The financial and operational impacts of European SMEs' use of trade credit as a substitute for bank credit

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Abstract

We study the impacts of the use of trade credit on SME financial performance and operational distress in a sample of 74,036 SMEs across 19 EU countries between 2006 to 2015. Under the premise that trade credit acts as a substitute for bank credit, our results show that supplying trade credit improves profitability, but we show little evidence that such an investment is more profitable for bank credit richer SMEs, although such firms did redistribute more bank fund through trade credit to their customers. For receivers, we show that the use of trade credit finance alleviates operational distress, especially for those SMEs facing liquidity constraints, such as those which have less access to bank credit or under credit tightened periods. This distress reduction effect is also reflected in their profitability indicators. However, the longer the average collection period and credit period, the less effective the trade credit effects respectively on improving SME profitability and reducing operational distress.

Keywords: Trade credit, Bank lending, Credit constraints, SME profitability, SME distress, European Union

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1: Introduction

Small and Medium-sized Enterprise (SME) sector makes a great contribution to economy. In the EU for example, there were 23.9 million SMEs in 2016, accounted for 99.8% of all enterprises, and provided over 93 million jobs (66.6% of total employees) and €4,030 billion (56.8%) of value added (European Commission 2017). During the Financial Crisis, around 200,000 EU SMEs shut down, resulted in approximately 5 million job losses, catastrophically damaging the economic stability. Of the decisive roles played by SME sectors, EU's economic success and financial stability depend crucially on their growth and performance.

Literature focusing on the development of SME sector has shown that financing is a crucial determinant of SME development, and financing obstacle has been identified as one of the most serious problems for EU SMEs (source: Survey of the Access to Finance of Enterprises, 2009-2016). Evidence has also shown that improved access to finance of SME sector is a key to achieving business success (Ayyagari et al. 2011) and employment growth (Campello and Larrain 2016). In the EU, smaller firms contribute on a larger scale towards job creation than do larger firms, underlining the importance of SMEs to EU's economic prosperity (de Wit and de Kok 2014).

In this respect, and since EU SMEs do not have a strong access to other financial instruments other than bank credit and trade credit (Palacin-Sanchez et al. 2018), empirical studies have attempted to tackle on SME credit constraints. For example, from the banking market perspective, in terms of bank size (Jackson and Tomas 1995), bank market power (Love and Peria 2015; Wang et al. 2020), although results are mixed and debates still continue.

EU SME bank credit supply significantly reduced during the recent Financial Crisis, and small bank loans (<€1m) declined by an average of around 47% (European Commission 2014). Compared to larger enterprises, SMEs are more vulnerable to financing constraints during a shortage in bank credit supply because they are generally more informationally opaque,

less capable of providing collaterals and lack of observable signals for credibility. Hence, SMEs are found to rely substantially on trade credit finance, making trade credit a widely used financial instrument in the EU. The total volume of trade credit is three times as high as bank credit in the US (Barrot 2016), around 18% (34%) of the total (current) assets of our European SME sample and two times as the total short-term bank credit over 2006 - 2015. Therefore, a deep study on the impact of trade credit use as an alternative to bank financing to SMEs has become increasingly essential.

Trade credit (i.e. accounts payable) is an arrangement[1] to purchase goods and services on account without making immediate payments and this arrangement puts less pressure on cashflow that immediate payment would make (ACCA 2019). As one of the few types of short-term finance available to SMEs, trade credit reduces the capital requirement of a business. Meanwhile, trade credit investment (i.e. accounts receivable) represents the credit to be received later by a firm from its customers and therefore, trade credit supplier SMEs act as a financial intermediary by providing liquidity to economic agents, making up imperfections in a lending market characterised by financial frictions. However, the implicit interest cost of trade credit is generally higher than that of bank credit, although a discount usually applies to bulk and early payments. Because of the high volume of trade credit usage in the EU as a financing instrument, recent studies have started pondering the relations between trade credit and bank credit. Existing studies, e.g. Ogawa et al. (2013) and Yang (2011), have documented that trade credit is a useful alternative to bank credit whereby it offers a buffer for SMEs that are more financially constrained, but less is focused on its financial and operational impacts for both SME trade credit receivers and suppliers.

This paper, as the first cross-country empirical study, extends existing literature by documenting the economic effects of both the use and supply of trade credit on SME

[1] For a review of trade credit policy contract structure, please see Bazzana et al. (2019).

performance, especially for those SMEs that have less access to bank credit and under the conditions of tightened bank credit supply. This study makes contributions to the existing literature in several ways. Under the premise that trade credit acts as a substitute for bank credit, *first*, we examine, for the first time in a cross-country European sample, the impacts of trade credit on both receivers and suppliers, allowing us to examine several economy-wide factors that could potentially alter SMEs' financing pattern and the volume of bank credit supply. *Second*, in response to Martinez-Sola and Garcia-Teruel (2014)'s call, we extend their study by examining the trade credit investment - profitability nexus for SMEs during a period of economic downturn, rather than an economic expansion. *Third*, prior literature has shown that trade credit financing instrument is a strong alternative to short-term bank credit. We extend this stream of literature by showing for the first time that such an alternative financing channel can significantly reduce operational distress, especially for financially constrained firms. Moreover, we contribute to the knowledge on the moderating effects of timing management on both suppliers and receivers. *Finally*, our unique cross-country panel-structured data consists of a richer number of observations and industry coverage than many other empirical studies (e.g. Martinez-Sola et al. 2013; Love et al. 2007) and allows us to control for banking market factors, e.g. banking market competition, therefore enhancing the external validity of the results.

An EU sample[2] composed of 79,036 SMEs over the period of 2006 - 2015 is used for our empirical analysis on the impacts of trade credit investment on SME suppliers' profitability and trade credit finance on SME receivers' operational distress. Our cross-country panel nature of the data allows sufficient flexibility in choosing empirical methodologies. We choose specific empirical approach in terms of model specifications and estimators individually for

[2] Our sample includes the following countries: Austria, Cyprus, Germany, Denmark, Estonia, Spain, France, UK, Greece, Croatia, Hungary, Ireland, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, and Slovenia. Iceland as a non-EU state is included along with the other 19 EU members in our sample. However Icelandic SMEs contribute only 0.17% to our sample's observations and we decided to keep the sample to provide a full picture of SME trade credit in European countries.

each of the research questions, and the main approach is established on panel data fixed-effect estimations. To test the moderating effects proposed in this study, we include both interaction term and grouping techniques to assure result validity.

The principal findings of the study are that, SMEs that had less access to bank credit relied more on trade credit and vice versa, supporting the 'Substitution Hypothesis'. In contrast, SMEs that had a greater capability of accessing bank credit, used less trade credit but redistributed more credit to their customers. Our main research hypotheses are built based on the premise of the trade credit - bank credit substitution nexus, and the fact that EU SMEs relied heavily on trade credit during our sample period. Accounts receivable investment represented 25.7% of the total assets of our sample SMEs. Therefore, we first examine the motives of SMEs supplying trade credit to their customers. We show that trade credit investment improved supplier firms' profitability, supporting the view that such an investment may stimulate market demand, sustain customer relations, and generate direct gain through credit terms. This finding is consistent with a single country study by Martinez-Sola et al. (2014) in Spain. However, in addition to that we adopt a significantly larger sample, our study is different from them in the research background, where ours is during the period of economic recession or economic stagnation, but their study focuses on a period of economic expansion[3]. Moreover, we find little evidence that trade credit investment was more profitable for bank credit rich SMEs or those who had a greater demand variability.

We also identify a beneficial effect of using trade credit for the receivers in terms of alleviating their operational distress, especially for those SMEs who faced liquidity constraints, such as those which were financially constrained by limited access to bank credit, or under credit tightened periods. This distress reduction effect is also reflected in SME profitability

[3] Martinez-Sola et al. (2014) have called for a study on trade credit investment effects in a period of economic downturn. We hope our focus on trade credit investment can answer their question and can be a supplement to their study.

measures (e.g. ROA). Advancing existing literature on the importance of trade credit finance as an alternative to bank credit for SMEs (e.g. Casey and O'Toole 2014; Garcia-Appendini and Montoriol-Garriga 2013), our study documents that this alternative financing instrument can alleviate SME business distress, especially for those facing liquidity constraints, although the length of credit period offsets the effect. In addition, this paper also deepens our understanding on the benefits of using trade credit on growth management (Ferrando and Mulier 2013) and mitigating financial constraints (Agostino and Trivieri 2019). Moreover, we show that the longer the average collection period and credit period, the weaker the beneficial effects of trade credit on improving profitability and reducing operational distress. Our empirical findings have survived a large variety of robustness checks, e.g. variable substitution, different model specifications and estimators. They are also robust to several econometric concerns, such as reverse causality and country and industry-level heterogenous trade credit practices.

The rest of the paper is structured as follows. Section 2 proposes the hypotheses. Section 3 introduces the research data and sample and depicts the facts of EU SME financing. Section 4 describes the research methodologies and presents the findings on the testing of research hypotheses. Section 5 summarises and discusses the research implications.

2: Literature and Hypotheses

2.1: Literature background

Trade credit is a convenient tool which can be used by most businesses, for supplies of goods and services (ACCA 2019). The agreement between lenders and borrowers can be easy to organise and maintain, although the implicit interest cost of trade credit is generally higher than that of bank credit[4], and failure to comply with the agreement could lead to even higher costs

[4] Casey and O'Toole (2014) argue that trade credit is not necessarily more costly than bank credit for European SMEs during credit supply constrained periods (e.g. in the aftermath of Financial Crisis). Marotta (2005) supports this view in an Italian sample.

and loss of business partners. Literature has concluded two main categories of the existence and use of trade credit as 'business aspect' and 'financial aspect' (e.g. Psillaki and Eleftberiou 2015). The 'business' view sees trade credit as a way to 1) reduce transaction costs (Summers and Wilson 2002) and enable credit rich suppliers to finance customers (Fabbri and Klapper 2008), 2) execute price discrimination because different credit periods granted practically differ the nominal prices to customers (Marotta 2005) and 3) offer implicit quality guarantees, especially for firms or products that are new to the market (Emery and Nayar 1998). In addition, financially constrained firms also use trade credit to improve their credibility for bank credit access (Yang 2011). The 'financial' view suggests that trade credit suppliers may have advantages in comparison with bank lenders in terms of 1) credit risk assessment (Jain 2001), 2) perceived customer default probability (Cunat 2007) and 3) rescuing values on repossessions in an event of payment default (Longhofer and Santos 2003).

With the unique features of trade credit in comparison with bank credit, literature has been focusing extensively on the relation between them, where two hypotheses are mostly used to explain the relation. The Substitution Hypothesis proposes that trade credit is a substitute for bank credit, especially when a firm has less capability in accessing bank credit, or when the bank lending is tightened or costly (Carbo-Valverde et al. 2016). In contrast, the Complementarity Hypothesis suggests that firms use both trade credit and bank credit as financial instruments (Palacin-Sanchez et al. 2018). The results of examinations on these two hypotheses vary immensely across studies. For some EU examples, Casey and O'Toole (2014) and Palacin-Sanchez et al. (2018) back the substitution hypothesis; whilst Norden et al. (2019) and Andrieu et al. (2018) provide supporting evidence to the complementarity hypothesis. There has also been evidence showing that the use of trade credit in terms of trade credit practices and common payment terms could be very diverse across different institutional specificities, such as financial systmems (Marotta 2005; Cassia and Vismara 2009).

As literature has evidenced that both Substitution and Complementarity hypotheses can be factual, we are not committed to re-examining which hypothesis dominates, but to purely providing a background for latter development of the key hypotheses and to examine which one of the following competing hypotheses below would have a better fit for our European SME sample.

Research background hypothesis H1a (Substitution Hypothesis): Trade credit acts as a substitute for bank credit for SMEs.

Research background hypothesis H1b (Complementarity Hypothesis): Trade credit acts as a complement to bank credit for SMEs.

Our empirical results (Section 4.1) show that trade credit finance is a substitute for bank credit in this sample. However, who extend trade credit? Do SMEs extend more trade credit if they are more liquid?[5] Petersen and Rajan (1997) and Nilsen (2002) propose a redistributional role of trade credit, by which firms with better access to capital market would redistribute the credit to customers that are financially weaker. Hence, trade credit suppliers act as financial intermediaries and channel short-term fund from upstream capital market to downstream customers, smoothing financial frictions. Love et al. (2007) have shown that SMEs, that are more financially vulnerable to credit crunch, extend less trade credit to their customers. Such a decline is driven by the reduction in economic-level credit supply and a more developed banking market, which presumably supply more bank credit, stimulate the redistribution of bank credit via trade credit (Deloof and Rocca 2015). Based on U.S. data, Petersen and Rajan (1997) show that a firm's external finance capability is positively related to the amount of trade credit extended (invested). Because SMEs generally do not have a strong access to capital

[5] We do not have access to trade credit agreement data and/or relationships between trade credit suppliers and receivers. We acknowledge that trade credit supplied to sample receivers can come largely from out-of-sample firms in this instance.

market and money market, the upstream funds could be provided in the kind of bank lending. Therefore, to provide relevant information for latter research questions in our European sample, we test:

Research background hypothesis H1c (Bank Credit Redistribution Hypothesis): SMEs that have a greater capability of accessing to bank credit extend more trade credit.

2.2: Trade credit investment and SME performance

In examining the above background hypotheses, we show, in Section 4.1, that trade credit finance is a substitute for bank credit in this sample (H1a) and 'bank credit richer' SMEs redistribute bank credit through trade credit to their customers (H1c). In addition, it has shown that accounts receivable investment represented more than a quarter of the total assets of European SMEs (Garcia-Teruel and Martinez-Solano 2010), e.g. around 25.7% of total assets in our sample. We therefore ponder the incentives of SMEs in extending trade credit as a substitute for bank credit.

