Effects of financial distress and financing constraints on trade credit provisions

Igbekele Sunday Osinubi
Royal Docks School of Business and Law, University of East London, London, UK

Received 23 April 2020
Revised 13 July 2020
6 August 2020
Accepted 6 August 2020

Abstract

Purpose – Existing studies that documented the effect of financial distress on trade credit provisions did not include measures financial constraint. It is possible that financial distress is tie to financial constraints, and both financial distress and financial constraints mutually reinforce each other in their effects on trade credit provision. The purpose of this study is to evaluate the effects of financial constraint and financial distress on trade credit provisions in the UK FTSE 350 listed firms.

Design/methodology/approach – This study employs panel data in the estimation of the determinants of accounts payables and accounts receivables of the UK FTSE 350 firms from 2009 to 2017.

Findings – This study finds that financial distress has significant positive effect on accounts payables and a significant negative effect on accounts receivables. Financial constraints have significant negative effect on accounts payables and a significant positive effect on accounts receivables.

Practical implications – Trade creditor desiring to maintain an enduring product-market relationship grant more concessions to customer in financial distress. The amount of trade credit that sellers provide to financially constrained firm is an increasing function of the buyer's creditworthiness. The urgent cash needs of financially distressed firms lead them to sell trade receivables to factoring company leading to reduction in trade receivables. Firm facing external financing constraints increase trade credit to customers in anticipation of cash flow inflow to enhance liquidity.

Originality/value – This study shows that financial distress and financial constraints mutually reinforce each other in their effects on trade credit provisions, and firm's financing condition contributes to divergence in trade credit policies.

Keywords Trade credits, Accounts payables, Accounts receivables, Financial distress, Financial constraints

Paper type Research paper

1. Introduction

Trade credit is a component of working capital that represents the amount collectible by suppliers when customers are allowed to delay payment (Ghoul and Zheng, 2016). Despite the economic significance of trade credit, it involves high implicit costs in the form of lost cash discounts if the customers had made cash payments (Hasan and Habib, 2019). A number of studies have found that a host of variables determines trade-credit provisions (Petersen and Rajan, 1997). Petersen and Rajan (1997) find that firms with sales drop and negative profits increase trade receivables to their clients which they attributes to a voluntary attempt to gain market share and sales and to an unwanted increase in receivables given the impaired ability of troubled firms to enforce the timely collection of their commercial credit. Molina and Preve (2012) compare receivables policy of firms facing profitability problems, which they defined as the pre-financial distress stage, to receivables policy of firms facing cash flow problems, usually in full-blown financial distress. They found that firms facing profitability problems attempt to apply aggressive credit policy to clients in order to gain market shares, especially if

The author gratefully acknowledges the insightful comments from the anonymous reviewers. The author also benefited greatly from the contribution, useful comments, and suggestions of participants at the 2019 British Accounting and Finance Association Annual Conference.

Declaration of interest: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Asian Review of Accounting
Vol. 28 No. 4, 2020
pp. 545-566

1321-7348
DOI 10.1108/ARA-04-2020-0058

they have the market power to do so without incurring significant sales losses. They also find that firms cut their trade receivables in an attempt to get cash when they experience serious cash flow problems.

This study extends Molina and Preve (2009, 2012) study and posits that it is possible financial distress is tie to financial constraints, and both financial distress and financial constraints mutually reinforce each other in their effects on trade credit provision. For example, at the onset of financial distress, investors face estimation risk as the future cash flows become more uncertain, management reputation suffer, supplier risk the loss of a customer, customers may seek other suppliers and lenders are likely to increase the cost of borrowing to combat increasing default risk (Whitaker, 1999; Wruck, 1990). Thus, financial distress situation may lead to a condition where firm finds it difficult to obtain external finance for profitable projects. The inability of the firm to raise external finance and the distress situation may both influence company's trade credit policy.

Considering the trends in worldwide size of trade credit provisions (Barrot, 2016), and the significant cost implications of the use of trade credits (Hasan and Habib, 2019), understanding the relative roles of financial constraints and financial distress in determining whether a company provides or receives trade credit is central to corporate finance literature. The evidence in this study will provide a better understanding to corporate managers, researchers, policymakers, and fund providers on the relative importance of financial distress and financial constraints on trade credit provisions. In addition to being the first study to examine the relationship between financial conditions and trade credit provisions, this study extends the theoretical perspective to understand the effect of financial conditions on the provisions of trade credit.

This study employs panel data in the estimation of the determinants of accounts payables and accounts receivables of the UK FTSE 350 firms from 2009 to 2017. This study finds that financially distressed have a significant positive effect on accounts payables. This result suggests that financial distress firm can take advantage of a creditor if it generates a large percentage of the creditor's profit (Wilner, 2000), trade creditor desiring to maintain an enduring product-market relationship grant more concessions to a customer in financing distress, while the debtors anticipate larger renegotiation concessions, and agrees to pay a higher interest rate to the trade creditor. The result further indicates that distress firms are willing to pay the higher interest rate on trade credit because associated renegotiations are more likely. Additional analysis indicates that financial distress is prevalent among young firms, and that young firms that are financially distressed pass on the adverse effect of their distress to suppliers by defaulting on accounts payables, leading to an increase in trade payables (Boissay and Gropp, 2007). The result shows a significant negative relationship between financial distress and accounts receivables. The negative relationship suggests that the urgent cash needs of financially distressed firms, and the sale of its trade receivables to a factoring company leads to a significant reduction in trade receivables of distressed firms (Molina and Preve, 2009).

On the other hand, the result further show a significant negative relationship between financial constraint and accounts payables. This result indicate that the amount of trade credit that sellers provide to the buyer is an increasing function of the buyer's creditworthiness (Frank and Maksimovic, 2004). Since financial constrained firms may have low credit worthy status in the financial market, suppliers tend to reduce supply of trade credits to them. The result suggests that if a firm face financial constraints, there is an overall reduction in credit received from both the financial markets and trade customers, possibly due to concern for creditworthiness of the financial constrained firm. Additional analysis shows that financial constraints are prevalent among small firms; and since small firms are unlikely to be monitored by rating agencies or the financial press, there may be large information asymmetries between these firms and potential public investors (Petersen and Rajan, 1994). Therefore, suppliers reduce trade credit to small firms that are financially constrained.

The result further shows that financial constraints have a significant positive effect on accounts receivables. This results can be explained by the reasoning that firm facing external financing constraints or external capital rationing increase supply of trade credit in anticipation of future cash flow to finance the profitable projects. The remaining sections of this study are organized as follows: Section 2 discusses the conceptual definitions and hypotheses development. Section 3 discusses the methodology and estimation techniques. Section 4 presents the results of the data analysis. Section 5 discusses the implications of the results and offers a recommendation.

2. Conceptual definitions and empirical hypotheses

The main hypothesis in this study is that trade credit provisions is link to firm's cash flow, and financial distress and financial constraints could influence trade credit policy. This hypothesis is based on several streams of the trade credit literature. The first set of theories claims that suppliers have an implicit stake in the survival of their clients, implying that they are willing to provide financial support to customers in difficulties (Cuñat, 2007; Wilner, 2000). The theory suggests that it is profitable for suppliers to lend to customers as long as the discounted value of all future rents obtained from continuing the commercial relationship with the client is large enough to offset the opportunity cost of financing the loan. Wilner (2000) further argues that a firm in distress can take advantage of a creditor if it generates a large percentage of the creditor's profit. The trade creditor desiring to maintain an enduring product-market relationship grant more concessions to a customer in financing distress, while debtors anticipating larger renegotiation concessions agrees to pay a higher interest rate to trade creditor.

The second set of theories is based on the argument that clients resort to trade credit when there is rationing in bank markets (Biais and Gollier, 1997; Burkart and Ellingsen, 2004). When liquidity is relatively unrestricted, customers prefer to finance themselves through cheaper bank debt. However, as liquidity dries up, buyers are rationed by banks and they must complement their financing with trade credit. In these models, suppliers are able to extend trade credit because they have advantage to overcome moral hazard and asymmetric information frictions with respect to banks. Moreover, suppliers obtain a mark-up on trade credit over their funding costs, which makes the extension of trade credit profitable from the supplier's perspective. These theories have different implications depending on suppliers' funding position, and in particular, on their opportunity cost of funds (Garcia-Appendini and Montoriol-Garriga, 2013).

2.1 Financial distress and trade payables

Purnanandam (2008) argues that financial distressed firm is more likely to violate debt covenants or miss coupon or principal payments without being insolvent. These violations impose deadweight losses in the form of financial penalties, accelerated debt-payments, operational inflexibility and managerial time and resources spent on negotiations with the lenders. Despite the financial distress conditions, extending trade credit helps to develop long-lasting relations with customers; these relations not only ensure continued sales to the buyer but also reduce information gathering and evaluation costs (Kennett, 1980). Wilson and Summers (2002) found that suppliers are better place to assess buyer risk and have lower collection costs than financial institutions. The reputational capital of buyer may also encourage suppliers to extend trade credit (Wu *et al.*, 2014; Zhang *et al.*, 2014). Suppliers will be willing to extend trade credit to financially distressed customers with good reputation. Lee and Stowe (1993) further argue that allowing buyers to use a product before paying for it helps reduce the costs of verifying product quality. The foregoing discussion suggests that the reputational capital of distressed firms and the sellers' desire to develop a long-lasting

relationship with distressed firms will lead to an increase in trade credit provisions to distressed firms. The above discussions lead to the following hypotheses:

H1a. There is a significant positive relationship between financial distress and trade payables in the UK FTSE 350 firms.

