Substitute or complement? The use of trade credit as a financing source among SMEs

Darush Yazdanfar and Peter Öhman
Department of Business, Economics and Law, Mid Sweden University, Sundsvall, Sweden

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Abstract

Purpose – This study aims to investigate trade credit as a financing source among small- and medium-sized enterprises (SMEs), particularly the influence of short-term debt, long-term debt and profitability on the use of such credit.

Design/methodology/approach – Ordinary least squares (OLS), fixed-effects and generalized method of moments (GMM) system models were used to analyze a large cross-sectional panel data set of 15,897 Swedish SMEs in five industry sectors for the 2009-2012 period.

Findings – The study provides empirical evidence that long-term debt and profitability each significantly and negatively influence trade credit (i.e. accounts payable) and that short-term debt positively influences trade credit. Notably, while trade credit seems to complement other short-term debt, it replaces long-term debt. Moreover, firm size in terms of sales is positively related and firm age is negatively related to accounts payable. Industry affiliation is another significant explanatory variable.

Practical implications – The results provide debt holders, potential investors, policymakers and academic researchers with insights into the relationship between trade credit demand, on the one hand, and external financing (i.e. short- and long-term debt) and internal retained earnings (i.e. profit), on the other. From a manager's perspective, the findings may be important for decision-making regarding trade credit use.

Originality/value – When investigating trade credit determinants, the literature has seldom distinguished between short- and long-term debt and considered that they may influence the use of trade credit in different ways. The present study adds to the literature by using OLS, fixed-effects and GMM system models to analyze a large cross-sectoral sample in a high-tax country where both bank loans and trade credit are considered important financing instruments.

Keywords Trade credit, Small- and medium-sized enterprises, Accounts payable, Long-term debt, Short-term debt

Paper type Research paper

1. Introduction

Trade credit is a legally binding agreement between two business partners in which the buyer can purchase goods or services on account and pay the supplier at a later date, i.e. a short-term loan to a buyer provided by a supplier (Cuñat and Garcia-Appendini, 2012). The importance of trade credit can be illustrated by Kohler *et al.*'s (2000) finding that 55 per cent of the total short-term credit received by UK firms during the 1983-1995 period was in the form of trade credit. The present study focuses on the buyer side (i.e. the demand side) of trade credit. Trade credit appears as accounts payable on the buying firm's balance sheet.

Because of the significance of trade credit agreements, research into the determinants of trade credit has increased in recent years (Seifert *et al.*, 2013). However, research into the relationship between trade credit and determinants in the form of other financing sources is more limited (Ghosh, 2015). Several researchers have attempted to identify determinants of trade credit demand using a financial approach (Schwartz, 1974; Biais and Gollier, 1997;

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Atanasova, 2007; Huang *et al.*, 2011). Among the determinants identified in previous studies are internal financing (i.e. profit) and external financing instruments (mainly bank credit). However, short- and long-term debt are rarely distinguished. This study examines the nature of the relationship between trade credit and short- and long-term debt and profitability.

The present study also focuses on small- and medium-sized enterprises (SMEs). A common challenge for SMEs, especially small and young ones, is access to external financing in terms of bank loans (Peel *et al.*, 2000; Wilson and Summers, 2002; Danielson and Scott, 2004). This challenge has been explained by the fact that SMEs are often linked to financial markets characterized by information asymmetry and agency conflicts, high verification costs, adverse selection and moral hazards (Carpenter and Petersen, 2002; Berger and Udell, 2006). To overcome problems related to credit rationing, trade credit is regarded as an important short-term financing instrument for SMEs (Cassia and Vismara, 2009; Gama *et al.*, 2010; Garcia-Teruel and Martinez-Solano, 2010).

The aim of the present study is to empirically investigate the aforementioned firm-level determinants of trade credit among SMEs in various industries. In line with previous studies conducted in other countries (Garcia-Teruel and Martinez-Solano, 2010; Martinez-Sola *et al.*, 2014; Ghosh, 2015; Psillaki and Eleftheriou, 2015), the main interest is whether trade credit is an alternative or complement to other financing sources. In addition, other firm-level determinants highlighted in the literature (i.e. size, age, and industry affiliation) are considered.

Previous studies suggest that firm financing behaviour is context-dependent and can vary because of differences in legal, regulatory and financial systems (Michaelas *et al.*, 1999; Daskalakis and Psillaki, 2008; Mac an Bhaird and Lucey, 2014), and that firms' financial decisions are influenced by the taxation level (Mackie-Mason, 1990). Moreover, common payment terms and trade credit practices may vary considerably depending on the financial system (Marotta, 2005; Cassia and Vismara, 2009).

Internationally, the Swedish economy can be described as a small, export-oriented economy with universal social benefits funded by high taxes (Swedish Central Bank, 2013). Almost 99 per cent of all firms in Sweden are SMEs. These firms account for approximately 70 per cent of the Swedish labour force and, in recent decades, have been the main job creators in Sweden (Statistics Sweden, 2013). Traditionally, bank loans have been an important financing instrument for Swedish firms, and national regulations have tried to prevent unexpected and extensive firm bankruptcies (Larsson, 1998; Öhman and Wallerstedt, 2012). Although many Swedish companies are financed largely with bank loans (secured by collateral), SMEs are encouraged to use trade credit and other short-term financing because such financing sources seldom involve any demand for collateral (Yazdanfar, 2012). In sum, the large share of SMEs, relatively high taxes, and importance of bank loans and trade credit as SME financing instruments make Sweden a valid case for an empirical investigation.