Investing in accounts receivable could help supplier firms either indirectly improve business prospects or generate direct income over their credit constrained customers who need trade credit as an alternative financing tool for bank credit (Emery 1984). The theoretical foundation of the relation between trade credit investment (i.e. accounts receivable) and SME profitability can be established on trade credit theories that are developed from transactional (operational), financing and commercial views.

The transactional motives suggest that the existence of trade credit decreases transaction costs of making payments on delivery (Ferris 1981). That is, firms can improve their operational efficiency by economising on transaction costs of economic exchanges using trade credit (Dary and James Jr. 2019; Emery 1984). In addition, firms may invest in trade credit to adapt variable demands and reduce inventory cost by stimulating demand during economic stagnation or

periods of low demand (Ferris 1981), which all in turn would benefit firm profitability and sustain strong business position (Wilner 2000). According to the financing motives, trade credit suppliers acting as financial intermediaries mobilising short-term liquidity to customers may enjoy financial gains that come from implicit rate of return of trade credit terms (Emery 1984). It is common that trade credit arrangements offer early payment discount; however, the implicit annual rate could be very high (e.g. 40%, Ng et al. 1999) if discount is not executed. Therefore, firms with excessive liquidity or in a better position to redistribute cheap bank finance can better appreciate the rate of return on their idle liquidity, and it also alleviates customer firms' financing constraints during the periods with tight monetary policy (Dary and James Jr. 2019). Finally, from a commercial perspective, trade credit investment improves supplier firm's long-term prosperity as it attracts new customers and establishes and maintains healthy commercial relations with customers, therefore stimulating market demand (Wilner 2000; Cheng and Pike 2003). From the views of marketability, the 'quality guarantee hypothesis' (Emery and Nayar 1998) proposes that trade credit agreement provides a guarantee to customers that enables them to verify quality of goods before making a payment. This marketing tool could be more useful for small firms with less market share, as granting trade credit may be not only an investment, but a necessity (Martinez-Sola et al. 2014). Cunat (2007) notes that trade credit suppliers also act as liquidity providers, insuring against liquidity shocks when bank credit is hard to access, and such liquidity shocks could endanger the survival of their customer relations where such customers could be their crucial business partners. Petersen and Rajan (1997) find that many trade credit suppliers have a stake in the performance of their customer firms, incentivising them to back up their customers during bank credit tightening period for the suppliers' own good by extending trade credit as a substitute for bank credit (H1a).

These three perspectives are not mutually exclusive from each other at a firm's management level. In addition to the aforesaid benefits and gains of investing in accounts

receivable, trade credit suppliers acting as financial intermediaries also take less credit risk than bank lenders. The reasons behind the built-in advantages are that, first, in an event of trade credit payment default, the products value more to the trade credit suppliers than to the banks, since trade credit suppliers operate in a relevant business area to customers (Longhofer and Santos 2003). However, this does not apply to standardised products of which a reference price can be easily set, or products that cannot be repossessed. Second, the default rate of trade credit receivers (e.g. customers) is lower to trade credit suppliers than to banks because customers are less likely to strategically default since the trade credit suppliers are more vital for their businesses due to the lack of alternative producers and soft information possessed (Cunat 2007). Third, trade credit suppliers may have access to better information than banks do in regards to the credibility and default likelihood of customers (Jain 2001). Such an information advantage exists because trade credit suppliers and their business clients operate in closely related business areas, and hence the problem of information asymmetries is mitigated. Trade credit also results in less monitoring and screening costs especially for those informationally opaque borrowers from a bank's perspective, leading to an increase in sales, high financial revenue (e.g. market power) and eventually profitability for trade credit suppliers. This effect could be even stronger in economies where banks are not keen to invest in soft information acquisition and to build lending relationships with SMEs (e.g. Information-based Hypothesis, see Love and Peria 2015; Han et al. 2017). Last, the opportunity cost of funding customers for trade credit suppliers could be less than that for banks, because trade credit suppliers may increase their profits by providing additional sales on credit for those customers who are more financially constrained by bank credit and rely more on trade credit finance (H1a). Additionally, compared with banks, trade credit suppliers' prospects are more related to their customers' performance (Giannetti et al. 2011).

While there are benefits of investing in trade credit and suppliers are likely to face less credit risk than bank lenders, undertaking such an investment is certainly not costless. Suppliers are still exposed to financial risks such as borrower default, late payment and systematic risks, which may damage their business performance. There are also administrative costs in extending trade credit, such as monitoring, enforcement, and management costs (Dary and James Jr. 2019), as well as transaction costs for converting accounts receivables into cash (Martinez-Sola et al. 2014). Furthermore, holding accounts receivables on the balance sheet instead of cash sale implies opportunity cost. That is, suppliers may have less funds available for promising investments if their customers delay payment (Martinez-Sola et al. 2014). Therefore, there should be an optimal trade credit policy that maximises business performance. In our study, we assume that supplier firms have taken considerations of the costs associated in deciding the level of such an investment, although some firms, e.g. those who have less bargaining power, could be forced to extend to a point that exceeds the optimal level (the Quality Guarantees view, Emery and Nayar 1998).

There have been studies on the relation between trade credit policy and firm profitability, such as Deloof (2003), Banos-Caballero et al. (2012), Pais and Gama (2015), and Tauringana and Afrifa (2013). These studies, for instance, do not have a sheer focus on trade credit investment, but accounts receivable time management and cash conversion cycle, instead. Empirical studies on the direct relation between trade credit investment and SME performance are limited, although plenty of attention has been paid to listed and / or large enterprises, such as Abuhommous (2017) for listed Jordanian firms; Aktas et al. (2012) for large US enterprises; and Hill et al. (2012) for listed US firms. To our knowledge, only three studies are close to ours. Both Dary and James Jr. (2019) and Martinez-Sola et al. (2014) have found a positive effect of trade credit investment on firm profitability; but their studies only focus on a specific industry (i.e. agro-food) or a single country (i.e. Spain). Using a sample of over 600,000 euro area firms

that are mainly SMEs, Ferrando and Mulier (2013) show that accounts receivable investment helps to alleviate imperfections in the product market, and they evidence that firms use the trade credit channel to manage growth. To this end, we test the following hypothesis:

H2a: Extending trade credit would improve the profitability of SME suppliers.

If H2a is valid, we expect to explore if the effect could vary over firm and macroeconomic characteristics. Variable and unstable demand for products and services may increase a firm's operating and inventory management costs. When the demand fluctuations are predictable, firms always plan to adjust production in advance; but when such fluctuations are less predictable, an immediate response by altering selling price or varying production to match demand could be costly. Therefore, these firms, which face variable market demand, have an operational motive to use accounts receivables to mitigate uncertainty caused by demand fluctuations, which in turn stimulate sales by relaxing or tightening trade credit terms to adapt variable demands (Emery 1987). Therefore, SMEs with variable demands[6] may benefit more from trade credit investment. Hence, we propose and test the following hypothesis.

H2b: The favourable effect of trade credit investment is stronger for SME suppliers with greater sales volatility (greater demand variability).

In comparison with large enterprises, SMEs generally have more difficulties in obtaining cheap bank credit because[7] 1) they are more informationally opaque, 2) they are less capable of providing collaterals as guaranties to banks and 3) banks' lending activities to SMEs involve higher credit risk, known as Moral Hazard problem (Holmstrom and Tirole 1998). Therefore, SMEs are more vulnerable to financing constraints during a shortage of bank credit supply,

[6] However, our data cannot indicate if the demand variation is predictable or not by managers.
[7] Please see Wang et al. (2020) for a discussion on the intrinsic bank financing constraints of SMEs.

such as in economic downturns. Ruckes (2004) shows that because the default probability of borrowers increases when economic outlook worsens, the proportion of creditworthy firms is likely to reduce, banks becoming less attractive to compete over price[8] and therefore, general lending standards are tightened. In such a case, firms with less capability of bank credit access (e.g. small businesses) are more financially constrained, as Demiroglu et al. (2012) have shown that the effect of tightened lending standards is associated with a higher margin of decline in private firms' bank financing ratio compared with public firms. Hence, financially constrained firms (e.g. small businesses) may have to rely more on trade credit as a substitute for bank credit, thus boosting demand. Moreover, as it is tested in this sample, trade credit acts more likely as a substitute for bank credit (H1a), and bank credit rich firms redistribute funds to their customers (H1c). Owing to an overall bank credit deficiency in a worsen economy, if businesses supply trade credit to their financially and liquidity constrained customers, supplier firms may not only gain directly from trade credit terms, but also encourage sales and achieve greater market share (Kestens et al. 2012). This leads to the following hypothesis:

H2c: SME suppliers can better improve their profitability through trade credit investment during economic downturns.

We show in our baseline hypotheses testing that in this sample, trade credit is a substitute for bank credit, and SMEs that have a greater capability of accessing to bank credit extend more trade credit. Thus, financially unconstrained supplier firms act as financial intermediaries channelling and mobilising funds in the form of trade credit, from upstream bank creditors to downstream 'constrained' customers (H1a and H1c, e.g. Carbo-Valverde et al. 2016; Nilsen 2002). This financing channel facilitates the growth of their customers. In return, for those who

[8] In contrast, in sound economic conditions, the likelihood of firms' default rates fall, banks' costly screening and monitoring process become less marginally beneficial and thus, competition on price becomes fiercer.

are able to redistribute more, this channel may better enhance supplier firms' sales and reinforces business relationships between them (Wilner 2000). Moreover, suppliers mobilising bank credit to grant short-term trade credit finance to their customers may also gain from the difference between the implicit rate of trade credit investment return and bank financing cost. Such a difference could be greater for supplier firms that have more bank credit access as it would be an indication of strong bank financing position (e.g. cheaper cost), therefore letting them become more profitable from trade credit investment. To these arguments, we test:

H2d: The favourable effect of trade credit investment is stronger for SME suppliers that have a better access to bank credit.

Granting trade credit comes with risks and costs, such as payment default risk, administrative, insurance, and transaction costs. As discussed previously, firms have a commercial motive to extend trade credit as an instrument to increase sales and improve marketability; but timing of trade credit management may be also associated with supplier firms' costs. Although there should be an optimal trade credit policy in terms of cost and period, SMEs, especially smaller firms, may have less bargaining power over the policy (Emery and Nayar 1998). Small firms as trade credit suppliers operating in a competitive market, or those new market entrants, may be forced to extend trade credit as a quality guarantee to customers with market power (e.g. larger and more established companies, vital customers). This market power disadvantage resulted from insufficient bargaining power may lead to non-optional granting and unfavourable trade credit terms for suppliers, such as longer repayment period and higher discount for prompt payment (Cheng and Pike 2003; Abuhommous 2017). All these elements may have a negative impact on firm performance. Longer collection period caused by passive granting or delayed payment from customers, can also result in sizeable bank financing costs, and/or lead to payment delay to their own trade credit suppliers, therefore offsetting gains from

trade credit investment. Moreover, the length of collection period has a direct impact on a trade credit supplier's opportunity cost, i.e. funds available for investment (Tauringana and Afrifa 2013). The longer the collection period, whether planned or unplanned, the higher the damage to firm performance from extending trade credit for firms that are less liquid (e.g. SMEs). This is because many SMEs are likely to hold insufficient funds for expansion projects and sensitive to cash; therefore the opportunity cost of cash tied-up in longer term accounts receivable may offset the gains from trade credit investment. To these reasons, we hypothesise:

H2e: The favourable effect of trade credit investment is weakened for SME suppliers that need longer time to collect funds back.

2.3: Trade credit finance and SME operational distress

In testing H2a, we have also found that financing more through trade credit channel also has a favourable impact on SME profitability, although such an effect is less pronounced compared with the one in H2a. Given that our sample is in the period of and immediately after the Financial Crisis, SMEs might be more financially and operationally distressed and had less access to bank credit. As shown, more than 0.2 million SMEs went bankrupt each year during the Crisis (European Commission 2016), and small loans (<€1m) to SMEs declined significantly (above source). In our sample, short-term bank finance declined from 2008 for the majority of sample countries, with the sharpest decline in Estonia, France, Croatia and Netherlands. Hence, such a positive effect of trade credit finance on SME performance might be a reflection of the reduction of business distress.

The rationales and the motives of supplying trade credit (see Sections 2.1 and 2.2) suggest that, when financially constrained customers experience temporary liquidity shocks (e.g. a reduction in bank credit supply), supplier firms are incentivised to provide a buffer to them for their own prosperity (e.g. stimulate demands, maintain relations, stake in customer

firms). Literature has documented that financially constrained firms rely more heavily on trade credit as a substitute for bank credit (Garcia-Appendini and Montoriol-Garriga 2013; Agostino and Trivieri 2019). Fisman (2001) documents that firms financing through trade credit are less sensitive to input shortages that could incur business disruption. In our sample, if trade credit is a substitute for bank credit (H1a), and trade credit suppliers have the motives to provide liquidity insurance to customers (H2), it is reasonable to conjecture that financially constrained and distressed SMEs would have to rely more on trade credit finance to alleviate credit constraints, and/or to used trade credit as a temporary financial instrument under deprived economic conditions to alleviate operational distress. The increased supply of trade credit has been documented to be a tool to reduce the overall level of constraints in an economy (Guariglia and Mateut 2016). Moreover, the liquidity injection and insurance functions of trade credit finance to trade credit receivers reduce their business uncertainty (Cunat 2007), signals sound financing credibility and repayment capability to banks (Yang 2011) and reduces the information barriers between trade credit suppliers and receivers, thus reducing credit constraint distress (Jain 2011). The distress-reduction effect could also be stronger for SMEs with more difficulties in accessing to bank finance, such as inherent financing constraints or a reduction in bank credit supply. Casey and O'Toole (2014) show that credit rationed firms are more likely to apply for trade credit during the 2007-08 Financial Crisis rather than other financial instruments, suggesting that trade credit as one of the limited instruments is more crucial to their business. Love et al. (2007) have shown that vulnerable firms benefited more through trade credit finance after the 1990s financial crisis in emerging markets. Agostino and Trivieri (2019) also show that Italian manufacturing SMEs' adoption of trade credit finance improves their performance in terms of operational efficiency by mitigating financing constraints. Although their study does not examine on operational distress level, they find that the favourable impact is stronger during the most recent Financial Crisis. Our study does not merely

focus on the bank credit reduction caused by financial crises, but bank credit access difficulties in general (e.g. debt finance usage). For all the above arguments, we test the following two hypotheses:

H3a: Trade credit finance as a substitute for bank credit alleviates the operational distress of SMEs.

