Trade Credit in Times of Crisis: Evidence from European SMEs

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Abstract
This paper investigates the use of trade credit in a sample of small and medium enterprises in Europe, before and after the outbreak of the subprime financial crisis and the sovereign debt crisis (2006-2013). It aims to verify if trade credit is an alternative source of funding compared to other sources of financing. It also tests if firms that grant extended payment terms to their customers tend to demand delayed accounts payable from their suppliers. Results suggest that SMEs with a high probability of insolvency – therefore more likely to have difficult access to financial markets – and high numbers of days of sales outstanding tend to use trade credit more extensively. Distressed and weaker SMEs are less able to match accounts receivable to accounts payable. Finally, our evidence suggests that in the years of financial crises, the substitution hypothesis is weakened and liquidity shocks may be propagated trough trade credit channels.

Keywords*:* trade credit, SMEs, crisis

1. Introduction

The economic role of trade credit has been widely explored in the literature (Lee and Stowe, 1993; Long *et al*., 1993; Deloof and Jegers, 1996; Pike *et al*., 2005) and trade credit may be considered an important source of short-term finance. Turning to trade credit may have financial motivations, as firms tend to substitute trade credit for bank financing when credit from financial institutions is constrained (Petersen and Rajan, 1997; Nilsen, 2002). However, as liquidity dries up trade credit may also complement bank financing, since trade partners are more likely to overcome problems related to moral hazard and information asymmetries (Burkart and Ellingsen, 2004), granting extended payment terms and thus signaling to financial institutions the creditworthiness of firms. Therefore, bank financing and trade credit may be seen either as substitutes or complements. They tend to be substitutes when access to capital markets is difficult; then, firms use more trade credit. They are complements when trade credit – obtained according to the assessment made by the

credit provider with respect to the creditworthiness of the firms – increases the good reputation of creditors and allows them to earn easy access to bank financing.

The relationship between the use of trade credit and the extension of trade credit has also been widely investigated. According to the matching hypothesis (Bastos and Pindado, 2013), when firms increase the supply of trade credit, they tend to demand also more trade credit. However, when firms' access to other financial sources is difficult – e.g. they are credit-constrained – they may reduce their supply of trade receivables *and* increase the use of trade payables. Therefore, the relation between trade credit use and trade credit supply may be mediated by the ability of firms to access other financial sources, or by the efficiency of the financial system.

According to these considerations, during a financial crisis, trade credit is likely to act as a channel of propagation of financial shocks. Indeed, the deterioration of credit access becomes a matter both for highly distressed firms and for those who are not financially distressed. When credit access is difficult, the substitution effect may be amplified, so that the use of trade credit is expected to grow. At the same time, if firms' partners are financially distressed, companies are asked an extension of accounts receivable, resulting in turn into a higher demand for accounts payable (matching effect). Following this interpretation of contagion, one should expect that, in the years of financial crisis, the (positive) relation between financial distress and trade credit use and the (positive) relation between accounts receivable and accounts payable are both enhanced (Bastos and Pindado 2013).

However, if financial shocks reduce the probability of obtaining credit for *all* firms (both financially distressed and not), it may happen that firms are not able to provide trade credit extensions to their customers but, at the same time, the need of payment extensions from their suppliers increases. Therefore the matching hypothesis does not necessarily hold in not-efficient financial markets or periods of financial instability. As in the *redistribution view,* (Love *et al*. 2007) firms in a stronger financial position may be more affected by financial crises and reduce the extension of trade credit to weaker firms due to a credit crunch. Therefore, in times of crises, financially constrained firms may receive fewer payment extensions from their suppliers. This does not support the substitution hypothesis, suggesting that trade credit may be a channel of propagation of liquidity shocks (Love and Zaidi, 2010).

In light of this premise, the aim of the paper is twofold. On the one hand, it investigates the validity of the substitution and matching hypotheses, thus contributing to the existing debate in the literature. On the other hand, it explores how the substitution function works in times of financial crisis.

More specifically, this empirical analysis studies whether SMEs with a higher probability of insolvency, then less access to financial markets, tend to increase accounts payable terms (substitution hypothesis) and if trade credit terms received from suppliers of SMEs match trade credit terms offered to customers (matching hypothesis). The empirical analysis also aims to verify if the relation between trade credit terms received from suppliers and trade credit terms offered to customers may be mediated by the SMEs financial soundness. Finally, the study aims to verify if the probability of insolvency of SMEs impacts differently on the level of accounts payable, in times of crisis, thus mitigating the substitution hypothesis.

To this aim, our empirical analysis is carried out on a sample of European SMEs observed over the time span immediately before and after the outbreak of two financial crises, identified by the subprime crisis (2008) and the sovereign debt crisis (2010-11). The reason for this choice is that trade credit is of particular importance to SMEs, given their greater difficulty in accessing capital markets (Petersen and Rajan, 1997; Berger and Udell, 1998; Fisman and Love, 2003). Moreover, there is not a wide literature on the topic related to European SMEs in crises periods. Therefore, the paper moves from the reference literature and contributes to it studying a peculiar sample of firms over a crucial time horizon.

The estimation is carried out using General Method of Moment (GMM) which allows controlling for possible endogeneity problems, due to unobservable firms' heterogeneity and simultaneity in the relation among key variables.