The study adds to the literature by focusing on empirical data from a country whose conditions differ somewhat from those of other previously studied countries. The data also relate to a period influenced by the global financial crisis, which has been found to have affected firms' use of trade credit (Ghosh, 2015; Psillaki and Eleftheriou, 2015). More importantly, the study contributes to the literature by distinguishing between short- and long-term debt and by finding that these influence the use of trade credit in different ways. While trade credit seems to complement other short-term debt, it is an alternative to long-term debt. This is of interest not only to academics but also to creditors and other societal actors, particularly firm managers and owners.

The remainder of the paper is organized as follows: Section 2 presents the theoretical framework and previous empirical studies to develop hypotheses. Following this is an overview of the data sample, variable selection and model specification in Section 3. Section 4 presents the empirical results, and the paper ends with a discussion and concluding remarks in Section 5.

2. Theoretical framework and previous empirical studies

2.1 Theoretical framework

Various factors can underpin the use of trade credit, and several theoretical frameworks have been developed to explain its use. A common view is to distinguish between operational, commercial and financial approaches (Garcia-Teruel and Martinez-Solano, 2010; Martinez-Sola *et al.*, 2014). According to the operational approach, the motivation of buyers and suppliers of trade credit is to reduce the transaction costs of cash management and thereby improve cost efficiency (Wilson and Summers, 2002). As a result, the parties can anticipate product and payment flows and be more flexible with regard to variation in transactions, simplifying cash management (Long *et al.*, 1993).

According to the commercial approach, trade credit can be used by the supplier to encourage sales, enabling the buyer to pay later and assess the quality of the goods before paying for them (Chung and Liao, 2006). Therefore, trade credit can be used to establish beneficial long-term business relationships (Ng *et al.*, 1999; Wilson and Summers, 2002).

According to the financial approach, trade credit is assumed to be one of the short-term financing instruments that substitutes for and/or complements other financing sources. The demand for trade credit, like any other financing instrument, is therefore determined by its implied cost (i.e. interest rate). Accordingly, firms use trade credit as an option if it is better and cheaper than other financing alternatives (Schwartz, 1974). A common question regarding the use of trade credit from a financial perspective is why companies choose to finance each other when traditional financial institutions such as banks exist, particularly in countries where bank loans are commonly used. The issue is interesting because previous studies demonstrate that the implicit interest rate on trade credit is significantly higher than on loans from banks and other traditional financial institutions (Jain, 2001; Cuñat, 2007). Bougheas *et al.* (2009) explain the demand for trade credit by referring to the difficulty of accessing bank credit and, in agreement with pecking-order theory, note that firms' incentives to use trade credit depend on the accessibility and costs of alternative financing sources (Petersen and Rajan, 1997). According to pecking-order theory, internally generated financing, i.e. profit, is typically preferred to external financing (Myers and Majluf, 1984). However, trade credit can be a means for a dominant buyer to obtain favourable price discrimination.

2.2 Previous empirical studies and hypotheses

Deloof and Van Overfelt (2011) suggest that firms having good access to bank loans tend to supply trade credit to financially constrained firms. From that perspective, suppliers can play the role of intermediaries, lending money through trade credit to firms facing barriers to obtaining external financing through conventional capital markets (Bougheas *et al.*, 2009). The close relationship between supplier and buyer enables the supplier to gain information and more effectively monitor the buyer in a cheaper way than a financial institution can (Biais and Gollier, 1997). Deloof and Jegers (1999) confirm that firms with a cost advantage over banks and other traditional financial institutions offer more trade credit to their customers than do other suppliers.

According to Mateut *et al.* (2006), firms that have difficulties obtaining bank loans will increase their use of trade credit, and Schwartz (1974) has suggested that financially

constrained firms tend to use trade credit as an alternative to bank loans. Atanasova (2007) investigated financial constraints and their effect on firm financing policies among 2,000 UK firms from 1981 to 2000, and found that trade credit was used as an alternative to other institutional financing sources. Garcia-Teruel and Martinez-Solano (2010) examined 47,197 SMEs in Europe over the 1996-2002 period, and provided empirical evidence that firms with alternative financing sources are less likely to resort to the use of trade credit. In the same vein, Niskanen and Niskanen (2006), who sampled 840 small Finnish firms for the 1994-1996 period, found that firms subject to financial constraints used trade credit more frequently than did other firms. The latter finding is in line with that of Danielson and Scott (2004), who examined a random sample of 3,642 small businesses operating in various industries in 1995. Deloof and Jegers (1999) studied the role of trade credit as a financing instrument in 661 Belgian firms for the 1989-1991 period, concluding that accounts payable is an alternative to short-term bank credit.