H3b: The favourable impact of trade credit finance on operational distress is stronger for those SMEs with stronger liquidity constraints, such as those who have less access to bank finance, or under the economies where subject to less credit supply.

Granting trade credit is not cost-free (see Section 2.2), so is receiving one. In fact, financing short-term through trade credit can be very expensive, especially when early payment discount cannot be triggered. Ng et al. (1999) estimate the effective annual interest rate on trade credit is over 40%, and more than 72% of firms cannot frequently benefit from early payment discount, although Marotta (2005) has shown that early-payment discount offered reduces payment delays. A more recent study on a large number of trade credit contracts by Klapper et al. (2012) documents that the implicit cost of trade credit finance is equivalent to 54% per annum, if receivers cannot benefit from early payment discount. This high cost of non-early payment could become a hindrance towards the development of receivers, therefore offsetting the distress reduction effect. Moreover, a longer repayment period (e.g. late payment) could diminish or destroy the value or quality of a receiver's relationship with its supplier, especially when the receiver's payment capability affects the supplier's payment capability to the latter's own creditors (e.g. bank, upstream trade credit suppliers) (ACCA 2019). This relationship damage could lead to the loss of a supplier, heavily distressing the operation of a firm (ACCA 2019). Based on these arguments, we finally hypothesis as follow:

H3c: The strength of the favourable impact for trade credit receivers is negatively associated with the lengths of average credit period (time to clear accounts payable in days).

3: Data Sources and Sample

This paper adopts secondary data to empirically examine the above hypotheses. We obtained financial accounting information of 79,036 EU and Icelandic SMEs[9] over the period of 2006-2015 from Amadeus database[10] provided by BvD in which 99% of the samples are private firms. An advantage of using Amadeus is the harmonised international format of financial statements. SMEs are defined according to European Commission as those firms which have less than 250 employees and less than €50m turnover (or €43m balance sheet total) [11] to ensure the homogeneousness in terms of reporting unit. We exclude sample firms which do not meet our criteria in some particular ways[12]. Country-level data are collected from the Worldbank and the European Commission, and they are matched with SME data through country code and year. Full variable definitions are presented in Appendix A, followed by descriptive statistics in Appendix B, otherwise independently specified[13].

[9] EU countries in our sample include Austria, Cyprus, Germany, Denmark, Estonia, Spain, France, UK, Greece, Croatia, Hungary, Ireland, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, and Slovenia. Ideally, we would have data from all the 28 EU countries, instead of 19. However, for the remaining EU countries that are not included in our sample, they either do not have enough observations on the key variables in our sample, are lack of observations for early sample period (e.g. before 2011), or the sample is strongly biased by several industries. Hence, the 9 remaining EU countries are not included in this study. In addition, for the study of hypotheses set 3 (H3s), Cyprus, Denmark, UK, and Ireland are dropped from the initial sample, due to insufficient accounting information to gauge the Z-score that is used for testing H3s.

[10] Due to the low quality of SME accounting information in the full Amadeus subscription (e.g. unreasonable and missing values), we use the sub-subscription of Amadeus which contains firms with more valid data coverage. However, our database has a lower representativeness on micro-sized and/or start-up firms compared with study such as Fungacova et al. (2017).

[11] Estimation is used when partial SME-defining-information is not available (see Amadeus online help).

[12] We screen out sample firms based on their activity locations (e.g. overseas territories), industries and legal forms. Details are available from authors on request.

[13] We manually manage firm data outliers instead of using winsorization as the latter could distort and misrepresent original data although the number of observations is not sacrificed. In total, less than 1% of the initially collected data are removed, and full methodologies on outlier cleaning process are available from the authors on request.

Table 1 presents the composition of SMEs from each country and industry for our unbalanced panel. Overall, UK, France and Spain account for the majority of observations (71%) and Year 2015 sees the lowest number of observations at the time of data collection. On average, an SME has 7.6 years of data available in the sample, with the highest in Portugal (8.6) and France (8.3), and lowest in Cyprus (3.8) and Denmark (4.5). At industry level (Nace Rev. 2), 57.7% of the total observations operate in Wholesale & Retail Trade, and Manufacturing industries. The variation of average observation years available to each industry is unobvious.

(Please insert Table 1 about here, thank you)

In our sample countries, the general economic condition as reflected by GDP per capita growth rate declined across all countries from 2007 (Table 2, Panel D), with the worst reported for Estonia and Latvia. Poland is the only country that has not experienced a negative value although the growth rate has slowed down since the Crisis eroded. The recovery since 2011 has been strongest in Lithuania and Latvia, and weakest in Greece and Cyprus, where those countries could not turn the GDP growth rate into positive until 2014.

Table 2 (Panel C) and Table 3 present the total short-term bank credit ratio for our sample. On average, shot-term bank credit accounted for 9.7% of SME total assets, where Cypriot (16.7%), Greek (15.9%) and British (15.0%) SMEs appeared to have better access to short-term bank credit but worse in Netherlands (0.5%), Germany (5.7%) and France (6.1%). Due to the deprived macroeconomic conditions during the sample period, EU SMEs were adversely influenced by a significant reduction in bank lending. In the aftermath of the Financial Crisis, banks' short-term credit supply decreased in most of the sample countries, and the rebounds were insignificant, indicating cautious and tightened short-term lending standards of banks.

Trade credit is a substitute and used as a financing instrument for SMEs when bank short-term credit is less accessible (see Section 4.1). Table 2 (Panel A and B) and Table 3

present statistics for the trade credit variables (see definitions in Appendix A). The results provide an indication of the great importance of trade credit usage which was 1.9 times of the short-term bank credit. Trade credit finance accounts for 18.4% of total SME assets averagely, 14.7% in the UK, 27.6% in France, 14.9% in Spain and 11.1% in Germany. SMEs are always financed more through trade credit than short-term bank credit only except for the UK and Austria, with the highest difference in France (4.5×) and Malta (2.8×). Trade credit investment on average represents 25.7% of total assets, which is 1.4 times of the total trade credit received, indicating that SMEs in this sample were mostly net providers of credit.

Timing is also a crucial element in trade credit management because of its high costs. Table 3 (Panel A) shows a large country disparity in regards to the collection and credit days. On average, SMEs in Greece (108), Portugal (101) and Cyprus (99) needed to wait at least three months to receive payments; those in Austria (24), Germany (28) and Estonia (30) received payments within one month. In terms of trade credit days, sample firms in Cyprus (62), Slovenia (61) and Greece (60) made payments over a 2-month period, and the fastest in Estonia (15), Austria (18) and Germany (20). A firm yields a funding gap if it pays suppliers faster (credit period) than it receives payments due to it (collection period). Table 3 (Panel A) shows that, on average of the whole period, all countries experienced a funding gap, with the highest multipliers reported for Netherlands (3.2×) and Spain (2.3×), and lowest for Latvia (1.2×) and France (1.2×). In addition to the country-level heterogeneities, Table 3 (Panel B) also shows that the average collection and credit period vary significantly across industries. This evidence suggests the existence of intrinsic heterogeneities whereas trade credit practices vary across financial systems and industries. We therefore introduce in Section 4 an approach that eliminates this intrinsic heterogeneity for our empirical analysis.

(Please insert Tables 2 and 3 vertically about here, thank you)

4: Empirical Strategy and Results

4.1: Background hypotheses

To test our background competing hypotheses (H1a vs. H1b) under the presence of contemporaneous causality, the following bi-directional models are employed. The variable *'Bank credit'* is the usage of bank credit[14] scaled by total assets for firm *i* in industry *j* country *c* and at time *t*. Because trade credit is in short-term by nature (Huyghebaert and Wang 2016), in some models we consider short-term bank credit only. Following De Haan and Sterken (2006), the variable *'Creditors'* is calculated as total trade credit received (accounts payable) scaled by total assets. F and M are vectors of firm-specific and macroeconomic control variables. θ and τ refer to fixed-effects and time-effects, and ε is a disturbance term consisting of unobservable individual time-invariant effect and remainder disturbance. Variables controlling for factors affecting bank credit usage and trade credit usage are included following Love and Peria (2015) and Abdulla et al. (2017)[15].

$$\text{Bank credit}_{ijct} = \alpha + \beta\times\text{Creditors}_{ijct(t-1)} + C_1\times F_{ijct(t-1)} + C_2\times M_{c,t-1} + (\theta_{ijc}) + (\tau_t) + \varepsilon_{ijct} \quad \textbf{(1)}$$

$$\text{Creditors}_{ijct} = \alpha + \beta\times\text{Bank credit}_{ijct(t-1)} + C_1\times F'_{ijct(t-1)} + C_2\times M'_{c,t-1} + (\theta'_{ijc}) + (\tau'_t) + \varepsilon'_{ijct} \quad \textbf{(2)}$$

Baseline results of Equation (1) and (2) are presented in Tables 4 and 5. All models are estimated by fixed-effect estimator[16] following the Hausman test; otherwise individually noted. The endogeneity problem of contemporaneous causation is apparent in testing this set of hypotheses; therefore, in addition to switching the dependent and main interested independent

[14] According to Amadeus user manual and Fungacova et al. (2017), short-term and long-term bank credit are respectively recorded and named as 'loans' and 'long-term debt' in the Amadeus database. Total bank credit is the sum of these two elements.

[15] All variables with a prime sign are for Equation (2). We include firm size, cash-richness, tangibility, liquidity and growth opportunity in both equations. At country-level, banking market competition and bank credit supply are added in Equation (1) to capture SME bank financing conditions, and interest rate is added in Equation (2) to reflect credit price. GDP growth rate as an indicator of economic condition is added in both equations.

[16] The standard errors for fixed-effect models are clustered at firm-level. Results do not change if they are clustered at industry or country level (same for all F.E. models throughout this paper).

variables, we also lag right-hand side variables to mitigate the reverse causality problem[17]. In both tables (respective Models 5 and 6), we check[18] whether the results are the same for different size classes of the sample firms by splitting our sample into micro & small-sized and medium-sized, according to European Commission' definition. Finally, in respective Models 7 and 8 (Table 4 and 5), we specify the models in first-difference and in a dynamic form with lagged dependent variables[19]. These respectively capture the real yearly change of variables, and accounts for dependent variable persistency.

Focusing on the results, in Table 4, the main interest variable, *creditors* (trade credit received to total assets), has significantly negative coefficients across all models at 5% level (except for Model 4). This indicates a negative relationship between the usage of trade credit finance and bank credit, suggesting a substitution effect rather than a complementarity one. Table 5 presents the baseline results of Equation (2). The significantly negative coefficients at 5% level of bank credit variables[20] indicate that SMEs in our sample with superior access to bank credit rely less on trade credit finance.

[17] 't' and 't-1' in Note 1 respectively denotes a contemporaneous model and an explanatory variable one-year lagged model (same throughout the paper). Macroeconomic variables are all one-year lagged to adapt a response lag of small microeconomic agents toward economic fluctuations (Leon, 2015), despite the unlikeliness of contemporaneous causality between our firm- and macro-level variables.

[18] We thank two anonymous referees for this advice. Same check on the different size groups of sample firms is also performed for other hypotheses sets. Firms with less than 50 employees, and turnover less than 10 million euros, are regarded as 'Micro and Small' sized. Other firms with less than 250 employees, and turnover less than 50 million euros, are regarded as 'Medium' sized.

[19] The first-difference models are estimated by OLS estimator with robust standard errors. The dynamic panel data models are estimated by 'two-step system GMM estimator' (Arellano and Bover 1995; Blundell and Bond 1998). In the dynamic model, we treat both lagged dependent variable and main independent variables as endogenous, and the lag length for instrument variables are decided based on the best results of the overidentifying restriction tests for validity, and error terms serial correlations tests. We prefer System-GMM over 'Difference GMM' (Arellano and Bond 1991) because it is criticised that lagged levels are often rather poor instruments, especially if the variables are close to a random walk (Baum 2006). However, the System-GMM includes both lagged levels and lagged difference in an equation system. Moreover, Roodman (2009) shows that 2-stage estimator is asymptotically more efficient than 1-stage estimator. Same approaches (1st difference and dynamic models) apply to hypotheses set 2. We thank an anonymous referee for suggesting these approaches.

[20] We also use short-term bank credit usage (variable name: ST Bank credit, Models 3 and 4) because trade credit is naturally in short-term.

