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Complementarity Between Supply and Demand of Trade Credit in Firm Performance: Evidence from Europe

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Abstract

Our study investigated the interaction of credit from suppliers (trade payables) and credit given to customers (trade receivables) in order to better understand how the reliance on credit from suppliers and credit given to customers interact with each other to affect firms' performance. Using a sample of 26,731 firm-year observations from 28 European countries, we found new empirical evidence that both trade payables and trade receivables have a more positive effect on firm performance than would be the case if their individual effects were considered in isolation; thus, a complementarity may exist between the credit from suppliers and credit given to customers, affecting firms' performance. Interestingly, our results showed greater sensitivity to certain firm-specific characteristics. In particular, the interaction effect of trade payables and trade receivables was stronger for young firms, firms with growth potential, and financially constrained firms. Further analysis also revealed that the interaction effect of trade payables and trade receivables was stronger for small- and medium-sized enterprises (SMEs), and firms in countries with French/German legal origins, or countries with more debt-reliant bank-based economies.

Keywords: trade payable; trade receivable; firm performance; complementary effect; crisis

JEL Classification: G30; G31; G32; G01

1. Introduction

In this research, we investigate how the credit from suppliers and the credit to customers interact with each other and affect the firm's performance. Previous studies examining the impact of trade credit on firms' performance have either focused on upstream suppliers (Afrifa & Gyapong, 2017; Afrifa et al., 2024; Goto et al., 2015; Hill et al., 2012; Li et al., 2016) or downstream customers in isolation (Baños-Caballero et al., 2014; Guariglia & Mateut, 2016; Martínez-Sola et al., 2014), but our study includes both. It does not only examine upstream suppliers and downstream customers, but also assesses how trade payables (TP) and trade receivables (TR) synergistically interact to enhance firms' performance. Estimation of the effect of trade credit on a firm's performance may be inadequate if the interaction effects are omitted from the analysis because of their strategic importance to firms' production and sales (Ferrando & Mulier, 2013; Goto et al., 2015). In this study, we therefore estimate the interaction effect between the two trade credits on firms' performance.

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Unlike traditional frameworks that collapse these variables into a single net trade credit or broad working capital aggregate, which implicitly assumes they are perfect substitutes, our interactive approach demonstrates that TP and TR are structurally non-linear complements that yield a synergistic performance premium.

While the trade credit received from suppliers helps firms to acquire the necessary input for production by buying on credit and paying later (Goto et al., 2015), the trade credit granted to customers helps firms to increase their revenue by persuading customers to buy more products (Afrifa et al., 2018; Hill et al., 2012). Giving credit to customers may deprive firms of liquidity (Aktas et al., 2015), but this can be partly offset by suppliers' credit (Afrifa & Gyapong, 2017; Goto et al., 2015). It is suggested that suppliers' credit allows firms to extend credit to their customers without running out of cash (Caglayan et al., 2012); thus, we argue that, through their suppliers, firms that have access to trade credit are likely to give more credit to their customers, sell more products, and hence enhance their profitability via the exploitation of economies of scale and scope. Furthermore, this practice of trade credit redistribution operates strictly within the established legal boundaries of conventional European contract law frameworks, which validate, govern, and provide a stable regulatory environment for such commercial credit transmissions across supply chains.

We also consider the sensitivity of the interaction effect of TP and TR on performance relative to certain firm-specific characteristics, including firm age, sales growth, and financial constraints. First, the interaction of TP and TR on firms' performance may be crucial for younger firms, because they largely depend on the credit from suppliers to give credit to their customers. Previous studies find that the firm's age is a determinant of TP and TR (Afrifa & Gyapong, 2017; Cunat, 2007). Younger firms do not have access to institutional finance (Fowowe, 2017) because of their lack of a long-standing relationship with banks (Niskanen & Niskanen, 2006), and may therefore have to rely on suppliers' credit to finance production. Moreover, younger firms, due to their newness in the market, struggle to make sales and must, therefore, use trade credit as an instrument to entice customers to buy more products (Van den Bogaerd & Aerts, 2015); hence, in order to give credit to customers, younger firms may have to depend on credit from suppliers to finance credit to customers. As a result, the interaction effect of TP and TR is expected to be higher for younger firms. This research examines how the firm's age influences the interaction impact value of TP and TR on its performance.