2.2 Financial distress and trade receivables

Molina and Preve (2009) argue that a firm could enter financial distress because its clients fail to pay their bills, or a negative exogenous shock in sales can cause a mechanical drop in the levels of trade receivables. This situations can drive the firm into financial distress, and therefore would suggest a positive relationship between financial distress and trade receivables. However, Meltzer (1960) suggests that the incentive to extend trade credits to clients should decrease during the period of high inflation, since the present value of receivables is lower. In addition, Molina and Preve (2009) show that firms have a greater incentive to reduce their trade receivables under higher inflation, even if they are not in financial distress, making it more difficult to distinguish the effect of financial distress on firm's trade receivables. Other studies demonstrate that in the presence of a clearly exogenous shock generated by a macroeconomic crisis in a country, firms decrease their level of trade receivables; and that in the event of a country-wide macroeconomic shock, firms first experience an unwanted increase in trade receivables, and then react by sharply decreasing their level of trade receivables to their clients (Love *et al.*, 2007).

However, Opler and Titman (1994) found that financial distress firms lose customers, valuable suppliers, employees and significant market share to their healthy counterparts. Molina and Preve (2009) also argue that a negative effect of financial distress on trade receivables could be due to the urgent cash needs of financially distressed firms. Distressed firms could have a reduced level receivables if the firm sells its trade receivables to a factoring company instead of directly reducing its trade receivables. When the distressed firm sells its trade receivables through factoring, the firm drops the trade receivables from its balance sheet in exchange for cash from the factoring company. If a firm in financial distress sells its trade receivables to a factoring company, the effect on its balance sheet and the need for cash is the same as if the firm directly cuts its credit to clients. In the end, the relation between financial distress and trade receivables will be the same whether the firm uses factoring to collect the receivables faster or directly reduces credit to clients. This discussion leads to the following hypothesis

H1b. There is a significant negative relationship between financial distress and trade receivables in the UK FTSE 350 firms.

2.3 Financial constraints and trade payables

A firm is financially constrained when the wedge between its internal and external costs of funds increases (Kaplan *et al.*, 1997). Financially constrained firms may have to forgo positive NPV projects due to costly external financing (Froot *et al.*, 1993). Therefore, the ability of the firm to invest in profitable projects in the presence of financial constraints would be sensitive to internal cash flow (Kaplan *et al.*, 1997). Frank and Maksimovic (2004) argue that if information asymmetries cause banks not to be able to distinguish risky borrowers from safe ones and if borrower liability is limited, financially constrained borrowers may be willing to bear the ensuing higher interest rates. Therefore, charging higher interest rates does not help banks in sorting borrowers, hence, banks resort to credit rationing.

Prior studies show that trade credit is an important form of alternative financing for firms facing financial constraints in the presence of asymmetric information, liquidity shocks or distress risk (Chen *et al.*, 2017; Cuñat, 2007; Deloof and Jegers, 1999; Molina and Preve, 2012;

Petersen and Rajan, 1994, 1995; Wilner, 2000). In other words, firms lacking suitable alternative financing opportunities use trade credit, despite the higher implicit cost associated with this form of financing (Ng *et al.*, 1999). Increasing demand for trade credit could result from credit rationing (Danielson and Scott, 2004; Howorth and Reber, 2003; Seifert *et al.*, 2013). Financial constraints firms might find it more profitable to increase demand for trade credit in order to mitigate the costs of borrowing, which may be higher than the discounts received for early cash payments (Bougheas *et al.*, 2009; Mateut *et al.*, 2015).

Furthermore, the redistribution theory of trade credit posits that firms with better access to capital will redistribute the credit they receive to less advantaged firms via trade credit (Meltzer, 1960; Nilsen, 2002; Petersen and Rajan, 1997). The theory argues that suppliers provide liquidity to customers experiencing a temporary liquidity shock. Accordingly, when liquidity in the financial market is scarce, cash-rich suppliers face lower opportunity cost of funds and are in a better position to provide liquidity insurance through an increased amount of trade credit provided to their constrained clients (Cuñat, 2007; Garcia-Appendini and Montoriol-Garriga, 2013; Wilner, 2000). Garcia-Appendini and Montoriol-Garriga (2013) find support for the redistribution theory of trade credit by showing that firm's use of trade credit is a function of their suppliers' liquidity, and that the use of trade credit increased the most for clients with more liquid suppliers. The forgoing discussions suggests that financial constraints firms might find it more profitable to increase demand for trade credit in order to mitigate the costs of borrowing, which may be higher than the discounts received for early cash payments (Bougheas *et al.*, 2009; Mateut *et al.*, 2015).

However, Frank and Maksimovic (2004) argue that the amount of trade credit that sellers provide to the buyer is an increasing function of the buyer's creditworthiness. Thus, empirically less creditworthy buyer gets fewer trade credits overall, since suppliers will be unwilling to sell on credit as suppliers tend to mitigate adverse selection. If the inability of financial constrained firm to get funds from bank or financial market is due to their low credit worthiness, suppliers will reduce trade credits to financial constraints firms. This leads to the following hypothesis:

H2a. There is a significant negative relationship between financial constraints and trade payables in the UK FTSE 350 firms.

2.4 Financial constraints and trade receivables

The ability of a firm to invest in profitable projects in the presence of financial constraints from external sources of funds would be sensitive to internal cash flow (Kaplan *et al.*, 1997). Financial constrained firm may increase credit sales to customers in order to increase access to external finance since the asset could be used as collateral for loans from financial institutions (Biais and Gollier (1997). Financial constrained firms may also find it profitable to increase credit sales to customers in order to reduce inventory holding costs, which could be higher than the opportunity cost of internal capital and the discounts offered to customers for early cash payments (Bougheas *et al.*, 2009; Mateut *et al.*, 2015). Meltzer (1960) suggests that trade credit act as a substitute for financial credit during periods of tight monetary policy, leading to an increase in trade credit provisions. Furthermore, Molina and Preve (2009, 2012) argue that firms that can exert market power are likely to increase trade receivables by reducing the terms of trade receivables without paying a large penalty in terms of a sales drop, which ultimately lead to increase cash inflow to the firm. The foregoing discussions suggests that financially constrained firms will be willing to increase trade credit provisions to customers with a view to collect cash within a short period to mitigate the firm's financial constraint. Financial constrained firm may increase trade credit to customers with the aim of increasing the firm's total assets, which can be used as collaterals to facilitate access to external fund. The foregoing discussion leads to the following hypothesis:

H2b. There is a significant positive relationship between financial constraints and trade receivables in the UK FTSE 350 firms.

3. Empirical design and data

3.1 Data sources and sample selection

To test the hypotheses, this study generated a stratified, random sample of 250 corporations from the FTSE 350 listed firms for the period 2009 to 2017. In common with most studies, all financial firms, principally insurance companies, and banks are excluded because they have different regulatory environments and different reporting conventions compared to other companies. This study identifies all companies that were listed on the FTSE 350 in the Bloomberg database as of May 2018. A backward snowballed approach was used to include all those companies in the sample back to the year 2009. This approach is necessary because additions and deletions to FTSE firms in the UK follow an automatic rule, which leads on average, to 2 or 3 changes to the members of the FTSE 350 at each quarterly review (Danbolt *et al.*, 2018). Consequently, the sampling method helps to eliminate survival bias. Accounting data were taken from the Bloomberg database.

3.2 Empirical specification

This study extends the model use in (Atanasova and Wilson, 2003; Deloof and Jegers, 1999) in evaluating the determinants of trade credit provisions. The empirical specification for the model is stated in equations (1) and (2).

Model 1

$$\frac{\mathrm{AP}_{it}}{\mathrm{TA}_{i,t-1}} = \alpha_{it} + \beta_{it}\mathrm{FD}_{it} + \beta_{it}\mathrm{FC}_{it} + \beta_{it}\frac{\mathrm{AR}_{it}}{\mathrm{TA}_{i,t-1}} + \beta_{it}\frac{\mathrm{INV}_{it}}{\mathrm{TA}_{i,t-1}} + \gamma_{it}Z_{it} + \varphi_i + \varepsilon_t + \mu_{it} \quad (1)$$

Model 2

$$\frac{\mathrm{AR}_{it}}{\mathrm{TA}_{i,t-1}} = \alpha_{it} + \beta_{it}\mathrm{FD}_{it} + \beta_{it}\mathrm{FC}_{it} + \beta_{it}\frac{\mathrm{AP}_{it}}{\mathrm{TA}_{i,t-1}} + \beta_{it}\frac{\mathrm{INV}_{it}}{\mathrm{TA}_{i,t-1}} + \gamma_{it}Z_{it} + \varphi_i + \varepsilon_t + \mu_{it} \quad (2)$$

This study employs panel data and focuses on the dynamics of a firm's behavior on the use and provision of trade credits. The firm-specific effect that captures characteristics of the firm which are not observable but have significant impact on the firm's trade credit provision decisions is measured by φ_i. The time-specific effects that are the same for all firms at a given point in time but vary through time are measured by ϵ_t. The μ_{it} is a disturbance term which is assumed to be serially uncorrelated with mean zero.