Our results show that the substitution and the matching hypotheses are confirmed for SMEs, in line with part of the existing literature. At the same time, we find a non-linear relation between accounts receivable and payable in the matching hypothesis, since the impact of receivables on trade payables is smaller for firms with a higher probability of insolvency. Therefore, distressed and weaker SMEs are less able to match receivables to payables, in line with the redistribution view (Love *et al*. 2007). Moreover, in the years of financial crises, the substitution hypothesis is weakened. Indeed, during the economic downturn, the same level of creditworthiness implies a lower extension of accounts payable terms. In the years of the crises, SMEs receive lower payment delays from suppliers, distressed by the systemic credit crunch. Clearly, suppliers, upset by a systemic crisis, may be less likely to grant trade credit to their customers.

The paper is structured as follows. Section 2 gives a brief review of the literature that leads to the research hypotheses. Section 3 illustrates the models and the methodology. Section 4 describes the sample while Section 5 discusses the main results. The last section sets forth brief conclusive assessments and the implications of the studied phenomenon.

2. Literature review and research hypotheses

2.1 Financial function of trade credit and substitution hypothesis

Trade credit is the financing between enterprises, resulting from the granting of deferred payment to the customer by the supplier. The reasons that lead to the use of trade credit are multiple, but can be traced to real and financial functions. The real functions are related to the supply of credit that supports the sales policy. Trade credit is used to strengthen customer relationships, to ensure the quality of products or allow price discrimination; ultimately, it may be a possible answer to the variability in demand and a tool to improve the profitability of companies (Lee and Stowe, 1993; Long *et al*., 1993; Deloof and Jegers, 1996; Pike *et al*., 2005).

From the financial point of view, trade credit may represent a source of funding alternative to bank loans or other sources of financing. Literature weighs on the relevance of the financial reasons, distinguishing transactional and financial components of trade credit. The transactional reasons refer to trade credit as a synchronisation tool between receipts and payments instead of using the money, for a better forecast of cash flow, and treasury management planning, in the case of unexpected payments. Schwartz (1974) and Ferris (1981) claim that the demand and supply of trade credit for transactional reasons explain the short term and very short term components of trade credit, which reduces the transaction costs and the liquidity buffers for precautionary reasons. The payment terms can be extended when the demand for goods decreases and can be reduced when the demand for goods increases, making trade credit a flexible operational tool in uncertain conditions of trade flows of the company. Emery (1987) and Long, Malitz and Ravid (1993) show that the reasons cited also explain the countercyclical trend of trade credit.

The financial reasons are related to the use of trade credit as a useful source of financing determined by the insufficiency and inadequacy of sources of finance from third parties or banks (Duca 1986; Jaffe and Stiglitz 1990; Petersen and Rajan 1997). The importance of financial reasons in intercompany financing is justified by the following factors: the greater availability of trade credit compared to other financing sources; the lower cost of trade credit in comparison to other forms of financing; the higher ductility of trade credit which, on one hand, has no complex contractual formulas and, on the other hand, may have an extended duration with no extra costs.

Many theories have explained the financial use of trade credit, relying on market imperfections such as transaction costs and asymmetric information, leading to adverse selection and moral hazard phenomena (Bastos and Pindado 2007).

Imperfections in the financial markets may determine rationing of credit (Schwartz 1974), which has a greater influence on the financing of opaque or young enterprises (Huyghebaert 2006). Constrained clients increase the demand for trade credit when rationing exists in the bank markets (Biais and Gollier, 1997). Burkart and Ellingsen, 2004 developed a model in which trade credits and bank financing are substitutes for firms with unconstrained access to financial markets and bank funding. These results are confirmed by Gama and Mateus (2010) who find that in general, bank financing and supplier credits may be substitutes.

Supplier credits may be an important financial tool also for internationally active firms, as argued by Engemann *et al*. (2014). They find that trade credits and bank financing are substitutes in a sample of German manufacturing firms for the period 1994-2009.

During a credit crunch, suppliers may be liquidity providers for small and opaque firms and trade credit can be a substitute for bank financing (Biais and Gollier, 1997; Burkart and Ellingsen, 2004; Petersen and Rajan, 1997; Burkart, Ellingsen and Giannetti 2011).

Inaccurate information on the financial system and the presence of underdeveloped financial institutions (Fisman, Love 2003) and also weak legal recovery rules (Carmignani 2004) may determine substitutability or complementarity between trade credit and bank financing. So trade credit may also be a complementary source of funding to bank financing.

Complementarity conditions are noted when non-financial enterprises know how to monitor the creditworthiness of firms and they are able to transfer funds, borrowing from banks and intermediaries and granting deferred payments to firms otherwise rationed for reasons of misinformation (Demirguc, Kunt and Maksimovic 2001). In this case, trade credit can also be a signal, as granting deferred payments can mitigate misinformation that may cause problems for opaque enterprises and decrease credit rationing. Receiving trade credit means receiving trust from suppliers and this improves the visibility and reputation of the companies, making banks more willing to provide loans.

Therefore, a dynamic and complementary relationship between trade credit and bank financing exists and it is also a partial substitution relationship. Small firms rely on trade credit because they are subject to credit rationing - this makes a substitution effect - and, at the same time, trade credit acts as a signal to reveal information to banks about the reliability of firms financed by their suppliers, facilitating access to bank financing.

Substitutability and complementarity between trade credit and bank financing are not mutually exclusive, but they can occur in the same economic and financial system.

2.2 Trade credit in crises periods

Trade credit is predominantly based on long-term relationships and may involve sunk costs (Cuñat 2007). In order to maintain a long market relationship, trade creditors have the interest in keeping their customers in healthy operating conditions and may grant more credit to financially distressed customers than banks do (Wilner 2000). Thus empirical evidence suggests that supplier might be able to help financially constrained firms and to mitigate the negative effect of financial crises. When liquidity in the financial markets is scarce, larger cash-rich firms may provide trade credit to their constrained clients, so financial crises may provide the opportunity to study the role of trade credit as an alternative source of financing in compensating unavailable credit from financial markets.