Second, the interaction effect of TP and TR on firms' performance may be greater for firms with positive sales growth. This is because firms use TP and TR to increase sales (Afrifa & Gyapong, 2017; Ferrando & Mulier, 2013). To increase their market share, firms must offer credit to customers as an incentive (Hill et al., 2012; Nadiri, 1969); however, the level of credit firms offer to their customers is partly dependent on the level of suppliers' credit they can obtain (Fabbri & Klapper, 2016; Hill et al., 2012). As a result, positive sales growth should increase the significance of TP and TR for firms. This research considers how sales growth affects the interaction impact of TP and TR on the firm's performance.

Third, the interaction effect of TP and TR on firms' performance may be higher for financially constrained firms. Financially constrained firms lack access to institutional finance (Petersen & Rajan, 1997) and may, therefore, depend on credit from suppliers as the main source of funding to meet production (Goto et al., 2015). Many studies have found financially constrained firms to be more reliant on suppliers' credit (Abdulla et al., 2017; Atanasova, 2007). Moreover, financially constrained firms, like all other firms, may have to offer credit to customers in order to meet sales targets, and this is possible if such financially constrained firms have access to suppliers' credit as a substitute for institutional finance. Studies have shown that firms that have access to credit offer customers more credit (Tsuruta, 2015). As Molina and Preve (2009) suggest, firms tend to rely on TP in order

to finance their TR. This research, therefore, examines how the financial constraints borne by firms influence the interaction effect of TP and TR on firms' performance.

Using a sample of 26,731 firm-year observations from all 28 countries within the EU over the period of 2008–2017, we investigate whether the simultaneous use of TP and TR has a more positive effect on firms' performance than would be the case if their individual effects are considered in isolation. After controlling for year, industry, and country fixed effects, we found that the estimated coefficient of the TP–TR interaction term (TP × TR) is statistically significant, economically sizable, and larger than the direct coefficients of TP and TR. In fact, the coefficient of TP × TR is larger in absolute value than the addition of the coefficients of TP and TR, implying a significant positive complementary relationship exists between the credit from suppliers and credit to customers.

Further regression analyses also show that the interaction effect of TP and TR is found to be stronger for (1) young firms, (2) firms with positive sales growth, and (3) financially constrained firms. Importantly, the results reveal that, due to their difficulties in accessing other sources of finance, the interaction effect of TP and TR is found to be stronger for firms operating in countries with underdeveloped economies, and SMEs. Finally, the trend of our results did not change when we replace Tobin's Q with an alternative measure of firm performance, based on the return on assets (ROA) of the firm, or even after controlling for possible endogeneity and omitted-variable bias.

Our study makes several important theoretical and practical contributions to finance and accounting literature. First, we contribute to the emerging literature examining the effect of TP and TR on firms' performance. Although studies that separately examine the effects of TP and TR firms' performance are abundant, evidence of their complementary effect on firms' performance is scarce. Prior studies that investigate the effects of TP and TR has focused on the relationship between net trade credit and firms' performance (Caglayan et al., 2012; Love et al., 2015). To the best of our knowledge, this study is among the first to explicitly isolate and empirically test the non-linear complementary relationship between upstream supplier credit (trade payables) and downstream customer credit (trade receivables) regarding corporate performance.

The prior literature in this domain has heavily gravitated toward evaluating the relationship between net trade credit and firm outcomes (e.g., Love et al., 2015; Caglayan et al., 2012). However, evaluating trade credit solely through a net lens ($TR - TP$) or within aggregate working capital metrics inherently treats payables and receivables as perfect substitutes. This conventional method obscures the operational frictions identified by liquidity and transaction cost theories.