However, Vaidya's (2011) study of Indian firms indicated that trade credit and bank loans were complementary, i.e. firms with better access to bank credit could receive more trade credit. The finding that trade credit and bank credit are complementary was supported by Ghosh (2015), who examined data on a sample of 8,459 Indian manufacturing firms for the 1993-2012 period. The results from India confirmed previous findings of Demirgüç-Kunt and Maksimovic (2001), who suggested that firms tend to use trade credit to complement bank loans. Moreover, Biais and Gollier (1997) and Huang *et al.* (2011) suggest that trade credit demand and bank loans are positively related. It should also be noted that Ghosh (2015) found that, during the recent global financial crisis, trade credit and bank credit turned out to be substitutable instead of complementary, especially for financially unconstrained firms. At the same time, Psillaki and Eleftheriou (2015) found that trade credit extended to small French firms during periods of tight money acts as a complement to rather than substitute for bank credit.

Although previous results are inconsistent, most studies demonstrate that firms tend to demand more trade credit when access to bank loans is insufficient. Accordingly, trade credit may be an important source of short-term debt and an alternative to other financing sources (Petersen and Rajan, 1997; Deloof and Jegers, 1999; Kohler *et al.*, 2000; Atanasova, 2007; Bougheas *et al.*, 2009; Garcia-Teruel and Martinez-Solano, 2010). Taken together, the following two hypotheses are accordingly formulated:

H1. The trade credit level is negatively related to the level of other short-term debt.

H2. The trade credit level is negatively related to the level of long-term debt.

Although Bougheas *et al.* (2009) have suggested that trade credit in terms of accounts payable is positively related to firm profitability, most previous studies have found a negative relationship between the two variables. In line with the pecking-order theory, Petersen and Rajan (1997) have suggested that firms able to generate capital internally are likely to reduce their demand for trade credit, and Niskanen and Niskanen (2006) found that firms with strong internal financing are likely to exclude trade credit.

Deloof (2003) studied a sample of 1,009 large Belgian non-financial firms for the 1992-1996 period, and the results indicated a significant negative relationship between accounts payable and profitability. Lazaridis and Tryfonidis (2006) found the same pattern when investigating the impact of accounts payable on profitability among firms operating in various Greek industries for the 2001-2004 period, and so did Garcia-Teruel and Martinez-Solano (2007) when investigating 8,872 Spanish SMEs for the 1996-2002 period. Similar results were reported by Samiloglu and Demirgunes (2008), who used a sample of 5,843 Turkish manufacturing firms for the 1998-2007 period, and by Gill *et al.* (2010), who

analysed 88 American manufacturing firms for the 2005-2007 period. In addition, Vaidya (2011) used a sample consisting of 1,522 Indian firms and found that profitable but financially constrained firms avoided using trade credit. Altogether, most previous studies have proposed a negative relationship between trade credit and firm profitability, leading to the following hypothesis:

H3. The trade credit level is negatively related to firm profitability.

Theoretically, firm size is associated with the degree of information asymmetry and with the ability to establish relationships with both banks and other credit suppliers. Thus, the size of the firm is expected to affect the demand for trade credit (Petersen and Rajan, 1997; Wilson and Summers, 2002; Danielson and Scott, 2004; Huyghebaert, 2006; Giannetti *et al.*, 2011). In the present study, size is associated with firms' access to bank loans (cf. Rajan and Zingales, 1995; Petersen and Rajan, 1997). Because of insufficient availability of bank loans, smaller firms are more likely to rely on trade credit than are larger firms (Atanasova and Wilson, 2003; Rodríguez-Rodríguez, 2006). This is supported by empirical results reported by Danielson and Scott (2004) and Niskanen and Niskanen (2006), although Garcia-Teruel and Martinez-Solano (2010) found that larger firms, with greater growth opportunities and greater investments in current assets receive more trade credit financing from their suppliers. All things considered, the following hypothesis is formulated:

H4. The trade credit level is negatively related to firm size.

In addition, firm age has been assumed to be related to access to bank loans, thereby affecting the trade credit level, possibly because the degree of information asymmetry is inversely related to firm age (Myers and Majluf, 1984). However, empirical results regarding the impact of age on the use of trade credit are mixed. While Wilson and Summers (2002), Niskanen and Niskanen (2006) and Gama *et al.* (2010) found a negative relationship between age and accounts payable, Petersen and Rajan (1997), Danielson and Scott (2004) and Garcia-Teruel and Martinez-Solano (2010) found a positive association between them. Based on the assumption that the degree of information asymmetry is inversely related to the firm's age, the following hypothesis is formulated:

H5. The trade credit level is negatively related to firm age.

Industry affiliation is another determinant within this field of research (Fishman and Love, 2003; Giannetti *et al.*, 2011; Psillaki and Eleftheriou, 2015). Wilson and Summers (2002) demonstrated that the use of trade credit is significantly affected by industry sector characteristics. Ng *et al.* (1999) found that the use of trade credit varied considerably across industries but that the variation was small within each industry. Similarly, Marotta (2005) argued that the use of trade credit is generally uniform within any industry, but would probably vary across industry sectors. Therefore, the last hypothesis is as follows:

H6. The trade credit level is related to industry affiliation.