Literature related to the relief of financial reasons in the use of trade credit in crises periods and related to the existence of a substitution function is not univocal.

Blasio (2005) shows that firms replace bank financing with trade credit, but the magnitude of the substitution effect is modest.

Empirical analysis related to the financial crisis of 1998 in four East Asian countries does not support the hypothesis that trade credit may be a substitute of bank financing in times of crisis. Love and Zaidi (2010) find that, after the crisis, firms constrained by financial markets receive less trade credit and shorter time of repayment and also reduce credit extension to their customers.

Sheng *et al.* (2013) study whether trade credit is used as a substitute for bank financing in crisis periods in Latin America. In their study, the substitution hypothesis cannot be rejected for small firms, but is not confirmed homogeneously for all the firms in different countries. Moreover, they find that big firms tend to use other sources of financing.

Most recent works focus on the period of the 2007-2008 financial crisis, the severe recession that has hit the global economy and has caused contractions in international trade and a general credit crunch.

Coulibaly *et al.* (2011) investigate whether the ability of firms to replace external finance with trade credit enhanced their relative performance during the crisis and also whether the relative inability of export-intensive firms to use trade credit as an alternative source of finance contributed to the decline in sales experienced by these enterprises. Their results indicate that some firms relied more on trade credit from suppliers in order to cope with the decrease in funding opportunities, which allowed them to set better sales. Furthermore, they find that export-intensive firms, with financial vulnerability, resorted less to trade credit as an alternative source of finance, and hence experienced sharper declines in sales than the domestically-oriented firms.

Appendini and Garriga (2013) have focused on the effect of the 2007-2008 financial crisis on trade credit. They find that, after a negative shock to bank financing, trade credit taken by constrained

firms increased. Companies with high pre-crisis liquidity levels increased the trade credit granted to other firms and experienced better performance as compared to ex-ante cash-poor firms. The findings of their work are consistent with firms providing liquidity to their clients when bank financing is scarce. These findings highlight the importance of non-financial firms in offering substitute credit in times of financial stress.

Casei and O'Toole (2014), using euro area firm-level data, test whether bank lending constrained small and medium-sized enterprises are more likely to use alternative sources of financing, including trade credit, during the recent 2007-2008 financial crisis. Their constraint indicators identify both credit-rationed firms and self-rationed firms, that is firms that reject loans on the basis of high costs. Results of the work show that credit-rationed firms are more likely to use trade credit and intercompany credit tends to act as a substitute for bank loans.

Ultimately it is possible to state that the latest works related to the financial crisis of 2007-2008 are unanimous in affirming the validity of the substitution hypothesis.

2.3 Matching hypothesis and contagion effect

Generally, enterprises adopt a combination of accounts receivable and payable that is coherent both in terms of amount as in terms of duration. Small and medium-sized enterprises may be subject to conditions of sale from suppliers that have a larger market share: the offer of trade credit, imposed by the exploitation of the market power of suppliers, may determine the adoption of a balancing strategy, financing the supply of trade credit with trade debt. However, the granting of trade credit exposes the firms to costs and financial risks. Considering the costs, the granting of credit on sales requires the firms to use financial resources on which interest could be earned and this implies an opportunity cost (Nadiri 1969). The granting of trade credit exposes the firms to financial risks because late payments may expose firms to liquidity problems and in some cases to bankruptcy. Then the relative dimension of accounts receivable in the balance sheets of small and medium enterprises is important in terms of the overall management of the company and may be closely related to the incidence of accounts payable.

Ultimately trade credit terms offered to customers should match trade credit terms received from suppliers. During a financial crisis, a trade credit contagion may occur if firms with a high level of accounts receivable defer payments to their suppliers and these, in turn, postpone payments to their suppliers. This cascading effect may give rise to a contagion effect. According to this interpretation of contagion, one should expect that, in the years of financial crisis, the (positive) relation between financial distress and trade credit use and the (positive) relation between accounts receivable and accounts payable are both enhanced (Bastos and Pindado 2013).

However, in a systemic financial crisis, suppliers of financially constrained firms may also suffer negative systemic liquidity shocks. During a financial crisis, the firms that normally have access to financial market may be severely affected by the crisis – more than firms normally financially constrained – and may reduce trade credit granted to customers because they themselves are financially constrained. Therefore, the impact of the financial crisis may be exacerbated and trade credit may also act as a channel of propagation of financial shocks. Indeed the matching hypothesis does not necessarily hold in periods of financial instability, as in the *redistribution view* (Love *et al*. 2007).

The redistribution view (Petersen and Rajan, 1997; Nilsen, 2002) posits that firms with better access to financial markets may redistribute the credit they receive to other firms, granting trade credits. However, during a financial crisis sources from the financial system can be reduced and there may be no credit to distribute through trade credit. So Love *et al*. (2007) expand the traditional setting of the redistribution view and argue that during a financial crisis the credit crunch that affects financial lenders also affects nonfinancial lenders i.e. firms that do not receive credit are not able to redistribute credit. Therefore, during crisis times, the supply chains might amplify the liquidity shocks, (Love and Zaidi, 2010) because firms cut the credit to their customers.

In light of these empirical evidences, it can be argued that during systemic financial crises both substitution and matching hypotheses may be weakened.

2.4 Research hypotheses

Compared to the literature described above, the present work aims to find empirical evidence that supports the substitution and the matching hypotheses and aims to verify if these relations are observable during the latest European financial crises for high-risk SMEs.