This study estimates two-way random-effects panel models for the following reasons. First, fixed-effects models typically produce biased estimates when the time period is relatively short (Chintagunta *et al.*, 1991). Although the time frame for this study is nine years, some firms contribute fewer than 9 observations because of missing data. Second, a limited number of periods in which a firm is financially constrained may bias a fixed-effect estimates. Specific tests stated in Baltagi and Chang (1994), Greene (2003) and Hsiao (2007) are used to verify if the variance components of the disturbance term have fixed effects or random effect. The Durbin–Watson statistic is used to test the presence of autocorrelation in the estimates. This study also estimates the variance inflation factor (VIF) for each independent variable in the model. Gujarati (2003) states a variance inflation factor (VIF) < 10 is the threshold for avoiding the multi-collinearity problem.

3.2.1 Dependent variables. Consistent with Atanasova and Wilson (2003), the dependent variable for model 1 is accounts payables to lag total assets ($AP_{it}/TA_{i,t-1}$), and the dependent variable for model 2 is accounts receivables to lag total assets ($AR_{it}/AT_{i,t-1}$). This study chooses these variable rather than average day's payables outstanding or accounts payables to sales (also days sales outstanding for model 2), because they are better measures of trade credit as a source of finance for firm's assets. The accounts receivables to lag total assets indicates the ability of firms to enforce timely collection of their commercial credit (Molina and Preve, 2009, 2012; Petersen and Rajan, 1997). In the sensitivity analysis, this study uses the ratio of accounts payables to total debt (AP_{it}/TD_{it}), to total debts captures the substitutability effect of trade credits. That is, whether firm uses trade credit as a substitution for external finance. This study also uses the ratio of accounts receivables to total sales ($AR_{it}/SALES_{it}$) in the sensitivity analysis to capture market competition, the demand for the company's products, an attempt to capture more market (Molina and Preve, 2012; Petersen and Rajan, 1997), and an attempt to reduce inventory holding costs (Bougheas *et al.*, 2009; Mateut *et al.*, 2015).

3.2.2 Independent variables. The main variable of interest are financial distress and financial constraints. Firstly, this study estimates the effect of financial distress on trade credit provisions excluding financial constraints in the estimation model. Then, the study estimates the effect of financial constraints on trade credit provisions excluding financial distress in the estimation model. Finally, the estimation of both the effect of financial distress and financial constraints on trade credit provisions.

3.2.2.1 Financial distress. This study uses the Zmijewski (1984) financial distress score as a proxy for financial distress (FD_{it}). The Zmijewski (1984) distress score is computed using the index below. A higher Zmijewski's score indicates a higher likelihood of bankruptcy.

$$FD_{it} = -4.336 - \left[4.513^{*}\left(\frac{NI_{it}}{TA_{it}}\right)\right] + \left[5.679^{*}\left(\frac{TD_{it}}{TA_{it}}\right)\right] + \left[0.004^{*}\left(\frac{CA_{it}}{CL_{it}}\right)\right]$$

All firms are rank according to their distress score for each year. Firms in the top thirty percentiles of the distress score in each year are considered financially distressed and a dummy variable 1 is assigned to such firms. The results of the estimates in this study are unaffected when alternative measures of financial distress are used in the estimation. For robustness test, this study uses the Asquith *et al.* (1994) measure of financial distress. A firm is classified as financial distress (FD_{it}) if the interests cover, measured by the ratio of earnings before interest, taxes, depreciation, and amortization to interest expense is less than 0.8 in any particular year or if the firm reported losses for three consecutive years.

3.2.2.2 Financial constraints. The second variable of interest is the firm's financial constraints. The literature is divided on the proxy that best captures financial constraints and as a result, empirical studies tend to employ a range of measures for robustness (Farre-Mensa and Ljungqvist, 2016). Existing proxies aim to infer financial constraints from firm's statements about their funding situation or changes in investment plans, their actions (such as not paying a dividend), or their characteristics such as being young or small, having low leverage, or no credit rating. Aterido *et al.* (2013) argue that there is a need to distinguish between access to and use of formal financial services. While firms and individuals with access but no need for financial services are of less concern for policymakers, constrained access that translates into reduced use of formal financial services constitutes a challenge. Since the focus of this study is about firms funding situation or changes in investment plans due to liquidity condition this study uses dividend payout ratio as a measure of financial constraints (FC_{it}). This is consistent with Aterido *et al.* (2013) argument on the need to focus financial constraint measure on the use of fund rather than access to fund. This study assumes that dividend payout ratios gives a better indication on the firm's use of funds.

Consistent with Linck *et al.* (2013) all firms are rank according to their dividend payout ratios for each year. Firms in the bottom three deciles of dividend payout ratios each year are considered financially constrained and a dummy variable 1 is assigned to such firms.

3.2.3 Control variables. The nature of the firm's assets might influence its financing policy. This study includes the ratio of accounts receivables to assets ($AR_{it}/AT_{i,t-1}$) in Model 1 and ratio of accounts payables to assets ($AP_{it}/AT_{i,t-1}$) in Model 2, to test the maturity-matching hypothesis. The maturity-matching hypothesis states that the firm matches the maturity structure of their debt to the maturity structure of their assets (Ozkan, 2000). Firms might attempt to match their accounts receivables to accounts payables and vice versa. The ratio of inventory to total assets ($INV_{it}/AT_{i,1-t}$) is included in the control variables as a proxy for transaction cost arguments that firms with higher raw materials inventory borrow more from their suppliers, and that buyers use trade credits to bridge the period between purchase and payments, in order to reduce the transaction costs of paying bills. Also, in firms where inventories largely consist of raw materials, or where raw materials are slowly consumed in the production process, the collateral values of suppliers are higher. If this feature provides suppliers with financing advantage, firms, which find it difficult to raise bank debt will gladly, take up the offered trade credit (Huyghebaert, 2006).

The Z_{it} is a vector that includes other control variables that affect trade credit provisions as evidenced by extant literature. This study includes sales growth ($SGROW_{it}$) defined as the ratio of the annual change in sales revenue to net sales revenue. Firms that experience a sharp increase or decrease in sales for exogenous reasons may experience a change in their trade credits. They may be perceived as a rapidly growing client by the suppliers and this might induce a positive bias in their incentives to offer more trade credit, or the opposite may be true in the case of steep declines in sales (Molina and Preve, 2012). Board size ln(BDSIZE) is included in the control variable and is defined as the natural logarithm of a number of directors on board. Larger board reduces information asymmetry (Chen and Jaggi, 2000), with the potential to bring more experience, knowledge and offer better advice (Dalton *et al.*, 1999). Almeida and Campello (2007) argue that asset tangibility ($TANG_{it}$) increases a firm's ability to obtain external financing. Firms with more tangible assets obtain more external financing because such asset mitigates contractibility problems: tangibility increases the value that can be captured by creditors in default states. Asset tangibility also affects the credit status of the firm, as firms with very tangible assets may become unconstrained. Asset tangibility is measured as a ratio of Property, Plant and Equipment to total assets. This study also includes gross margin ($GMARGIN_{it}$) in the control variables, measured as the ratio of gross profit to sales. Consistent with Petersen and Rajan (1997) the inclusion of gross margin tests whether firms with higher margins offer more trade credits. The ratio of a number of independent directors to a total number of directors on board ($INDIR_{it}$) is included in the control variables. The role of independent directors includes traditional monitoring and advising on business finance (Xia *et al.*, 2019). This study conjectures that firms with well-connected independent directors might be able to obtain finance from the financial market and would not have to rely on the use of trade credit, which is a costly source of finance. Appendix presents a detailed definition of model variables.

4. Results

4.1 Descriptive analysis

Panel A of Table 1 shows that the mean, median and standard deviation for account payables, accounts receivables, financial distress, financial constraints and the control variables. The results shows that the average ratio of accounts receivables to total assets is higher than the average ratio of accounts payables for total assets.