3. Sample, variable selection and model specification

3.1 Sample

Data were obtained from "Affärsdata", a commercial databank that contains firm-level financial data from Swedish limited companies. Because of the lack of data before 2009, this study focuses on the period from 2009 to 2012. The SME definition used here is the one provided by Statistics Sweden (2013). The targeted population comprised all non-financial firms with 1-199 employees and in operation at the end of 2012 across five industry sectors. In addition, the sample is divided into two SME categories: small firms (1-49 employees) and

medium-sized firms (50-199 employees). To avoid sampling bias, firms for which there were missing values, outliers and/or inconsistent figures were excluded from the sample. The final sample consisted of 15,897 SMEs across the retail, wholesale, manufacturing, health care and construction industries with complete information for the 2009-2012 period. The industry classification was based on the Swedish Standard Industry Classification (SIC).

3.2 Variable selection

As demonstrated in Section 2, the picture that emerges of the relationships between the determinants and the use of trade credit is not coherent. The fact that researchers have focused on various contexts using various sample selections, methods and variables seems to explain the lack of consensus. Because of the research scope and availability of data, the present study focuses on firm-level determinants as described below.

The dependent variable, trade credit, is proxied by accounts payable, which is in line with studies by, for example, Deloof (2003), Lazaridis and Tryfonidis (2006), Garcia-Teruel and Martinez-Solano (2007), Samiloglu and Demirgunes (2008) and Ghosh (2015). Accounts payable is defined as the ratio of accounts payable to total assets.

The short-term debt (STD) ratio is defined as debt repayable within one year, as a percentage of total assets, and the long-term debt (LTD) ratio is defined as debt repayable beyond one year, as a percentage of total assets. Return on assets (ROA) is used as a proxy for profitability, which is consistent with several previous studies (Petersen and Rajan, 1997; Vaidya, 2011). ROA is defined as the firm's book value of net profit after taxes divided by total assets. Proxies such as turnover, total assets and number of employees have previously been used for firm size. Considering that turnover can be closely related to the use of trade credit, and as recommended by Coad (2009), the present study measured firm size as the natural logarithm of the firm's book value of sales (i.e. turnover). The natural logarithm of the number of years from firm inception to the year of data collection is used as a proxy for firm age, which is in line with Yazdanfar and Öhman (2014). Finally, a categorical variable was used as a dummy for each industry.

3.3 Model specification

To test the explanatory power of the independent variables, the sample estimation for the ordinary least squares (OLS) regression model that forms the basis of our study was specified as follows:

Model 1:

$$\begin{aligned} Accounts\ payable_{i,t} = {} & \alpha_t + \beta_1 STD_{i,t} + \beta_2 LTD_{i,t} + \beta_3 ROA_{i,t} \\ & + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} \\ & + \beta_6 Indus_i + \mu_{i,t} \end{aligned}$$

Where,

α_t	= constant;
$Accounts\ payable_{i,t}$	= ratio of accounts payable to total assets;
$STD_{i,t}$	= debt repayable within one year, as a percentage of total assets;
$LTD_{i,t}$	= debt repayable beyond one year, as a percentage of total assets;
$ROA_{i,t}$	= firm's book value of net profit after taxes, as a percentage of total assets;
$Size_{i,t}$	= size of firm *i* at time *t*; the natural logarithm of the firm's book value of sales;

$Age_{i,t}$ = age of firm i at time t; the natural logarithm of the number of years since firm inception;
$Indus_{i,t}$ = categorical variable used as a dummy for each industry;
$\mu_{i,t}$ = error term;

As the study is based on longitudinal data, we investigated the stability of the relationships between the variables across the studied period. The underlying equations for random-effects (Model 2) and fixed-effects (Model 3) regressions for the total sample were as follows:

Model 2:

$$\begin{aligned} Accounts\ payable_{i,t} = {} & \alpha_t + \beta_1 STD_{i,t} + \beta_2 LTD_{i,t} + \beta_3 ROA_{i,t} \\ & + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} \\ & + \beta_6 Indus_i + \eta_i + \mu_{i,t} \end{aligned}$$

Model 3:

$$\begin{aligned} Accounts\ payable_{i,t} = {} & \alpha_t + \beta_1 STD_{i,t} + \beta_2 LTD_{i,t} + \beta_3 ROA_{i,t} \\ & + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} \\ & + \beta_6 Indus_i + \eta_i \end{aligned}$$

All parameters of the random- and fixed-effects models are similar to those of the OLS model except for η_i, which accounts for unobservable individual effects for each firm. Based on the results of the Hausman test, indicating that the fixed-effects model is applicable, the random-effects results are not reported in Table III.

