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RESEARCH ARTICLE

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Trade credit and corporate growth

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Abstract

While the underlying causal linkage between trade credit and corporate growth has mainly been explored, the primary factors that channel the relationship are limited. This article hypothesises a nonlinear relationship between trade credit and corporate growth due to the existing theoretical arguments on the benefit and cost of using suppliers' credit by corporations to enhance growth. Based on a panel of 23,023 non-financial companies from the United Kingdom over a 10-year period, evidence from this study reveals a nonlinear (concave) relation between trade credit and corporate growth: positive for low trade credit received and negative for high credit received. We also find trade credit to be sensitive to financial crisis, financial constraints and growth strategy. The predictability is stronger during a financial crisis, among financially constrained corporations and corporations pursuing an aggressive growth strategy. We also find growth to be higher in firms that move closer to achieving an optimal credit level. This relationship holds for both the above- and below-optimal deviations. These findings have implications for a more balanced and nuanced view of trade credit management.

KEYWORDS

Employment growth, financial constraint, financial crisis and corporate growth, monetary contraction, trade credit, Trade payables

1 | INTRODUCTION

The importance of trade payables (hereafter trade credit) to corporate growth cannot be overemphasized. For example, according to Aktas et al. (2015), trade credit became the dominant finance source for the average US corporate inventories and receivables at the end of 2011. Klapper et al. (2012) document that before the financial crisis of 2007, 90% of global merchandise trade was almost funded by trade credit. In the Euro area, trade credit remains a stable source of finance for corporate growth (Ferrando & Mulier, 2013) and an integral part of modern business (Kestens et al., 2012; McGuinness & Hogan, 2016; Paul & Boden, 2008) in the wake of the global financial crisis.

Several theoretical and empirical studies have established a link between trade credit and corporate growth (Ferrando & Mulier, 2013; Long et al., 1993; Niskanen & Niskanen, 2006; Oh & Kim, 2016). However, the evidence has remained mixed and inconclusive, with some indicating a positive and others negative association. There are several possible reasons for the conflicting results ranging from the statistical method used, country, sample size, and study period. This study suggests that one of the possible

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reasons for the conflicting results may have been due to prior studies not distinguishing between trade value-added effects on growth during the financial downturn and the financial constraint. According to the financing theory, trade credit becomes a meaningful substitute for bank credit during a financial downturn and an essential finance source for financially constrained corporations (Casey & O'Toole, 2014; McGuinness et al., 2018).

Consistent with prior studies, trade credit eases corporate overall financial burden during periods of monetary contraction by acting as an alternative cash management tool to finance corporate production and liquidity needs for growth (see Goto et al., 2015; Kling et al., 2014; McGuinness & Hogan, 2016). According to McGuinness and Hogan (2016), corporations that use suppliers' credit are in a better position to keep their operational activities stable and are less likely to experience liquidity constraints during this period. Following this line of argument, we contend that trade credit offers much more benefit to corporations during periods of increased financial downturns and financial constraints. If this suggestion is conceivable, we expect increased financial downturns and financial constraints to affect trade credit on firm growth significantly.

Knowledge of the relationship between trade credit and growth is essential because long-term corporate performance (Afrifa, 2015) and survival (McGuinness et al., 2018) are pre-determined by corporate growth opportunities. A firm achieving growth can create future resource buffers for subsequent expansion and competition (Wiklund & Shepherd, 2003). According to Delmar et al. (2013), corporations can achieve a sizable performance only after growth. Several studies have postulated a link between growth, performance, and survival (Coad, 2010; Delmar et al., 2013). In addition, corporate growth is linked to managerial rewards (Jensen & Meckling, 1976) and shareholder value (Fuller & Jensen, 2002). For instance, Frydman and Jenter (2010) state that managers prefer growth to profits because of the benefits they derive from running bigger corporations. Ramezani et al. (2002) also argue that the existence of growth leads to shareholder value maximization.

Our study's objective is to investigate whether the relationship between trade credit and firm growth is nonlinear, which may explain the current conflicting empirical findings. To achieve our objectives, we use panel data of 23,023 non-financial companies from the United Kingdom over a 10-year period. Our empirical test results suggest a nonlinear relationship between trade credit and corporate growth. Specifically, the results show that trade credit positively relates to corporate growth at the lower level and negatively at higher levels of trade credit. Further, our results show that trade credit is sensitive to the financial crisis, among financially constrained corporations and corporations pursuing an aggressive growth strategy. In particular, the results show that both financial downturns and financial constraints positively moderate the relationship between trade credit and corporate growth. The evidence suggests that although higher levels of trade credit use may have more costs than benefits, corporations tend to benefit more from using trade credit to enhance their growth during increased periods of financial crisis and financing constraints. We suggest that such insight explains the contradictory results relating to corporate growth and trade credit relationship.

We performed three additional checks to verify the robustness of our results. Our first test verifies an optimum level of trade credit and how deviation from both sides of the optimum affects corporate growth. Our findings suggest that corporate growth is enhanced as the percentage of trade credit to asset ratio moves closer to the 75th percentile, beyond which corporate growth gradually declines with additional trade credit to asset composition. We perform a second complimentary check to verify whether the relationship is sensitive to corporate size, monetary condition, and corporate growth strategy. Our evidence finds that trade credit is sensitive to corporate size, monetary condition, and corporate growth strategy. Our final check adopts several instruments in a two-step procedure to resolve potential endogeneity and reverse causality problems in our estimation. The results remain consistent after controlling for endogeneity.

The study contributes to the literature in two ways: First, we contribute to the growing debate on the effect of trade credit on firm growth. We distinguish our paper from prior research by considering the possibility of a nonlinearity effect, given the costs and benefits of using suppliers' credit as a source of finance (Baños-Caballero et al., 2014; García-Teruel & Martínez-Solano, 2010). Consistent with the transaction costs and financing advantage theories, previous studies provide evidence that trade credit is a vital source of finance to fuel corporate growth (Ferrando & Mulier, 2013) and improve survival chances (McGuinness et al., 2018). Investigating the nonlinearity of trade credit on corporate growth is essential as growth increases profitability (Delmar et al., 2013) and shareholders' wealth. Our findings add to the literature by showing for the first time that, although trade credit is an essential source of finance for growth, there is a threshold that negatively affects growth. To the best of our knowledge, no study has documented such evidence.

Second, we contribute to the literature by demonstrating that the effect of trade credit on corporate growth hinges on financial crisis, financial constraints and growth strategy. The existing literature is almost unanimous in finding that trade credit is more important during a financial crisis (Love et al., 2007; McGuinness et al., 2018), to

financially constrained corporations (Carbo-Valverde et al., 2016; Casey & O'Toole, 2014) and corporation pursuing aggressive growth strategy (Hill et al., 2012). These findings are based on the fact that the banking system contracts during financial crisis (Casey & O'Toole, 2014; Garcia-Appendini & Montoriol-Garriga, 2013) is more biased toward financially constrained corporations (Carbo-Valverde et al., 2016; McGuinness et al., 2018) and not sufficient to finance corporation pursuing aggressive growth strategy (Cunat, 2007). The study's evidence suggests that trade credit use offers much more benefit to corporations during periods of increased financial downturns, financial constraints and aggressive growth strategies. This evidence is essential for managers of financially constrained and corporations pursuing aggressive growth strategies with important implications for how managers may utilize trade credit during financial crisis.

The rest of this paper is structured as follows: Section 2 reviews the literature and develops hypotheses to be tested; Section 3 defines the data and outlines the models; Section 4 presents the empirical results followed by a discussion, whilst Section 5 presents the summary and conclusions.

2 | THEORY, EMPIRICAL LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Several theories have provided various theoretical arguments to support the role of trade credit on corporate growth. However, a significant number of these arguments have been based on the transactional cost and financing advantage theory of trade credit. In view of this, we adopt these theories to establish a theoretical link between trade credit and corporate growth. The transactional cost theory suggests that economic transactions have potential costs due to the resultant friction that arises in undertaking transactions among exchange parties (Bag, 2013; Petersen et al., 2019; Williamson, 1985). According to Bag (2013), such frictions are mainly caused by opportunistic behaviour that usually arises when two parties in an exchange fail to fulfil their obligations. Consequently, transaction costs are designed to compensate for any market imperfections as a result of these opportunistic behaviours between two parties in an exchange (Petersen et al., 2019; Williamson, 1985).

Within transactional cost theory, lending relationships have been viewed as one of the mechanisms through which friction in exchanging goods and services among economic agents can be mitigated (Bag, 2013). Trade credit represents an important lending mechanism through which corporations mitigate the uncertainty inherent in a typical financial exchange (Goto et al., 2015). This is because trade credit provision is relationship-based lending (Cunat, 2007; Uchida et al., 2013), which offers suppliers information advantage about their borrowers (Agostino & Trivieri, 2014; Goto et al., 2015) and the quality of products offered (Kim & Shin, 2012). Drawing insights from the information advantage perspective, corporations can enhance their operational efficiency and corporate growth by reducing the transactional cost of finance on corporate operations.

The financing advantage theory of trade credit has also provided several theoretical arguments to support the link between trade credit and corporate growth. This theory suggests that using trade credit gives corporations a cost advantage. Within the financing advantage theory, trade credit can be an important alternative source of finance for the short-term operational needs of corporations (Goto et al., 2015). Compared to cash credit, the buyer is less likely to expropriate or divert the credit facility (Aktas et al., 2015); as a result, with a higher level of trade credit, corporations can channel the credit to the necessary inputs to manage their growth (Ferrando & Mulier, 2013). Cunat (2007) argues that fast-growing corporations may finance themselves with trade credit when other finance types are not sufficiently available. According to the financing theory, trade credit becomes a meaningful substitute for bank credit during a financial downturn and an essential finance source for growth among financially constrained corporations (Casey & O'Toole, 2014). According to McGuinness and Hogan (2016), during of financial downturn, corporations that use suppliers' credit are in a better position to grow disproportionately faster as these corporations can keep their operational activities stable and are less likely to experience liquidity constraints.