Label	*N*	Median	Mean	SD
Panel A				
AP	1,776	0.06	0.13	0.52
AR	1,666	0.08	0.18	0.86
FD	1,960	0.00	0.30	0.46
FC	1,978	0.00	0.40	0.49
TANG	2,091	0.22	0.35	0.90
INV	1,663	0.06	0.15	0.86
GMARGIN	1,571	0.38	0.44	0.27
SGROW	2,127	5.26	9.09	31.38
BDSIZE	2,169	2.20	2.10	0.42
INDIR	2,227	0.57	0.49	0.27

Total assets percentile range	Mean AP	Mean AR	Firm's age percentile range	Mean AP	Mean AR
Panel B					
1–10	0.16	0.22	1–10	0.14	0.18
10–25	0.17	0.3	10–25	0.08	0.1
25–50	0.14	0.21	25–50	0.1	0.2
50–75	0.08	0.1	50–75	0.09	0.12
75–90	0.09	0.09	75–90	0.15	0.17
90–100	0.07	0.06	90–100	0.19	0.31
ANOVA *F*	4.6	4.73		2.51	1.82
$P_r > F$	0.0004	0.0003		0.0284	0.106

Note(s): This table reports the mean, median, and standard deviations of variables used in this study for the entire sample it also shows the mean values of accounts payables and accounts receivables for total assets percentile range and firm's age percentile range. AP is the ratio of Accounts Payables to Total Assets ($AP_{it}/TA_{i,t-1}$); AR is the ratio of Accounts Receivable to Total Assets ($AR_{it}/TA_{i,t-1}$); *FD_{it} is a measure of financial distress computed with the Zmijewski's (1984) financial condition index:* $FD_{it} = -4.336 - \left[\left(4.513*\left(\frac{NI_{it}}{TA_{it}}\right)\right] + \left[5.679*\left(\frac{TD_{it}}{TA_{it}}\right)\right] + \left[0.004*\left(\frac{CA_{it}}{CL_{it}}\right)\right]$; All firms are rank according to their distress score for each year. Firms in the *top thirty percentiles of the distress score in each year are considered financially distressed and a dummy variable 1 is assigned to such firms. FC_{it} is the measure of financial constraints and it is a dummy variable 1 if a firm dividend payout ratio ranks in the bottom three deciles of dividend payout ratios* for sample FTSE 350 firms in each year; $TANG_{it}$ Asset Tangibility, ratio of Property, Plant and Equipment to total assets ($PPE_{it}/TA_{i,t-1}$); *INV_{it} Ratio of inventory to total assets ($INV_{it}/TA_{i,1-t}$)*; $GMARGIN_{it}$ Gross margin, ratio of gross profit to sales [$(REV_{it} - COGS_{it})/REV_{it}$]; $SGROW_{it}$ *Ratio of the annual change in sales revenue to net sales revenue [$(SALES_t - SALES_{i,t-1})/SALES_{i,t-1}$]*; $BDSIZE_{it}$ natural logarithm of number of directors on board ln(BDSIZE); $INDIR_i$ Ratio of number of independent directors to total number of directors on board

Table 1.
Descriptive statistics

The results show that average of 13% of the FTSE 350 firm's assets were financed by accounts payables while average of 18% of the FTSE 350 assets consists of accounts receivables. This results suggests that the FTSE 350 provides more trade credit to customers than they received from suppliers. The average financial distress firms is 0.30. This indicates that about 30% of the FTSE 350 firms are financially distressed when they are ranked by their score on the Zmijewski (1984) financial distress model. The average financial constrained is 0.40. This indicates that about 40% of the FTSE 350 firms are financially constrained when ranked by their dividend payout ratios.

Panel B of Table 1 average ratio of accounts payables to total assets is higher for bottom fifty percentiles than the upper fifty percentiles of FTSE 350 firms when ranked by total assets. This result indicates that smaller firms used more of trade credit to finance their assets than big firms. The *F*-statistic for the analysis of variance indicates that there is a significant

difference in the proportion of total assets financed with trade credits by the firms each assets percentile categories. On the other hand, average ratio of accounts payables to total assets is lower for bottom fifty percentiles than the upper fifty percentiles of FTSE 350 firms when ranked by firm's age. This result indicates that younger firms get less trade credit from suppliers. Since firm's age indicates the length of relationship with suppliers, the results indicates that firms that have long relationship with their suppliers gets more trade credits from those suppliers. The *F* statistic for the analysis of variance indicates that there is a significant difference in the proportion of total assets financed with trade credits by the firms each age percentile categories.

Table 2 presents the correlation matrix, and shows that financial distress (FD) firms receives less trade credit from suppliers. The direction of relationship in the correlation matrix is not in line with the predictions in this study. This might be due to the omissions of the ratio of accounts receivables to assets in the estimation of the correlation coefficients. The correlation matrix also shows that financial constraint (FC) firms receive less trade credit from suppliers which is in line with the prediction in this study. Financial distress firms reduced credit sales to their customers, which is also in line with the prediction in this study. Financial constraints firms reduced credit sales to customers which is not in line with the prediction in this study. This might be due to the omission of the ratio of accounts payables to assets in the estimation of the correlation coefficients. All the variables have a VIF less than 10, which confirms that there is no multicollinearity problem in the sample.

4.1.1 Financial distress, financial constraints, and accounts payables. Table 3 presents the OLS, Two-way Random effects and Two-step System GMM estimation of the effects of financial distress and financial constraints on accounts payables. The effect of financial distress and financial constraint on accounts payables were first estimated independently, then the joint effect of both financial distress and financial constraints on accounts payables were estimated. In the OLS estimation, the Durbin–Watson test for all the OLS estimates shows that autocorrelation is not a problem since the Durbin–Watson statistics are greater than or about 1.50. All the main variables retained their direction and significance in the two-way random effects estimates. Financial distress has a significant positive effect on accounts payables while financial constraints has a significant negative effect on accounts payables in all the estimation techniques. The significant positive effect of financial distress on accounts payables indicates that financial distressed firms get more trade credits from suppliers. Based on this result, this study accepts the first hypothesis, that is, *H1a: There is a significant positive relationship between financial distress and trade payables in the UK FTSE 350 firms.* The significant positive effect of financial distress on accounts payables also supports Meltzer (1960) argument that suppliers pass funds via trade credits to less liquid buyers, which helps to assist weaker trading partners. The results also supports Wilner (2000) argument that a firm in distress can take advantage of a creditor if it generates a large percentage of the creditor's profit. Trade creditor desiring to maintain an enduring product-market relationship grant more concessions to a customer in financing distress, while the debtors anticipate larger renegotiation concessions, and agrees to pay a higher interest rate to the trade creditor.

The result in Table 3 shows a significant negative coefficients for the relationship between financial constraints and accounts payables. Based on this result, this study accepts the second hypothesis, that is, *H1b: There is a significant negative relationship between financial constraints and trade payables in the UK FTSE 350 firms.* It can be argued that financial constraints firms are not creditworthy, hence they do not have access to funds in the financial market, and trade partners reduce the supply of credit to customers that are not creditworthy. The significant negative results indicate that trading partners may be concern about the creditworthiness of their customers who do not have access to the finance market. The result do not support the financial assistance argument of trade credit which suggests that

Table 2.
Spearman correlation matrix

Spearman correlation coefficients		1	2	3	4	5	6	7	8	9	VIF (AP)	VIF (AR)
1	AP											
2	AR	0.52***										
3	FD	−0.14***	−0.09***								1.03	1.03
4	FC	−0.12***	−0.13***	0.07***							1.04	1.04
5	TANG	−0.19***	−0.18***	0.20***	0.05**						1.01	1.03
6	INV	0.36***	0.15***	−0.19***	0.03	0					1.46	2.97
7	GMARGIN	−0.26***	−0.06**	0.04	−0.04*	−0.02	−0.25***				1.04	1.04
8	SGROW	0.06***	0.01	−0.10***	0.04**	−0.10***	0.07***	0.04*			1.03	1.03
9	BDSIZE	−0.08***	−0.01	0.04**	−0.03*	0.04*	−0.09***	0.09***	−0.09***		1.02	1.02
10	INDIR	0.06***	0.03	−0.02	−0.07***	0.03*	0.02	−0.06**	−0.10***	0.05**	1.03	1.03

Note(s): *Denotes statistical significance at the 10% level. **Denotes statistical significance at the 5% level. ***Denotes statistical significance at the 1% level. This table reports the Spearman correlation coefficients and the Variance Inflation Factor (VIF) of variables used in this study. AP is the ratio of Accounts Payables to Total Assets ($AP_{it}/TA_{i,t-1}$); AR is the ratio of Accounts Receivable to Total Assets ($AR_{it}/TA_{i,t-1}$); *FD_{it} is a measure of financial distress computed with the Zmijewski's (1984) financial condition index:* $FD_{it} = -4.336 - \left[\left(4.513 * \left(\frac{NI_{it}}{TA_{it}}\right)\right] + \left[5.679 * \left(\frac{TD_{it}}{TA_{it}}\right)\right] + \left[0.004 * \left(\frac{CA_{it}}{CL_{it}}\right)\right]$; All firms are rank according to their distress score for each year. Firms in the *top thirty percentiles of the distress score in each year are considered financially distressed and a dummy variable 1 is assign to such firms. FC_{it} is the measure of financial constraints. FC is a dummy variable 1 if a firm's dividend payout ratio ranks in the bottom three deciles of dividend payout ratios* for sample FTSE 350 firms in each year. $TANG_{it}$ Asset Tangibility is the ratio of Property, Plant and Equipment to total assets ($PPE_{it}/TA_{i,t-1}$). *INV_{it} Ratio of inventory to total assets ($INV_{it}/TA_{i,1-t}$);* $GMARGIN_{it}$ Gross margin, ratio of gross profit to sales [$(REV_{it} - COGS_{it})/REV_{it}$]; $SGROW_{it}$ *Ratio of the annual change in sales revenue to net sales revenue [$(SALES_t - SALES_{i,t-1})/SALES_{i,t-1}$];* $BDSIZE_{it}$ natural logarithm of number of directors on board ln(BDSIZE); $INDIR_i$ Ratio of number of independent directors to total number of directors on board