To overcome the potential endogeneity problem, the generalized method of moments (GMM system) approach – proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) – was applied to panel data. In line with Arellano and Bond (1991), and for data availability reasons, we estimated our model using lagged STD, lagged LTD and lagged ROA as instrumental variables. To assess the robustness of using these instrumental variables, Hansen J tests were conducted. The results are presented in Table III. The parameters of the GMM system model (Model 4) are similar to those used in the OLS model:

Model 4:

$$\begin{aligned} Accounts\ payable_{i,t} = {} & \alpha_t + \beta_1 STD_{i,t} + \beta_2 LTD_{i,t} + \beta_3 ROA_{i,t} \\ & + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} + \beta_6 Indus_i \\ & + \mu_{i,t} \end{aligned}$$

Finally, the following OLS model was used for each industry sector:

Model 5:

$$\begin{aligned} Accounts\ payable_{i,t} = {} & \alpha_t + \beta_1 STD_{i,t} + \beta_2 LTD_{i,t} + \beta_3 ROA_{i,t} \\ & + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} \\ & + \mu_{i,t} \end{aligned}$$

4. Results of the empirical analyses

4.1 Descriptive statistics

Descriptive statistics of firm characteristics for the complete sample and each industry-related subsample are presented in Table I. As shown, the average firm is approximately 22 years old (the standard deviation is just over 15 years). The average number of employees is almost ten, but the standard deviation reveals variation. The retail industry is well represented, including 42 per cent of the sampled firms, while the second and third largest industries are the wholesale and manufacturing industries with 18 per cent each. On average, firms in the wholesale industry are the oldest (just over 25 years) and have the most employees (just over 16), while the health-care industry firms are the youngest (just over 15 years) and have the fewest employees (just over 3). Wholesale firms, on average, are the largest in terms of the natural logarithm of sales, while health-care firms are the smallest.

Comparing the ratios of trade credit (i.e. accounts payable) across industry sectors, the retail trade industry has the highest level (mean 0.14) and health care the lowest (mean 0.02). Thus, industry sector seems to play a significant role in determining a firm's trade credit (TC) ratio. The industry with the highest short-term debt (STD) is manufacturing (mean 0.32), while the lowest STD is found among wholesale firms (mean 0.19). On average, the wholesale industry appears to have the highest long-term debt (LTD) ratio (mean 0.17), while the health-care industry has the lowest (mean 0.04). The levels of profitability (ROA) also differ across industries, with the health-care industry having the highest (mean 0.25). ANOVA results presented in Table I indicate statistically significant differences between industry sectors for all variables included in the study at the 1 per cent level.

4.2 The results of correlation analysis

Table II reports the Pearson correlation matrix showing coefficients of correlation between TC (i.e. accounts payable) and the independent variables for the complete sample. Pearson correlation analysis is conducted to identify the direction and strength of relationships between the variables included in the main model and to investigate the variables that are potentially highly correlated with each other. TC is positively and significantly correlated with the variables STD, size and age; conversely, TC is negatively and significantly correlated with LTD and ROA. Among the independent variables, there are significant negative correlations between STD and all other variables, as well as between ROA and all other variables. LTD is negatively and significantly correlated with all independent variables except age.

Moreover, size is positively and significantly correlated with age. As both size and age are positively related to TC, this indicates that older and larger SMEs tend to use relatively more trade credit. Because the coefficients between the independent variables are rather low, there is no indication of risk of multicollinearity among the variables included in the model.

4.3 The results of the multiple regression models

The results for the complete sample are summarized in three columns in Table III. According to the OLS model, the estimated coefficient for STD indicates a positive impact on accounts payable ($\beta = 0.110$, $p = 0.000$), in contrast to the expectation expressed in *H1*. LTD is negatively related to accounts payable, which means that a firm with relatively low LTD tends to use relatively more accounts payable as a financing source, and vice versa ($\beta = -0.083$, $p = 0.000$). This is in agreement with *H2*. In line with *H3*, profitability (ROA) is found to be negatively related to accounts payable at the 1 per cent significance level ($\beta = -0.078$, $p = 0.000$). In terms of firm characteristics, size significantly and positively influences accounts payable ($\beta = 0.017$, $p = 0.000$). Thus, in contrast to *H4*, larger SMEs in terms of sales use more trade credit than do smaller SMEs. In contrast to *H5*, the impact of

Table I.
Summary of descriptive statistics

Industry	TC	STD	LTD	ROA	Size	Age	Employees
Retail							
Mean	0.14	0.23	0.07	0.11	8.98	22.04	7.98
SD	0.10	0.13	0.12	0.13	1.26	15.24	13.70
N observation	27,016	27,016	27,016	27,016	27,016	27,016	27,016
N firms	6,754	6,754	6,754	6,754	6,754	6,754	6,754
% firms of total	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Wholesale							
Mean	0.12	0.19	0.17	0.10	9.80	25.37	16.30
SD	0.10	0.12	0.14	0.17	1.60	17.47	26.23
N observation	11,560	11,560	11,560	11,560	11,560	11,560	11,560
N firms	2,890	2,890	2,890	2,890	2,890	2,890	2,890
% firms of total	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Manufacturing							
Mean	0.09	0.32	0.09	0.11	9.09	23.84	13.60
SD	0.07	0.15	0.13	0.15	1.32	14.99	20.95
N observation	11,232	11,232	11,232	11,232	11,232	11,232	11,232
N firms	2,808	2,808	2,808	2,808	2,808	2,808	2,808
% firms of total	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Health care							
Mean	0.02	0.21	0.04	0.25	7.86	15.31	3.24
SD	0.04	0.11	0.08	0.20	0.81	9.48	6.13
N observation	7,180	7,180	7,180	7,180	7,180	7,180	7,180
N firms	1,795	1,795	1,795	1,795	1,795	1,795	1,795
% firms of total	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Construction							
Mean	0.11	0.37	0.08	0.11	8.52	19.28	7.00
SD	0.09	0.17	0.12	0.18	1.29	12.57	13.62
N observation	6,600	6,600	6,600	6,600	6,600	6,600	6,600
N firms	1,650	1,650	1,650	1,650	1,650	1,650	1,650
% firms of total	0.10	0.10	0.10	0.10	0.10	0.10	0.10