2.1 | Hypotheses development

2.1.1 | Trade credit and corporate growth

The impact of trade credit use on corporate operation has recently received much attention. In a classical study, Ferris (1981) suggests that trade credit facilitates operational efficiency and corporate growth by reducing the transactional cost of finance on corporate operations. Within the financing advantage theory, trade credit can be an important alternative source of finance for the short-term operational needs of corporations (Goto et al., 2015). As a result, industries that heavily rely on trade credit grow disproportionately faster than their peers who do not. This evidence has been established in several empirical literature. For instance, using data from a panel of 37 industries and 44 countries, Fisman and Love (2003) investigate the relationship between trade

credit, intermediary financial development, and industry growth. Evidence from the study suggests a positive relationship between trade credit and corporate growth. In particular, the authors find evidence of high growth rates among corporations in industries with higher accounts payable rates. The evidence also highlights the relevance of financial development for economic growth. Specifically, the findings reveal that corporations in industries with higher accounts payable exhibit higher growth rates in countries with relatively weak financial institutions. On a separate note, Niskanen and Niskanen (2006) investigate the determinants of corporate trade credit policies in a bank-dominated financial environment and find a significantly positive relationship between trade credit on growth among Small Finnish corporations. The study concludes that in a bank-dominated financial environment, corporations willing to grow, or ones whose sales are declining, may choose a strategy of extending more trade credit than the average corporate in its industry to increase their sales. In a similar study, Ferrando and Mulier (2013) examined how a sample of 600,000 European corporations use the trade credit channel to manage growth. Using over 2.5 million observations of corporations in 8-Euro area countries from 1993 to 2009, the study finds a significantly positive relationship between trade credit and corporate growth. The authors find that corporations use trade credit channels to manage growth. Further, they argue that although the marginal impact of trade credit on growth tends to be lower in countries where trade credit channel is present, the total impact is still higher across the sample.

Another strand of the literature suggests that the use of trade credit attracts high transactional costs (Bougheas et al., 2009; Ferris, 1981; Klapper et al., 2012; Petersen & Rajan, 1997), which could adversely affect corporate growth. Based on the transactional cost perspective, the study postulates two pathways through which this affects corporate growth. First, trade credit is still generally classified as low in the pecking order theory (Fisman & Love, 2003) due to its high implicit transactional cost inherent in negotiating, implementing, and monitoring contract relationships among corporations (Jain, 2001). Burkart and Ellingsen (2004) argue that because most trade credit transactions are mostly inputs rather than cash, suppliers' information advantage sources tend to be input driven. As a result, corporations are still faced with high monitoring costs in terms of how effective these inputs are used to maximize the lenders' expected return. According to Kestens et al. (2012), suppliers tend to pass all the associated insurance and default premium for non-payment of credit to customers through trade credit in the form of the implicit interest cost. Analysing several trade credit contracts, Klapper et al. (2012) find a typical estimated annual interest rate of trade credit to be much higher than what a bank might charge for comparable loans. To protect themselves against any uncertainties surrounding trade credit contracts, corporations often purchase trade credit insurance (TCI) (Yang et al., 2021). Face with this relatively high additional cost of finance, corporations with large trade debtors (relative to their total assets) are likely going to be constrained in terms of their ability to finance new investment opportunities for growth.

Second, the theory also proposes that stretching accounts payables could create additional transaction costs, especially when the firm runs short of cash, which may cause a reduction in growth. Under such conditions, corporations will find it challenging to meet their repayment obligations to enjoy the discount for early payments, and avoid late payments penalties and possible deterioration in credit ratings. This could potentially impact corporate growth adversely. There has been a stream of empirical literature supporting this evidence. For instance, Oh and Kim (2016) examine how corporate growth opportunities affect their trade credit policies in China. Using a panel of Chinese non-financial listed corporations for the period 2003–2013, they find the relationship between growth opportunities and trade credit to be significantly negative and more pronounced in private corporations than in state-owned enterprises. They justified these findings with the argument that corporations with high growth opportunities have limited access to traditional markets risk having adequate internal funds for investment in future growth by increasing accounts payables. As a result, these corporations reduce their trade credit investment to support future growth.

Therefore, the type of association (positive or negative) implied by both theoretical and empirical findings from extant literature suggests that the possibility that the relationship between trade credit and corporate growth could be virtualised as nonlinear, with the expected relation being positive for lower trade credit and negative at higher levels. Precisely, we expect corporate growth to rise as trade credit increases until a certain trade-credit level is reached, given that the increased growth will not offset the high risk borne. Equally, beyond this optimum, due to the low return of current assets, we argue that increases in trade credit may lead to decreases in corporate growth. Thus, we expect trade credit and growth to relate positively at low trade-credit levels and negatively at higher levels. Against this backdrop, the following hypothesis is formulated:

> **H1.** *Trade credit has a significantly nonlinear relationship between trade credit and corporate growth.*

2.1.2 | Trade credit, financial crisis and corporate growth

Several studies have investigated trade credit implications during monetary policy shocks and business downturns. Theoretical evidence suggests that trade credit plays a countercyclical role for a corporation whose bank credit becomes constrained due to monetary policy shocks or business downturns (Burkart & Ellingsen, 2004). For instance, the redistribution theory, developed by Meltzer (1960), suggests that large liquid corporations are net credit suppliers to smaller corporations because they have better access to bank finance.

Similarly, there has been a stream of evidence in the literature supporting the substitution role of trade credit during periods of 'tight' monetary conditions (Bougheas et al., 2009; Burkart & Ellingsen, 2004). According to this theory, downstream corporations suffering from credit rationing from banks during contractionary periods rely more on suppliers' finance to support growth. In other words, from the credit receiver's point of view, trade credit becomes a substitute for bank credit during a tight monetary contraction when bank credit is rationed.

Empirically, several studies have investigated the implication of trade credit on corporate operations during a financial downturn. For instance, Bastos and Pindado (2013) investigate the use of trade credit by corporations from countries that have recently undergone a financial crisis and find empirical evidence that during the financial crisis, corporations with high levels of days of sales outstanding and a high probability of insolvency use more trade credit to fund their operations. Kestens et al. (2012) examine whether the 2008 financial crisis impacted companies' trade credit and whether trade credit changes mitigated the crisis's impact on corporate profitability. Using a sample of non-financial Belgian companies, over the period 2006 and 2009, they document that despite the overall negative impact of the crisis on corporate performance, the impact was lower (greater) for corporations that reported an increase in trade receivables (payables) in crisis compared to pre-crisis periods. Similarly, McGuinness and Hogan (2016) used a panel of 7618 Irish SMEs to determine the extent to which trade credit acted as a substitute for bank finance among Small and Medium-sized Enterprises (SMEs) aftermath of the financial crisis of 2008. Evidence from the study suggests that trade credit played a vital role in adjusting the sector by easing the burden of the financial crisis for some SMEs. In particular, they find the relative importance of trade credit to increase for financially 'vulnerable' SMEs that are less liquid, highly dependent on short-term bank finance, and have greater intangible assets. The study also finds that financially stronger corporations extended relatively more trade credit to financially vulnerable SMEs in the aftermath of the financial crisis.

Carbo-Valverde et al. (2016) examined whether trade credit provided an alternative source of external finance to SMEs during the recent global financial crisis. Using firm-level Spanish data, the evidence finds that credit-constrained SMEs intensely depend on trade credit during the financial crisis to support a firm's investment and growth decisions.

The overall evidence suggests an empirical link between trade credit use and corporate growth during a financial crisis. Following the evidence presented, we argue that given its overall cost associated, trade credit provides more benefit to corporate operational growth needs during a period of financial crisis relative to non-crisis periods. The empirical literature suggests that during crisis periods, trade credit plays a countercyclical role for corporations whose bank credit becomes constrained due to the monetary policy shocks by acting as an alternative cash management tool to fund corporate production and growth needs (see Goto et al., 2015; Kling et al., 2014; McGuinness & Hogan, 2016). Based on this evidence, we develop the following hypothesis:

> **H2.** *Financial crisis positively moderates the relationship between trade credit and corporate growth.*

2.1.3 | Trade credit, financial constraints and corporate growth

The financing advantage theory suggests a cost advantage for corporations that use trade credit. According to the theory, trade credit provides a useful buffer source of finance for financially constrained corporations due to its cost advantage (Hill et al., 2012; Petersen & Rajan, 1997). Prior studies (Love et al., 2007; McGuinness et al., 2018) support the important role of trade credit as an alternative to bank finance, especially for corporations in financial distress. Hill et al. (2012) contend that the scarcity of external finance for financially constrained corporations makes it essential for a constrained corporation to rely on suppliers' credit in order to enhance its growth. On the other hand, the use of trade credit entails adverse effects, such as default risk and late payment (Wu et al., 2012), which negatively constrain the growth of corporations that face financial constraints.

Despite this, several studies (Ferrando & Mulier, 2013; Kling et al., 2014; McGuinness et al., 2018) have demonstrated that the relative importance of trade credit tends to be more pronounced among financially constrained corporations. For instance, McGuinness et al.