Table 3.
Financial distress, financial constraints, and accounts payables

Dep. Var.				$AP/AT_{i,t\text{-}1}$					
		OLS			Two-way RE			Two-step system GMM	
	FD	FC	FD & FC	FD	FC	FD & FC	FD	FC	FD & FC
Intercept	–0.0040	0.0180	0.0170	0.0000	0.0170	0.0140			
	(–0.17)	(0.7)	(0.65)	(0.01)	(0.52)	(0.42)			
FD	0.042***		0.048***	0.028***		0.033***	0.002***		0.002***
	(4.51)		(5.01)	(2.7)		(3.08)	(12.7)		(5.32)
FC		−0.03***	−0.035***		−0.023***	−0.025***		−0.006***	−0.006***
		(–3.64)	(–4.1)		(–2.65)	(–2.81)		(–31.2)	(–27.3)
AR	0.551***	0.554***	0.552***	0.547***	0.549***	0.548***	0.432***	0.455***	0.438***
	(80.8)	(80.3)	(80.8)	(84.3)	(83.8)	(83.9)	(82.2)	(122.)	(121.)
TANG	0.030***	0.031***	0.030***	0.031***	0.031***	0.030***	0.075***	0.081***	0.071***
	(7.75)	(7.94)	(7.65)	(8.7)	(8.64)	(8.53)	(129.)	(80.0)	(33.4)
INV	0.281***	0.279***	0.281***	0.285***	0.284***	0.284***	0.340***	0.330***	0.337***
	(57.0)	(56.4)	(57)	(62.2)	(61.3)	(61.5)	(155.)	(211.)	(220.)
GMARGIN	−0.0000	0.0010	−0.0050	0.0250	0.0270	0.0200	−0.11***	−0.112***	−0.114***
	(–0.04)	(0.1)	(–0.36)	(1.22)	(1.3)	(0.96)	(–93.4)	(–92.3)	(–56.5)
SGROW	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000
	(–1.38)	(–1.34)	(–1.05)	(–0.99)	(–0.91)	(–0.81)	(.)	(.)	(.)
BDSIZE	−0.0040	−0.0030	−0.0060	−0.0060	−0.0060	−0.0070	−0.01***	−0.007***	−0.010***
	(–0.41)	(-0.35)	(–0.64)	(-0.47)	(–0.45)	(–0.53)	(–24.6)	(–17.2)	(–15.1)
INDIR	−0.0070	−0.0130	−0.0120	−0.0250	−0.0280	−0.0270	−0.02***	−0.021***	−0.021***
	(–0.41)	(–0.69)	(–0.64)	(–1.31)	(–1.41)	(–1.35)	(–29.4)	(–32.4)	(–20.0)
Observations	1,201	1,192	1,180						
Cross sections				219	221	215	219	221	221
Time series				8	8	8	8	8	8
MSE	0.14109	0.14312	0.14114	0.014	0.015	0.015			
R-Square	0.9483	0.9473	0.9492	0.956	0.955	0.956			
Adj. R^2	0.9479	0.947	0.9488						
F value	2732.0***	2659.1***	2427.87***						
D-W	1.492***	1.501***	1.515***						
Autocorrelation	0.254	0.249	0.243						
VC cross sect.				0.005	0.005	0.005			

(*continued*)

Dep. Var.	$AP/AT_{i,t-1}$								
	OLS			Two-way RE			Two-step system GMM		
	FD	FC	FD & FC	FD	FC	FD & FC	FD	FC	FD & FC
VC time series				0	0	0			
VC error				0.015	0.015	0.015			
Hausman test				13.66*	11.26	14.06			
AR(m) test									
Lag 1							−2.13**	−2.28**	−2.13**
Lag 2							1.21	1.13	1.09
Sargan Test							155.45	154.53	152.06

Note(s): *Denotes statistical significance at the 10% level. **Denotes statistical significance at the 5% level. ***Denotes statistical significance at the 1% level. This table reports the effects of the estimation of financial distress (FD) and financial constraints (FC) on Accounts Payables (AP). AP is the ratio of Accounts Payables to Total Assets ($AP_{it}/TA_{i,t-1}$); AR Ratio of Accounts Receivable to Total Assets ($AR_{it}/TA_{i,t-1}$); FD_{it} is a measure of financial distress computed with the Zmijewski's (1984) financial condition index: $FD_{it} = -4.336 - \left[\left(4.513 * (\frac{NI_{it}}{TA_{it}})\right)\right] + \left[5.679 * \left(\frac{TD_{it}}{TA_{it}}\right)\right] + \left[0.004 * \left(\frac{CA_{it}}{CL_{it}}\right)\right]$; In order to determine distress firms, the distress score are rank for each firm for each year. Firms in the top thirty percentiles of the distress score in each year are considered financially distressed and a dummy variable 1 is assigned to such firms. FC_{it} is the measure of financial constraints. FC is a dummy variable 1 if a firm's dividend payout ratio ranks in the bottom three deciles of dividend payout ratios for sample FTSE 350 firms in each year. $TANG_{it}$ Asset Tangibility is the ratio of Property, Plant and Equipment to total assets ($PPE_{it}/TA_{i,t-1}$). INV_{it} Ratio of inventory to total assets ($INV_{it}/TA_{i,1-t}$); $GMARGIN_{it}$ Gross margin, ratio of gross profit to sales [$(REV_{it} - COGS_{it})/REV_{it}$]; $SGROW_{it}$ Ratio of the annual change in sales revenue to net sales revenue $[(SALES_t - SALES_{i,t-1})/SALES_{i,t-1}]$; $BDSIZE_{it}$ natural logarithm of number of directors on board ln(BDSIZE); $INDIR_i$ Ratio of number of independent directors to total number of directors on board

Table 3.

financially strong firms should extend more trade credits to trading partners that face more financial constraints owing to poor access to bank loans and the financial market.

The control variable AR shows a significant positive relationship with AP. This is consistent with the maturity-matching hypothesis which suggests that firm matches the maturity structure of their debt to the maturity structure of their assets (Ozkan, 2000). TANG shows a significant positive coefficient. This indicates that trade suppliers are willing to extend more trade credit to firms that are able to provide more collaterals to support their demand for finance in the financial markets. INV show a significant positive coefficients. This result is consistent with the explanation that trade credit can be issued against inventory (the matching hypothesis), since inventory can be easily liquidated.

In addition to the endogeneity bias due to omitted unobservable company characteristics, reverse causality could also be a potential source of endogeneity. As a robustness test, this study estimates a two-step generalized method of moments (GMM) based on Arellano and Bond (1991). The system GMM has been found to be more efficient, compared to the difference GMM (Blundell and Bond, 1998), because system GMM performs well in the presence of heteroskedasticity with a small time-series dimension. Rather than predict the lagged dependent variable based solely on its previous value. The estimate requires firms to have data for at least five consecutive years, which is a necessary condition to have a sufficient number of periods to be able to test for the second-order serial correlation, this left unbalanced panel observations.

The quality of the GMM estimates depends on the validity of the matrix of instruments and on the assumption that the error term does not exhibit autocorrelation. Given that the equation has been formulated in first differences, the residuals are supposed to be correlated to the order 1 but not to order 2. The results of the System GMM estimates in Table 3 shows that the autoregressive estimates AR(m) is significant in lag one year but not in a lag to the second year, this result indicates that the system GMM is well-fitted. The Sargan test is a test of the validity of the instrument used in the model. The joint null hypothesis is that the instruments are not valid; that is, they are correlated with the error term, and that the excluded instruments are not correctly excluded from the estimated equation. The estimated probability values of the Sargan test are greater than 0.05. Therefore, this study rejects the null hypothesis that the moment's conditions conferred by the instrumental variable (lagged dependent variables) used in the model are not valid. This result suggests that the model as estimated is not mis-specified.