By introducing a multiplicative interaction specification ($TP \times TR$), our framework treats these two instruments as distinct, simultaneous arms of a unified credit redistribution network. This allows us to offer novel empirical evidence that the strategic alignment of both credit channels generates an operational synergy and a subsequent performance premium that direct, isolated, or net linear models fail to capture.

The findings of this study, therefore, shed light on trade credit policies that improve the economic performance of firms; for instance, in their attempts to achieve higher returns, firms can increase their reliance on suppliers' credit and, consequently, extend credit to their customers, because it will probably increase sales and earnings.

Second, we also contribute to the literature by identifying a number of important, and potentially confounding, factors that affect the interaction effect of TP and TR on firms' performance. In particular, we analyse the complementary effect of TP and TR on firms' performance, conditional on firm age, sales growth, and financial constraints, thereby offering a theoretical insight into our understanding of the relationship between trade credit and firms' performance.

Third, we add to the literature an analysis of the effect of the interaction of TP and TR on firms' performance in cross-country contexts, using a sample period spanning 2008–2017. This enables us to examine whether the effect of the interaction of TP and TR on firms' performance is time-dependent and whether the 2007–2009 financial crisis alters this relationship. In the years following the crisis, there was a substantial decline in overall economic activity, which in turn increased pressure on firms to revise their trade credit policies. How the interaction of TP and TR influenced firms' performance during the financial crisis is an empirical matter that we address in this study.

The remainder of the paper continues as follows. The next section presents the literature review and hypothesis development. Section 3 discusses the research design and data. Section 4 presents and discusses the empirical results. The further analysis is presented in Section 5, followed by a description of the robustness checks in Section 6. The final section provides the concluding remarks.

2. Theoretical Framework and Hypothesis Development

The effect of trade credit resembles three intermeshing cogwheels. The three wheels are linked by the cogs so that a small circular movement of the two small wheels (TP and TR) leads to a large circular movement of the large wheel (firm performance).

To unify these dynamics, we synthesise the prevailing literature into an integrated framework termed the "Credit Redistribution Cycle." This framework explicitly connects transaction cost, liquidity, and financing theories to explain why the simultaneous management of both trade credits generates a non-linear performance premium. Transaction cost theory dictates that firms must offer credit (TR) to reduce customer transaction costs, optimise inventory management, and stimulate sales demand (Petersen & Rajan, 1997). However, liquidity theory identifies the resulting financial friction: granting credit inevitably drains cash and ties up working capital in receivables (Aktas et al., 2015). Financing theory provides the structural resolution to this tension: extracting credit from upstream suppliers (TP) fills this liquidity gap, functioning as an essential alternative source of non-institutional capital (Molina & Preve, 2009). Rather than operating as independent or purely offsetting mechanisms, these components form a continuous feedback loop where a firm's capacity to achieve downstream transaction cost efficiencies via TR is structurally dependent on, and fuelled by, its upstream financing capacity via TP.

We proposed that the simultaneous use of TP and TR would have a positive effect on firms' performance. To explain the complementary positive effect of TP and TR on firms' performance, we integrated three core theoretical perspectives: financing theory, liquidity theory, and transaction cost theory. Along with other theories (e.g., price discrimination, financial distress theory, redistribution view), these three theories have been extensively used by several researchers as the theoretical bases for their hypotheses (e.g., Afrifa et al., 2018; Petersen & Rajan, 1997). This indicates that no single theory provided a complete explanation of trade credits and its impact on firms' performance.