(2018) demonstrated the financing advantage role of trade among financially constrained SMEs when bank sources of funds are limited. Noted in the study, the authors find that credit helped financially constrained SMEs survive the recent financial crisis. Further, Abdulla et al. (2017) also note trade credit as an alternative source of finance for private corporations compared to public corporations, as the latter have better access to alternative and cheaper funding sources due to their listing status. While prior research has highlighted the role of trade credit in easing financial distress, it has not directly examined the growth implications of trade credit use among financially constrained corporations. In light of this, the following hypothesis is formulated:

> **H3.** *Financial constraints positively moderate the relationship between trade credit and corporate growth.*

3 | METHOD AND DATA

3.1 | Data

The sample for the study is taken from the AMADEUS database over the 2005–2014 period. The selection of the sample period is based on three justifications: First, this is the most extended period for which data are available on AMADEUS. Second, Westhead and Storey (1997) argues that at least one decade of the sample is needed to analyse the dynamics of the business sector. Finally, consistent with prior financial literature (Aktas et al., 2015), we excluded financial corporations from our sample due to the differences in their accounting requirements (Afrifa, 2015) and corporation missing five or more annual reports. Besides, all variables were winsorised at 1% (Rahaman, 2011) to reduce outliers' influence. Therefore, the final sample consists of an unbalanced panel of 23,023 corporations over 10 years and represents 229,219 firm-year observations. All the independent and control variables lagged by 1 year to reduce the concerns that trade payables and corporate growth are determined in equilibrium.

3.2 | Variables definitions and empirical methods

3.2.1 | Dependent variable

The main dependent variable is corporate growth, which is captured using value-added. Following prior studies by Ferrando and Mulier (2013), in this study, we defined value-added as the sum of profit (loss) for the period and minority interest, taxation, cost of employees, depreciation and interest paid. We took a natural log transformation of value-added to normalize the data distribution. Based on this, we were able to construct our value-added measure as:

$$\text{value added}_{it} = \log(\text{value added}_{it}) + \log(\text{value added}_{it-1}). \quad (1)$$

3.2.2 | Independent variable

The main independent variable of interest in this study is trade credit. We constructed trade credit as the ratio of days-to-pay accounts payable, measured as the ratio of trade payables to total assets. Filbeck and Krueger (2005) argue that trade credit varies significantly across industries. The NACE 2 industry classification system is used to group corporations into industries. There are 21 industries and 10 years, led by construction to 210 industry/year averages.

3.2.3 | Control variables

Following prior studies in this area, we control several corporate characteristics in order to ensure that any of these factors do not drive any trade credit impact on growth. Some of these characteristics include firm age (Rahaman, 2011), firm size (Aktas et al., 2015; Ferrando & Mulier, 2013) and financial leverage (Niskanen & Niskanen, 2006; Rahaman, 2011). All variables are defined in Table 1. We expect firm age to be positively related to growth because older corporations have established contacts, industry experience and easier access to resources (Rahaman, 2011). Firm size is expected to negatively affect corporate growth because smaller corporations can adapt to ever-changing business environments (Yang & Chen, 2009). Financial leverage is expected to be negatively related to corporate growth because of the agency cost of debt (Jensen & Meckling, 1976).

Table 4 reports the overall mean distribution across the sample from 2005 to 2014. All variables have been winsorised at 1% and lagged by 1, 2 and 3 years since these relationships are not necessarily contemporary but likely reflect long-term effects. The table shows that the relationship between trade credit and corporate growth varies across sample firms over the period 2005–2014. To further examine the heterogeneity level across the sample across the period, we decompose the corporation into industries based on the Nomenclature of Economic Activities (NACE) 2 industry classification. Looking at

TABLE 1 Variables definitions

Variable	Acronym	Measurement
Firm's growth	GROWTH	Value added: log (value added$_{it}$ − log (value addded$_{it-1}$)
Employment growth	EGROWTH	Employee growth: log (Number of Employees$_{it}$ − log (Number of Employees$_{it-1}$)
Trade credit-to-assets ratio	TCrTA	Trade credit which is the ratio of days-to-pay accounts payable (DPA), measured as accounts payables/total assets
Trade credit-to-sales ratio	TCrTS	Trade credit which is the ratio of days-to-pay accounts payable (DPA), measured as accounts payables/total sales
D	*D*	*D* is equal to 1 if the trade credit level of firm i is below its median in year *t*, and 0 otherwise
The linear measure of trade credit	TCrTA × *D*	Interactive term of *D* and TCrTA which identifies firm-years with lower or positive trade credit
The nonlinearity of trade credit technique 1	TCrTA × (1 − *D*)	Denotes firm-years with negative levels of trade credit
The nonlinearity of trade credit technique 2	$TCrTA^2_{t-1}$	TCrTA multiplied by TCrTA
Profit margin	PROFIT MARGIN	Measured as net income/sales
Asset tangibility	ATAN	Tangible fixed assets scaled by total assets
Financial leverage	LEV	Total debt scaled by total assets
Firm age	AGE	Number of years between incorporation and the calendar year-end of each firm
Gross domestic product	GDP	The annual GDP growth rate for the UK
Residual of trade credit	RESIDUAL	The absolute value of residual from the determinants of trade credit regression. CRISIS is an indicator variable, which identifies the financial crisis. It is equal to one for fiscal years 2007, 2008, and 2009
Financially constrained	Financial constraint	Financially constrained if Cash and cash equivalent, scaled by total assets of firm i is below its median in year *t*. The dummy variable takes value one if the corresponding firm-year observation is financially constrained and 0 otherwise
Financial crisis	CRISIS	An indicator variable, which identifies the financial crisis. It is equal to one for fiscal years 2007, 2008, and 2009

our variables of interest, Table 2 shows a significant level of heterogeneity in terms of the mean distribution of trade credit use across all industries over the period 2005–2014. In general, trade credit use is more prevalent among wholesale and retail trade, manufacturing and real estate activities, with high trade credit investment of 16%, 13.7% and 13.7%, respectively. The electricity, gas and air conditioning supply industry has the lowest trade credit at 5%. We attribute this heterogeneity level to the differences in operational structures and trade credit terms among these individual corporations operating in these industries.

To further determine the heterogeneity in growth during the financial crisis (2007–2009), we estimated the mean distribution of all the relevant variables across sample corporations from 2005–2014. The results of Table 3 and Figure 1 show a significant variation in growth and trade credit use during the 3 years of the financial crisis (2007–2009). We noticed a significant drop in growth and trade during the crisis. We noticed a significant drop in corporate growth at the beginning of the crisis in 2007, followed by a slight improvement during the crisis's peak and a significant rise after that. On the other hand, we found that trade credit-to-assets ratio increased during the financial crisis (2007–2009), rising to a high of 10.5% at the peak of the crisis (2008) and starting to decline gradually as the economy recovered. This overall evidence accentuates the importance of trade credit for firms during economic downturns for corporate growth.

3.3 | Descriptive statistics

Table 4 reports the descriptive statistics for the study. We paid much attention to trade credit and growth variables because of their relevance in this paper. The table

TABLE 2 Industry distribution of a sample

Industry focus	NACE	GROWTH	TCRTA	ASSETS	AGE	ATAN	LEV
Agriculture, forestry and fishing	A	7.7098	10.6027	22.8691	17.3852	40.8782	9.8810
Mining and quarrying	B	9.5450	14.894	1189.655	17.0880	46.2695	13.7821
Manufacturing	C	6.1531	13.6930	100.5454	17.5032	30.0628	11.0058
Electricity, gas, steam and air-conditioning supply	D	9.6156	4.5671	545.6379	17.5007	51.4243	23.1673
Water supply; sewerage, waste management and remediation activities	E	8.0984	9.0470	332.6866	18.3040	42.1445	20.4366
Construction	F	5.9901	12.1604	101.7189	17.5277	26.7272	17.1794
Wholesale and retail trade; repair of motor vehicles and motorcycles	G	6.1551	16.4059	84.4016	17.9694	22.8390	9.1310
Transportation and storage	H	6.6399	11.9342	124.7816	18.0375	26.4364	14.9453
Accommodation and food service activities	I	6.1527	7.1897	107.4590	17.6036	51.7598	22.4368
Information and communication	J	8.1860	7.9784	479.5772	17.9152	27.6103	15.2704
Real estate activities	L	8.3001	13.6570	639.6645	17.4857	40.9441	24.0651
Professional, scientific and technical activities	M	5.4450	4.7497	79.6761	17.6088	41.3121	30.4607
Administrative and support service activities	N	7.3846	7.3587	614.8660	18.0692	34.5634	23.9809
Public administration and defence; compulsory social security	O	7.7478	6.9409	356.0283	17.5310	32.2478	22.4714
Education	P	5.7885	7.1058	403.3861	17.3713	28.4219	21.4593
Human health and social work activities	Q	3.5645	5.8306	25.8335	16.8440	49.3322	9.6618
Arts, entertainment and recreation	R	7.8163	6.4146	40.1841	16.9892	48.3549	22.5274
Other service activities	S	5.8687	6.3369	87.7389	17.3739	53.1391	21.2028
Activities of households as employers; undifferentiated goods	T	6.8709	7.2758	85.3333	17.6791	36.3799	14.6330
Activities of extraterritorial organizations and bodies	U	7.2876	5.2799	206.8268	14.9505	29.5800	18.1344
Others		6.7438	5.0507	134.9825	17.1313	23.1889	16.6328
	Total	7.0030	8.7845	274.4692	17.4223	37.3151	18.2126

Note: The table provides the sample's mean distribution across industries for 229,219 firms-years across 23,023 corporations from 2005–2014. Variable definitions are provided in Table 1. NACE Rev. 2 refers to the statistical classification system of economic activities (industries) in the European Community.

TABLE 3 Time distribution of a sample

YEAR	GROWTH	TCrTA	ASSETS	AGE	ATAN	LEV
2005	–	8.9730	197.2617	17.2562	35.3135	16.1086
2006	5.8379	8.6449	221.8646	17.1451	36.0834	16.2783
2007	1.2122	8.5562	234. 6315	17.0368	36.6601	16.8937
2008	5.1507	10.5054	260.0911	17.0013	37.0975	17.9108
2009	7.4142	10.3422	301.6669	17.2141	37.7996	19.1317
2010	7.4951	9.4456	272.3165	17.5255	38.0207	19.1374
2011	8.0638	7.8293	281.5082	17.7684	37.7845	19.5675
2012	9.2891	7.0448	400.6017	17.9594	37.8080	19.5346
2013	9.7393	8.0485	300.4639	18.2812	38.2594	19.2388
2014	8.8249	8.4546	299.9801	19.0102	38.3238	18.3248
Total	7.0030	8.7845	277.0386	17.6198	37.3151	18.2126

Note: This table provides the sample's mean distribution across time for 229,219 firms-years across 23,023 corporations from 2005–2014. Variable definitions are provided in Table 1.

demonstrates a significant variation in the mean between the median and median and between the 10th and 90th percentile values of all the relevant variables. The results show that, on average, corporations grow at 8% with a median of 5%. In terms of trade credit, the table reports that trade credit represents around 31% of total corporate assets.