4.1.2 Financial distress, financial constraints, and accounts receivable. Table 4 presents the OLS, the Two-way Random effects and two step System GMM estimation of the effects of financial distress and financial constraints on accounts receivables. The effect of financial distress and financial constraint on accounts payables were first estimated independently, then the effect joint effect of both financial distress and financial constraints on accounts payables were estimated. The Durbin-Watson test for all the OLS estimates shows that autocorrelation is not a problem since the Durbin-Watson statistics are greater than 1.50. All the main variables retained their direction and significance in the two-way random effects estimates. Financial distress (FD) has a significant negative effect on accounts receivables while financial constraints has a significant positive effect on accounts receivables in all the estimation techniques. The significant negative effect of financial distress on accounts receivables indicates that financial distressed firms reduced credits sales to customers. Based on this result, this study accepts the third hypothesis, that is, *H2a: There is a significant negative relationship between financial distress and trade receivables in the UK FTSE 350 firms.* This result indicates that financially troubled firms reduce the supply of trade credits to their customers. The result is consistent with Opler and Titman (1994) who suggests that financial distress firms lose customers, valuable suppliers, employees and significant market share to their healthy counterparts. The result is also consistent with Molina and Preve (2009)

Table 4. Financial distress, financial constraints, and accounts receivables

Dep. Var.	$AR/AT_{i,t-1}$								
	OLS			Two-way RE			Two-step system GMM		
	FD	FC	FD & FC	FD	FC	FD & FC	FD	FC	FD & FC
Intercept	0.0020	−0.0370	−0.0350	−0.0110	−0.0470	−0.0400			
	(0.05)	(–0.84)	(–0.8)	(–0.2)	(–0.83)	(–0.72)			
FD	−0.063***		−0.072***	−0.044**		−0.052***	−0.01***		−0.014***
	(–4.06)		(–4.56)	(–2.5)		(–2.94)	(–20.3)		(–28.2)
FC		0.051***	0.058***		0.047***	0.050***		0.010***	0.005***
		(3.6)	(4.05)		(3.12)	(3.3)		(23.6)	(20.5)
AP	1.532***	1.523***	1.534***	1.56***	1.560***	1.562***	0.549***	0.614***	0.565***
	(80.8)	(80.3)	(80.8)	(84.3)	(83.8)	(83.8)	(129.)	(105.)	(88.0)
TANG	−0.042***	−0.043***	−0.041***	−0.04***	−0.045***	−0.043***	−0.14***	−0.161***	−0.117***
	(–6.38)	(–6.52)	(-6.31)	(–7.24)	(–7.28)	(–7.08)	(–41.5)	(–44.7)	(–31.4)
INV	−0.369***	−0.364***	−0.370***	−0.39***	−0.384***	−0.386***	0.132***	0.098***	0.123***
	(–31.5)	(–31.2)	(–31.5)	(–34.0)	(–33.7)	(–33.7)	(59.5)	(30.6)	(36.3)
GMARGIN	0.0160	0.0140	0.0240	−0.0240	−0.0190	−0.0130	−0.21***	−0.171***	−0.178***
	(0.62)	(0.52)	(0.91)	(–0.7)	(–0.56)	(–0.39)	(–60.6)	(–44.6)	(–93.0)
SGROW	0.000*	0.000*	0.0000	0.0000	0.0000	0.0000	0.000***	0.000***	0.000***
	(1.82)	(1.79)	(1.56)	(1.56)	(1.5)	(1.4)	(66.5)	(35.0)	(39.3)
BDSIZE	0.0150	0.0150	0.0200	0.0210	0.0220	0.0240	−0.01***	−0.001**	−0.004***
	(0.87)	(0.87)	(1.13)	(0.94)	(0.94)	(1.04)	(–24.2)	(–2.39)	(–7.92)
INDIR	0.0000	0.0080	0.0070	0.0270	0.0320	0.0300	−0.02***	−0.017***	−0.017***
	(0.03)	(0.27)	(0.24)	(0.84)	(0.96)	(0.91)	(–14.6)	(–19.3)	(–12.1)
Observations	1,201	1,192	1,180						
Cross sections				219	215	215	219	215	215
Time series				8	8	8	8	8	8
MSE	0.23508	0.23721	0.23525	0.042	0.043	0.043			
R-Square	0.894	0.893	0.8957	0.904	0.904	0.905			
Adj. R^2	0.8933	0.8922	0.8949						
F value	1256.23***	1233.59***	1116.57***						
D-W	1.577***	1.587***	1.591***						
Autocorrelation	0.212	0.206	0.205						
VC cross sect.				0.014	0.013	0.013			

(*continued*)

Table 4.

Dep. Var.	AR/AT$_{i,t-1}$								
	OLS			Two-way RE			Two-step system GMM		
	FD	FC	FD & FC	FD	FC	FD & FC	FD	FC	FD & FC
VC time series				0	0	0			
VC error				0.043	0.044	0.044			
Hausman test				15.08*	9.77	13.82			
AR(m) test									
Lag 1							−2.65***	−2.51**	−2.68***
Lag 2							0.61	0.75	0.51
Sargan test							154.87	149.85	153.26

Note(s): *Denotes statistical significance at the 10% level. **Denotes statistical significance at the 5% level. ***Denotes statistical significance at the 1% level. This table reports the effects of the estimation of financial distress (FD) and financial constraints (FC) on Accounts Receivables (AR). AP is the ratio of Accounts Payables to Total Assets (AP$_{it}$/TA$_{i,t-1}$); AR Ratio of Accounts Receivable to Total Assets (AR$_{it}$/TA$_{i,t-1}$); *FD$_{it}$ is a measure of financial distress computed with the Zmijewski's (1984) financial condition index:* $\mathrm{FD}_{it} = -4.336 - \left[\left(4.513 * \left(\frac{\mathrm{NI}_{it}}{\mathrm{TA}_{it}}\right)\right] + \left[5.679 * \left(\frac{\mathrm{TD}_{it}}{\mathrm{TA}_{it}}\right)\right] + \left[0.004 * \left(\frac{\mathrm{CA}_{it}}{\mathrm{CL}_{it}}\right)\right]$; In order to determine distress firms, the distress score are rank for each firm for each year. Firms in the *top thirty percentiles of the distress score in each year are considered financially distressed and a dummy variable 1 is assign to such firms. FC$_{it}$ is the measure of financial constraints. FC is a dummy variable 1 if a firm's dividend payout ratio ranks in the bottom three deciles of dividend payout ratios f*or sample FTSE 350 firms in each year. TANG$_{it}$ Asset Tangibility is the ratio of Property, Plant and Equipment to total assets (PPE$_{it}$/TA$_{i,t-1}$). *INV$_{it}$ Ratio of inventory to total assets (INV$_{it}$/TA$_{i,1-t}$);* GMARGIN$_{it}$ Gross margin, ratio of gross profit to sales [(REV$_{it}$ – COGS$_{it}$)/REV$_{it}$]; SGROW$_{it}$ *Ratio of the annual change in sales revenue to net sales revenue [(SALES$_t$ – SALES$_{i,t-1}$)/SALES$_{i,t-1}$];* BDSIZE$_{it}$ natural logarithm of number of directors on board ln(BDSIZE); INDIR$_i$ Ratio of number of independent directors to total number of directors on board

argue that a negative effect of financial distress on trade receivables could be due to the urgent cash needs of financially distressed firms. Such a negative relationship could also arise if the distressed firm sells its trade receivables to a factoring company instead of directly reducing its trade receivables.

Table 4 also show that for financial constraints (FC) have significant positive effects on accounts receivables. Based on this result, this study accepts the fourth hypothesis, that is, *H2b: There is a significant positive relationship between financial constraints and trade receivables in the UK FTSE 350 firms*. This result supports the argument in Meltzer (1960) who argues that trade credit act as a substitute for financial credit during periods of tight monetary policy, leading to an increase in trade credit provisions. The result also indicates that financially constrained firms may use trade credit as collateral for loans from financial institutions, to ease the supplier-side finance requirements to buy input resources (Biais and Gollier, 1997).

In addition, the result supports the argument that sellers can better enforce debts contracts because when the buyer defaults on credits, the seller can seize the goods that they sold on credit and sell them to other customers (Mian and Smith, 1992). The control variable AP shows a significant positive relationship with AR in all the estimations. This result is consistent with the maturity-matching hypothesis, which suggests that firm matches the maturity structure of their debt to the maturity structure of their assets (Ozkan, 2000). TANG shows a significant negative coefficient and indicates that since FTSE 350 firms are successful and growing firms, refrain from offering trade credits to customers because they can obtain the much-needed finance from other sources as they increase investment in tangible fixed assets. INV has a significant negative effect on accounts receivable, and indicates that inventories serve as a buffer for internal finance, and a substitutes for accounts receivable (Carpenter *et al.*, 1994; Kim and Choi, 2001), leading to a decrease in trade receivables.

To further reduce endogeneity concerns, this study performs several complementary analysis by firm's age and size. Petersen and Rajan (1994) argue that it is possible for lenders to obtain sufficient information on firm's ability to service debt-like claims by observing its past interactions with other fixed claims holders like employees or prior creditors. In such case, they argue that the age of the firm could determine the lender's cost and availability of funds. They further argue that small firms are unlikely to be monitored by rating agencies or the financial press. As a result, there may be large information asymmetries between small firms and potential public investors. Similarly, Hadlock and Pierce (2010) argue that size and age are the most important characteristics of the firm that determines a firm's ability to raise fund in the public capital market.

In additional analysis which are not reported, this study ranks firms by size and age for each year. Firms in the lower 25th percentile of total assets in each year are coded small firms and a dummy variable 1 is assigned to firms in the category. Firms in the lower 25th percentile of age in each year are coded young firms and a dummy variable 1 is assigned to firms in the category. This study interacts the young firms' dummy variable with financial distress variable and the small firm dummy variable with financial constraints variable. Both of these variables are used in the regression estimation. The result shows a significant positive impact of the interaction of young firms with financial distress on accounts payables, and a significant negative impact of the interaction of small firms and financial constraints on accounts payables. Conversely, the results show a significant negative impact of the interaction of young firms with financial distress on accounts receivables, and a significant positive impact of the interaction of small firms and financial constraints on accounts receivables.