The research hypotheses are as follows:

H1. Trade credit terms received from suppliers of SMEs match trade credit terms offered to customers (matching hypothesis).

H2. SMEs with less access to financial markets tend to increase accounts payable terms (substitution hypothesis).

H3. The relation between trade credit terms received from suppliers and trade credit terms offered to customers is non-linear and is mediated by the SMEs financial soundness.

H4. During financial crises, the same level of SMEs creditworthiness implies a lower extension of accounts payable terms.

3. Model and Methodology

In order to verify the research hypotheses, we start from a baseline model (equation 1), where the use of trade credit for each firm (accounts payable, $payab_{it}$) is a function of (*i*) the lagged value of accounts payable ($payab_{it-1}$); (*ii*) the probability of insolvency of the firm (pi_{it}); (iii) accounts receivable ($receiv_{it}$); (iv) a number of firm-specific and country-specific controls (x_{it}), generally recognized as crucial determinants of trade credit by the literature. Then we move from the baseline model to equations (3) and (4), where we consider the interaction between accounts receivable and the probability of insolvency, $receiv_{it}*pi_{it}$ (equation 3) and the interaction between the probability of insolvency (pi_{it}) and a dummy variable which identifies the periods of financial crises (equation 4).

The variables used for the analyses are presented in Table 1.

Insert Table 1 about here

The baseline model (equation 1) is as follows:

$$payab_{it} = \alpha + \beta_1 payab_{it-1} + \beta_2 receiv_{it} + \beta_3 pi_{it} + \gamma' x_{it} + \eta_i + d_c + \lambda_t + \varepsilon_{it} \quad (1)$$

Following the existing literature (e.g. Bastos and Pindado, 2013; Love *et al.,* 2007), $payab_{it}$ is the number of days-to-pay accounts payable. It corresponds to the average number of days of delayed payments, measured by the ratio of total accounts payable to operating revenue, multiplied by 360. Similarly, $receiv_{it}$ is the average number of days of delayed collections of accounts receivable, captured by the ratio of total accounts receivable to operating revenue, multiplied by 360.

Trade credit terms offered to customers should match trade credit terms received from suppliers. If the matching hypothesis is satisfied, we expect to find a positive coefficient β_2, meaning that the higher the extension of trade credit, the higher the use of trade credit.

The dynamic structure of the model implies that firms are not able to adjust their financing structure without delay, due for instance to the presence of adjustment costs (García-Teurel and Solano, 2009). For this reason, the model accounts for the possibility of delays in trade payables management policies ($payab_{it-1}$).

Following Bastos and Pindado (2013), which in turn refer to Pindado, Rodrigues and de La Torre (2008), the credit quality of a firm can be approximated by the predicted probability of financial distress (pi_{it}), based on a year-by-year logistic regression:

$$Prob(Y > 0) = \delta_0 + \delta_1 \frac{ebit_{it}}{ta_{it}} + \delta_1 \frac{debt_{it}}{ta_{it}} + \delta_1 \frac{retearn_{it}}{ta_{it}} + a_i + d_t + \omega_{it} \quad (2)$$

The dependent variable is a dummy equal to one if the leverage of the firm[1] is higher than the third quartile or if earnings before interest taxes, depreciation, and amortization (EBITDA) is below the first quartile. This dummy identifies firms that are financially distressed. Explanatory variables are (*i*) profitability, i.e. earnings before interests and taxation, scaled to total asset ($\frac{ebit_{it}}{ta_{it}}$); (*i*) financial expenses, here approximated by total debt to total assets ($\frac{debt_{it}}{ta_{it}}$) and (*iii*) cumulative profitability, captured by retained earnings to total assets[2].

The predicted probability is used as a proxy for the accessibility to financial markets: the higher the probability of insolvency, the lower the probability of obtaining bank financing. This variable captures the relation between trade credit and other sources of financing. If trade credit is an alternative source of financing and acts as a substitute for other sources of credit, including bank financing, the coefficient β_3 is expected to be positive.

Following Bastos and Pindado (2013), x_{it} is a vector of control variables, including (i) firms' total fixed assets, divided by total assets, as a proxy for the collaterals of the firm (fix_{it}); (ii) firm's net income scaled by total assets, as a proxy for the level of activity of the firm, i.e. asset turnover ($assturn_{it}$); (iii) number of employees, as a proxy for the size, i.e. the bargaining power of the firm ($empl_{it}$). Moreover, we introduce also country-level variables, in order to control for heterogeneous macroeconomic performances and for those factors that affect the trade credit market but that are not due to firms' characteristics: (iv) the growth rate of Gross Domestic Product (GDP, $gdpgr_{it}$); (v) the growth rate of private sector credit flow, measured as the share of country's GDP ($gw\_privcred_{it}$).

The error term includes four components. η_i denotes all the unobservable characteristics of the firms that vary across firms but are assumed constant for each of them. The time dummies λ_t capture the factors affecting all firms simultaneously; d_c are country-specific dummies; ε_{it} is a random disturbance.

Moving from the baseline specification, the baseline model (equation 1) is augmented with the interaction between accounts receivable and the probability of insolvency, $receiv_{it}$*pi_{it}.

$$payab_{it} = \alpha + \beta_1 payab_{it-1} + \beta_2 receiv_{it} + \beta_3 pi_{it} + \beta_4 receiv_{it} * pi_{it} + \gamma' x_{it} + \eta i + d_c + \lambda_t + \varepsilon_{it} \quad (3)$$

The interaction term captures any non-linear effect in the relation between accounts receivable and payable, which may be moderated by the probability of insolvency of the firm. The intuition is simple: the matching hypothesis may not be verified for highly distressed SMEs, since

[1] We approximate firms' leverage by the total assets/equity ratio.
[2] We derive retained earnings using the balance-sheet data of firms.

they may not be able to reduce terms of the supply of trade credit but, at the same time, they may suffer from a reduction of terms of trade credit obtained. In this situation, we should observe an increase in the length of trade credit extensions and a drop in the length of accounts payable. If this hypothesis is confirmed, the coefficient of this variable should be statistically significant and the sign is expected to be negative.