The Pearson correlation coefficients are presented in Table 5 for all the continuous variables included for testing the association between trade credit and corporate growth. The correlation results indicate a significant positive relationship between trade credit and growth at the 1% level.

Since the coefficient of correlations between all the independent variables did not exceed the threshold of 0.87 or 0.90, as Field (2013) suggested, their inclusion in the multiple regression analysis would not create the problem of multicollinearity.

4 | EMPIRICAL APPROACH

4.1 | The baseline specification

We build our empirical model based on Goddard et al. (2002) augmented version of the law of proportionate effect (LPE), which was adopted by Ferrando and Mulier (2013) to investigate how corporations use trade credit channels to manage growth. The advantage of using this methodology is that it provides an economic explanation of the LPE by incorporating several economic variables that determine firm growth. The technique also has the advantage of more degrees of freedom, less multicollinearity among the explanatory variables, improved efficiency of econometric estimates, and controls for the unobservable heterogeneity among the sample that can be observed through time. Like Ferrando and Mulier (2013), our study adopts a dynamic model to investigate the relationship since growth is a dynamic process. Hence, the process could have a deterministic effect on growth.

Prior studies have used several approaches to determine nonlinearity among variables. This study adopts two techniques to determine whether the relationship between trade credit and corporate growth is nonlinear. The two procedures allow corporations to transit between classes. In the first technique, we construct a dummy variable (D), where D is equal to 1 if the trade credit level of corporate i is below its median in year t, and 0 otherwise. Next, we interact the (TCrTA) with a dummy variable, D and $(1 - D)$. Specifically, in the final model, the interaction variable (TCrTA $\times$ D) identifies firm-years with lower or positive trade credit. At the same time (TCrTA $\times$ $(1 - D)$) denotes firm-years with negative levels of trade credit (see Aktas et al., 2015). In the second technique, we estimate nonlinearity following a similar approach to Baños-Caballero et al. (2012). In the approach, we capture nonlinearity by using both (TCrTA), and it is square ($TCrTA^2$). (TCrTA) measures lower levels of trade credit, while TCrTA 2 measures higher trade credit levels. Based on this, we build our empirical model as follows:

$$Y_{it} = \alpha + \beta Y_{it} + TC_{it-1} + TC'_{it-1} + X_{it-1} + \mu_{it}, \quad (2)$$

$$\mu_{it} = \upsilon_i + \upsilon_t + \upsilon_{jt} + \varepsilon_{it},$$

where, Y_{it} is the dependent variable measured by the growth of firm i between period t and $t - 1$. TC_{it-1}

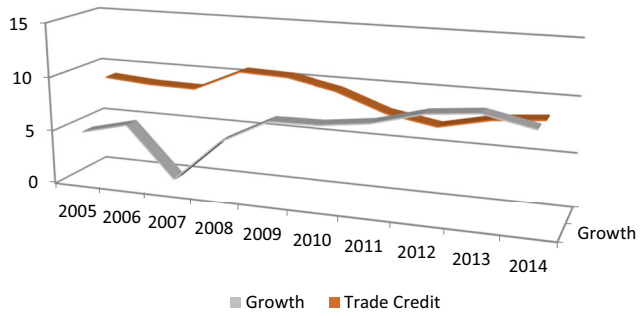

FIGURE 1 Annual trade credit growth variation [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 4 Summary descriptive statistics

Variables	Obs	MEAN	10th	*SD*	MEDIAN	90th
Growth (%)	228,058	6.79	−23.32	8.7443	5.1293	41.1679
TCrTA (%)	229,219	30.96	0.09	27.030	12.413	72.992
ASSETS (£M)	229,219	282.7257	2.7180	200.1040	119.4230	976.6520
AGE (years)	229,120	17.6778	5.4137	14.4464	12.9178	47.3096
ATAN (%)	229,219	37.4101	0.8120	34.8896	26.8302	75.2370
LEV (%)	228,782	18.4030	0.0430	25.5306	13.7318	73.8044

Note: The table provides the summary statistics of 229,219 firm-years across 23,023 corporation over 2005–2014. Variable definitions are provided in Table 1.

TABLE 5 Pearson correlation coefficients

Variable	Growth	TCrTA	AGE	ASSETS	ATAN	LEV
Growth	1					
TCrTA	−0.0409	1				
	0.0000					
AGE	0.0103	0.013	1			
	0.0042	0.000				
ASSETS	0.2358	0.0641	0.0209	1		
	0.000	0.000	0.000			
ATAN	0.1965	−0.0276	−0.0034	0.3388	1	
	0.000	0.000	0.026	0.000		
LEV	0.0548	−0.0002	−0.0015	−0.0034	−0.0028	1
	0.000	0.9163	0.4182	0.0546	0.107	0.000

Note: This table presents Pearson correlation coefficients for the 229,219 firm-years across 23,023 corporations over 2005–2014. Variable definitions are provided in Table 1.

denotes trade credit at lower levels, TC'_{it-1} depicts high levels of trade credit, X_{it-1} is a set of firm characteristics variables known to affect corporate growth. μ_{it} The regression error term consists of unobserved specific effects such as firm υ_i, time υ_t, industry effect that varies across time υ_{jt} and idiosyncratic shock over time ϵ_{it}. To help select the suitable panel estimation technique, the Hausman (1978) test was performed. The Hausman test rejected the null hypothesis that the individual effects are uncorrelated with the regressors and, therefore, we adopt the fixed-effects regression model to estimate the parameters.

4.2 | Baseline estimation specifications 2

Table 6 reports the estimated coefficients on the relationship between trade credit and corporate growth. In columns (2) and (3) of Table 6, we report the results of the nonlinear relationship between trade credit and corporate growth using the asymmetric model technique of nonlinearity. In each of the columns, we captured nonlinearity using two interactive variables. In the first variable (TCrTA × D), we interact trade credit with dummy variable (D) to identify corporations with lower or positive trade credit levels. In the second variable (TCrTA × $(1 - D)$), we interact the (TCrTA) with a dummy variable $(1 - D)$ identifying corporation with negative levels of trade credit. However, in columns (5) and (6) we re-estimate the relationship using a different technique of nonlinearity by taking industry-mean adjusted trade credit (TCrTA) and its square ($TCrTA^2$).

The results of Table 6 find trade credit to be positive and statistically significant at 1% at lower levels and a significantly negative relationship of 1% at higher levels, in columns (2) and (3), respectively. The study also finds similar evidence in columns (5) and (6), confirming the existence of significant nonlinear concave relations between corporate growth and trade credit. The evidence supports hypothesis 1 of the study. It is consistent with the two opposing effects (benefit and cost) of trade credit use on corporate growth. The results suggest an optimal level at which corporations converge through time to increase their growth using trade credit. In other words, trade credit use could enhance corporate growth to a point beyond which corporations could incur financing and opportunity costs; this negatively affects growth.

At lower levels, corporations could benefit from using trade credit as an alternative source of finance in order to improve their growth by reducing transactional costs (Ferris, 1981), enhancing a prompt payment discount (Petersen & Rajan, 1997), improving corporate creditworthiness (Atanasova, 2007) and improving the supplier–customer relationship (Cunat, 2007). However, at the higher level, over-reliance on trade credit use could incur financing and opportunity costs to the buyer, which tends to exceed the benefit and thus reduces corporate growth. Based on this, we argue that the cost of trade credit surpasses its initial benefits at higher levels. As a result, the initial positive trade credit profit relation would become negative at high trade credit levels.

The results from Table 6 show that past growth has a significantly negative impact on current growth. Similar to Ferrando and Mulier (2013), our evidence suggests that corporations which have experienced high growth in the past are more likely to experience low growth in the future due to the financing cost of servicing previous years' credit, which often tends to expose corporations to higher financial risk. Consequently, these corporations are less successful in accessing institutional finance for

growth. Rostamkalaei and Freel (2016) identified the cost of recent past paid interest rate charges as a substantial growth constraint. This evidence rejects the LPE growth hypothesis that a firm's past performance has a less significant effect on its growth. The study finds that the estimated coefficient of leverage size, age, liquidity ratio, and financial slack to impact a corporation grows significantly in the control variables. In particular, we find a significantly positive relationship between leverage and corporate growth, which supports the free-cash (Jensen, 1986) and tax argument (Modigliani & Miller, 1963), which is also consistent with the research of Rahaman (2011).

We also find a significantly negative relationship between liquidity ratio and corporate growth, indicating that debt increases agency costs for corporations (Ebaid, 2009) and improves corporate growth. We also find a negative relationship between corporate growth and size, which supports the argument that smaller corporations are more able to adapt to the ever-changing business environments and, as a result, grow faster. Company age is found to have a direct and significant positive effect on performance at the 5% level. This also supports Rahaman (2011) argument that older corporations have established contacts, industry experience and easier access to resources and, as a result, grow faster.