(*continued*)

Industry	TC	STD	LTD	ROA	Size	Age	Employees
Total							
Mean	0.11	0.25	0.09	0.12	8.98	21.92	9.85
SD	0.10	0.15	0.13	0.16	1.41	15.13	17.97
N observation	63,588	63,588	63,588	63,588	63,588	63,588	63,588
N firms	15,897	15,897	15,897	15,897	15,897	15,897	15,897
ANOVA							
F	2,263.1**	3,069.5**	1,733.7**	1,410.9**	13,215.5**	44,677.6**	900.3**
ANOVA Significance	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: ** ANOVA at 0.01 level; TC = trade credit in terms of accounts payable; STD = short-term debt; LTD = long-term debt; ROA = return on total assets

Table I.

Variables	TC	STD	LTD	ROA	Size	Age
TC	1	0.134**	−0.107**	−0.136**	0.285**	0.060**
p-Value	–	0.000	0.000	0.000	0.000	0.000
STD	0.134**	1	−0.260**	−0.009*	−0.005**	−0.256**
p-Value	0.000	–	0.000	0.028	0.000	0.000
LTD	−0.107**	−0.260**	1	−0.162**	−0.033**	0.049**
p-Value	0.000	0.000	–	0.000	0.000	0.000
ROA	−0.136**	−0.009*	−0.162**	1	−0.021**	−0.114**
p-Value	0.000	0.028	0.000	–	0.000	0.000
Size	0.285**	−0.05**	−0.033**	−0.021**	1	0.145**
p-Value	0.000	0.000	0.000	0.000	–	0.000
Age	0.060**	−0.256**	0.049**	−0.114**	0.145**	1
p-Value	0.000	0.000	0.000	0.000	0.000	–
N	63,588	63,588	63,588	63,588	63,588	63,588

Table II.
Results of the correlation analysis of the variables included in the study

Notes: *Coefficients significant at the 0.05 level; **coefficients significant at the 0.01; TC = trade credit in terms of accounts payable; STD = short-term debt; LTD = long-term debt; ROA = return on total assets

firm age on accounts payable is insignificantly negative ($\beta = -0.000$, $p = 0.590$). In accordance with *H6*, the results confirm that the industry has an impact on the trade credit level.

Comparison of the coefficients indicates that the highest coefficient is between STD and accounts payable, followed by LTD and profitability, respectively. Thus, STD followed by LTD and profitability are the most important variables in terms of influencing accounts payable.

The results indicate that the model with six independent variables accounts for 18 per cent of the change in the dependent variable. Other variables, including managerial, contextual and macroeconomic factors, explain the remaining 82 per cent of the variance. The validity tests of the model, including the *F*-statistic and variance inflation factor (VIF), confirm that the complete OLS model is appropriate for hypothesis testing.

According to the Hausman test, presented in Table III, the fixed-effects model is another appropriate method to be implemented. The results of this model are similar to the OLS results regarding most of the relationships between the variables at the 1 per cent significance level. However, the fixed-effects model suggests no significant relationship between STD and accounts payable ($\beta = 0.002$, $p = 0.486$).

With one exception – the association between age and accounts payable is significantly negative – the GMM results are similar to the OLS results, confirming that the variables included in the present study influence the use of trade credit in terms of accounts payable. The validity tests of the GMM system model – i.e. the Wald test and Hansen J test – indicate the robustness of the results.

In Table III, the complete sample is divided into small firms (1-49 employees) and medium-sized firms (50-199 employees). The OLS results for the two SME categories regarding the association between STD, LTD and size and TC are similar to the results for the complete sample. However, the results for the small firms differ from those for the medium-sized firms regarding the relationship between profitability and age and TC. While the relationship between ROA and accounts payable is positive and significant in the group of small firms, the same relationship is positive but insignificant in the medium-sized firms. While the relationship between age and accounts payable is negative in both SME categories, it is insignificant in the group of small firms and significant in the medium-sized firms.