In times of financial crisis, when banks reduce the credit lines and liquidity is scarce, the probability of insolvency rises for all firms. At the same time, firms may not be able to obtain the same trade credit as before the crisis. In the redistribution view (Love *et al*. 2007), this is due to a contraction of trade credit from firms that used to redistribute credit to the constrained ones. In other words, in times of crisis, the same probability of insolvency of SMEs may be associated with a reduction in the length of accounts payable received, and this, in turn, may result in a mitigation of the substitution hypothesis.

In order to test the relation between firms' creditworthiness and accounts payable – the substitution hypothesis – in times of financial crisis, equation (3) is augmented with the interaction between the probability of insolvency (pi_{it}) and a dummy variable which identifies the periods of financial crises ($crisis_t$).

$$payab_{it} = \alpha + \beta_1 payab_{it-1} + \beta_2 receiv_{it} + \beta_3 pi_{it} + \beta_4 receiv_{it} * pi_{it} + \beta_5 pi_{it} * crisis_t + \gamma' x_{it} + \eta_i + \lambda_t + \varepsilon_{it} \quad (4)$$

When financial crises arise, and all firms are credit-constrained, firms that used to supply trade credit to financially constrained ones suffer from negative systemic liquidity shocks, and may reduce trade credit granted to customers. Firms may thus be double-constrained: by financial markets and by their suppliers of trade credit. If this hypothesis is confirmed, then the coefficient of the interaction variable $pi_{it} * crisis_t$ should be significant and have a negative sign.

Taken together, equations (3) and (4) introduce a notion of contagion where the trade credit chain may exacerbate the impact of the financial crisis for credit-constrained firms. Indeed, when pi_{it} is high, firms are less able to match accounts receivable and payable. Since they have less bargaining power, it is likely that they are not able to reduce trade credit terms and/or less able to obtain trade credit extensions. Moreover, in times of crisis, firms risk to be also crunched by their suppliers: for these firms, the substitution hypothesis tends to weaken. Thus, the crisis might have a direct effect on the substitution hypothesis, through the $pi_{it} * crisis_t$ variable, and might have an indirect effect on the matching hypothesis, through the increase in the probability of insolvency of firms.

In order to test the research hypothesis described above, this paper estimates equations (1), (3) and (4) by system Generalized Method of Moments (GMM), as in Blundell and Bond (1998). Indeed, as recognized in the recent literature (Bastos and Pindado 2013; García-Teurel and Solano,

2009), the GMM approach solves the two main problems arising in the study of trade credit, i.e. unobservable heterogeneity and endogeneity. As for the former, unobservable characteristics which concern firms may impact on trade credit, and if correlated to the regressors, they lead to biased estimates. On the other hand, there are several double-causality problems, since firm-specific regressors are likely to be determined by the dependent variable; for instance, firms may define the terms of accounts receivable in accordance with the terms of credit obtained from suppliers. In light of this, system GMM exploits the lags of the independent variables as instruments for the first-differenced model, and the lags of the first-differenced variables as instruments for the levels, simultaneously allowing to control for unobservable heterogeneity and correct the bias due to endogeneity.

4. Sample and data

In order to estimate models (1), (3) and (4), a panel of European firms from the Amadeus Bureau van Dijk dataset has been employed. The focus is on EU28, small and medium, private limited non-financial companies, not quoted and observed over the period 2005-2013, a time span including both the subprime crisis (2008) and the sovereign debt crisis (2010-11).

Before starting the analysis, observations in the extreme 1% tails of the sample distribution have been trimmed, as well as all implausible values on the key variables (negative assets, accounts payable and receivable implying more than one-year commercial credit and debt duration, etc.). Moreover, only the firms with non-missing observations of the key variables for at least five consecutive years have been included.

The final sample consists of 2.378 firms, to the amount of 11.985 observations. The descriptive statistics and the distribution of firms across countries are shown in Tables 2-3.

Insert Tables 2-3 about here

5. Results

The results of the estimation of models (1), (3) and (4) are shown in Table 4.

Starting from the first, baseline specification, the sign of the coefficient of the probability of insolvency supports the substitution hypothesis, as in Bastos and Pindado (2013), meaning that firms that have more difficult access to financial markets obtain more trade credit extension from

their suppliers. In terms of magnitude, when the probability of insolvency grows by 5%, the accounts payable grow by almost one day.

Moreover, the matching hypothesis is verified: the coefficient of $receiv_{it}$ is positive and statistically significant. When the length of the commercial credit grows by 10 days, the length of the trade credit obtained by the firm grows by 1,2 days.

Looking at the control variables, we find that size (*empl*) and asset turnover positively affect the length of trade credit obtained by firms, while countries where the growth rate of private credit is higher show lower lengths of trade credit.

Moving to the second specification (model 3), the coefficient of the interaction variable $receiv_{it} * pi_{it}$ is statistically significant and negative. This non-linear effect of accounts receivable reveals how the matching hypothesis hinges on the financial soundness of the firms. Indeed, the higher the probability of insolvency, the lower the ability of the SMEs to match accounts payable terms to accounts receivable terms. For high levels of pi_{it}, an increase in accounts receivable terms may result into a reduction, rather than a growth, in the length of trade credit obtained by the firm.