Above results show a clear negative association between the amount of trade credit usage and bank credit usage across various model specifications and estimation techniques, suggesting that trade credit is a substitute for bank credit in our sample, supporting H1a. Our results show little evidence supporting the complementarity hypothesis (H1b). Results on control variables are mostly consistent with the literature but some of them are not statistically significant or robust. It is worthwhile to mention that the variable 'Lerner Index', that reversely captures the competition level of a banking market, is negatively related to bank credit supply in all fixed-effect models. This suggests that SME financing constraints are mitigated in a more competitive banking market, supporting 'Market Power Hypothesis'[21]. This discovery contrasts with the 'Information-based hypothesis' whereby bank market power motivates banks to invest in soft information acquisition and to build lending relationships to reduce information asymmetries. Such a finding is worth noticing because it indicates that in our sample, banks might have an even greater information gap on borrowers than those SME trade credit suppliers, especially for those firms who are more informationally opaque.

Moreover, Models 9-11 (Table 5) show a significantly positive impact of bank finance access on the amount of trade credit extended (i.e. accounts receivable), evidencing the redistribution effect whereby SMEs in a stronger bank financing position extend more trade credit[22]. In addition, we find further supporting evidence to the redistribution effect in which the positive association between bank credit ratio and trade credit extended is more pronounced for those SMEs who are less financially constrained as indicated by WW index, HP index or

[21] See Han et al. (2017) and Wang et al. (2020) for a review on 'Market Power Hypothesis' and 'Information-based Hypothesis'.

[22] The relation between trade credit investment (debtors) and bank credit could also be in reverse direction as Ferrando and Mulier (2013) suggest that banks may relieve lending standards if the accounts receivable can be used as collateral. We therefore reverse the bank credit ratio and trade credit ratio of Models 9-11 in Table 5 (not reported) and the negative association remains.

ASCL-index[23]. However, the results do not show that firms with higher level of cash holdings or liquidity tend to extend more trade credit. All results do not change if we replace short-term bank credit by total bank credit.

In a succinct conclusion, our results support the Substitution Hypothesis (H1a) and the Bank Credit Redistribution Hypothesis (H1c). Such results are used for the build-ups of hypotheses sets 2 and 3 (see Section 2). Further robustness checks are performed as follows. First, baseline models are regrouped by country, industry, and year to check if the main results are driven by a specific group of firms. Second, despite the observation loss, we change the scaling factor for all firm-level variables from total assets to total sales or total current assets. Last, all the fixed-effects models are re-estimated by random-effect maximum-likelihood estimator and two-way fixed-effect estimator[24]. All results are not meaningfully altered[25].

(Please insert Tables 4 and 5 vertically about here, thank you)

4.2: Trade credit investment and SME profitability

4.2.1: Empirical specification and baseline results

Moving onto the test of the main hypotheses of this study (H2a), we propose Equation (3) below. ROA is earnings before interest and tax to total assets in real number. TC investment (variable name: debtors) is accounts receivable, i.e. trade credit supplied, divided by total assets. All other notes are same as above. Equation (3) includes 9 variables to control for factors affecting the profitability of an SME at both firm and economic-level. Models are either specified

[23] These results are not reported for space reason but are available on request from the authors. See Whited and Wu (2006), Hadlock and Pierce (2010) and Mulier et al. (2016) for a review of the WW, HP and ASCL index.
[24] However, Baum (2006) states that time fixed-effects should be removed if macroeconomic factors are controlled for because those factors do not vary across firms.
[25] These additional robustness check outputs are not reported for space reason but available on request from the authors.

contemporaneously or one-year lagged for non-macroeconomic independent variables to avoid reverse causality.

$$ROA_{ijct} = \alpha + \beta \times TC\ Investment_{ijc(t-1)} + C_1 \times F_{ijc(t-1)} + C_2 \times M_{c,t-1} + (\theta_{ijc}) + (\tau_t) + \varepsilon_{ijct} \quad \textbf{(3)}$$

As presented in Table 2, on average, during the 10-year period, Estonian (8.3%) and Polish (7.4%) SMEs had the highest ROA (%). Greek (2.9%) and Irish (3.3%) SMEs were least profitable. For most countries, the ROA ratio intensely declined during the Financial Crisis. For the four biggest economies in the sample on average, ROA (%) declined by 27.6%, 28.3%, 29.4% and 40.0% respectively for UK, France, Germany and Spain from 2007 to 2009, and the whole sample has its second lowest ROA ratio (4.8%) in year 2009, just a tiny bit more than year 2012 (4.7%). Most of the countries had a rebound immediately post to the Financial Crisis, but struggled again in 2012. After that, all countries except for Austria, Cyprus, Estonia and Latvia, have seen an improvement of ROA since 2013, where Spain, Greece and Malta had the highest growth rate, and the whole sample reveals a 26.5% increase from 2012 to 2015. The ROA ratio was more stable in the UK, France and Portugal as indicated by standard deviation, where SMEs from Cyprus, Iceland and Estonia show a greater profitability volatility.

Table 6 presents the regression outputs of Equation (3). Models 1-4 are estimated by fixed-effect estimator[26] following the Hausman test, where Models 3 and 4 split the sample into micro & small-sized and medium-sized. Models 5 and 6 are specified respectively in first-difference and a dynamic form. The last column (7) adopts a quadratic form to detect non-linearity.

The main results reveal that trade credit investment (variable name: *debtors*) has significantly positive coefficients across all models at 1% level (except for Model 6, at 10%

[26] Estimations with random-effect maximum-likelihood estimator are also performed but not presented for space reason. All results support the baseline findings and are available from authors on request.

level), and this effect does not vary much across firms in different size groups. SME profitability is positively affected by the amount of trade credit investment; therefore the benefits and gains in such an investment outweigh its costs associated, in general supporting H2a whereby trade credit investment improves SME profitability as hypothesised from transactional, financing, and commercial perspectives. In numbers, an SME increases trade credit investment by 10% of its total assets generates a ROA ratio increase in percentage by 0.3, which is a 7.6% (5.4%) positive deviation from the regression sample's median (mean) ROA value. Even though the linear and quadratic forms are both statistically significant in Model 7, the symmetry axes (turning point) is not located in a meaningful area and therefore it supports the baseline linear relation observed. However, one should be cautious when interpreting the non-linearity test result as pointed out by Lind and Mehlum (2010), that this test may only be a necessary condition, but not a sufficient one. Compare to some studies mentioned in Section 2, our supporting evidence from a European sample to H2a is consistent with Abuhommous (2017) in Jordan and Martinez-Sola et al. (2014) in Spain, and Dary and James Jr. (2019), a study on listed agro-food US firms. Our study is the first ever cross-country study on European SMEs. Moreover, we have also tested the effects of trade credit finance ratio (variable name: creditors) on SME profitability[27] and found that trade credit finance has a favourable impact on SME profitability, although the effect is less pronounced (see more discussion in Section 4.3).

(Please insert Table 6 about here, thank you)

4.2.2: Further robustness checks

We check the robustness of earlier results in the following ways in Table 7. First, we adopt alternative profitability measures, including return on equity ratio[28] (Model 1), annual growth

[27] Empirical outputs are not reported for space reason, but available from authors on request.
[28] Return on equity is calculated as profit (loss) before interest and tax divided by shareholders fund (Amadeus database), in real numbers (not percentage).

rate of real added value[29] (Model 2), return on sales ratio[30] (Model 3), and two-year moving average growth rate of the ROA ratio[31] (Model 4). Second, Table 2 has shown that the amount of trade credit granted varies significantly across industries, suggesting the inherent differences in terms of the nature and pattern of trade credit investment at industry-level. Trade credit practices and common payment terms are uniform within industries but vary appreciably across industries (Fisman and Love 2003). Firms must adapt to industry standards to maintain competitiveness (Paul and Boden 2008). We therefore transform trade credit variables into the difference against industry-level yearly median values (Model 5) to eliminate this concern. Third, we test if the baseline findings are driven by a specific group of firms by regrouping SMEs according to country (Models 6-7), industry (Models 8-10), and year (Models 11-12). All the above robustness check estimation outputs are meaningfully consistent with the baseline findings. In addition, we follow Garu and Reig (2019) and scale all firm-level variables by total sales or total current assets, instead of total assets. Main results still hold[32].

(Please insert Table 7 about here, thank you)

4.2.3: Heterogeneity tests

In this section we test our sub-hypotheses (H2b, H2c, H2d and H2e) in Table 8 by employing both interaction term and grouping approaches based on Equation (3). The merits of using both approaches are threefold. First, it is not ideal in some circumstances to split the sample (e.g. split sample by country-level data). Second, two approaches assure result robustness as the exact mathematical forms are less important. Third, grouping allows further robustness check

[29] Added value is the sum of profit (loss) for the period and minority interest, taxation, cost of employees, depreciation and interest paid. All variables are adjusted by GDP deflator (see Ferrando and Mulier 2013).

[30] Return on sales is calculated as profit (loss) before interest and tax divided by total sales, in real numbers (not percentage)

[31] ROA growth rate is defined as ROA's difference in two consecutive years divided by the average ROA of these two years.

[32] Results are not reported for space-saving purpose but available from the authors on request.

on the baseline model to see if the results are driven by firms with specific characteristics. For all the interaction term models, to ensure the validity of the interpretations on the proposed interaction terms, the tested elements are included in the regression analysis as well. This is because it is argued that if an endogenous relation exists, it is more likely to appear in such variables, instead of the interaction terms. (Dittmar and Mahrt-Smit 2007, same below in Section 4.3).

Hypothesis H2b predicts that the favourable effect of trade credit investment on profitability is stronger for SME suppliers with variable or unstable demand (i.e. greater sales volatility[33]). To test this hypothesis, we split the sample into two according to the median of sales volatility in the whole sample, less (Model 1) and more (Model 2). Model 3 then utilises the full sample but includes a variable that interacts *sales volatility (SV)* with *debtors*. H2b would expect that the coefficient of *debtors* variable is significantly larger in Model 2 than in Model 1, and the interaction term should be positively significant. However, our results do not show strong supporting evidence to H2b, as the coefficients of debtors do not differ significantly from each other, and even the interaction term is positive, it is hardly economically and statistically significant.

Hypothesis H2c predicts that during economic downturns, SME suppliers who invest more in trade credit finance can increase their profitability. We capture country-level economic conditions by both GDP growth rate and unemployment rate. Grouping approach is not an ideal choice as the moderating factor is measured at country-level. Relying on the interaction term approach (Models 4 and 5), we show that sample SMEs performed better during sound economic conditions (higher GDP growth rate or lower unemployment rate). However, the

[33] Sales volatility is measured by dividing the standard deviation of sales by its mean value over a three-year period.

interaction term in Model 4 is insignificant and hardly significant in Model 5, showing little evidence supporting H2c.

Moving onto H2d which hypothesises that SME suppliers can better improve their profitability if they have more bank credit available for redistribution. We examine the bank credit accessibility moderating effects from both macroeconomic and microeconomic levels. In Model 6, we interact *BCS* (domestic credit to private sector by banks as a percentage of GDP) with *debtors*. *BCS* captures the amount of bank credit supply in an economy. We show an interesting finding that SMEs may be less profitable from investing in trade credit when the economic wide bank credit supply increases. This could be caused by a reduction in the need of trade credit as a substitute for bank credit when the economy-wide credit supply increases, and potential trade credit receivers may obtain a better deal from bank lenders in terms of price and maturity. This result shows no direct support to H2d. At firm-level, we split the sample into those who have less (Model 7) and more (Model 8) access to short-term bank credit. Although the coefficient of debtors in Model 8 is higher than Model 7, the difference is negligible. Moreover, the interaction term in Model 9 is not statistically significant even at 10% level. Additionally, we test using the total bank credit ratio (variable name: Bank credit) instead of the ratio of short-term bank credit to assets (variable name: ST bank credit), and results remain unchanged. All these findings cast doubt on H2d.

Finally, we examine hypothesis H2e in Models 10-12, where the first two (Models 10 and 11) are regrouped given the median value of collection period (days)[34] in the whole sample. The last column adopts the whole sample with the addition of an interaction term. The results show that the coefficient of *debtors* variable is significantly higher for the sub-sample with shorter collection period (0.56) than those with longer collection period (0.41), translated into an approximately 36.2% stronger effect. Similarly, the interaction term Model (12) presents a

[34] Accounts receivable times 360, divided by operating revenue.

meaningfully consistent result[35], supporting H2e. SMEs which needed longer time to collect accounts receivable may have higher opportunity costs (Tauringana and Afrifa 2013), or may have less bargaining power over trade credit terms (Emery and Nayar 1998; Cheng and Pike 2003; Abuhommous 2017), both weakening the favourable effect on profitability. At this point, one may raise a concern[36] on the institutional specificities and industry heterogeneity whereas trade credit practices and common payment terms vary appreciably according to financial systems (Marotta 2005; Cassia and Vismara 2009) and industries (Fisman and Love 2003). This should be noted as Table 2 has shown, and Section 3 has discussed, that the average collection period and credit period vary significantly across countries and industries, suggesting inherent differences of trade credit practices and terms about timing. We therefore additionally transform collection period variable into the difference against industry-level and country-industry-level yearly median values, respectively, to eliminate the intrinsic heterogeneities. These additional tests[37] confirm the above findings.

(Please insert Table 8 about here, thank you)

4.3: Trade credit finance and SME distress

4.3.1: Model specification

We employ Equation (4) to test H3a on the effect of trade credit finance usage on SME operational distress. Z-score is a score-based index reflecting the operational distress level of an SME. The variable *'Creditors'* is the ratio of an SME's accounts payable (i.e. trade credit received) divided by total assets (see Appendix A). Equation (5) includes specific interactive terms to examine the possible moderating effects hypothesised for H3b and H3c in Section 2.3.

[35] Despite the small coefficient, the result is economically significant because the ROA is measured in real number.
[36] We thank an anonymous referee for raising this issue.
[37] These additional tests' results are not perfectly consistent with the ones presented, but in general provide similar findings. As there are 6 additional models for these tests, we do not present them for space reason.