TABLE 6 Trade credit and corporate growth: baseline specification

Variable	(1) Growth	(2) Growth	(3) Growth	(4) Growth	(5) Growth	(6) Growth
$Growth_{t-1}$	−0.463***	−0.459***	−0.402***	−0.473***	−0.467***	−0.404***
	(−75.01)	(−72.38)	(−62.65)	(−86.65)	(−80.32)	(−63.33)
$TCrTA_{t-1} \times D$	0.205***	0.358***	0.223***			
	(16.44)	(18.73)	(9.66)			
$TCrTA_{t-1} \times (1 - D)$		−0.746***	−0.336***			
		(−18.57)	(−5.39)			
$TCrTA_{t-1}$					−0.00188***	−0.00178***
					(−13.30)	(−12.16)
$TCrTA^2_{t-1}$				0.00274**	0.152***	0.144***
				(3.15)	(13.14)	(12.03)
AGE_{t-1}			0.00199***			0.00199***
			(5.48)			(5.86)
$SIZE_{t-1}$			−0.0917***			−0.102***
			(−6.50)			(−7.70)
ASSET TANGIBILITY$_{t-1}$			−0.447***			−0.453***
			(−16.45)			(−16.57)
$LEVERAGE_{t-1}$			−0.0131			−0.0314
			(−0.49)			(−1.30)
Firm- and year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
CONSTANT	−0.139***	−0.140***	0.945***	−0.114**	−3.024***	−1.672***
	(−16.47)	(−16.50)	(6.80)	(−3.15)	(−12.91)	(−4.81)
Fisher statistic	270.38***	344.67***	943.91***	9.92**	176.98***	807.55***
Number of observations	39,817	39,817	31,847	39,817	39,817	31,847
Adjusted *R*-squared	0.226	0.227	0.230	0.220	0.223	0.229

Note: This table reports the fixed effects trade credit and corporate growth regressions for the 229,219 firm-years across 23,023 corporations over 2005–2014, with *t*-statistics (reported in parentheses). The dependent variable is corporate growth ($GROWTH_{t-1}$). Columns 1 and 4 report a linear estimation of the relationship, and columns 2, 3, 5 and 6 the nonlinear concave estimation using the two nonlinear techniques for model 2. 2 and 3 reports nonlinearity using the asymmetric model technique ($TCrTA_{t-1} \times (1 - D)$) whereas 5 and 6 present estimations for nonlinearity using the square of TCrTA ($TCrTA^2_{t-1}$). Variable definitions are provided in Table 1. The independent variables are lagged by 1 year concerning the dependent variable. *D* is a dummy variable taking value one if the TCRTA or TCRTA of corresponding firm-year observation is below the industry median and 0 otherwise. ***, ** and * represent coefficients significant 1%, 5% and 10% levels correspondingly (two-tailed tests). *T*-statistics are in parentheses.

TABLE 7 Trade credit and corporate growth: financial crisis and financial constraint

	Financial crisis		Financial constraint	
Variable	**(1)**	**(2)**	**(3)**	**(4)**
$Growth_{t-1}$	−0.405***	−0.401***	−0.403***	−0.402***
	(−58.88)	(−69.36)	(−61.04)	(−64.65)
$TCrTA_{t-1} \times D$	0.155***		0.138***	
	(16.36)		(10.37)	
$TCrTA_{t-1} \times (1 - D)$	−0.00192***		−0.00171***	
	(−16.10)		(−10.58)	
$TCrTA_{t-1} \times (1 - D) \times$ Crisis	0.00458***			
	(27.23)			
$TCrTA_{t-1}$		0.233***		0.233***
		(11.82)		(9.88)
$TCrTA^2_{t-1}$		−0.358***		−0.374***
		(−6.52)		(−5.66)
$TCrTA^2_{t-1} \times$ Crisis		1.784***		
		(36.94)		
$TCrTA_{t-1} \times (1 - D) \times$ Financial constraint			0.135**	
			(2.73)	
$TCrTA^2_{t-1} \times$ Financial constraint				1.740***
				(17.04)
AGE_{t-1}	0.00198***	0.00199***	0.00199***	0.00204***
	(5.88)	(5.42)	(5.94)	(5.64)
$SIZE_{t-1}$	−0.0990***	−0.0954***	−0.102***	−0.0976***
	(−7.97)	(−6.14)	(−7.69)	(−6.87)
ASSET TANGIBILITY$_{t-1}$	−0.458***	−0.448***	−0.467***	−0.449***
	(−18.12)	(−16.77)	(−15.18)	(−16.72)
$LEVERAGE_{t-1}$	−0.0355	−0.0202	−0.0342	−0.0178
	(−1.42)	(−0.73)	(−1.41)	(−0.62)
Firm- and year-fixed effects	Yes	Yes	Yes	Yes
Number of observations	31,847	31,847	31,847	31,847
Adjusted *R*-squared	0.2335	0.2384	0.229	0.2383

Note: This table presents the fixed effects regressions of the relationship between trade credit, financial crisis, financial constraint and corporate for the 229,219 firm-years across 23,023 corporations over the period 2005–2014, with *t*-statistics (reported in parentheses). The dependent variable is corporate growth ($GROWTH_{t-1}$). Variable definitions are provided in Table 1. The independent variables are lagged by 1 year to the dependent variable. *D* is a dummy variable taking value if the $TCrTA_{t-1}$ or $TCRTA_{t-1}$ of corresponding firm-year observation is below the industry median and 0 otherwise. Columns (1) and (2) estimate the impact of the crisis, whilst columns (3) and (4) estimate the impact of financial constraints on the relationship. CRISIS is an indicator variable, which identifies the financial crisis. It is equal to one for fiscal years 2007, 2008 and 2009. Financial constraint is a dummy variable taking value one if the corresponding firm-year observation is financially constrained and 0; otherwise, ***, ** and * represent coefficients significant at the 1%, 5% and 10% levels correspondingly (two-tailed tests). *T*-statistics are in parentheses.

4.3 | Trade credit, corporate growth and the financial crisis

In the next empirical analysis, we investigate the effect of the financial crisis on the relationship between trade credit and corporate growth. Given the consensus that emerged in prior studies that during the recent financial crisis, there was a decline in economic activities due to the overall decline in liquidity, resulting in a decline in the growth of corporations, we investigate whether the crisis affects corporate growth vary across firms with different levels of trade credit. To achieve this, we estimate

the interaction effect of the financial crisis and trade credit on corporate financial performance.

The dynamic panel regression results are presented in columns (1) and (2) of Table 7. Consistent with our expectation, we found the two nonlinear (concave) relation techniques between corporate growth and trade credit to be consistent with previous estimations. However, we found the interaction term of trade credit and crisis significant and positive throughout all four columns. The results suggest that the financial crisis positively moderates the relationship between trade credit and corporate growth, confirming hypothesis H2 of the study. Although the crisis had an overall negative impact on growth, the impact tends to be lower for corporations that use trade credit. Based on our findings, we conclude that trade credit provides more benefit to corporate operational growth needs during a financial crisis period relative to non-crisis periods. This is consistent with extant literature, which suggests that during crisis periods, trade credit plays a countercyclical role for corporations whose bank credit becomes constrained due to the monetary policy shocks by acting as an alternative cash management tool to fund corporation production and growth needs (see Goto et al., 2015; Kling et al., 2014; McGuinness & Hogan, 2016).

4.4 | Trade credit, corporate growth, and the financial constraint

We further explore this analysis by looking at the potential impact of financial constraint on the relations between trade credit and corporate growth. We aim to investigate whether the impact of trade credit on corporate growth may vary based on corporate financing constraint. Our argument is built on the premise that owing to the scarcity of finance, financially constrained corporations can often not pursue optimal investment growth strategies. This weakens the operational health of the corporate and its growth potential. Relative to financially unconstrained corporations, constrained corporations have limited access to capital and face costly external financing, making them more likely to experience low growth than constrained corporations. Against this backdrop, we investigate whether and to what extent this growth decline differs among corporations with different trade credit levels.

Table 7 presents evidence of the relationship between trade credit, financial constraint, and growth. Evidence from columns (3) and (4) of Table 7 indicates that the interaction of trade credit and financial constraints in all the columns to be positive and statistically significant at 1%, supporting the study's hypothesis H3. Thus, financial constraint positively moderates the relationship between trade credit and corporate growth. Our findings suggest that the maximum benefit of using trade credit among financially constrained corporations tends to exceed the initial implicit and financing cost, thus enhancing growth at a higher level. Therefore, we argue that trade credit reduces the overall burden of financial constraint on corporate growth among financially constrained corporations. This is consistent with extant literature, which suggests the relevance of trade credit on corporate operations among financially constrained corporations (Ferrando & Mulier, 2013; Kling et al., 2014; McGuinness & Hogan, 2016).

The evidence suggests that financially constrained corporations could benefit from using trade credit as an alternative source of finance to enhance their growth through reducing transactional costs (Ferris, 1981), enhancing a prompt payment discount (Petersen & Rajan, 1997), improving firm creditworthiness (Atanasova, 2007) and improving the supplier-customer relation (Cunat, 2007).