The significant positive impact of the interaction of young firm and financial distress on accounts payables suggests that financial distress is prevalent among young firms, and that

young firms that are financially distressed pass on the adverse effect of their distress by defaulting on their suppliers, leading to an increase in trade payables (Boissay and Gropp, 2007). Similarly, the significant positive negative impact of the interaction of small firms and financial constraints suggests that financial constraints are prevalent among small firms and that since small firms are unlikely to be monitored by rating agencies or the financial press, there may be large information asymmetries between these firms and potential public investors (Petersen and Rajan, 1994). Therefore, suppliers also reduce trade credit to small firms that are financially constrained. Furthermore, this study uses the Hadlock and Pierce (2010) Size-Age index which a commonly used to proxy for financial constraints. For each year, firms are ranked by their score on the size-age index. A dummy variable 1 is assigned to firms in the bottom 3 deciles of the Size-Age index. The result is unaffected by the use of this alternative proxy for financial constraints.

5. Implications and conclusions

This study evaluates the effects of financial distress and financial constraints on accounts payables and accounts receivables in FTSE 350 listed firms. The results show that financially distressed have a significant positive effect on accounts payables. This result suggests that trade creditor desiring to maintain an enduring product-market relationship grant more concessions to a customer in financing distress, while the debtors anticipate larger renegotiation concessions, and agrees to pay a higher interest rate to the trade creditor (Wilner, 2000). The result further indicates that financial distress firms are willing to pay the higher interest rate on trade credit because associated renegotiations are more likely. On the other hand, the result shows a significant negative relationship between financial distress and accounts receivables. This result suggests that the urgent cash needs of financially distressed firms, and the possibility of thee distressed firm selling its trade receivables to a factoring company lead to a reduced level of trade receivables (Molina and Preve, 2009). The result also suggests that financial distress firms lose customers, valuable suppliers, employees and significant market share to their healthy counterparts leading to a reduced level of accounts receivables (Opler and Titman, 1994). Additional analysis indicates that financial distress is prevalent among young firms, and that young firms that are financially distressed pass on the adverse effect of their distress by defaulting on their suppliers, leading to an increase in trade payables (Boissay and Gropp, 2007).

Financial constraints have a significant negative effects on accounts payables, which indicates that the amount of trade credit that sellers provide to the buyer is an increasing function of the buyer's creditworthiness (Frank and Maksimovic, 2004). Since financial constrained firms are likely to have a low credit worthy status in the financial market, suppliers tend to reduce the supply of trade credits to them. This result implies that there is an overall reduction in credit received from both the financial markets and trade customers by financial constrained firm, probably due to concern for their creditworthiness. Suppliers like the financial market are unwilling to take the risk of extending credits to financially constrained firms. On the other hand, financial constraints have a significant positive effect on accounts receivables, suggesting that firm facing external financing constraints or external capital rationing increase supply of trade credit in anticipation of future cash flow to finance the profitable projects. Financial constrained firms may use trade credit as collateral for loans from financial institutions, to ease the supplier-side finance requirements to buy input resources (Biais and Gollier, 1997), leading to an increase in the level of trade receivables. Additional analysis indicates that financial constraints are prevalent among small firms and since there may be large information asymmetries between small firms and potential public suppliers reduce trade credit to small firms that are financially constrained.

The results in this study imply that suppliers provide liquidity insurance to their clients when they are financially distressed, and underscore their role as liquidity providers of last resort (Wilner, 2000; Cunat, 2007). The results in this study also imply that firms that experience financial trouble reduce trade credit provisions to their customers, or that they sell their trade credits to a factoring company. These results are consistent with the redistribution view of trade credit provision (Meltzer, 1960; Petersen and Rajan, 1997; Nilsen, 2002). On the other hand, firms' suppliers are concerned with credit worthiness of firms that finds it difficult to raise funds from the financial markets and therefore also reduce supply of trade credit to firms that are financial constrained. While firms that are financial constrained increase trade credit to their customers in anticipation of a cash flow from customers that could help alleviate their financial constraint. The findings in this study highlights the importance of non-financial firms in offering substitute credit in times of financial distress and in selling more on credit when financially constrained. The results points suggests that policies aimed at enhancing trade credit could prove more effective to foster economic growth.

References

Almeida, H. and Campello, M. (2007), "Financial constraints, asset tangibility, and corporate investment", *Review of Financial Studies*, Vol. 20 No. 5, pp. 1429-1460.

Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *The Review of Economic Studies*, Vol. 58 No. 2, p. 277.

Asquith, P., Gertrier, R. and Stein, D.S. (1994), "Anatomy of financial distress: an examination of junk-bond issuers", *The Quarterly Journal of Economics*, Vol. 109 No. 3, pp. 625-658.

Atanasova, C.V. and Wilson, N. (2003), "Bank borrowing constraints and the demand for trade credit: evidence from panel data", *Managerial and Decision Economics*, Vol. 24 Nos 6-7, pp. 503-514.

Aterido, R., Beck, T. and Iacovone, L. (2013), "Access to finance in Sub-Saharan Africa: is there a gender gap?", *World Development*, Vol. 47, pp. 102-120.

Baltagi, B.H. and Chang, Y.-J. (1994), "Incomplete panels", *Journal of Econometrics*, Vol. 62 No. 2, pp. 67-89.

Barrot, J.-N. (2016), "Trade credit and industry dynamics: evidence from trucking firms", *The Journal of Finance*, Vol. 71 No. 5, pp. 1975-2016.

Biais, B. and Gollier, C. (1997), "Trade credit and credit rationing", *Review of Financial Studies*, Vol. 10 No. 4, pp. 903-937.

Blundell, R. and Bond, S. (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, Vol. 87 No. 1, pp. 115-143.

Boissay, F. and Gropp, R.E. (2007), "Trade credit defaults and liquidity provision by firms", Working Paper No. 753, ECB Working Paper, available at: https://www.econstor.eu/handle/10419/153187 (accessed 6 July 2020).

Bougheas, S., Mateut, S. and Mizen, P. (2009), "Corporate trade credit and inventories: new evidence of a trade-off from accounts payable and receivable", *Journal of Banking and Finance*, Vol. 33 No. 2, pp. 300-307.

Burkart, M. and Ellingsen, T. (2004), "In-kind finance: a theory of trade credit", The *American Economic Review*, Vol. 94 No. 3, pp. 569-590.

Carpenter, R., Fazzari, S. and Petersen, B. (1994), "Inventory investment, internal-finance fluctuation, and the business cycle", *Brookings Papers on Economic Activity*, Vol. 25, pp. 75-138.

Chen, C.J.P. and Jaggi, B. (2000), "Association between independent non-executive directors, family control and financial disclosures in Hong Kong", *Journal of Accounting and Public Policy*, Vol. 19 No. 4, pp. 285-310.

Chen, D., Liu, M., Ma, T. and Martin, X. (2017), "Accounting quality and trade credit", *Accounting Horizons*, Vol. 31 No. 3, pp. 69-83.

Chintagunta, P.K., Jain, D.C. and Vilcassim, N.J. (1991), "Investigating heterogeneity in brand preferences in logit models for panel data", *Journal of Marketing Research*, Vol. 28 No. 4, pp. 417-428.

Cuñat, V. (2007), "Trade credit: suppliers as debt collectors and insurance providers", *Review of Financial Studies*, Vol. 20 No. 2, pp. 491-527.

Dalton, D.R., Daily, C.M., Johnson, J.L. and Ellstrand, A.E. (1999), "Number of directors and financial performance: a meta-analysis", *Academy of Management Journal*, Vol. 42 No. 6, pp. 674-686.

Danbolt, J., Hirst, I. and Jones, E. (2018), "Gaming the FTSE 100 index", *The British Accounting Review*, Vol. 50 No. 4, pp. 364-378.

Danielson, M.G. and Scott, J.A. (2004), "Bank loan availability and trade credit demand", *Financial Review*, Vol. 39 No. 4, pp. 579-600.

Deloof, M. and Jegers, M. (1999), "Trade credit, corporate groups, and the financing of Belgian firms", *Journal of Business Finance and Accounting*, Vol. 26 Nos 7-8, pp. 945-966.

Farre-Mensa, J. and Ljungqvist, A. (2016), "Do measures of financial constraints measure financial constraints?", *Review of Financial Studies*, Vol. 29 No. 2, pp. 271-308.

Frank, M. and Maksimovic, V. (2004), "Trade credit, collateral, and adverse selection", Unpublished Manuscript, University of Maryland, available at: https://pdfs.semanticscholar.org/be54/35d3e58ac50909e8eac1d186aaaff6834743.pdf (accessed 14 February 2020).

Froot, K.A., Scharfstein, D.S. and Stein, J.C. (1993), "Risk management: coordinating corporate investment and financing policies", *The Journal of Finance*, Vol. 48 No. 5, pp. 1629-1658.