For both equations, firm size, age, industry-level sales growth rate, GDP growth rate and inflation are added to control for the factors affecting an SME's operational health.

$$\text{Z-Score}_{ijct} = \alpha + \beta_1 \times \text{Creditors}_{ijc(t-1)} + C_1 \times F_{ijc(t-1)} + C_2 \times M_{c,t-1} + (\theta_{ijc}) + (\tau_t) + \varepsilon_{ijct} \quad \textbf{(4)}$$

$$\text{Z-Score}_{ijct} = \alpha + \beta_1 \times \text{Creditors}_{ijc(t-1)} + \beta_2 \times V_{ijc(t-1)} \times \text{Creditors}_{ijc(t-1)} + \beta_3 \times V_{ijc(t-1)} + C_1 \times F_{ijc(t-1)} + C_2 \times M_{c,t-1} + (\theta_{ijc}) + (\tau_t) + \varepsilon_{ijct} \quad \textbf{(5)}$$

SME distress (Z-score) is measured by borrowing the Altman Z-score (Altman and Sabato 2007) which is the version that is specifically designed for private firms, as given by Equation (6), where the higher the score, the lower the financial distress, and vice versa. Altman and Sabato (2007) prove that the score has an out-of-sample prediction power which is almost 30% higher than a generic corporate model. Under the absence of credit score data for our sample SMEs, this is by far known as the most reliable estimation that is widely used in both academic research and as a financial analysis tool in industry. For most countries, the Z-score declined during the Financial Crisis period and reached the lowest point in year 2009. However, the Z-score of more than half of the sample countries gradually bounced back since early 2010s. SMEs of larger economies (i.e. France, Spain and Germany) were less shocked by the Financial Crisis as shown by lower Z-score volatility, compared with smaller economies in our sample (e.g. Estonia and Latvia).

$$\text{Z-score} = 0.717 \times (\text{Working Capital / Assets}) + 0.847 \times (\text{Retained Earnings / Assets}) + 3.107 \times (\text{Earnings Before Interest and Tax / Assets}) + 0.42 \times (\text{Total Debt / Total Liabilities}) + 0.998 \times (\text{Sales / Assets}) \quad \textbf{(6)}$$

4.3.2: Results from continuous variable models

Table 9 displays the results for testing hypotheses H3a, H3b and H3c. All explanatory variables are one-year lagged to avoid reverse causality and all models are estimated by fixed-effect

estimator according to Hausman test. Models 1-4 are designed for testing H3a, where Model 2 substitutes the denominator of variable *'creditors'* to the volume of bank debt usage. Models 3 and 4 split the sample into two different size groups. Models 5-9 adopt an interaction term to capture the moderating effects hypothesised in H3b and H3c.

The coefficients of creditors are positive and significant at 1% level across all first four models, suggesting that trade credit finance as a substitute for bank credit alleviates the operational distress of SMEs, supporting H3a and, revealing the importance of using trade credit as a short-term finance instrument for management. Numerically, a one-standard-deviation (1SD) increase (Model 1) in trade credit finance ratio (0.185) results in an increase of Z-score by 0.125, which is a 5.4% (5.0%) deviation from the median (mean) value of Z-score, so that the effect is economically meaningful. Our findings are close to some recent studies, for example, Agostino and Trivieri (2019), who have shown that trade credit positively affects firm operational efficiency by mitigating financial constraints.

We include 4 interaction terms individually in Models 5-8 to test the moderating effects of bank credit accessibility (H3b). In Model 5, bank credit supply variables, as calculated by domestic credit to private sector by bank (% of GDP), are used to capture economy-wide bank credit supply. Even in developed financial markets, the supply of bank finance differs significantly and is sensitive to monetary policy (Ferrando and Mulier 2013). Model 6 includes a variable 'FC' which is coded as one if the year is in between 2007-2010; zero otherwise. It is assumed and empirically observed in our data that bank credit supply declined during and immediately after the 2007-08 Financial Crisis, therefore creating the need for alternative finance channels (e.g. trade credit). From macroeconomic perspectives, the negatively (positively) significant interaction terms in Model 5 (6) indicate that the favourable effect of trade credit finance on alleviating operational distress of SMEs is more pronounced during a shortage of bank credit supply. Using Model 6 as an example, the partial effects of trade credit

finance ratio increase from 0.60 in non-crisis years to 0.76 during the crisis, which is a 26.9% increase in terms of magnitude, although the Z-score generally declined during the Crisis. This suggests that trade credit as a substitute for bank credit provides a stronger buffer for SMEs to avoid distress during the period that is subject to tightened bank credit supply and subsequent economic downturn, supporting H3b. The next two models examine the H3b effect at firm-level. Models 7 and 8 respectively include short-term and total bank debt usage ratios into Equation (5). The negatively significant coefficients for both interaction terms indicate that, SMEs who have less access to bank credit[38] could reduce their distress level by seeking trade credit finance as a substitute for bank credit. Numerically, a decrease of bank credit ratio from the 75th to 25th position of this sample results in an increase of the favourable partial effect of trade credit finance by a magnitude of 17.6%, advocating H3b. However, the baseline relation is not sensitive to the cost (interest rate) of bank credit for SMEs[39].

Hypothesis H3c predicts a negative coefficient of the interaction term of *credit period* and *creditors*. We capture the length of credit period as trade creditors time 360, divided by operating revenue. The higher the value, the longer the repayment period. Model 9 shows a positive association (negative coefficient) between firm operational distress level and credit period length in days. The coefficient on the interaction term reveals that, although trade credit finance as an alternative financing instrument alleviates SME distress, such an effect is undermined if an SME struggles to repay before a short-term period (e.g. discount date), supporting H3c. As hypothesised, the possible reasons are the high implicit interest cost of trade credit finance and spoiling of creditor-debtor relationship. In addition, we split the sample into two according to the median of credit days (31.1), and results remain unchanged. Finally, for

[38] Such firms could be those which are more informationally opaque, less capable in providing collaterals or borrowing from banks with higher market power.

[39] As discussed in Chui et al. (2016), under the absence of loan-level data, the cost of bank credit at firm-level is implicitly proxied by the ratio of financial expenses to average total bank credit. The cost of debt ratios interacted with trade creditors are not statistically significant in the regression analysis and results available from the authors on request.

the same reason explained when testing H2e, we transform credit period variable into the difference against industry-level and country-industry-level yearly median values, results are consistent with H3c[40].

(Please insert Table 9 about here, thank you)

4.3.3: Robustness tests (LDVMs)

The Altman Z-score is interpreted as a continuous variable in Section 4.3.2. However, the original intention of the Z-score is to gauge a firm's degree of operational distress and chance of survival that can be assorted. Hence, not only for robustness checks, Limited Dependent Variable Models (LDVMs) also allow us to construe the effects from a probability perspective.

We follow Heim et al. (2017), and as a common standard (see Altman and Sabato 2007), we generate a variable *'Z-Trinary'* that defines an SME as being distressed (Z-score<1.23, coded as 1), safe (>2.9, coded as 3) or otherwise in grey-zone (coded as 2). In addition, the dependent variables are specified in a binary form. The cut-off is set to be the halfway point (2.07) to both distress zone (coded as 1) and safe zone (coded as 0), and the variable is named *'Z-Binary'*. Finally, the cut-off point is in accordance with above (1.23 and 2.9) for variable *'Z-B, no grey'* and therefore the observations in grey-zone models are dropped.

All LDVMs' results are presented in Table 10. Those models with a trinary form dependent variable are estimated by random-effect ordered logit estimator, and random-effect panel probit estimator for binary form dependent variable models[41]. We check the robustness of models with binary form dependent variables by estimating all models using fixed-effect

[40] These additional test outputs are not reported for space reason, but available from authors on request.
[41] The most common goodness-of-fit measure for probit/logit model - Pseudo R^2, is not available under panel data setting, thus the calculation follows Stata guidance that it compares the log-likelihood value of a model with the same model but all variables besides constant are excluded. This is based on the principal that in probit/logit panel data settings, and log-likelihood should be 0 if the model is perfectly fit.

panel logit estimator[42]. Leaving the observation-loss caused by this estimator aside, results do not conceptually differ from the ones displayed in Table 10.

In examining H3a, the estimation outputs for all the LDVMs provide consistent evidence to Section 4.3.2, although the interpretation is from a probability perspective. For example, Model 1 with dependent variable *'Z-Binary'* reveals that a one-standard-deviation increase in trade credit finance ratio leads to an approximately 40% decrease in the probability of being distressed[43]. Such empirical evidence supports H3a where trade credit as a substitute for bank credit alleviates the likelihood of SMEs being operationally distressed.

Next, unlike the continuous dependent variable models (Table 9), as shown in Models group 4, *'bank credit supply'* interacted with trade credit finance is not statistically significant in all LDVMs. Additionally, Financial Crisis period interaction terms do not present consistent results across three LDVMs, all casting doubts on the country-level bank credit supply moderating effect concluded before. However, moving onto firm-level bank credit accessibility models, using Model 7 (Table 10) where '*Z-Binary'* is used as dependent variable (2nd line) as an example, one hypothetical firm has less access to bank credit (25th percentile of the sample), and the other has more access to short-term bank credit (75th percentile). The magnitude of the probability reduction of the firm being distressed when having a specific increment of trade credit finance usage, is 12% stronger for the 25th one compared with the 75th one. Interactions with short-term bank credit ratio predict similar conclusion that are statistically significant but on a smaller magnitude. Such empirical results support H3b. Finally, Models 8s in Table 10 present conceptually consistent results as the one in Table 9, supporting H3c.

(Please insert Table 10 about here, thank you)

[42] Fixed-effect panel probit estimator is not possible unless time series is close to infinity. See more from Lancaster (2000).

[43] The interpretation of '40%' could be exaggerated because the variable *'Z-Binary'* treats observations that are originally defined as in the grey zone either distressed or not distressed.

5: Conclusion

Due to the great contribution of SME sector to the EU economy in terms of job creation and value added, its performance and operational health are pivotal to EU's economic success and financial stability. This paper studies the financial and operational impacts of SMEs' use of trade credit as a substitute for bank credit in an unbalanced panel composed of 74,036 SMEs across 19 EU countries over 2006 to 2015.

Our research first shows that during and immediately after the 2007-08 Financial Crisis, trade credit was used as a substitute for bank credit for sample SMEs and played a more important role than short-term bank credit in providing liquidity to SMEs. Bank credit rich SMEs appeared to redistribute bank funds through trade credit to their customers, supporting the *Substitution Hypothesis (H1a)* and *Bank Credit Redistribution Hypothesis (H1c).*

This study then builds up two main sets of research hypotheses based on the premise of the trade credit - bank credit substitution nexus, and the fact that EU SMEs do not have a strong access to other financial instruments other than bank credit and trade credit (Palacin-Sanchez et al. 2018) because of their natural difficulties in obtaining bank credit (e.g. Wang et al. 2020). As accounts receivable investment represented more than a quarter of the total assets of our sample SMEs, the first set of main hypotheses examine the reasons why some SMEs are motivated to extend trade credit to their customers. Our conjectures are established through the trade credit theories that are developed from transactional, financing, and commercial perspectives. The core results are that, trade credit extended by suppliers, as an investment and as a substitute for bank credit for customers, improved their profitability *(H2a)*. This supports the views that such an investment may help trade credit suppliers stimulate market demand, improve operational efficiency, sustain customer relations, and generate direct gains through credit terms. These benefits and gains from trade credit investment outweigh the relevant costs in our sample, e.g. default risk and opportunity cost. However, little evidence shows that such

an investment was more profitable for supplier firms with a greater demand variability (*H2b*), or for bank credit rich SMEs (*H2d*) even though the latter supplied more trade credit. In addition, we do not find supporting evidence that investing more trade credit during economic downturns could better improve supplier firms' performance as hypothesised in *H2c*.

In addition to examining the benefits to trade credit suppliers, the second set of research hypotheses aim to understand how trade credit as a substitute for bank credit can have an impact on SME receivers. We document that trade credit received alleviated SME operational distress (*H3a*), especially for those SMEs who faced liquidity constraints (*H3b*), such as those which were less capable of accessing bank credit, or under credit tightened periods. This distress reduction effect is also reflected in SME profitability measure as trade credit received had a favourable impact on sample SMEs' profitability.

Finally, we show that the longer the average collection period and credit period, the weaker the usefulness of trade credit effects respectively in improving SME profitability (*H2e*) and reducing operational distress (*H3c*). The main reasons behind are that, for suppliers, longer collection period could be the result of non-optional granting due to insufficient bargaining power. Delayed payment could also introduce passive payment delay to their own credit suppliers (e.g. banks, upstream suppliers). Moreover, the length of collection period is positively related to their opportunity cost. For receivers, trade credit could be very expensive if early payment discount cannot be triggered. In addition, a longer repayment period could spoil the relationship with suppliers.

Our empirical results are robust to a wide range of model specifications (e.g. fixed-effect models, LDVMs) and econometric concerns (e.g. reverse causality, economic significance, dynamic form). One major concern is the natural heterogeneities of the use and timing management of trade credit across different industries and financial markets. We eliminate these intrinsic heterogeneities in our robustness checks by performing additional tests

that transform relevant variables into the difference against country-industry-level yearly median values.