The last model (model 4) tests how the substitution hypothesis works in periods of crisis. The coefficient of the interaction variable $pi_{it} * crisis_t$ is statistically significant and has the expected negative sign. This confirms the view that when system liquidity dries up, firms do not necessarily obtain the same trade credit as before the crisis. As already remarked, this is line with the redistribution view (Love *et al*. 2007) of trade credit: trade credit provided by firms with better access to financial markets may reduce in times of crisis, resulting into a mitigation of the substitution hypothesis.

Taken together, these results show that trade credit chains may have amplified the negative liquidity shock brought about by the last financial crises in Europe, that hit harder credit-constrained firms. This mechanism works through a direct effect on the substitution hypothesis – a negative coefficient of the $pi_{it} * crisis_t$ variable – and an indirect effect on the matching hypothesis, since the crisis is likely to increase the probability of insolvency of firms.

Insert Table 4 about here

5.1 Robustness checks

Looking at the distribution of firms across countries, shown in Table 3, it seems that observations are not homogenously distributed within the European area considered in our sample. Indeed, almost 90% of overall observations correspond to Spanish and Italian firms. Though this

circumstance may depend on our focus on small and medium enterprises, however it casts some doubts on the generality of the results of our analysis. For this reason, we have checked whether results have been driven by the peculiar characteristics of firms located in these two specific geographical areas, re-estimating the models (1), (3) and (4) with a subsample which excludes firms from Spain and Italy. As reported in Table 5, the main implications of the analysis are not driven by geography: the sign of the key investigated relationships is confirmed for all the models, meaning that both the substitution and the matching hypothesis hold, and both are mitigated in times of crisis.

Insert Table 5 about here

6. Conclusion

This paper focuses on the relevance of financial motivations in the use of trade credit. Using firm-level data from European SMEs, over the period immediately before and after the outbreak of the financial crises (2006-2013), the study tests the existence of conditions of substitutability between trade credit and other sources of funding. It also aims to verify if trade receivables are positively related to accounts payable - which supports the matching hypothesis (Bastos and Pindado 2013) – and if the matching hypothesis may be verified for small and weak firms in conditions of distress. Finally, the paper tests the relevance of financial motivations in periods of crises. It contributes to understanding the consequences of financial crises on trade credit channel, that may have amplified the negative liquidity shock brought about by the last financial crises in Europe.

Our results show that conditions of substitutability are generally observable. Indeed, a positive and significant relation exists between the probability of insolvency and accounts payable: this result indicates that firms with a greater probability of insolvency tend to rely more on intercompany financing. Small and medium enterprises characterized by weak financial conditions can hardly turn to the financial markets and are therefore more likely to replace funding by third parties with the intercompany credit. In order to maintain their business relationships, trade creditors may grant more credit to financially distressed customers than banks and other lenders do (Wilner 2000).

Our empirical evidence also suggests that trade receivables are positively related to accounts payable. The relationship between trade receivables and trade payables terms is positive and statistically significant, meaning that firms which extend the terms of payment to their customers

also demand extensions in the payment terms to their suppliers, with the aim of matching trade payables to trade receivables.

Our paper does not only provide new evidence of the existence of the matching hypothesis. It also focuses on the persistence of this positive relationship when SME's probability of insolvency rises. Results highlight that the higher the probability of insolvency, the lower the matching effect. Therefore, the financial weakness of firms reduces their ability to compose and strike a balance between accounts receivable and payable. Since suppliers are generally able to effectively and promptly assess the reduction of the creditworthiness, they may be less likely to grant extended payment terms.

Finally, the results related to the relevance of financial motivations in the years of the financial crises show how the substitution hypothesis works in those periods. Since the study includes also non-crises years, this allows to observe the difference – if any – in trade credit behavior of SMEs when the system liquidity drops. Indeed, the significant relationship between the interaction variable $pi_{it} * crisis_t$ and accounts payable terms shows that in economic downturns the substitution function weakens. These results may be considered in line with the redistribution view (Petersen and Rajan 1997; Nilsen 2002) adapted to scenarios of financial crises (Love *et al*. 2007). During a financial crisis, all potential sources of funds reduce and this affects both financial and non-financial lenders. Though the credit crunch is likely to affect firms with better access to financial markets, more than firms already constrained by financial markets, these latter may suffer from a reduction in payment extension since there are fewer funds to redistribute. Ultimately, trade credit provided to SMEs may reduce over the crisis years, resulting into a mitigation of the substitution function of trade credit.

These findings have a clear implication for trade finance policy during financial crises. Specifically, they suggest to support trade credit channels trough timely injections of liquidity to companies, avoiding the double – financial and intercompany – crunch and trying to preserve the weakest part of the economy, i.e. SMEs.

The present work is a preliminary version. The future perspectives of this work will lead to broadening both the sample and the period of observation. Furthermore, there are very different countries in the sample and this may suggest using a control that relates to the credit protection rules in the countries being surveyed.

References

Bastos, R., Pindado, J. 2007, An agency model to explain trade credit policy and empirical evidence, *Applied Economics*, No. 39, 2631–2642.

Bastos, R, Pindado, J. 2013, Trade credit during a financial crisis: A panel data analysis, *Journal of Business Research,* No. 66, 614-620.

Berger, A.N. Udell, G.F. 1998, The Economics of Small Business Finance: The Role of Private Equity and Debt Markets in the Financial Growth Cycle, *Journal of Banking and Finance* No. 22, 613-673.