Garcia-Appendini, E. and Montoriol-Garriga, J. (2013), "Firms as liquidity providers: evidence from the 2007–2008 financial crisis", *Journal of Financial Economics*, Vol. 109 No. 1, pp. 272-291.

Ghoul, E.S. and Zheng, X. (2016), "Trade credit provision and national culture", *Journal of Corporate Finance*, Vol. 41, pp. 475-501.

Greene, W.H. (2003), *Econometric Analysis*, 5th ed., Pearson Education, New Delhi.

Gujarati, D. (2003), *Basic Econometrics*, 4th ed., McGrawhill, Boston.

Hadlock, C.J., Pierce, J.R. and Pierce, J.R. (2010), "New evidence on measuring financial constraints: moving beyond the KZ index", *Review of Financial Studies*, Vol. 23 No. 5, pp. 1909-1940.

Hasan, M.M. and Habib, A. (2019), "Social capital and trade credit", *International Review of Financial Analysis*, Vol. 61, pp. 158-174.

Howorth, C. and Reber, B. (2003), "Habitual late payment of trade credit: an empirical examination of UK small firms", *Managerial and Decision Economics*, Vol. 24 Nos 6–7, pp. 471-482.

Hsiao, C. (2007), *Analysis of Panel Data*, 2nd ed., 8. print., University Press, Cambridge.

Huyghebaert, N. (2006), "On the determinants and dynamics of trade credit use: empirical evidence from business Start?ups", *Journal of Business Finance and Accounting*, Vol. 33 Nos 1-2, pp. 305-328.

Kaplan, S.N., Zingales, L. and Zingales, L. (1997), "Do investment-cash flow sensitivities provide useful measures of financing constraints?", *Quarterly Journal of Economics*, Vol. 112 No. 1, pp. 169-215.

Kennett, D.A. (1980), "Altruism and economic behavior: II private charity and public policy", *The American Journal of Economics and Sociology*, Vol. 39 No. 4, pp. 337-352.

Kim, Y. and Choi, W.G. (2001), *Has Inventory Investment Been Liquidity-Constrained? Evidence from U.S. Panel Data*, No. 01/122, International Monetary Fund, available at: https://ideas.repec.org/p/imf/imfwpa/01-122.html (accessed 14 February 2020).

Lee, Y.W. and Stowe, J. (1993), "Product risk, asymmetric information, and trade credit", *Journal of Financial and Quantitative Analysis*, Vol. 28 No. 2, pp. 285-300.

Linck, J.S., Netter, J. and Shu, T. (2013), "Can managers use discretionary accruals to ease financial constraints? Evidence from discretionary accruals prior to investment", *The Accounting Review*, Vol. 88 No. 6, pp. 2117-2143.

Love, I., Preve, L.A. and Sarria-Allende, V. (2007), "Trade credit and bank credit: evidence from recent financial crises", *Journal of Financial Economics*, Vol. 83 No. 2, pp. 453-469.

Mateut, S., Mizen, P. and Ziane, Y. (2015), "Inventory composition and trade credit", *International Review of Financial Analysis*, Vol. 42, pp. 434-446.

Meltzer, A.H. (1960), "Mercantile credit, monetary policy, and size of firms", *The Review of Economics and Statistics*, Vol. 42 No. 4, available at: https://org/10/djj6v7.

Mian, S.L. and Smith, C.W. (1992), "Accounts receivable management policy: theory and evidence", *The Journal of Finance*, Vol. 47 No. 1, pp. 169-200.

Molina, C.A. and Preve, L.A. (2009), "Trade receivables policy of distressed firms and its effect on the costs of financial distress", *Financial Management*, Vol. 38 No. 3, pp. 663-686.

Molina, C.A. and Preve, L.A. (2012), "An empirical analysis of the effect of financial distress on trade credit", *Financial Management*, Vol. 41 No. 1, pp. 187-205.

Ng, C.K., Smith, J.K. and Smith, R.L. (1999), "Evidence on the determinants of credit terms used in interfirm trade", *The Journal of Finance*, Vol. 54 No. 3, pp. 1109-1129.

Nilsen, J.H. (2002), "Trade credit and the bank lending channel", *Journal of Money, Credit, and Banking*, Vol. 34 No. 1, pp. 226-253.

Opler, T.C. and Titman, S. (1994), "Financial distress and corporate performance", *The Journal of Finance*, Vol. 49 No. 3, pp. 1015-1040.

Ozkan, A. (2000), "An empirical analysis of corporate debt maturity structure", *European Financial Management*, Vol. 6 No. 2, pp. 197-212.

Petersen, M.A. and Rajan, R.G. (1994), "The benefits of lending relationships: evidence from small business data", *The Journal of Finance*, Vol. 49 No. 1, pp. 3-37.

Petersen, M.A. and Rajan, R. (1995), "The effect of credit market competition on lending relationships", *Quarterly Journal of Economics*, Vol. 110 No. 2, pp. 407-443.

Petersen, M.A. and Rajan, R.G. (1997), "Trade credit: theories and evidence", *Review of Financial Studies*, Vol. 10 No. 3, pp. 661-691.

Purnanandam, A. (2008), "Financial distress and corporate risk management: theory and evidence", *Journal of Financial Economics*, Vol. 87 No. 3, pp. 706-739.

Seifert, D., Seifert, R.W. and Protopappa-Sieke, M. (2013), "A review of trade credit literature: opportunities for research in operations", *European Journal of Operational Research*, Vol. 231 No. 2, pp. 245-256.

Whitaker, R.B. (1999), "The early stages of financial distress", *Journal of Economics and Finance*, Vol. 23 No. 2, pp. 123-132.

Wilner, B.S. (2000), "The exploitation of relationships in financial distress: the case of trade credit", *The Journal of Finance*, Vol. 55 No. 1, pp. 153-178.

Wilson, N. and Summers, B. (2002), "Trade credit terms offered by small firms: survey evidence and empirical analysis", *Journal of Business Finance and Accounting*, Vol. 29 Nos 3 & 4, pp. 317-351.

Wruck, K.H. (1990), "Financial distress, reorganisation, and organisational efficiency", *Journal of Financial Economics*, Vol. 27 No. 2, available at: https://org/10/cpv8db.

Wu, W., Firth, M. and Rui, O. (2014), "Trust and the provision of trade credit", *Journal of Banking and Finance*, Vol. 39, pp. 146-159.

Xia, C., Zhang, X., Cao, C. and Xu, N. (2019), "Independent director connectedness in China: an examination of the trade credit financing hypothesis", *International Review of Economics and Finance*, Vol. 63, pp. 209-225.

Zhang, Q., Dong, M., Luo, J. and Segerstedt, A. (2014), "Supply chain coordination with trade credit and quantity discount incorporating default risk", *International Journal of Production Economics*, Vol. 153, pp. 352-360.

Zmijewski, M.E. (1984), "Methodological issues related to the estimation of financial distress prediction models", *Journal of Accounting Research*, Vol. 22, p. 59.

Appendix
Variable labels and definitions

Dependent variables

AP Ratio of Accounts Payables to Total Assets ($AP_{it}/TA_{i,t-1}$)

AR Ratio of Accounts Receivable to Total Assets ($AR_{it}/TA_{i,t-1}$)

Independent variables

FD_{it} Zmijewski's (1984) distress score for financial distress

$$FD_{it} = -4.336 - \left[\left(4.513*\left(\frac{NI_{it}}{TA_{it}}\right)\right] + \left[5.679*\left(\frac{TD_{it}}{TA_{it}}\right)\right] + \left[0.004*\left(\frac{CA_{it}}{CL_{it}}\right)\right]$$

All firms are rank according to their distress score for each year. Firms in the top thirty percentiles of the distress score in each year are considered financially distressed and a dummy variable 1 is assigned to such firms.

FC_{it} Dummy variable 1 if a firm dividend payout ratio ranks in the bottom three deciles of dividend payout ratios for sample FTSE 350 firms in each year.

Control variables

AR_{it} Ratio of accounts receivables to assets ($AR_{it}/TA_{i,t-1}$) in Model 1

AP_{it} Ratio of accounts payables to assets ($AP_{it}/TA_{i,t-1}$) in Model 2

INV_{it} Ratio of inventory to total assets ($INV_{it}/TA_{i,1-t}$)

$SGROW_{it}$ Ratio of the annual change in sales revenue to net sales revenue [$(SALES_t - SALES_{i,t-1})/SALES_{i,t-1}$]

$BDSIZE_{it}$ natural logarithm of number of directors on board ln(BDSIZE)

$TANG_{it}$ Asset Tangibility, ratio of Property, Plant and Equipment to total assets ($PPE_{it}/TA_{i,t-1}$)

$GMARGIN_{it}$ Gross margin, ratio of gross profit to sales [$(REV_{it} - COGS_{it})/REV_{it}$]

$INDIR_{it}$ Ratio of number of independent directors to total number of directors on board.

Corresponding author
Igbekele Sunday Osinubi can be contacted at: i.s.osinubi@uel.ac.uk