2.1. Trade Credit (Received/Granted) and Firm Performance

The interactive effect of TP and TR on firms' performance is expected to be greater than the sum of the individual effects (in other words, 1 + 1 would be greater than 2). While TP help firms to acquire the necessary input for production by buying on credit and paying later (Goto et al., 2015), TR permit firms to increase their sales by persuading customers to purchase more frequently and/or in larger quantities (Afrifa et al., 2018; Hill et al., 2012). Consistent with the transaction cost perspective, TP and TR cumulatively and collectively help firms to produce and sell more than their rivals (without cutting the price for existing customers), thereby reducing their transaction costs, which often leads

to higher earnings/returns. It is also argued that firms that provide trade credit to their customers are more efficient in managing the costs of their inventories, especially the costs of warehousing and financing (Petersen & Rajan, 1997); hence, trade credit is a faster and more effective means of liquidating the firm's inventory (Afrifa et al., 2020).

More critically, firms that offer credit to customers without extracting credit from their suppliers face a shortage of cash or liquidity (Afrifa & Gyapong, 2017; Aktas et al., 2015; Goto et al., 2015). According to liquidity theory, the use of suppliers' credit allows firms to extend credit to customers without running out of cash, implying an inefficient redistribution of trade credit. It is also suggested that TP and TR are interdependent (Caglayan et al., 2012); thus, firms that extract more trade credit from suppliers can offer their customers more credit (Molina & Preve, 2012), thereby hedging the credit risk of their TR with TP (Ferrando & Mulier, 2013).

Previous studies have provided some evidence to suggest a possible higher interaction effect of TP and TR on firms' performance. Burkart and Ellingsen (2004) postulate that firms are debtors (obtaining credit from suppliers) and creditors (giving credit to customers) simultaneously, because they demand and offer trade credit concurrently. Early empirical evidence by Long et al. (1993) similarly highlights this dual behaviour, demonstrating that a firm's decision to extend trade credit is tightly linked to its own operational characteristics and financing alternatives. Specifically, Long et al. (1993) establish that trade credit serves as a product quality guarantee, allowing buyers to inspect goods before payment matures. In the context of our Credit Redistribution Cycle, this implies that a firm's capacity to offer downstream transaction cost efficiencies and quality assurances via TR is structurally dependent on its upstream financing capacity via TP. When suppliers extend credit lines (i.e., TP), the firm gains the financial flexibility required to extend quality-guaranteeing credit terms to its customers, thereby driving the synergistic performance premium proposed in the hypothesis. As Molina and Preve (2009) argue, firms use the credit from suppliers to finance part of the credit given to their customers. Lee and Rhee (2011) also suggest that the two types of trade credits are central to the supply chain of firms, because they influence the production and distribution of products. More recently, Afrifa et al. (2024) provide evidence that short-term credit policies, which jointly govern firms' use of TP and TR, materially affect operating performance. In light of all the above assertions, the following hypothesis was proposed:

H1. *The interactive effect of the two types of trade credits (TP and TR) on firms' performance will be greater than the sum of their individual effects.*

2.2. Firms' Heterogeneity and the Trade Credit–Firms' Performance Relationship

Regarding firms' age, TP and TR are crucial in enabling young or newly established firms to continue making and selling goods (Ferrando & Mulier, 2013; Gertler, 1988), thereby maximising their sales and profits while optimising the costs of producing goods for customers; hence, their interaction effect on performance is expected to be higher for young firms than for older ones. Consistently with financing theory, the ability of young firms to extend credit to their customers hinges partly on their suppliers' willingness to extend credit to them (Ferrando & Mulier, 2013). This is because young firms are more likely to fail than older or well-established ones (Colombelli, 2010) and are, therefore, likely to have greater difficulty in attracting funds from financial institutions (Petersen & Rajan, 1994). This explains why the credit that suppliers extend to less liquid young firms is a valuable source of external finance, without which those firms cannot continue to operate successfully. Viewed through the lens of our integrated framework, this Credit Redistribution Cycle becomes highly critical for younger firms precisely because they lack access to formal bank loans (Fowowe, 2017). Consequently, their capacity to unlock vital

transaction cost efficiencies and entice customers via TR is structurally and completely dependent on their upstream financing capacity via TP. Based on financing/liquidity theory perspectives, young firms are likely to rely on credit from suppliers in order to increase production and make more sales, which may enhance their performance; thus, we expected the interaction effect of TP and TR to be higher for young firms than for their older counterparts. Our second hypothesis stated:

H2. *Firm age will moderate the relationships of the two trade credits (TP and TR) with firms' performance in such a way that the association posited in Hypothesis 1 will be stronger for young firms than for older firms.*

Previous research regarding firms' growth has suggested that TP and TR help firms to successfully grow and innovate (Burkart & Ellingsen, 2004; Ferrando & Mulier, 2013). In their attempts to generate more sales, growing firms have a strong incentive to offer their customers more credit (Hill et al., 2012) and relax their credit terms, so that customers can buy more, which in turn reduces unit costs and may, therefore, generate more profit from the units sold. Although the extension of trade credit to customers can help firms to compete effectively (Dass et al., 2014) and increase the volume of their business (Chod et al., 2019), this results in a level of investment in trade receivables (Afrifa & Gyapong, 2017). If the amount of trade credit offered to customers is substantial, growing firms are likely to experience a shortage of cash, and there will be a greater demand for suppliers' credit as an important source of funding to finance their credit sales and compensate for the liquidity shortage or financing gap. This is consistent with the liquidity theory perspective (Afrifa et al., 2018; Burkart & Ellingsen, 2004). Based on the above discussion, we expected the interaction effect of TP and TR on firms' performance to be higher for growing firms than for static firms. We stated our third hypothesis:

H3. *Firm growth will moderate the relationship of the two types of credit (TP and TR) with firms' performance in such a way that the association posited in Hypothesis 1 will be stronger for growing firms than for static firms.*

Financially constrained firms may struggle to produce and sell their goods in the absence of trade credit. In particular, these firms are unable to give credit to customers without receiving credit from suppliers, due to their inability to obtain external financing from banks and other financial institutions (which is a sign of credit constraints). Consistent with the 'redistribution' view, trade credit can relieve credit constraints when unconstrained suppliers extend their credit to financially constrained customers such as young and small firms. As Cosci et al. (2020, p. 201) suggest, "trade credit is primarily a financing of last resort for firms that have exhausted or are unable to access bank credit". Similarly, Guariglia and Mateut (2016) argued that the ability of a firm to extend credit to its customers depends on its access to external sources of funding. Consistently with financing theory, financially constrained firms, or firms with negative cash flow, will typically demand more trade credit from their suppliers, so that they are able to remain financially stable and provide credit to their customers (Ferrando & Mulier, 2013), thereby possibly increasing their sales and earnings. As previous research has demonstrated, firms that are constrained in their access to bank loans tend to approach suppliers who can provide more trade credit to their clients (Abdulla et al., 2017). Consistent with this view, Afrifa et al. (2023) show that trade credit and bank credit can act as substitutes for one another, particularly for private firms that face tighter access to institutional finance. Just as with younger firms, the integration of this feedback loop provides a rigid non-linear baseline for financially constrained firms that face structural exclusions from banking capital (Atanasova, 2007). Because their cash

positions are heavily restricted, any market expansion or sales stabilisation attempted through lowering consumer friction (TR) cannot exist as an isolated corporate policy; it requires the concurrent extraction of upstream trade financing (TP) to avoid operational collapse. In light of the above discussion, it thus seemed reasonable to expect that financially constrained firms would be more likely to capture the benefits of, and use, both types of trade credit extension than their financially stable counterparts. Based on the arguments laid out in this section, the following hypothesis was proposed:

H4. *Financial constraints will moderate the relationship of the two types of credit (TP and TR) with firms' performance in such a way that the association posited in Hypothesis 1 will be stronger for financially constrained firms than for static firms.*