Our findings provide valuable insights for managers since we have documented the usefulness of accounts receivable / payable management in the maximisation of firm values and for the mitigation of operational distress, under an EU context. This could be more important for those SMEs that are more bank credit constrained. In addition, the findings could also be important to policy makers for tackling SME financing constraints and the research implications are as follows. First, although the benefits of trade credit management have been discussed, it cannot be ignored that the effects could be different if trade credit is more of a complement to bank credit. The current *'Substitutions Hypothesis'* may fit our sample as the sample is in a period of economic stagnation; but during economic expansion, trade credit may not be the only choice for SMEs. Second, policies tackling on SME financing constraints may not only merely focus on improving SME bank credit access, but also on facilitating a healthy adoption of trade credit finance, such as enhancing supervision on late payment. Third, policies may also focus on high costs of trade credit extended to financially constrained receivers by suppliers with greater market power. Last, promoting healthy competition between bank and trade credit lenders who have substantial industrial knowledge would be helpful in reducing information barriers and financial frictions between borrowers and lenders, and also allow larger suppliers to play a more important role in the provision of short-term finance to small businesses. Future studies may find it helpful if detailed trade credit agreement information would become available, and detailed industry-level studies would be useful for policy making as trade credit arrangements vary both across and within industries.

Appendix A: Definitions and Sources of Main Variables

Variables	Definition	Original sources
Main firm variables		
Profitability (ROA)	Earnings before interest and tax, divided by total assets	Amadeus
Debtors	Trade credit extended (Trade debtors, accounts receivable) scaled by total assets	Amadeus
Creditors	Trade credit received (Trade creditors, accounts payable) scaled by total assets	Amadeus
Collection period	Trade debtors time 360, divided by operating revenue	Amadeus
Credit period	Trade creditors times 360, divided by operating revenue	Amadeus
Bank credit	Sum of short-term and long-term bank loans, scaled by total assets	Amadeus
ST bank loans	Short-term bank loans scaled by total assets	Amadeus
Altman Z-score	Altman Z-score for private firms, see Chapter 4.3	Amadeus
Altman Z-score LDVM	Altman Z-score in Binary or Ternary form	Amadeus
Other firm variables		
Firm size	Natural logarithm of SME's total assets in dollars	Amadeus
Firm age	Natural logarithm of SME's age plus 10	Amadeus
Leverage	Total liabilities to total assets	Amadeus
Tangibility	Fixed tangible assets scaled by total assets	Amadeus
Cash-richness	Cash and cash equivalent divided by total assets (net cash)	Amadeus
Liquidity	Current assets minus stock, scaled by total assets	Amadeus
Depreciation	Depreciation to total assets	Amadeus
Growth Opportunity	Industry-level median intangible assets to total assets	Amadeus
Sales Growth	Industry-level median sales growth rate	Amadeus
Country variables		
Lerner index	A measure of banking market competition	Global Financial Development
Bank Credit supply	Domestic credit to private sector by banks (% of GDP)	World Development Indicators
GDP growth rate	Annual growth rate of GDP in percentage form	World Development Indicators
Unemployment rate	Annual unemployment rate (% of total labour force)	World Development Indicators
Interest rate	Annual nominal short-term interest rate in percentage form	European Comission
Inflation	Annual percentage inflation rate, GDP deflator	World Development Indicators

Appendix B: Descriptive Statistics

Variables	Obs.	Mean	Median	Std.Dev.	P1	P99
Main firm variables						
ROA	563260	5.765	4.152	13.283	-34.601	47.878
Debtors	563198	0.257	0.217	0.225	0.000	0.866
Creditors	563260	0.184	0.132	0.185	0.000	0.761
Collection period	518657	54.503	49.044	43.290	0.000	177.044
Credit period	533354	38.934	31.143	36.099	0.000	178.080
Bank credit	485213	0.218	0.144	0.231	0.000	0.915
ST bank credit	551470	0.097	0.029	0.148	0.000	0.680
Altman Z-score	352493	2.494	2.315	1.487	0.105	7.326
Other firm variables						
Size	563115	16.507	16.397	1.174	13.774	19.926
Age	562489	3.452	3.434	0.474	2.485	4.710
Leverage	535514	0.597	0.629	0.246	0.021	0.997
Cash-richness	538838	0.163	0.053	0.302	0.000	1.582
Tangibility	554280	0.220	0.124	0.244	0.000	0.947
Liquidity	556907	1.916	1.049	4.595	0.046	20.424
Growth.Opp.	546185	0.023	0.000	0.071	-0.004	0.386
Sales Growth	513971	0.013	0.005	0.086	-0.095	0.243
Depreciation	498193	0.031	0.022	0.029	0.000	0.134
Country variables						
Lerner index	509155	0.211	0.222	0.090	0.030	0.400
Bank Credit supply	562650	124.901	119.980	41.718	43.104	195.677
GDP growth rate	563260	0.851	1.361	2.624	-6.564	6.180
Unemp' rate	525435	10.643	8.600	5.831	4.300	26.300
Interest rate	548436	1.912	0.880	1.970	-0.020	7.910
Inflation	563260	1.514	1.539	1.406	-1.044	5.185

*Variables used for robustness and heterogeneity tests are not presented here

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Table 1: Main sample composition

Sample distribution by country

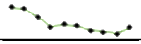
Country	Firms	%Firms	Obs.	%Obs.	Avg.years
Austria	1454	1.96%	9466	1.68%	6.51
Cyprus	130	0.18%	495	0.09%	3.81
Germany	7672	10.36%	49107	8.72%	6.40
Denmark	743	1.00%	3305	0.59%	4.45
Estonia	502	0.68%	4140	0.74%	8.25
Spain	14830	20.03%	118874	21.10%	8.02
France	16823	22.72%	139485	24.76%	8.29
UK	18875	25.49%	139719	24.81%	7.40
Greece	1711	2.31%	13482	2.39%	7.88
Croatia	793	1.07%	6521	1.16%	8.22
Hungary	1745	2.36%	12660	2.25%	7.26
Ireland	524	0.71%	3350	0.59%	6.39
Iceland	118	0.16%	978	0.17%	8.29
Lithuania	463	0.63%	3285	0.58%	7.10
Latvia	473	0.64%	3553	0.63%	7.51
Malta	221	0.30%	1324	0.24%	5.99
Netherlands	1158	1.56%	5795	1.03%	5.00
Poland	2370	3.20%	18423	3.27%	7.77
Portugal	2744	3.71%	23928	4.25%	8.72
Slovenia	687	0.93%	5372	0.95%	7.82
Total	74036	100.00%	563262	100.00%	7.61

Sample distribution by industry

Industry	Firms	%Firms	Obs.	%Obs.	Avg.years
A	942	1.27%	7293	1.29%	7.74
C	18313	24.74%	141948	25.20%	7.75
D	1166	1.57%	8292	1.47%	7.11
F	7154	9.66%	54065	9.60%	7.56
G	23199	31.33%	182993	32.49%	7.89
H	3837	5.18%	29298	5.20%	7.64
I	1577	2.13%	12139	2.16%	7.70
J	3085	4.17%	21906	3.89%	7.10
L	4452	6.01%	33074	5.87%	7.43
M	5299	7.16%	36496	6.48%	6.89
N	3637	4.91%	25909	4.60%	7.12
R	775	1.05%	5656	1.00%	7.30
S	596	0.81%	4170	0.74%	7.00
T	4	0.01%	23	0.00%	5.75
Total	74036	100.00%	563262	100.00%	7.61

A: agriculture, forestry and fishing. C: manufacturing. D: electricity, gas, steam and air conditioning supply. F: construction. G: wholesale and retail trade. H: transportation and storage. I: accommodation and food service activities. J: information and communication. L: real estate activities. M: professional, scientific and technical activities. N: administrative and support service activities. R: arts, entertainment and recreation. S: other service activities. T: activities of households as employers.

Table 2: Mean values of selected variables across 'Big-4' countries and years

	Germany	Spain	France	UK	Total (20)
A: Trade credit extended (Trade Debtors), scaled by total assets					
2006	0.1355	0.3265	0.3109	0.2296	0.2828
2007	0.1282	0.3224	0.3066	0.2270	0.2750
2008	0.1280	0.2899	0.2970	0.2145	0.2595
2009	0.1287	0.2770	0.2816	0.2113	0.2499
2010	0.1377	0.2772	0.2833	0.2256	0.2546
2011	0.1409	0.2734	0.2836	0.2296	0.2540
2012	0.1454	0.2708	0.2776	0.2267	0.2505
2013	0.1531	0.2692	0.2779	0.2281	0.2501
2014	0.1350	0.2689	0.2742	0.2268	0.2487
2015	0.1061	0.2635	0.2764	0.2284	0.2535
Trend					
B: Trade credit received (Trade Creditors), scaled by total assets					
2006	0.1043	0.1527	0.3028	0.1531	0.2045
2007	0.1120	0.1539	0.2982	0.1512	0.2017
2008	0.1071	0.1559	0.2864	0.1462	0.1934
2009	0.1029	0.1502	0.2672	0.1422	0.1817
2010	0.1103	0.1539	0.2702	0.1478	0.1849
2011	0.1137	0.1479	0.2750	0.1496	0.1825
2012	0.1135	0.1451	0.2694	0.1465	0.1786
2013	0.1138	0.1434	0.2681	0.1475	0.1766
2014	0.1040	0.1425	0.2636	0.1444	0.1742
2015	0.1531	0.1423	0.2576	0.1474	0.1809
Trend					

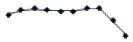
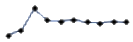
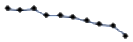
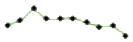
	Germany	Spain	France	UK	Total (20)
C: Short-term bank credit scaled by total assets					
2006	0.0544	0.0779	0.0664	0.1606	0.0953
2007	0.0587	0.0845	0.0657	0.1582	0.0973
2008	0.0603	0.1092	0.0626	0.1598	0.1034
2009	0.0584	0.0950	0.0609	0.1530	0.0982
2010	0.0578	0.0935	0.0610	0.1527	0.0981
2011	0.0581	0.0960	0.0596	0.1515	0.0987
2012	0.0609	0.0926	0.0564	0.1474	0.0966
2013	0.0604	0.0915	0.0570	0.1443	0.0945
2014	0.0482	0.0942	0.0604	0.1423	0.0949
2015	0.0339	0.0931	0.0564	0.1321	0.0903
Trend					
D: GDP per capita annual growth rate (%)					
2006	3.817	2.428	1.664	1.752	4.425
2007	3.399	1.866	1.730	1.760	4.291
2008	1.275	-0.484	-0.363	-1.406	0.172
2009	-5.379	-4.424	-3.439	-5.049	-5.941
2010	4.240	-0.446	1.463	1.119	0.741
2011	3.634	-1.351	1.587	0.719	1.683
2012	2.206	-2.684	-0.301	0.611	-0.223
2013	-1.599	-1.349	0.100	1.231	0.371
2014	3.038	1.664	-0.156	2.297	2.131
2015	1.183	3.354	0.801	1.398	3.351
Trend					

Table 3: Mean values of selected variable across countries or across industries

Panel A: Mean values of SME Return on Assets (%), Trade Credits and bank debt across countries							
Country	ROA	Altman Z-score	Debtors	Creditors	ST bank credit	Collection period	Credit period
Austria	6.2877	2.2457	0.1095	0.0818	0.1303	24.1432	17.8592
Cyprus	4.4747		0.3469	0.2690	0.1668	98.6515	62.3528
Germany	6.8491	2.6101	0.1373	0.1106	0.0572	27.7565	20.3955
Denmark	5.7143		0.2072	0.1091		45.5701	25.7275
Estonia	8.2774	2.8561	0.1615	0.0845	0.0810	30.1313	15.3606
Spain	3.7162	2.1093	0.2837	0.1489	0.0928	80.5053	34.8884
France	6.1795	2.8773	0.2870	0.2762	0.0607	56.5439	46.5196
UK	6.4947		0.2247	0.1474	0.1500	47.2062	29.0747
Greece	2.8691	1.7337	0.3465	0.2292	0.1590	108.3662	60.3470
Croatia	3.7395	1.9652	0.2670	0.1665	0.0603	78.8511	44.5215
Hungary	5.9695	2.4694	0.2160	0.1775	0.0872	41.9981	32.1494
Ireland	3.2824		0.1863	0.1441	0.1192	48.1931	34.1193
Iceland	6.0814	2.3859	0.1861	0.1489	0.0624	38.0434	30.1036
Lithuania	6.9472	2.7286	0.2711	0.2245	0.0823	49.6508	37.9269
Latvia	6.3524	2.9865	0.2174	0.2023	0.0925	35.3587	29.5264
Malta	6.2967	1.9530	0.2484	0.2193	0.0751	63.2502	47.3660
Netherlands	6.0897	2.2919	0.4076	0.1205	0.0047	80.8801	24.8899
Poland	7.3559	2.6233	0.2836	0.2204	0.0810	57.1395	40.5955
Portugal	3.6348	2.0354	0.3775	0.2175	0.1092	100.7163	53.2164
Slovenia	5.5385	2.3329	0.3031	0.2937	0.1367	70.8593	61.1349
Panel B: Mean values of SME Return on Assets (%), Trade Credits and bank debt across industries							
Industry	ROA	Altman Z-score	Debtors	Creditors	ST bank credit	Collection period	Credit period
A	3.7677	1.8860	0.1891	0.1374	0.1121	58.0597	37.1365
C	5.9478	2.2703	0.2726	0.1717	0.1003	70.2127	40.9971
D	4.0941	1.2930	0.1159	0.0668	0.0540	58.2771	26.2128
F	5.1069	1.9769	0.2890	0.1943	0.0843	74.0379	45.5885
G	6.3718	3.3392	0.2928	0.2683	0.1071	49.9151	38.7176
H	5.1099	2.5926	0.3483	0.2098	0.0809	62.8790	34.7223
I	2.1109	1.2112	0.0828	0.0712	0.0960	37.1359	29.8951
J	7.3031	2.1666	0.2777	0.1310	0.0811	69.6374	29.7640
L	2.1661	0.8647	0.0412	0.0261	0.0769	37.9250	21.3219
M	5.5985	1.7936	0.2231	0.1028	0.0882	64.4441	28.7811
N	5.7926	2.3666	0.2432	0.1241	0.1112	53.7470	25.6576
R	3.3170	1.8057	0.1058	0.0737	0.0743	35.9296	24.2603
S	6.9343	2.0955	0.1855	0.1078	0.1161	44.4976	23.7651

Industry codes: A: agriculture, forestry and fishing. C: manufacturing. D: electricity, gas, steam and air conditioning supply. F: construction. G: wholesale and retail trade. H: transportation and storage. I: accommodation and food service activities. J: information and communication. L: real estate activities. M: professional, scientific and technical activities. N: administrative and support service activities. R: arts, entertainment and recreation. S: other service activities. T: activities of households as employers (limited observation, not displayed). Other industries not included.