Biais, B. Gollier, C. 1997, Trade Credit and Credit Rationing, *Review of Financial Studies*, vol. 10, No. 4, 903-937.

Blasio, G. d. 2005, Does Trade Credit Substitute Bank Credit? Evidence from Firm-level Data. *Economic Notes*, Vol. 34, 85–112.

Blundell, R., Bond, S. 1998, Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics*, No. 87, 115–144.

Burkart, M. Ellingsen, T**.** 2004, In-Kind Finance: A Theory of Trade Credit, *American Economic Review*, Vol. 94(3), 569-590.

Burkart, M. Ellingsen, T. Giannetti, M. 2011, What you sell is what you lend? Explaining trade credit contracts, *Review of Financial Studies,* Vol. 24 (4), 1261-1298.

Carmignani, A. 2004, Funzionamento della giustizia civile e struttura finanziaria delle imprese: il ruolo del credito commerciale*,* Banca d'Italia, *Temi di discussione*, No. 497.

Casey, E. O'Toole, C.M. 2014, Bank lending constraints, trade credit and alternative financing during the financial crisis: Evidence from European SMEs, *Journal of Corporate Finance,* No. 27, 173–193.

Coulibaly, B., Sapriza, H. and Zlate, A. 2013, Financial frictions, trade credit, and the 2008–09 global financial crisis, *International Review of Economics & Finance*, No. 26, 25–38.

Cuñat, V. 2007, Trade Credit: Suppliers as Debt Collectors and Insurance Providers, *The Review of Financial Studies,* Vol. 20(2), 491-527.

Deloof, M. Jegers, M. 1996, Trade Credit, Product Quality, and Intragroup Trade: Some European Evidence, *Financial Management*, Vol. *25*(3), 33-43.

Duca, J. 1986, *Trade credit and credit rationing: a theoretical model,* Board of Governors of the Federal Reserve System, Research Papers in Banking and Financial Economics, No. 94.

Emery, G.W. 1987, An optimal financial response to variable Demand*, Journal of Financial and Quantitative Analysis*, Vol. 22, 209-225.

Emery, G.W. 1984, A pure financial explanation for trade credit, *Journal of Financial and Quantitative Analysis*, Vol. 19, 271-285.

Engemann, M. Eck, K. Schnitzer, M. 2014, Trade Credits and Bank Credits in International Trade: Substitutes or Complements?, *The World Economy*.

Ferris, J.S. 1981, A transactions theory of trade credit use*, Quarterly Journal of Economics*, vol. 96, No. 2, 243-270.

Fisman, R.J., Love, I. 2003, Trade Credit, Financial Intermediary Development and Industry Growth. *Journal of Finance*, No. *58*(1), 353-374.

Gama, A.P.M., Mateus, C. 2010, Does Trade Credit Facilitate Access to Bank Finance? An Empirical Evidence from Portuguese and Spanish Small and Medium Size Enterprises, *International Research Journal of Finance and Economics*, No. 45, 26-45.

Garcia-Appendini, E. Montoriol-Garriga, J. 2013, Firms as liquidity providers: Evidence from the 2007–2008 financial crisis, *Journal of Financial Economics*, No.109, 272–291.

Huyghebaert, N. 2006, On the Determinants and Dynamics of Trade Credit: Empirical Evidence from Business Start-ups, *Journal of Business Finance & Accounting*, Vol. 33, 305-328.

Jaffe, D.M. Stiglitz, J.E. 1990, *Credit rationing*, in Friedman B.M. e Hahn F.H., (Ed.), *Handbook of Monetary Economics*, Amsterdam, North Holland.

Lee, Y.W. Stowe, J.D. 1993, Product risk, asymmetric information, and trade credit*, Journal of Financial and Quantitative Analysis*, Vol. 28, No. 2, 88-96.

Long, M.S. Malitz, I.B. Ravid, S.A. 1993, Trade Credit, Quality guarantees, and Product Marketability, *Financial Management*, Vol. 22, No. 4, 117-127.

Love, I., Preve, L. A. Sarria-Allende, V. 2007, Trade credit and bank credit: evidence from recent financial crises, *Journal of Financial Economics*, No. 83, 453–69.

Love, I. Zaidi, R. 2010, Trade Credit, Bank Credit and Financial Crisis, *International Review of Finance*, No. 10, 125–147.

Mian, S.L. Smith, C.W. 1992, Accounts receivable policy management: theory and evidence, *Journal of Finance*, vol. 47, 169-200.

Nadiri, M.I. 1969, The determinants of trade credit in the US total manufacturing sector, *Econometrica,* No.37(3), 408–423.

Nilsen, J. 2002, Trade credit and the bank lending channel. *Journal of Money, Credit, and Banking*, No. 34, 226–253.

Petersen, M.A. Rajan, R.G. 1997, Trade credit: theories and evidence, *The Review of Financial Studies*, Vol. 10, 661–691.

Pike R., Nam Sang Cheng, Cravens K. 2005, Trade Credit Terms: Asymmetric Information and Price Discrimination Evidence From Three Continents, *Journal of Business Finance & Accounting*, Vol. 32, 1197-1236.

Pindado, J., Rodrigues, L., de La Torre, C. 2008, Estimating financial distress likelihood, *Journal of Business Research*, No. 61, 995–1003.

Schwartz, R.A. 1974, An economic model of trade credit, *Journal of Financial and Quantitative Analysis*, Vol. 9, 643-657.

Sheng, H. H., Bortoluzzo, A. B., Santos, G. A. P. dos 2013, Impact of trade credit on firm inventory investment during financial crises: evidence from Latin America. *Emerging Market Finance & Trade*, Vol. 49(Suppl. 4), 35-55.