Independent variables	OLS (complete sample)	Fixed-effects (complete sample)	GMM (complete sample)	OLS (small firms)	OLS (medium-sized firms)
STD	0.110**	0.002	0.904**	0.112**	0.057**
p-Value	(0.000)	(0.486)	(0.000)	(0.000)	(0.000)
SE	0.002	0.003	0.005	0.003	0.015
LTD	−0.083**	−0.093**	−0.094**	−0.083**	−0.129**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.003	0.003	0.004	0.003	0.169
ROA	−0.078**	−0.050**	−0.059**	−0.080**	−0.000
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.998)
SE	0.002	0.002	0.001	0.002	0.015
Size (Ln)	0.017**	0.023**	0.016**	0.019**	0.024**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.0008	0.0008	0.0003	0.0002	0.0016
Age (Ln)	−0.000	−0.035	−0.001**	−0.001	−0.016**
p-Value	(0.590)	(0.550)	(0.000)	(0.161)	(0.000)
SE	0.0004	0.0010	0.0000	0.0043	0.0027
Industry	−0.016**		−0.012	−0.161**	−0.007**
p-Value	(0.000)		(0.000)	(0.000)	(0.000)
Standard error	0.0002		0.0041	0.0003	0.0022
Constant	−0.019**	0.006**	0.013**	0.038**	0.099**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.003	0.007	0.000	0.003	0.019
D-W test	0.965			0.646	0.485
VIF	1.75			1.102	1.247
Partmeter	6			6	6
Wald (χ^2)			4,696.37		
p-Value			(0.000)		
$F(\chi^2)$	2,328.13	420.55		2,338.53	66.86
p-Value	(0.000)	(0.000)		(0.000)	(0.000)
N observation	63,588	63,588	63,588	61,505	2,083
Hausman (χ^2)		895.32			
p-Value		(0.000)			
Adjusted R^2	0.180	0.052	0.115	0.185	0.159
Hansen J chi^2 (χ^2)			0.974		
Hansen J (*p*)			0.323		

Notes: *Coefficients significant at the 0.05 level; **coefficients significant at the 0.01 level; STD = short-term debt; LTD = long-term debt; ROA = return on total assets; D-W test = Durbin–Watson statistic; VIF = the variance inflation factor

Table III. Results of the OLS, fixed-effects, and GMM system models for the complete sample, and results of the OLS model for small and medium-sized firms

Table IV shows the results of the OLS analyses for each of the five industry sectors. Most industry-related results correspond to the results for the complete sample, but some interesting differences are evident. In contrast to the result for the complete sample and for the other industry sectors, namely, that the relationship between STD and TC is significant and positive, for the retail and wholesale industries STD is significantly and negatively related to TC. For these two industries, the results are therefore in line with *H1*. Regarding the relationship between LTD and TC, and inconsistent with *H2*, the manufacturing and health-care industries differ from the others: in these two industries, there is a positive association, and in the health-care industry, the association is significant. Finally, the

Independent variables	Retail	Wholesale	Manufacturing	Health care	Construction
STD	−0.066**	−0.124**	0.268**	0.132**	0.315**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.0049	0.0076	0.0039	0.0033	0.0057
LTD	−0.147**	−0.163**	0.004	0.013**	−0.114
p-Value	(0.000)	(0.000)	(0.334)	(0.005)	(0.139)
SE	0.0052	0.0065	0.0046	0.0047	0.0077
ROA	−0.151**	−0.047**	−0.019**	−0.018**	−0.034**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.0049	0.0051	0.0037	0.0020	0.0051
Size (Ln)	0.023**	0.017**	0.010**	0.011**	0.016**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.0005	0.0005	0.0004	0.0004	0.0071
Age (Ln)	−0.021**	−0.017**	−0.001	0.000	−0.006**
p-Value	(0.000)	(0.000)	(0.451)	(0.637)	(0.000)
SE	0.0008	0.0013	0.0019	0.0005	0.0001
Constant	0.030**	0.080**	−0.079**	−0.089**	−0.125**
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SE	0.0051	0.0062	0.0047	0.0037	0.0066
D–W test	0.596	0.535	0.451	0.376	0.499
VIF	1.10	1.13	1.05	1.08	1.12
Parameters	5	5	5	5	5
$F(\chi^2)$	27,010	11,554	11,226	7,174	6,594
p-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N observation	27,016	11,560	11,232	7,180	6,600
Adjusted R^2	0.121	0.110	0.341	0.248	0.422

Table IV.
Summary of the regression model of the relationships between the explanatory variables and dependent variable in various industry sectors

Notes: *Coefficients significant at the 0.05 level; **coefficients significant at the 0.01 level; STD = short-term debt; LTD = long-term debt; ROA = return on total assets

health-care industry differs from all other industries regarding the association between age and TC. The adjusted R^2 for the industry sectors varies between 0.11 and 0.42.

Taken together, the empirical results suggest that trade credit complements other STD and is an alternative to LTD. The results also indicate that profitable SMEs are less likely to use trade credit as a financing instrument than are other SMEs, and that larger SMEs tend to use more trade credit than do smaller ones. Finally, the use of trade credit varies across industry sectors. In particular, while the manufacturing, health care and construction industries seem to use accounts payable as a complement to other STD, the retail and wholesale industries tend to use accounts payable as an alternative to STD. Unlike other industries, the manufacturing and health-care industries seem to use accounts payable as a complement to LTD.

5. Conclusions, limitations, implications and suggestions for further research

This study used panel data, consisting of 63,588 observations over the 2009-2012 period, to investigate firm-level determinants – primarily in terms of short-term debt, long-term debt and profitability – of trade credit demand among 15,897 Swedish SMEs across five industry sectors.

The results regarding the relationship between short-term debt and accounts payable are somewhat mixed. The results of the OLS and GMM system models are similar, indicating

that short-term debt is positively and significantly related to trade credit, while the fixed-effects model results indicate a positive but insignificant relationship between the variables. Taken together, a positive relationship between short-term debt and trade credit is indicated, in contrast to the findings of Deloof and Jegers (1999).