Note: please see variable definitions in Appendix A.

Table 4: Bank credit and trade credit

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent variable	**Bank credit**	**Bank credit**	**ST Bank credit**	**ST Bank credit**	**ST Bank credit**	**ST Bank credit**	**ST Bank credit**	**ST Bank credit**
Sample	full	full	full	full	micro & small-sized	medium-sized	full	full
Lagged (1) Dep. Var.								0.7540***
								(0.0109)
Creditors t(t-1)	**-0.1377*** **	**-0.0331*** **	**-0.0321*** **	0.0064***	**-0.0541*** **	**-0.0715*** **	**-0.0710*** **	**-0.0160** **
	(0.0042)	(0.0034)	(0.0027)	(0.0024)	(0.0031)	(0.0035)	(0.0025)	(0.0071)
Firm size t(t-1)	0.0471***	0.0385***	0.0193***	0.0157***	0.0215***	0.0194***	0.0195***	0.0012**
	(0.0012)	(0.0011)	(0.0007)	(0.0007)	(0.0013)	(0.0014)	(0.0008)	(0.0006)
Firm age t(t-1)	-0.0345***	-0.0389***	0.0005	-0.0027*	-0.0014	-0.0197***	0.0143***	-0.0019***
	(0.0020)	(0.0021)	(0.0013)	(0.0014)	(0.0024)	(0.0020)	(0.0032)	(0.0002)
Cash-richness t(t-1)	-0.0422***	-0.0253***	-0.0194***	-0.0130***	-0.0188***	-0.0222***	-0.0102***	-0.0056*
	(0.0015)	(0.0014)	(0.0010)	(0.0009)	(0.0016)	(0.0017)	(0.0008)	(0.0031)
Tangibility t(t-1)	0.1242***	0.0782***	-0.0140***	0.0019	-0.0216***	-0.0217***	-0.0181***	-0.0172***
	(0.0043)	(0.0038)	(0.0025)	(0.0024)	(0.0037)	(0.0045)	(0.0027)	(0.0048)
Liquidity t(t-1)	0.0018***	-0.0001	-0.0024***	-0.0008***	-0.0023***	-0.0049***	-0.0022***	-0.0005**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0002)
Growth Opp. t(t-1)	0.1010***	0.0673***	-0.0163**	0.0061	-0.0583***	0.0022	-0.0322***	0.0076**
	(0.0112)	(0.0109)	(0.0066)	(0.0068)	(0.0137)	(0.0098)	(0.0069)	(0.0034)
Lerner index t-1	-0.0225***	-0.0251***	-0.0078***	-0.0130***	-0.0026	-0.0085**	0.0069***	0.0180***
	(0.0032)	(0.0033)	(0.0024)	(0.0024)	(0.0042)	(0.0033)	(0.0019)	(0.0020)
Bank credit supply t-1	0.0003***	0.0003***	0.0001***	0.0001***	0.0002***	0.0001***	0.0001***	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP growth rate t-1	0.0003***	0.0007***	0.0004***	0.0005***	0.0002**	0.0008***	0.0003***	0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)
Constant	-0.5012***	-0.3483***	-0.2183***	-0.1620***	-0.2456***	-0.1469***	-0.0009***	-0.0011
	(0.0192)	(0.0184)	(0.0106)	(0.0109)	(0.0199)	(0.0233)	(0.0002)	(0.0088)
Note 1	t	t-1	t	t-1	t	t	t	t-1
Note 2							Variables in 1-yr. diff.	
Observations	470,172	403,549	526,409	451,431	189,974	226,921	433,620	449,179
Groups	70,213	67,886	73,661	71,471	38,757	41,401	N/A	71,325
Estimator	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.D. OLS	2S S-GMM
Adj-R^2	77.91%	79.63%	66.18%	68.17%	69.44%	69.98%	1.57%	N/A

*, ** and *** respectively represents significance at 10%, 5% and 1% level. Standard errors are reported in parentheses and they are clustered at firm-level. F.E. stands for fixed-effect estimator. The Adjusted R-squared for F.E. models account for variations captured by firm fixed-effects. Note 1 explains whether the firm-level variables are one-year lagged. Note 2 (Model 7) annotates that all dependent and independent variables are in 1-year difference, and Model 7 is estimated by OLS estimator with robust standard errors. Model 8 is estimated by two-step "System" GMM estimator (Arellano and Bover 1995; Blundell and Bond 1998). The results of relevant econometrics diagnostic tests designed for endogeneity correction models (i.e. Model 8), e.g. Overidentification tests and serial correlation tests, are not presented for space reason, same in below tables.

Table 5: Trade credit and bank credit

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Dependent variable	**Creditors**	**Creditors**	**Creditors**	**Creditors**	**Creditors**	**Creditors**	**Creditors**	**Creditors**	**Debtors**	**Debtors**	**Debtors**
Sample	full	full	full	full	micro & small-sized	medium-sized	full	full	full	full	full
Lagged (1) Dep. Var.								0.5769***			0.8355***
								(0.0093)			(0.0099)
Bank credit t(t-1)	**-0.0741*** **	**-0.0162*** **					**-0.1002*** **	**-0.0104** **			
	(0.0022)	(0.0018)					(0.0021)	(0.0044)			
ST Bank credit t(t-1)			**-0.0323*** **	0.0003	**-0.0817*** **	**-0.0696*** **			**0.0634*** **	**0.0427*** **	**0.0188*** **
			(0.0025)	(0.0021)	(0.0044)	(0.0034)			(0.0028)	(0.0023)	(0.0065)
Firm size t(t-1)	0.0146***	-0.0026***	0.0120***	-0.0016**	0.0157***	-0.0154***	0.0249***	-0.0105***	0.0037***	0.0072***	-0.0117***
	(0.0008)	(0.0008)	(0.0007)	(0.0007)	(0.0013)	(0.0011)	(0.0009)	(0.0004)	(0.0009)	(0.0010)	(0.0005)
Firm age t(t-1)	-0.0282***	-0.0166***	-0.0207***	-0.0140***	-0.0189***	-0.0560***	-0.0038	-0.0003	-0.0286***	-0.0029	0.0010***
	(0.0015)	(0.0016)	(0.0015)	(0.0016)	(0.0029)	(0.0020)	(0.0035)	(0.0002)	(0.0015)	(0.0034)	(0.0002)
Cash-richness t(t-1)	-0.0259***	-0.0122***	-0.0220***	-0.0110***	-0.0206***	-0.0255***	-0.0212***	0.0017	-0.0938***	-0.1118***	0.0112***
	(0.0011)	(0.0010)	(0.0010)	(0.0009)	(0.0018)	(0.0013)	(0.0010)	(0.0042)	(0.0014)	(0.0012)	(0.0039)
Tangibility t(t-1)	-0.0767***	-0.0380***	-0.0823***	-0.0388***	-0.0763***	-0.1188***	-0.0743***	0.0204***	-0.1627***	-0.1723***	0.0255***
	(0.0023)	(0.0019)	(0.0023)	(0.0019)	(0.0037)	(0.0037)	(0.0023)	(0.0036)	(0.0030)	(0.0028)	(0.0032)
Liquidity t(t-1)	-0.0018***	-0.0006***	-0.0020***	-0.0006***	-0.0016***	-0.0041***	-0.0014***	-0.0004**	-0.0003***	0.0001	-0.0001
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0000)	(0.0002)
Growth Opp. t(t-1)	-0.0803***	-0.0257***	-0.0871***	-0.0304***	-0.1560***	-0.0760***	-0.0673***	0.0171***	-0.1937***	-0.1876***	0.0073**
	(0.0076)	(0.0071)	(0.0070)	(0.0065)	(0.0134)	(0.0078)	(0.0078)	(0.0026)	(0.0074)	(0.0076)	(0.0032)
Interest rate t-1	0.0008***	0.0005***	-0.0001	-0.0001	0.0026***	-0.0010***	-0.0017***	-0.0016***	-0.0019***	-0.0025***	-0.0021***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GDP growth rate t-1	0.0010***	0.0009***	0.0009***	0.0008***	-0.0001	0.0012***	0.0000	-0.0007***	0.0022***	0.0003***	-0.0007***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0001)
Constant	0.0672***	0.2868***	0.0724***	0.2564***	0.0107	0.6573***	-0.0035***	0.1942***	0.3244***	-0.0037***	0.2227***
	(0.0133)	(0.0130)	(0.0119)	(0.0115)	(0.0218)	(0.0192)	(0.0002)	(0.0080)	(0.0137)	(0.0002)	(0.0108)
Note 1	t	t-1	t	t-1	t	t	t	t-1	t	t	t-1
Note 2							Variables in 1-yr. diff.		Variables in 1-yr. diff.		
Observations	478,854	411,203	536,802	462,300	193,606	232,860	388,020	406,954	538,981	447,769	466,793
Groups	70,574	68,295	74,029	71,939	39,006	41,918	N/A	68,047	73,939	N/A	72,324
Estimator	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.D. OLS	2S S-GMM	F.E.	F.D. OLS	2S S-GMM
Adj-R^2	80.12%	82.06%	78.47%	80.81%	79.40%	83.21%	3.66%	N/A	82.54%	7.41%	N/A

*, ** and *** respectively represents significance at 10%, 5% and 1% level. Standard errors are reported in parentheses and they are clustered at firm-level. F.E. stands for fixed-effect estimator. The Adjusted R-squared for F.E. models account for variations captured by firm fixed-effects. Note 1 explains whether the firm-level variables are one-year lagged. Note 2 (Models 7 and 10) annotates that all dependent and independent variables are in 1-year difference, and these two models are estimated by OLS estimator with robust standard errors. Models 8 and 11 are estimated by two-step "System" GMM estimator (Arellano and Bover 1995; Blundell and Bond 1998).

Table 6: Trade credit investment and SME profitability, baseline results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Dependent variable	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**
Sample	full	full	micro & small-sized	medium-sized	full	full	full
Lagged (1) Dep. Var.						0.6118***	
						(0.0168)	
Debtors t(t-1)	**0.0300*** **	**0.0818*** **	**0.0362*** **	**0.0269*** **	**0.0324*** **	**0.0175***	**0.0458*** **
	(0.0027)	(0.0026)	(0.0042)	(0.0041)	(0.0028)	(0.0093)	(0.0061)
SQ Debtors t-1							-0.0210***
							(0.0071)
Firm size t(t-1)	-0.0228***	0.0130***	-0.0231***	-0.0267***	-0.0398***	-0.0080***	-0.0227***
	(0.0010)	(0.0010)	(0.0017)	(0.0016)	(0.0014)	(0.0006)	(0.0010)
Firm age t(t-1)	0.0153***	-0.0250***	0.0292***	0.0105***	0.0112***	0.0029***	0.0151***
	(0.0018)	(0.0017)	(0.0030)	(0.0029)	(0.0041)	(0.0003)	(0.0018)
Leverage t(t-1)	0.0441***	-0.1888***	0.0589***	0.0527***	0.2124***	0.0184***	0.0442***
	(0.0030)	(0.0028)	(0.0048)	(0.0045)	(0.0040)	(0.0027)	(0.0030)
Tangibility t(t-1)	-0.0281***	-0.0437***	-0.0111***	-0.0420***	-0.0053*	-0.0013	-0.0282***
	(0.0026)	(0.0024)	(0.0034)	(0.0050)	(0.0029)	(0.0028)	(0.0026)
Sales growth t(t-1)	0.0197***	0.0337***	0.0078**	0.0276***	0.0406***	-0.0022	0.0197***
	(0.0019)	(0.0016)	(0.0032)	(0.0029)	(0.0018)	(0.0022)	(0.0019)
Cash-richness t(t-1)	0.0250***	0.0429***	0.0205***	0.0291***	0.0019	0.0131***	0.0247***
	(0.0014)	(0.0014)	(0.0023)	(0.0022)	(0.0013)	(0.0018)	(0.0014)
Depreciation t(t-1)	-0.1275***	-0.4759***	-0.1102***	-0.1387***	0.1362***	-0.1947***	-0.1292***
	(0.0183)	(0.0178)	(0.0358)	(0.0247)	(0.0184)	(0.0109)	(0.0183)
GDP growth rate t-1	0.0006***	0.0010***	0.0006***	0.0006***	-0.0002***	0.0027***	0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Inflation t-1	0.0002	0.0013***	0.0006*	0.0003	-0.0014***	-0.0001	0.0002
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
Constant	0.3600***	0.0346**	0.3061***	0.4393***	0.0001	0.1227***	0.3576***
	(0.0162)	(0.0161)	(0.0260)	(0.0265)	(0.0003)	(0.0126)	(0.0162)
Note 1	t-1	t	t-1	t-1	t-1	t-1	t-1
Note 2					Variables in 1-yr. diff.		
Observations	367,645	428,623	135,547	176,672	296,180	365,767	367,645
Groups	64,676	66,230	31,464	37,787	N/A	64,327	64,676
Estimator	F.E.	F.E.	F.E.	F.E.	F.D. OLS	2S S-GMM	F.E.
Adj-R^2	57.96%	59.42%	60.00%	58.56%	4.24%	N/A	57.96%

*, ** and *** respectively represents significance at 10%, 5% and 1% level. Standard errors are reported in parentheses and they are clustered at firm-level. F.E. stands for fixed-effect estimator. The Adjusted R-squared for F.E. models account for variations captured by firm fixed-effects. Note 1 explains whether the firm-level variables are one-year lagged. Note 2 (Mode 5) annotates that all dependent and independent variables are in 1-year difference, and the model is estimated by OLS estimator with robust standard errors. Model 6 is estimated by two-step "System" GMM estimator (Arellano and Bover 1995; Blundell and Bond 1998).