5 | ADDITIONAL ANALYSIS AND ROBUSTNESS CHECKS

5.1 | Additional analysis

5.1.1 | Deviation from optimal trade credit level

Trade credit's two opposing effects demonstrate a concave relationship between corporate trade credit and corporate growth. This section provides further evidence on how a deviation from the optimal trade credit level affects corporate growth. To achieve this, we perform two complementary tests. First, we investigate the existence of this optimal point using the estimated residuals from the benchmark specification for determinants of trade credit as identified by Garcia-Teruel and Martinez-Solano (2010) and García-Teruel and Martínez-Solano (2010). Following a similar approach by Martínez-Sola et al. (2013), the trade credit is eliminated and replaced by the estimated residuals to investigate its impact on corporate growth. The absolute values of these residuals represent *DEVIATION*. The rationale for adopting this technique is to determine whether deviations from the optimal trade credit level influence corporate growth. We expect a positive $\beta_1 < 0$ relation between corporate growth and deviation from optimal trade credit level. The models for the estimations are presented below:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 X_{it-1} + \beta_3 K_{it-1} + \eta_{it} + \lambda_{it} + I_s + \varepsilon_{it}, \quad (3)$$

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 X_{it-1} + \beta_3 Z_{it} + \beta_3 K_{it} + \eta_{it} + \lambda_{it} + I_s + \varepsilon_{it} \quad (4)$$

TABLE 8 Deviation of trade credit on corporate growth

Variable	(1)	(2)	(3)	(4)
Panel A: Deviation from the optimal trade credit level during the financial crisis and financial constraint				
$Growth_{t-1}$	−0.391***	−0.427***	−0.448***	−0.427***
	(−69.78)	(−60.76)	(−46.80)	(−61.14)
Deviation	−0.320***	−0.318***	−0.382***	−0.314***
	(−34.31)	(−21.86)	(−10.98)	(−12.54)
$Interact_{t-1}$		0.0909**		
		(3.08)		
Age_{t-1}	0.00392***	0.00405***	0.00467***	0.00400***
	(7.75)	(5.20)	(5.92)	(7.01)
$SIZE_{t-1}$	−0.0848***	−0.0773***	−0.0653***	−0.0772***
	(−7.00)	(−8.40)	(−7.73)	(−12.67)
ASSET $TANGIBILITY_{t-1}$	−0.735***	−0.712***	−0.680***	−0.710***
	(−31.58)	(−30.27)	(−11.85)	(−18.27)
$LEVERAGE_{t-1}$	−0.210***	−0.192***	−0.188***	−0.192***
	(−7.86)	(−4.64)	(−2.79)	(−4.08)
Financial constraint × Interact			3.632***	
			(3.27)	
Crisis × Interact				0.0714**
				(1.71)
Firm-and year fixed effects		Yes	Yes	Yes
Constant	14.07***	10.20***	2.855	13.00***
	(32.53)	(8.55)	(0.66)	(11.91)
Number of observations	27,064	19,433	9967	19,433
Adjusted *R*-squared	0.2271	0.2374	0.2408	0.2362

Variable	(1) 25th Percentile of trade credit-to assets ratio (0.09%)	(2) 50th Percentile of trade credit-to assets ratio (12%)	(3) 75th Percentile of trade credit-to assets ratio (44%)	(4) 90th Percentile of trade credit-to assets ratio (73%)
Panel B: Analysis of trade credit at 25th, 50th, 75th and 90th percentile				
$TCrTA_{t-1} \times D$	−1.488***	−1.503***	−2.625***	−2.569***
	(−15.71)	(−19.49)	(−26.73)	(−18.58)
$TCrTA_{t-1} \times (1 - D)$	0.119	0.571***	2.140***	1.960***
	(0.81)	(4.75)	(13.97)	(9.08)
AGE_{t-1}	0.00145***	0.00104***	0.000527	0.00203***
	(3.65)	(3.23)	(1.28)	(3.51)
$SIZE_{t-1}$	0.0637***	0.0956***	0.184***	0.269***
	(14.05)	(25.93)	(39.21)	(40.73)
ASSET $TANGIBILITY_{t-1}$	0.595***	0.235***	0.164***	0.0979***
	(23.19)	(11.24)	(6.16)	(2.61)
$LEVERAGE_{t-1}$	−0.0903***	−0.211***	−0.250***	−0.309***
	(−2.73)	(−7.84)	(−7.27)	(−6.39)

TABLE 8 (Continued)

Variable	(1) 25th Percentile of trade credit-to assets ratio (0.09%)	(2) 50th Percentile of trade credit-to assets ratio (12%)	(3) 75th Percentile of trade credit-to assets ratio (44%)	(4) 90th Percentile of trade credit-to assets ratio (73%)
Firm- and year-fixed effects	Yes	Yes	Yes	Yes
Constant	−1.278***	−0.782***	−0.864***	−1.007***
	(−25.58)	(−19.23)	(−16.68)	(−13.80)
Fisher statistic	601.28***	631.03***	632.86***	330.42***
Number of observations	67,124	67,124	67,124	67,124
Pseudo *R*-squared	0.0475	0.0319	0.067	0.078

Note: Panel A: This table presents the fixed effects regressions of the relationship between trade credit, financial crisis, financial constraint and firm for the 229,219 firm-years across 23,023 corporations over the period 2005–2014, with *t*-statistics (reported in parentheses). The dependent variable is firm growth ($GROWTH_{t-1}$). Variable definitions are provided in Table 1. The independent variables are lagged by 1 year to the dependent variable. *D* is a dummy variable taking value if the $TCrTA_{t-1}$ or $TCRTA_{t-1}$ of corresponding firm-year observation is below the industry median and 0 otherwise. Column 1 shows the regression results of whether deviations from the optimal trade credit level influence corporate growth. Column 2 shows how deviation from both sides of the optimum affects corporate growth. Column 3 shows how deviation from both sides of the optimum affects corporate growth during the crisis. Column 4 shows how deviation from both sides of the optimum affects corporate growth during a crisis and financial constraint. CRISIS is an indicator variable, which identifies the financial crisis. It is equal to one for fiscal years 2007, 2008 and 2009. Financial constraint is a dummy variable taking value one if the corresponding firm-year observation is financially constrained and 0; otherwise, ***, ** and * represent coefficients significant at the 1%, 5% and 10% levels correspondingly (two-tailed tests). *T*-statistics are in parentheses. Panel B: This table reports the quantile regression analysis of trade credit at the 25th, 50th, 75th and 90th percentile for the 229,219 firm-years across 23,023 corporation over 2005–2014 *t*-statistics (reported in parentheses). The dependent variable is firm growth ($GROWTH_{t-1}$). The main independent variable is the asymmetric model technique ($TCrTA_{t-1} \times D$) and ($TCrTA_{t-1} \times (1 - D)$). All variables are provided in Table 1. ***, ** and * represent coefficients significant at the 1%, 5% and 10% levels correspondingly (two-tailed tests).

where, Y_{it} is the dependent variable, which is measured by corporate growth, Y_{it-1} is the previous year's growth, X_{it-1} variables represent DEVIATION (DEVIATION) estimated as the absolute values of these residuals, K_{it-1} represents all the controls in a model (1) and (2), *Z* represents the interaction effect above and below the deviation. It is defined as above-optimal * DEVIATION. Above Optimal is a dummy variable that takes 1 for positive residuals, and 0 otherwise. η_{it} is the unobservable heterogeneity, λ_{it} controls for time effects, I_s controls for industry effect and ε_{it} the idiosyncratic shocks β_1 and β_2 are vectors of the parameters to be estimated. All these variables are defined in Table 1. In the second analysis, we investigate how deviation from both sides of the optimum affects corporate growth. To investigate this relationship, we constructed an interactive term (above-optimal * DEVIATION, above-optimal * DEVIATION * Crisis and above-optimal * DEVIATION * financial constraint). Above Optimal is a dummy variable that takes 1 for positive residuals and 0 otherwise.

Panel A of Table 8 presents the results. Column 1 shows the regression results of whether deviations from the optimal trade credit level influence corporate growth. Column 2 shows how deviation from both sides of the optimum affects corporate growth. Column 3 shows how deviation from both sides of the optimum affects corporate growth during the crisis. Column 4 shows how deviation from both sides of the optimum affects corporate growth during a crisis and financial constraint. Consistent with our expectation, we find the coefficient of deviation significantly negative at 1% in all the models. This suggests that corporate growth is reduced as they move away from their optimal trade credit level. The interactive terms' coefficients are positive and significant, indicating that growth is higher as corporations move closer to their optimal trade credit level.

5.1.2 | Deviation from optimal trade credit level using quantile regression

In the next empirical analysis, we focus on determining the level beyond which growth increases as corporations move closer to this optimum. To achieve this, we run separate quantile regressions (25th, 50th, 75th and 90th) of the trade credit-to-assets ratio to determine this point. Evidence from these estimates is presented in Panel B of Table 8. The table's result indicates that corporate growth is enhanced as corporations move closer to 75th percentile (when trade credit constitutes more than 44% of total assets), beyond which corporations begin to experience declining growth. We find the coefficient and *t*-statistic of trade credit $TCrTA^2_{t-1}$ in columns (1) and (2) = 0.119 (0.81), and 0.571(4.75) gradually increases respectively up to column (3) 2.140 (13.97) and then starts to decline in column (4) 1.960 (9.08). Based on these findings, we suggest that at the 75th percentile, the high

TABLE 9 Further analysis using alternative measures and growth strategy during the crisis period and financial constraint

	Fixed effects regressions			Multi-period logit regressions		
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$EGrowth_{t-1}$	−0.389***	−0.386***	−0.388***			
	(−52.51)	(−67.74)	(−67.73)			
$TCrTA_{t-1} \times D$	1.267***	1.318***	1.087***			
	(11.73)	(13.66)	(8.56)			
$TCrTA_{t-1} \times (1 - D)$	−0.445**	−0.464**	−0.383*			
	(−2.91)	(−3.04)	(−1.66)			
$TCrTA_{t-1} \times (1 - D) \times$ crisis		1.530***				
		(3.95)				
$TCrTA_{t-1} \times (1 - D) \times$ Financial constraint			0.481***			
			(3.16)			
$FGROWTH_{t-1}$				1.557***	1.542***	1.615***
				(184.74)	(182.52)	(185.15)
$TCrTA_{t-1} \times D$				0.234***	0.341***	0.342***
				(15.70)	(19.71)	(15.76)
$TCrTA_{t-1} \times (1 - D)$				−1.114***	−1.096***	−1.250***
				(−19.75)	(−16.45)	(−14.04)
$TCrTA_{t-1} \times D \times$ Crisis					−0.325***	
					(−10.95)	
$TCrTA_{t-1} \times (1 - D) \times$ Crisis					−0.146	
					(−1.18)	
$TCrTA_{t-1} \times (1 - D) \times$ Financial constraint						0.0932***
						(3.32)
Firm- and year-fixed effects adjusted	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted *R*-squared	0.2377	0.241	0.2284			

Note: This table presents the fixed effects and multi-period logit regressions on the relationship between trade credit, financial crisis, financial constraint and firm growth for 229,219 firm-years across 23,023 corporations over the period 2005–2014. *T*-statistics (reported in parentheses). The dependent variable in columns 1–3 is measured in corporate employment growth (EGROWTH). Variable definitions are provided in Table 1. The independent variables in these columns (1–3) are trade credit ($TCrTA_{t-1} \times D$) and its non-linearity ($TCrTA_{t-1} \times (1 - D)$). In columns (4–6), the dependent variable is 1 when the firm growth ($FGROWTH_{t-1}$) is more than 100% in any given period; otherwise, it is 0. The independent variable in these columns (4–6) consists of trade credit (by total assets ($TCrTA_{t-1}$)), and it is square ($TCrTA^2_{t-1}$). CRISIS is an indicator variable, which identifies the financial crisis. It is equal to one for fiscal years 2007, 2008 and 2009. Financial constraint is a dummy variable taking value one if the corresponding firm-year observation is financially constrained and 0; otherwise, ***, ** and * represent coefficients significant at the 1%, 5% and 10% levels correspondingly (two-tailed tests). *T*-statistics are in parentheses.

implicit cost of trade credit neutralized the marginal benefit of trade credit use, resulting in a decline in growth.