3. Data and Research Design

3.1. Sample Selection and Data

Our initial sample comprised all active publicly listed corporations across all 28 EU member states for which financial data between 2008 and 2017 were available in the ORBIS database, establishing a baseline of approximately 34,500 firm-year observations. We then applied a systematic two-stage exclusion framework to arrive at our final testing sample. Following established trade credit literature (e.g., Afrifa et al., 2018), we first excluded firms operating within the financial sector (NACE codes 64–66), removing approximately 6100 firm-year observations due to their fundamentally distinct liquidity and operational regulations. Second, we eliminated approximately 1669 firm-year observations identified as containing anomalous accounting metrics (such as negative total assets or negative equity) or missing key working capital parameters. To ensure that our dynamic generalised method of moments (GMM) estimators utilise perfectly consistent lag structures, any remaining incomplete data points were treated via listwise deletion. This screening cascade resulted in a final unbalanced panel of 26,731 firm-year observations. The step-by-step sample filtration process is summarised in Table 1 below.

Table 1. Sample Selection.

Filtration Stage/Criteria	Observations
Initial ORBIS Listed European Firm Exports (2008–2017)	34,500
Exclusion of Financial Sector Entities (NACE 64–66)	−6100
Exclusion of Anomalies & Missing Values (Listwise)	−1669
Final Unbalanced Panel Dataset	26,731

3.2. Definitions of Variables

Similar to previous studies (Martínez-Sola et al., 2013; La Porta et al., 2002), the Tobin's Q ratio is used as the main dependent variable. We measure the Tobin's Q ratio as the total assets minus the book value of equity, plus the market value of equity, scaled by total assets. A paper by Martínez-Sola et al. (2013), investigating the use of trade credit by firms, employed the Tobin's Q ratio as a measure of performance. For the robustness test, we also consider the operational performance measure of return on assets (ROA) as an alternative dependent variable.

The main independent variables of interest are TP, TR, and the interaction of TP and TR. Both the TP and TR are scaled by total assets (e.g., Afrifa et al., 2018; Ferrando & Mulier, 2013; Fisman & Love, 2003; Lin & Chou, 2015; Wu et al., 2014, 2012).

The firms' heterogeneity factors considered in this paper are the firms' age, sales growth, and financial constraints. Following Coad et al. (2013), Young is a dummy variable,

equal to one for firms below the age of 10 years, and zero otherwise. Prior research (e.g., Covin et al., 1990) suggests different age ranges to determine young firms; however, in order to establish an age threshold and obtain a high level of representativeness of young firms in our sample without increasing the age threshold too far, we divided the sample into two subgroups: young firms (≤10 years) and mature firms (>10 years).[1]

To differentiate between growing and static firms, a dummy variable (Pgrowth) is constructed. Pgrowth is a binary variable that takes the value of one for firms with positive sales growth, and zero otherwise. Financial constraint is measured using the Whited–Wu (WW) index (Whited & Wu, 2006). Following Cheng et al. (2014), the WW index is constructed as:

$$WW = -0.091 \cdot CF - 0.062 \cdot DIVPOS + 0.021 \cdot TLTD - 0.044 \cdot LNTA + 0.102 \cdot ISG - 0.035 \cdot SG$$

where CF is the ratio of cash holdings to total assets; DIVPOS is an indicator variable that is equal to one if the firm paid dividends, and zero otherwise; TLTD is the ratio of the long-term debt to total assets; LNTA is the natural log of total assets; ISG is the firm's industry sales growth; and SG is the firm's sales growth. A higher WW index indicates more severe financial constraints. To differentiate between more and less financially constrained firms, a dummy variable (constraint) is constructed. Constraint is equal to one for firms with a WW index above the mean, and zero otherwise.