Table 7: Trade credit and SME profitability, robustness tests

	Model 1	Model 2	Model 3	Model 4		Model 5	//
Dependent variable	**ROA**	**RAV**	**ROS**	**ROA-GR**		**ROA**	//
Sample	full	full	full	full		full	//
Debtors t-1	**0.0535*****	**0.0741*****	**0.0218*****	**0.1668*****	**Debtors_ID** t-1	**0.0278*****	
	(0.0060)	(0.0136)	(0.0028)	(0.0253)		(0.0027)	
Control variables?	Yes	Yes	Yes	Yes		Yes	
Constant?	Yes	Yes	Yes	Yes		Yes	
Observations	341,795	251,774	261,129	331,078			
Groups	62,290	51,374	46,563	63,627			
Estimator	F.E.	F.E.	F.E.	F.E.		F.E.	
Adj-R^2	52.47%	8.25%	55.29%	22.18%		58.30%	

	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Dependent variable	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**
Grouping	**By Country**			**By Industry**		**By Year**	
Sample	'big-4'	'non big-4'	manu.	wholesale	others	06-15	11-15
Debtors t-1	**0.0300*****	**0.0345*****	**0.0540*****	**0.0372*****	**0.0123****	**0.0164*****	**0.0201*****
	(0.0030)	(0.0063)	(0.0053)	(0.0042)	(0.0055)	(0.0037)	(0.0037)
Control variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	297,586	70,059	100,482	127,653	139,510	184,127	232,545
Groups	52,149	12,527	16,941	21,374	26,361	55,954	62,379
Estimator	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.
Adj-R^2	58.37%	56.17%	56.23%	60.42%	57.48%	64.00%	65.64%

*, ** and *** respectively represents significance at 10%, 5% and 1% level. Standard errors are reported in parentheses and they are clustered at firm-level. F.E. stands for fixed-effect estimator. The Adjusted R-squared for F.E. models account for variations captured by firm fixed-effects.

Table 8: Trade credit and SME profitability, heterogeneity tests

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Dependent variable	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**	**ROA**
Studied element	**Sales volatility**			**GDP grow. rate**	**Unemp' rate**	**Bank credit supply**	**ST Bank credit usage**			**Collection period (days)**		
Corr. Hypothesis	H2b			H2c		H2d	H2d			H2e		
Sample	Less	More	Full	Full	Full	Full	Less	More	Full	Shorter	Longer	Full
Regressors												
Debtors t-1	0.0327***	0.0307***	0.0304***	0.0289***	0.0262***	0.0454***	0.0292***	0.0337***	0.0316***	0.0561***	0.0412***	0.0992***
	(0.0047)	(0.0046)	(0.0033)	(0.0027)	(0.0036)	(0.0072)	(0.0050)	(0.0039)	(0.0029)	(0.0065)	(0.0037)	(0.0053)
Sales volatility t-1			-0.0240***									
			(0.0032)									
SV*Debtors t-1			0.0180*									
			(0.0094)									
GDP growth rate t-1				0.0023***								
				(0.0001)								
GDPGR*Debtors t-1				0.0004								
				(0.0003)								
Unemp. rate t-1					-0.0003***							
					(0.0001)							
Unemp*Debtors t-1					0.0003*							
					(0.0002)							
Bank credit supply t-1						-0.0320***						
						(0.0025)						
BCS*Debtors t-1						-0.0111**						
						(0.0050)						
ST Bank credit t-1									-0.0401***			
									(0.0042)			
ST BC*Debtors t-1									-0.0149			
									(0.0109)			
Collection period t-1												-0.0002***
												(0.0000)
Collect.P.*Debtors t-1												-0.0002***
												(0.0000)
Controls & constant ?	Yes for all models			Yes for all models		Yes	Yes for all models				Yes for all models	
Observations	125,932	117,355	244,060	367,468	367,645	367,630	175,967	184,002	359,969	158,059	166,742	324,803
Groups	35,906	37,368	44,236	64,653	64,676	64,674	44,823	44,128	63,558	39,234	39,528	61,025
Estimator	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.
Adj-R^2	71.44%	57.89%	61.71%	58.16%	57.95%	58.05%	62.02%	54.78%	58.07%	62.22%	59.66%	59.28%

*, ** and *** respectively represents significance at 10%, 5% and 1% level. Standard errors are reported in parentheses and they are clustered at firm-level. F.E. stands for fixed-effect estimator. The Adjusted R-squared for F.E. models account for variations captured by firm fixed-effects.

Table 9: Trade credit finance and SME distress, continuous variable models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Dependent variable	**Z-score**	**Z-score**	**Z-score**	**Z-score**	**Z-score**	**Z-score**	**Z-score**	**Z-score**	**Z-score**
Interaction terms					Bank K supply	F. Crisis	ST Bank credit	Bank credit	Credit days
Corr. Hypothesis	H3a	H3a	H3a	H3a	H3b	H3b	H3b	H3b	H3c
Sample	full	full	micro & small-sized	medium-sized	full	full	full	full	full
Creditors t-1	0.6780***	0.0075***	0.4813***	0.6795***	0.8639***	0.5987***	0.6892***	0.6905***	1.8557***
	(0.0293)	(0.0005)	(0.0428)	(0.0406)	(0.0819)	(0.0307)	(0.0308)	(0.0341)	(0.0509)
Bank credit supply t-1					-0.1731***				
					(0.0231)				
BCS*Creditors t-1					-0.1618***				
					(0.0613)				
Financial crisis t-1						-0.0435***			
						(0.0053)			
FC*Creditors t-1						0.1610***			
						(0.0172)			
ST Bank credit t-1							0.0056		
							(0.0220)		
ST BC*Creditors t-1							-0.2517***		
							(0.0934)		
Bank credi t-1								-0.1742***	
								(0.0210)	
BC*Creditors t-1								-0.4468***	
								(0.1148)	
Credit period t-1									-0.0018***
									(0.0001)
CP*Creditors t-1									-0.0075***
									(0.0004)
Firm size t-1	-0.0872***	-0.1727***	-0.0440***	-0.1892***	-0.0838***	-0.0868***	-0.0879***	-0.0962***	-0.0872***
	(0.0079)	(0.0116)	(0.0134)	(0.0123)	(0.0079)	(0.0079)	(0.0080)	(0.0084)	(0.0084)
Sales growth t-1	0.2989***	0.3362***	0.3675***	0.2884***	0.2905***	0.3235***	0.2992***	0.2871***	0.3094***
	(0.0148)	(0.0197)	(0.0280)	(0.0205)	(0.0151)	(0.0145)	(0.0148)	(0.0150)	(0.0148)
Cash-richness t-1	0.0247**	0.1619***	0.0015	0.0321*	0.0275**	0.0230*	0.0217*	0.0105	0.0322***
	(0.0125)	(0.0221)	(0.0208)	(0.0176)	(0.0125)	(0.0125)	(0.0125)	(0.0127)	(0.0124)
Firm age t-1	0.2880***	0.7143***	0.2994***	0.2173***	0.1737***	0.3171***	0.2844***	0.2660***	0.2072***
	(0.0263)	(0.0361)	(0.0474)	(0.0369)	(0.0302)	(0.0302)	(0.0263)	(0.0266)	(0.0256)
GDP growth rate t-1	0.0094***	0.0077***	0.0101***	0.0093***	0.0081***	0.0125***	0.0093***	0.0090***	0.0093***
	(0.0005)	(0.0008)	(0.0010)	(0.0007)	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0006)
Inflation t-1	-0.0057***	-0.0066***	-0.0080***	-0.0032*	-0.0103***	-0.0046***	-0.0056***	-0.0057***	-0.0075***
	(0.0014)	(0.0020)	(0.0031)	(0.0017)	(0.0017)	(0.0016)	(0.0015)	(0.0015)	(0.0014)
Constant	2.8016***	3.0839***	2.1578***	4.6268***	3.3352***	2.7061***	2.8282***	3.0752***	3.0408***
	(0.1487)	(0.2103)	(0.2430)	(0.2306)	(0.1671)	(0.1548)	(0.1495)	(0.1549)	(0.1521)
Notes		Creditors scaled by bank debt							
Observations	268,417	213,749	99,483	116,098	267,925	268,417	267,127	261,885	261,008
Groups	48,459	42,876	24,470	26,543	48,458	48,459	48,374	47,830	47,795
Estimator	F.E	F.E	F.E	F.E	F.E	F.E	F.E	F.E	F.E
Adj-R^2	87.10%	84.72%	88.29%	85.28%	87.13%	87.11%	87.13%	87.32%	87.36%

*, ** and *** respectively represents significance at 10%, 5% and 1% level. Standard errors are reported in parentheses and they are clustered at firm-level. F.E. stands for fixed-effect estimator. The Adjusted R-squared for F.E. models account for variations captured by firm fixed-effects. Section 'notes' explains individual restrictions as detailed.

Table 10: Trade credit finance and SME distress, LDVM models

	Model 1s	Model 2s	Model 3s	Model 4s	Model 5s	Model 6s	Model 7s	Model 8s
Dependent variable	Z-Trinary	Z-Trinary	Z-Trinary	Z-Trinary	Z-Trinary	Z-Trinary	Z-Trinary	Z-Trinary
	Z-Binary	Z-Binary	Z-Binary	Z-Binary	Z-Binary	Z-Binary	Z-Binary	Z-Binary
	Z-B, no grey	Z-B, no grey	Z-B, no grey	Z-B, no grey	Z-B, no grey	Z-B, no grey	Z-B, no grey	Z-B, no grey
Sample	full	micro & small-sized	medium-sized	full	full	full	full	full
Interaction terms	N/A	N/A	N/A	Bank K supply	F. Crisis	ST Bank credit	Bank credit	Credit days
Corr. Hypothesis	H3a	H3a	H3a	H3b	H3b	H3b	H3b	H3c
Creditors t-1	4.9224***	4.7319***	4.0242***	4.9040***	4.9237***	5.1786***	3.9748***	13.7301***
	-2.9145***	-2.8112***	-2.3338***	-2.6518***	-2.9532***	-3.0320***	-2.4754***	-8.6843***
	-6.9959***	-6.4929***	-5.3173***	-6.3992***	-7.3482***	-7.0761***	-6.1076***	-16.4907***
Bank credit supply t-1				-1.0427***				
				0.7048***				
				1.2990***				
BCS*Creditors t-1				-0.0229				
				-0.1701				
				-0.4549				
Financial crisis t					-0.3485***			
					0.2592***			
					0.4600***			
FC*Creditors t-1					0.1192*			
					0.0023			
					0.5955***			
ST Bank credit t-1						1.4210***		
						-0.6657***		
						-1.5036***		
ST BC*Creditors t-1						-3.6404***		
						1.6750***		
						2.0193**		
Bank credi t-1							-2.2350***	
							1.1619***	
							2.2792***	
BC*Creditors t-1							-2.1893***	
							0.7985***	
							1.6334***	
Credit period t-1								-0.0267***
								0.0237***
								0.0447***
CP*Creditors t-1								-0.0373***
								0.0151***
								0.0288***
Controls & Constant?	Yes to all	Yes to all	Yes to all	Yes to all	Yes to all	Yes to all	Yes to all	Yes to all
Observations	268,417	99,483	116,098	267,925	268,417	267,127	261,885	261,008
	268,417	99,483	116,098	267,925	268,417	267,127	261,885	261,008
	141,464	60,336	49,338	141,205	141,205	140,595	137,389	135,650
Groups	48,459	24,470	26,543	48,458	48,459	48,374	47,830	47,795
	48,459	24,470	26,543	48,458	48,459	48,374	47,830	47,795
	36,198	18,640	16,714	36,186	36,186	36,098	35,501	35,516
Estimator	RE OLOGIT	RE OLOGIT	RE OLOGIT	RE OLOGIT	RE OLOGIT	RE OLOGIT	RE OLOGIT	RE OLOGIT
	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP
	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP	RE-PP
Goodness-of-fit	16.51%	32.21%	27.60%	16.84%	16.59%	17.07%	19.53%	22.82%
	18.65%	35.54%	28.33%	19.12%	18.81%	19.11%	21.53%	26.27%
	26.74%	45.75%	35.58%	27.44%	27.08%	27.60%	31.55%	44.73%

*, ** and *** respectively represents significance at 10%, 5% and 1% level. For each model, the 1st, 2nd and 3rd line reports the corresponding result where 'Altman Z-score Trinary form', 'Altman Z-score Binary form' and 'Altman Z-score Binary form without grey zone observations' are used as dependent variables, respectively. Standard errors are not reported for space reason. RE OLOGIT stands for random-effect panel ordered-logit estimator, RE-PP stands for random-effect panel probit estimator. The calculation of 'Goodness-of-fit' values for all LDVM models is explained in footnote 41.