5.1.3 | Trade credit and corporate growth strategy

We extended our analysis further by examining whether the relationship between trade credit and growth could vary based on corporate growth strategy (organic vs. acquisition/inorganic growth). According to Coad (2007), corporate ability to grow depends on the strategy the corporation decides to adopt. For instance, corporations that pursue internal growth, also known as organic growth, slowly develop and integrate their internal capacity to grow. On the other hand, corporations may adopt acquisitions to expand their market share. This success depends significantly on the corporate ability to rapidly

TABLE 10 Trade credit and firm growth: further analysis using broad money supply and firm size classification

	(1)	(2)	(3)	(4)	(5)	(6)
$Growth_{t-1}$	−0.404***	−0.460***	−0.402***	−0.403***	−0.440***	−0.402***
	(−48.70)	(−54.19)	(−48.90)	(−63.89)	(−113.28)	(−63.30)
$TCrTA_{t-1} \times D$	0.135***	0.388***	0.193***	0.199***	0.398***	0.318***
	(6.49)	(15.10)	(4.35)	(14.51)	(9.63)	(8.39)
$TCrTA_{t-1} \times (1 - D)$		−0.813***	−0.270**		−0.731***	−0.517***
		(−17.44)	(−2.33)		(−6.05)	(−4.39)
BMS	−0.00611	0.00541	−0.00626			
	(−1.15)	(1.11)	(−1.19)			
$TCrTA_{t-1} \times D \times$ BMS	0.0121	−0.0176*	0.0239**			
	(1.63)	(−1.79)	(2.06)			
$TCrTA^2_{t-1} \times (1 - D) \times$ BMS		0.0259	−0.0578**			
		(1.03)	(−2.03)			
SME				0.0563***	0.372***	0.0655***
				(2.58)	(9.02)	(2.93)
$TCrTA_{t-1} \times D \times$ SME				−0.0847***	−0.203***	−0.166***
				(−4.28)	(−6.46)	(−4.11)
$TCrTA_{t-1} \times (1 - D) \times$ SME					0.431***	0.326*
					(3.03)	(1.95)
AGE_{t-1}	0.00187***		0.00189***	0.00196***		0.00196***
	(3.58)		(3.62)	(5.40)		(5.43)
$SIZE_{t-1}$	−0.0986***		−0.0956***	−0.0947***		−0.0917***
	(−5.05)		(−4.81)	(−5.96)		(−5.64)
ASSET TANGIBILITY$_{t-1}$	−0.510***		−0.511***	−0.445***		−0.445***
	(−13.41)		(−13.42)	(−16.99)		(−16.78)
$LEVERAGE_{t-1}$	0.0222		0.0351	−0.0211		−0.00732
	(0.68)		(1.09)	(−0.79)		(−0.27)
Cash reserve	−0.542***		−0.510***			
	(−3.13)		(−3.00)			
_cons	1.097***	−0.145***	1.059***	0.951***	−0.349***	0.911***
	(6.12)	(−13.31)	(5.75)	(5.92)	(−19.09)	(5.49)
N	19,852	26,372	19,852	31,847	39,817	31,847

Note: This table presents the moderation impacts of broad money supply and firm size on the relationship between trade credit firm growth for the 229,219 firm-years across 23,023 corporations over 2005–2014. *T*-statistics (reported in parentheses). The dependent variable is firm growth ($GROWTH_{t-1}$). Variable definitions are provided in Table 1. The independent variables are lagged by 1 year concerning the dependent variable. *D* is a dummy variable taking value if the $TCrTA_{t-1}$ or $TCRTA_{t-1}$ of corresponding firm-year observation is below the industry median and 0 otherwise. Columns (1) and (2) estimate the impact of broad money supply (BMS), whilst columns (3) and (4) estimate the impact of firm size (SME) on the relationship. BMS is measured as the ratio of broad money supply to GDP. SME is a dummy variable taking value one if the corresponding firm-year observation is classified by the UK Companies Act of 2006 and 0 for large corporations. ***, ** and * represent coefficients significant at the 1%, 5% and 10% levels correspondingly (two-tailed tests). *T*-statistics are in parentheses.

acquire new capabilities and production capacities from the acquired corporation. We argue that an essential tool in successfully achieving this is the use of trade credit. Inorganic growth corporations are better at exploring their growth opportunities using trade credit. Trade credit could be an alternative financing tool for production (Goto et al., 2015). Corporations can channel the credit to the necessary inputs such as payables or receivables to manage their growth (Ferrando & Mulier, 2013).

Trade credit information could be essential in reducing the agency problem between managers and investors

of acquisition corporations venturing into very competitive markets. Evidence suggests that most acquisition decisions are based on managerial dominance rather than shareholders' interests. According to Mueller (1970), managers often act in their interest in the acquisition rather than investors' interest. Aktas et al. (2015) empirical evidence reveal a high correlation between firm quality and trade credit. According to the authors, trade credit variations from one period to the next reveal information to outside investors about the firm's investment projects' quality, translating into better operation and growth.

On the other hand, the implicit cost of trade credit is likely to add to the already high acquisition and operating costs (Coad, 2007; Mueller, 1970) of these inorganic corporations, which could adversely affect their growth. Besides, the agency problem is likely to be exacerbated as managers, particularly mature corporations (often having high cash flow but few growth prospects), invest the high available cash flow on trade credit instead of distributing the earnings to shareholders (Jensen, 1986). We predict a nonlinear relationship between trade credit and corporate growth strategy based on these arguments. Following the work of Rahaman (2011), we categorized corporations based on their growth rate. Corporations are classified as organic if their growth rate between year $t-1$ and t is less than 100% and inorganic if it is more than 100%. We constructed a dummy variable equal to 1 for corporations that pursue an inorganic growth strategy in year t and 0 otherwise. The evidence is then estimated using a multi-period logit regression with the dummy as the dependent variable.

The results reported in columns (4), (5) and (6) of Table 9 are in line with our previous evidence of an open relationship between trade credit and corporate growth strategy. The evidence suggests that trade credit could be an essential success in achieving an aggressive growth strategy.

5.1.4 | Moderation impact of the broad money supply

We further extended our analysis by examining whether the broad money supply's effect can influence the relationship between trade credit and corporate growth. The broad money supply is channelled through banks (Altunok et al., 2020), a significant source of short-term funds (Goto et al., 2015). It is explained in the literature that corporations can access varied sources of finance during loosen monetary policy (Chen et al., 2019). During periods of heightened broad money supply, suppliers may be willing to offer customers credit to entice them to buy more. Studies show that when corporations can easily access funds at a cheaper cost because of heightened broad money supply, they adopt the strategic motive of accessing funds from financial institutions and then channelling them to customers (Burkart & Ellingsen, 2004; Petersen & Rajan, 1997).

However, in periods of a high broad money supply, suppliers' credit becomes less critical than bank credit (Huang et al., 2011) because of the implicit cost of forgoing cash discounts and the willingness of banks to extend credit (Chen et al., 2019). According to previous studies (Afrifa et al., 2018; Casey & O'Toole, 2014; McGuinness et al., 2018), suppliers' credit becomes more valuable only in a tight monetary policy period. Suppliers' credit is generally more expensive than bank credit. As such, a firm would instead access bank credit than trade credit in periods of the heightened broad money supply. Following this line of argument, a study by McGuinness et al. (2018) finds that corporation reduce their dependence on suppliers' credit during monetary expansion and increase it during monetary contraction. Thus, trade credit's value-added effect in periods of the broad money supply is expected to be lower and reduce corporate growth.

We predict that monetary policy positively moderates the relationship between trade credit and corporate growth. This study defines the monetary policy using a broad money supply as a broad money supply ratio to GDP. The results reported in columns (1)–(3) of Table 10 show the moderating impact of broad money supply on the relationship between trade credit and corporate growth. Consistent with previous studies, the evidence suggests that higher trade credit use during broad money supply periods is not value-adding for firms.

5.1.5 | Moderation impact of corporate size classifications

We present further analysis of the sensitivity of our analysis to corporate size. Existing evidence from industrial and corporate finance literature argues that SMEs grow disproportionately faster due to their flexibility (see Rahaman, 2011). This strand of literature documents that at the corporate level, corporate growth volatility decreases with corporate size. As reported in the literature, SMEs, which are characterized by a small amount of collateral relative to their liabilities, tend to have more problems accessing external finance. In this respect, trade credit could be necessary as an alternative source of finance to support SMEs' growth compared to large corporations (Ferrando & Mulier, 2013).

