 (0.017)	-0.305*** (0.069)
interest cover	-0.011 (0.007)	-0.003 (0.003)	0.001 (0.002)	-0.008* (0.004)	0.000 (0.003)	0.002 (0.003)	-0.014* (0.008)	-0.000 (0.035)	-0.001 (0.003)	-0.009 (0.010)	-0.002 (0.002)	-0.011 (0.011)
age	0.025 (0.041)	0.005 (0.023)	-0.002 (0.013)	-0.170 (0.123)	0.001 (0.019)	0.049* (0.027)	-0.010 (0.017)	-0.013 (0.017)	0.023 (0.019)	-0.003 (0.037)	0.002 (0.015)	0.008 (0.037)
logsales	1.853* (0.971)	-2.937*** (0.872)	2.666*** (0.294)	1.474*** (0.330)	2.539*** (0.260)	2.945*** (0.402)	0.461* (0.240)	1.409*** (0.246)	3.148*** (0.284)	1.731*** (0.519)	2.107*** (0.219)	2.048*** (0.666)
No. of obs.	4155	7636	7790	7853	12089	7041	5621	12208	7734	1198	18744	651
Chi-square	664.22	845.65	714.82	823.72	1214.55	870.12	201.87	886.35	1150.85	163.02	1900.41	63.83

` netTC = trade creditors – trade debtors, i.e. net TC received

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4 (cont.). Panel 1993-1999

Dependent variable: net TC / total liabilities

	small	medium	large	young	old	secure	risky	constrained	un- constrained	quoted AIM/OFEX	not quoted	public quoted
MS	0.187 (0.315)	-0.193 (0.157)	0.045 (0.126)	0.013 (0.155)	-0.126 (0.134)	-0.278 (0.205)	0.145 (0.168)	0.179 (0.122)	-0.337** (0.167)	-0.672** (0.338)	-0.055 (0.105)	-0.662* (0.355)
solvency	-0.371*** (0.019)	-0.314*** (0.013)	-0.259*** (0.010)	-0.262*** (0.011)	-0.340*** (0.011)	-0.623*** (0.017)	-0.093*** (0.010)	-0.204*** (0.009)	-0.437*** (0.013)	-0.240*** (0.026)	-0.310*** (0.008)	-0.173*** (0.031)
quiscore	-0.138*** (0.021)	-0.151*** (0.013)	-0.073*** (0.010)	-0.152*** (0.011)	-0.074*** (0.010)	-0.074*** (0.020)	-0.094*** (0.017)	-0.099*** (0.009)	-0.083*** (0.014)	-0.154*** (0.024)	-0.107*** (0.008)	-0.156*** (0.026)
interest cover	-0.001 (0.003)	-0.002 (0.001)	-0.000 (0.001)	-0.002* (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.007*** (0.003)	-0.003 (0.011)	-0.000 (0.001)	-0.011*** (0.004)	-0.002* (0.001)	-0.006 (0.004)
age	0.082*** (0.029)	-0.013 (0.014)	0.010 (0.011)	-0.224*** (0.044)	0.071*** (0.014)	0.090*** (0.014)	0.001 (0.012)	0.000 (0.010)	0.044*** (0.012)	0.050* (0.026)	0.023** (0.010)	0.014 (0.028)
logsales	-3.045*** (0.528)	0.089 (0.406)	1.271*** (0.203)	0.569*** (0.171)	0.241 (0.161)	0.806*** (0.197)	0.078 (0.151)	0.437*** (0.128)	1.174*** (0.165)	0.709** (0.327)	0.365*** (0.124)	1.318*** (0.452)
No. of obs.	11568	22451	23436	27847	31526	22240	14489	29352	30021	3497	55876	1718
Chi-square	1272.25	2660.14	2113.10	2759.03	3031.87	2365.96	232.94	1922.91	3321.68	424.13	5384.04	239.48

` netTC = trade creditors – trade debtors, i.e. net TC received

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%