Wilner, B.S. 2000, The exploitation of relationships in financial distress: the case of trade credit, *Journal of Finance,* Vol. 55(1), 153-178.

Appendix

Table 1 : Regression Variables

payab	ratio of total accounts payable to operating revenue, multiplied by 360
$payab_{t-1}$	lagged value of accounts payable (*payab*)
receiv	ratio of total accounts receivable to operating revenue, multiplied by 360
pi	probability of financial distress, based on a year-by-year logistic regression
*pi*crisis*	interaction between the probability of insolvency (pi_{it}) and a dummy variable which identifies the periods of financial crises ($crisis_t$)
*receiv*pi*	interaction between accounts receivable and the probability of insolvency
empl	number of employees
fix	firms' total fixed assets, divided by total assets
assturn	net income scaled by total assets
gw_privcred	growth rate of private sector credit flow, measured as share of country's Gross Domestic Product
gdpgr	the growth rate of Gross Domestic Product

Tables 2 – Descriptive statistics

statistics	**payb**	**receiv**	**tot assets**	**fix**	**empl**	**assturn**	**pi**
N	14,856	14,856	14,856	14,856	14,856	14,856	14,856
mean	63.61	93.33	4629.08	0.36	32.92	0.03	0.43
sd	39.031	58.565	3936.576	0.228	34.952	0.047	0.297
min	0.8933	0.5194	178.8260	0.0049	1	-0.1708	0.0000
max	254.8733	295.3306	25103.3600	0.9695	249	0.3229	0.9998

Table 3 – Distribution of firms across countries

Code	**Country**	**Firms**	**Observations**
BE	Belgium	2	11
BG	Bulgaria	22	134
CZ	Czech Republic	54	360
DE	Germany	16	96
EE	Estonia	15	82
ES	Spain	669	3759
FI	Finland	31	214
FR	France	115	714
UK	United Kingdom	65	399
EL	Greece	2	13
HR	Republic of Croatia	9	61
HU	Hungary	8	48
IE	Ireland	4	27
IT	Italy	1047	6934
PL	Poland	56	337
PT	Portugal	107	666
SE	Sweden	10	70
SI	Republic of Slovenia	106	659
SK	Slovak Republic	40	272

Table 4: Estimation results

	(1)			(3)			(4)		
Dependent: payb	**Coef.**	**Stand.error**	**P>z**	**Coef.**	**Stand.error**	**P>z**	**Coef.**	**Stand.error**	**P>z**
constant	-10.57	11.206	0.346	-18.53	12.328	0.133	-24.38	9.685	0.012
payb_t-1	0.49	0.093	0.000	0.56	0.092	0.000	0.59	0.091	0.000
receiv	0.12	0.058	0.038	0.23	0.082	0.006	0.20	0.074	0.006
pi	18.87	9.830	0.055	37.04	19.742	0.061	51.15	14.819	0.001
*pi*crisis*							-8.35	3.033	0.006
*receiv*pi*				-0.25	0.149	0.089	-0.29	0.130	0.025
empl	0.01	0.049	0.809	0.02	0.045	0.728	0.02	0.044	0.587
fix	1.38	8.785	0.875	1.37	8.443	0.871	-0.24	8.027	0.976
assturn	159.95	61.282	0.009	118.76	56.865	0.037	124.23	57.728	0.031
gw_privcred	-0.03	0.085	0.713	-0.08	0.089	0.360	-0.08	0.088	0.337
gdpgr	-0.47	0.214	0.029	-0.37	0.202	0.065	-0.29	0.203	0.149
time dummies		yes			yes			yes	
country dummies		yes			yes			yes	
Hansen	39.18 (p-value= 0.595)			42.23 (p-value=0.804)			38.58 (p-value = 0.955)		
n.instruments	75			85			90		
observations	11,985			11,985			11,985		

Table 5: Robustness checks

	(1)			(3)			(4)		
Dependent: payb	**Coef.**	**Stand.error**	**P>z**	**Coef.**	**Stand.error**	**P>z**	**Coef.**	**Stand.error**	**P>z**
constant	-13.14	11.935	0.271	0.95	15.027	0.950	-15.26	18.958	0.421
payb_t-1	0.26	0.140	0.065	0.25	0.137	0.067	0.30	0.110	0.007
receiv	0.14	0.068	0.039	0.30	0.118	0.010	0.41	0.173	0.017
pi	33.41	13.627	0.014	34.88	17.379	0.045	53.15	18.622	0.004
*pi*crisis*							-13.07	7.735	0.091
*receiv*pi*				-0.36	0.205	0.082	-0.48	0.272	0.078
empl	0.05	0.063	0.410	-0.08	0.050	0.106	-0.13	0.055	0.015
fix	22.07	19.419	0.256	17.26	18.459	0.350	25.78	20.142	0.200
assturn	100.33	52.683	0.057	17.41	56.377	0.757	60.24	65.995	0.361
gw_privcred	0.05	0.076	0.489	0.10	0.077	0.174	0.10	0.080	0.211
gdpgr	-0.35	0.189	0.062	-0.21	0.201	0.307	-0.19	0.212	0.364
time dummies		yes			yes			yes	
country dummies		yes			yes			yes	
Hansen	36.11 (p-value = 0.688)			55.13 (p-value = 0.619)			29.75 (p-value = 0.922)		
n.instruments	72			91			75		
observations	3,189			3,189			3,189		

Models (1), (3) and (4) are estimated with a subsample of firms, obtained excluding Italy and Spain from the analysis