In line with this, we extend our analysis to determine whether the relationship between trade credit and corporate growth could vary depending on corporate size. Precisely, we predict a more pronounced sensitivity of the

TABLE 11 Robustness: two-stage least square-based approach to estimate trade credit and firm growth

Variable	(1)	(2)	(3)
$TCrTA_{t-1} \times D \times$ Predict			1.107***
			(3.15)
$TCrTA_{t-1} \times (1 - D) \times$ Predict			−97.85***
			(−25.69)
PROFIT $MARGIN_{t-1}$	0.0002**	−0.0001***	
	(2.18)	(−3.24)	
GDP_{t-1}	0.0157***	0.00131***	
	(40.22)	(12.51)	
AGE_{t-1}	0.00028***	0.0001***	0.00664***
	(3.48)	(3.34)	(18.85)
$SIZE_{t-1}$	−0.0374***	0.00182***	0.487***
	(−38.10)	(6.85)	(24.58)
ASSET $TANGIBILITY_{t-1}$	−0.296***	−0.0659***	−5.428***
	(−55.64)	(−49.73)	(−35.81)
$LEVERAGE_{t-1}$	−0.205***	−0.0161***	−1.210***
	(−28.35)	(−8.18)	(−36.70)
Number of observations	151,474	151,474	67,105
Adjusted *R*-squared	0.0723	0.0276	0.1779
Durbin (score) chi^2	11.1735***	11.235***	
Wu–Hausman *F*-stats	11.3674***	11.4311***	
Hansen's *J* chi^2	5.839	0.145	
Firm- and year-fixed effects adjusted	Yes	Yes	Yes

Note: This table presents a two-stage regression approach to the relationship between trade credit and firm growth for the 229,219 firm-years across 23,023 corporations over 2005–2014. In the first stage regression, we regress $TCrTA_{t-1}$ (column 1) and its nonlinear $TCrTA_{t-1} \times (1 - D)$ column (2) on the following determinants (FIRMSIZE, asset tangibility and leverage) using PROFIT margin (PROFIT $MARGIN_{t-1}$) and GDP as instrumental variables. Based on the endogenous variables' predicted value, we can estimate the second stage from the first stage (1) and (2). $TCrTA_{t-1} \times D$ predict denotes predicted value for $TCrTA_{t-1}$; $TCrTA_{t-1} \times (1 - D)$ predict denotes predicted value for $TCrTA_{t-1} \times (1 - D)$. Durbin (score) chi^2 and the Wu–Hausman *F*-statistic test for endogeneity. Hansen's *J* chi^2 tests the relevance of the instrument. All variable definitions are found in Table 1. The independent variables are lagged by 1 year concerning the dependent variable. ***, ** and * represent coefficients significant at the 1%, 5% and 10% levels correspondingly (two-tailed tests). We clustered all standard errors at the firm level.

nonlinear relationship between trade credit and growth among SMEs compared to their relatively large counterparts. We decomposed our sample into SME and large corporations using the UK Companies Act 2006 corporate size classification to achieve this. Based on this classification, we categorized all firms in the sample into SMEs and large firms. We constructed an indicator dummy variable labelled 'SME', taking the value of one for firms with a turnover of not more than £25.9 million; balance sheet total assets of not more than £12.9 million and the number of employees of not more than 250 and zero for large firms.

Table 10 (columns 4–6) provides empirical results on firm size's impact on the trade credit-corporate growth relationship. Consistent with previous studies, the evidence suggests that higher trade credit use enhances SMEs' growth than their large counterparts. Compared to SMEs, we find a high use of trade credit not to be value-adding for large corporations. Thus, higher trade credit use is economically essential for SMEs (fast-growing) corporations than larger corporations.

5.2 | Robustness

5.2.1 | Alternative measures of trade credit on growth

In addition to the above analysis, we further investigate whether our analysis is robust compared to other alternative trade credit and firm growth measures. To achieve this, we scaled trade credit by sales as an alternative measure of trade credit. In terms of growth, we used corporate employment growth as an alternative measure of corporate growth. Related studies have adopted these variables (McGuinness & Hogan, 2016;

Rahaman, 2011). The results reported in columns (1), (2) and (3) of Table 9 are in line with our previous evidence of an open relationship between trade credit and corporate growth.

5.2.2 | Instrumental variables 2 stage least square (2SLS)

Given that our evidence might reflect omitted factors that affect trade credit and corporate growth that might not have been captured in our model, we re-estimated the relationship using a 2SLS regression. To ascertain the impact of these exogenous variables on trade credit, we incorporate as instruments in a 2SLS-based regressions approach. These instrumental variables will resolve the reverse causality problems in our estimations (Adams & Ferreira, 2009). First, we used the Durbin–Wu–Hausman test for endogeneity and documented significance in both the Durbin (score) chi-square and Wu–Hausman *F* statistic tests for endogeneity. The test indicated that the 2SLS approach is appropriate with the relevant instruments, given the potential presence of endogeneity problems.

In the first stage, we identify the various independent variables that may influence corporate trade credit decisions. Prior studies (García-Teruel & Martínez-Solano, 2010) identify the economy's state as a significant determinant of corporate trade credit policy. According to these authors, trade credit provisions tend to be high during periods of favourable macroeconomic conditions instead of deteriorating conditions. This can be explained by the fact that under deteriorating macroeconomic conditions, the liquidity shortage adversely affects trade credit's redistributive role, resulting in corporations holding high accounts receivable to postpone supplier payments.

We adopted the gross domestic product (GDP) growth to capture macroeconomic effects on trade credit use. Another instrumental variable we incorporated in the first stage model was profit margin (PM). We build our argument based on Petersen and Rajan's (1997) argument on the price discrimination theory, which suggests that profitable corporations usually have a high interest in increasing their sales using trade credit. According to García-Teruel and Martínez-Solano (2010), corporations with high-profit margins provide more trade credit than less profitable corporations. Based on the above evidence, we include GDP, PM and all the controls in the first stage of our standard 2SLS model. We used Hansen's *J* statistic to over-identify restrictions in a GMM model and found these instruments relevant for the estimation. Evidence can be found in Table 11.

Our first-stage regression findings are presented in columns (1) and (2) of Table 11. We use the endogenous variables' predicted value in the second stage to replace the instrumental variables' benchmark specification. Like Aktas et al. (2015), we standardized TCRTA by its standard of error and then adopted standardized TCRTA as an independent variable to reduce heteroskedasticity practical issues. As in column 3 of Table 11, the results confirm our previous evidence that trade credit enhances growth. We find the coefficient $\mathrm{TCrTA}_{t-1} \times D$ Predict to be positive and significant at 1%, whilst; $\mathrm{TCrTA}_{t-1} \times (1 - D)$ Predict remains negative and significant at 1% in both columns (2) and (3). However, the result implies that trade credit remains valuable for corporate growth after controlling for endogeneity.

6 | CONCLUSION

The study highlights the dominant role of trade credit on corporate growth using four different pathways. First, we investigate whether the relationship between trade credit and corporate growth is nonlinear due to the existing theoretical and empirical arguments on the benefits and cost of trade credit provisions among corporations to enhance growth. Second, we explore the sensitivity of the relationship between trade credit and corporate growth to financially constrained corporations and during periods of financial crisis. Third, we examine the existence of the optimal level of trade credit and its influence on corporate growth. Finally, we examine whether the corporation's growth strategy could influence the relationship's nature. To achieve this, we use a panel data fixed-effects regression model on a sample of 23,023 non-financial companies from the UK for the period 2005 to 2014. Evidence from the study reveals a nonlinear relation between trade credit use and corporate growth, which suggests that the use of trade credit requires a balance between benefit and cost for corporations in order to enhance their growth. In addition, our results also show that trade credit is sensitive to financial constraints and financial crises. In particular, the financial crisis and financial constraints moderate the association between trade credit and growth. The evidence suggests that although higher levels of trade credit use may have more costs than benefits to corporations, during a period of financial crisis and when faced with financing constraints, corporations tend to benefit more from using trade credit to enhance their growth.

Further analysis to determine the existence of an optimum level of trade credit and how deviation from both sides of the optimum effects on corporate growth, reveals that corporations have an optimal trade credit level (75th percentile). We find that growth becomes much enhanced as corporations move closer to this point, beyond which growth declines. In addition to this evidence, we perform

complementary checks to verify whether the relationship is sensitive to corporate size, monetary condition, and corporate growth strategy. Our evidence finds that trade credit is sensitive to corporate size, monetary condition, and corporate growth strategy. We also adopt several instruments in a two-step procedure to resolve potential endogeneity and reverse causality problems in our estimation. The results remain consistent after controlling for endogeneity.

Our results offer empirical evidence for academic literature on trade credit and policymakers. First, we offer new evidence of the relationship between trade credit and corporate growth, considering the possibility of non-linearity. Whereas corporations with low trade-credit levels tend to have growth, those with higher levels tend to experience lower growth. Our evidence also suggests a possible reason for the conflicting evidence on the relationship between trade credit and corporate growth. We suggest that a possible reason for the contradictory results on the impact of trade credit on corporate growth is the differences in financial market conditions. Specifically, the study's overall evidence suggests that trade credit use offers much more benefit to corporations during periods of financial downturn and financially constraint. This evidence is essential for managers of financially constrained corporations and has implications on how managers may utilize trade credit during financial crises.

Second, we suggest that managers focus on maintaining a level of trade credit, which optimizes trade credit use to minimize the opportunity cost and financial risk while also maximizing the operational, financial, and commercial benefits of taking trade credit. Managers should focus on maintaining a trade credit policy when trade credit constitutes more than 44% of total assets to maximize the benefit of trade credit use. We suggest using trade credit during periods of financial crisis and financially constraints, as the overall benefit outweighs the initial cost of trade credit use. The main limitation of this study is that the above findings are restricted to British non-financial firms and do not consider other sources of corporate finance, such as factoring. As a result, further and more extensive analyses in multiple contexts, countries and sources of finance, such as factoring, would be required in order to establish causal effects between the variables.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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