The three statistical models used are consistent, in that they all indicate that long-term debt is negatively related to trade credit. This supports previous findings that SMEs' access to long-term debt is relevant in explaining their use of trade credit (Schwartz, 1974; Danielson and Scott, 2004; Mateut *et al.*, 2006; Niskanen and Niskanen, 2006; Atanasova, 2007; Garcia-Teruel and Martinez-Solano, 2010).

By distinguishing between short- and long-term debt, this study suggests that they influence trade credit demand in different ways. While trade credit seems to complement other short-term debt, it seems to be an alternative to long-term debt. It must be recalled that the empirical data cover the 2009-2012 period, when firms' financing behaviour could have been affected by the recent financial crisis. Accordingly, it is possible that the financing pattern found by Ghosh (2015) concerning India, i.e. that trade credit and bank credit, turned out to be substitutable instead of complementary due to the crisis, may be valid for Sweden as well.

The empirical results also provide evidence that profitability negatively affects firms' use of trade credit in terms of accounts payable, which is in line with previous studies in other contexts (Deloof, 2003; Lazaridis and Tryfonidis, 2006; Garcia-Teruel and Martinez-Solano, 2007; Samiloglu and Demirgunes, 2008; Gill *et al.*, 2010; Vaidya, 2011). Considering this relationship, it seems as though financial constraints force less profitable SMEs to use trade credit as a financing instrument. Based on these results and in agreement with pecking-order theory, the sampled SMEs apparently follow a hierarchy in raising capital, preferentially using internal rather than external financing sources (Petersen and Rajan, 1997).

The present results further indicate that firm size and industry affiliation are significantly linked to trade credit. The observed relationship between firm size and accounts payable is in contrast to the results of several previous studies, but similar to the results reported by Garcia-Teruel and Martinez-Solano (2010). Accordingly, the present study suggests that larger SMEs tend to demand more trade credit than do smaller ones, and also have greater opportunities to sign legally binding agreements with suppliers. The detected industry effect on accounts supports results presented by Ng *et al.* (1999) and Wilson and Summers (2002). Of particular interest is the present finding that while the retail, wholesale and construction industries seem to use trade credit as an alternative to long-term debt, the manufacturing and health-care industries seem to use trade credit as a complement to long-term debt, supporting Psillaki and Eleftheriou's (2015) finding from France, that trade credit can act as a complement to rather than substitute for bank credit. Unlike the results reported by Wilson and Summers (2002), Niskanen and Niskanen (2006) and Gama *et al.* (2010), the present results indicate no relationship between firm age and accounts payable.

Of interest to SME managers and owners is the suggested distinction between short- and long-term debt in terms of their different relationships with trade credit in terms of accounts payable, a finding that merits further research. Also of interest is the finding that SMEs that face high financial constraints are more likely to view trade credit as an attractive financing option even though it is costly (Giannetti *et al.*, 2011), and that less profitable firms should be aware of the implicit costs of such financing (Murfin and Njoroge, 2015). If SMEs, particularly small ones, are forced to rely too much on trade credit to complement other short-term debt or as an alternative to long-term debt, their long-term performance could be jeopardized. A related insight is that SMEs are often linked to financial markets characterized by information asymmetry (Berger and Udell, 2006), which could increase the

demand for trade credit. Firm managers should therefore transparently use trade credit agreements with their suppliers to efficiently manage the costs associated with that financing source (Jain, 2001), and should also consider the commercial advantages of trade credit, such as the possibility of assessing the quality of goods before paying for them (Chung and Liao, 2006).

Like any research, the present study is subject to limitations that could affect suggestions for further research. First, the OLS, fixed-effects and GMM system models do not consistently find that short-term debt is positively and significantly related to trade credit, suggesting that caution is warranted when interpreting the results and that further research is needed. Second, the results were derived from studying five industries, meaning that the industry composition of the panel may not completely replicate the Swedish SME sector as whole. Further research could therefore usefully examine other industry sectors. Third, this study covers only a four-year period (2009-2012). Accordingly, future research could cover longer periods to minimize the time effect as well as the influence of the global financial crisis on trade credit demand. Ghosh (2015) and Psillaki and Eleftheriou (2015) concluded that the financial constraints that firms encounter vary over time, possibly influencing firm managers' decisions to use trade credit. During the crisis, the relationship between trade credit and bank credit differed from the relationship before the crisis. Fourth, as the scope of any study is necessarily limited by data availability, this study has not controlled for managerial factors or macroeconomic factors. For instance, interest rates were extremely low in Sweden during the 2009-2012 period. Future studies could therefore consider such variables.

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About the authors

Darush Yazdanfar is an Associate Professor (PhD) of Business Administration at Mid Sweden University and Centre for Research on Economic Relations. His research interests are corporate finance, the stock market, risk management and entrepreneurial finance.

Peter Öhman is a Professor (PhD) of Business Administration at Mid Sweden University and Centre for Research on Economic Relations. His research interests are accounting, auditing, banking and property. Peter Öhman is the corresponding author and can be contacted at: Peter.Ohman@miun.se