We follow the literature and include certain firm-specific characteristics that are likely to affect firms' performance. Specifically, we include firms' size (Martínez-Sola et al., 2014), sales growth (Afrifa et al., 2018), finance leverage (Aktas et al., 2015), group affiliation (Locorotondo et al., 2014), cash reserves (Opler et al., 1999), firms' age (Afrifa et al., 2018), and the type or size of auditor (Alsabah & Alshehabi, 2026a; Gyapong et al., 2016).

3.3. Models

The hypotheses were tested using the panel data methodology. In order to control for any possible endogeneity issues in this paper, especially in relation to TP and TR, we employ the generalised method of moments (GMM). The GMM is a common estimator in panel data because it allows instrumental variables to be selected from within the model and uses the lags of the independent variables as instruments. We therefore estimate the following equation to examine the interaction effect of TP and TR on firms' performance (H1):

$$\begin{aligned} Q_{it} = {} & \beta_0 + \beta_1 TP_{it-1} + \beta_2 TR_{it-1} + \beta_3 (TP \times TR)_{it-1} \\ & + \beta_4 Control_{it-1} + \text{Year FE} + \text{Industry FE} + \text{Country FE} + \varepsilon_{it}. \end{aligned} \quad (1)$$

To test whether firms' heterogeneity (firms' age, sales growth, financial constraints) influenced the effect of the interaction of TP and TR on firms' performance (H2, H3, H4), we estimate the following model:

$$\begin{aligned} Q_{it} = {} & \beta_0 + \beta_1 TP_{it-1} + \beta_2 TR_{it-1} + \beta_3 (TP \times TR)_{it-1} \\ & + \beta_4 Heterogeneity_{it-1} + \beta_5 (TP \times Heterogeneity)_{it-1} \\ & + \beta_6 (TR \times Heterogeneity)_{it-1} + \beta_7 (TP \times TR \times Heterogeneity)_{it-1} \\ & + \beta_8 Control_{it-1} + \text{Year FE} + \text{Industry FE} + \text{Country FE} + \varepsilon_{it}, \end{aligned} \quad (2)$$

where Q = Tobin's Q ratio, and Heterogeneity = either Young, Pgrowth, or Constraint.

Year, industry, and country fixed effects were also included to control for economic cycles, industry trends, and country-level differences. Appendix A presents the detailed variable definitions.

3.4. Descriptive Statistics and Correlation

Table 2 reports the descriptive statistics of the variables included in our regression analyses. The mean of Tobin's Q ratio is 1.500, which is consistent with previous research (e.g., Patel et al., 2018). The relatively compact standard deviation of this metric (0.118) is structurally driven by the total-asset-scaling of our proxy, which naturally dampens market volatility relative to equity-deflated alternatives. This compressed variance also reflects our target sample of mature, publicly listed European corporations and the systematic exclusion of extreme insolvency outliers that would otherwise artificially bloat the distribution's tails. Consequently, the distribution represents a stable, steady-state baseline for listed corporate performance within the EU. The mean values of TP and TR are 10.5% and 13.2% respectively, suggesting that the trade credit given by European listed firms exceeds the credit extended by their suppliers. This is consistent with the financing theory: listed firms with access to external finance (Abdulla et al., 2017) serve as financial intermediaries for their financially constrained customers (Petersen & Rajan, 1997). Empirical studies have reported a similar pattern of summary statistics for TP and TR (Wu et al., 2012). Young firms represent about 34.5% of the sample observations. The descriptive statistics also shows that 64.3% of firm/year observations have positive annual sales growth, and 34.7% of the sample observations have a financial constraint score above the mean value of the WW index.

Table 2. Descriptive statistics.

Variable	Obs.	Mean	p50	Std. Dev.	p10	p25	p75	p90
Tobin's Q	26,731	1.500	1.482	0.118	1.390	1.432	1.532	1.593
Trade payables (TP)	26,731	0.105	0.088	0.077	0.024	0.043	0.143	0.206
Trade receivables (TR)	26,731	0.132	0.107	0.090	0.049	0.069	0.166	0.241
Young	26,731	0.345	0.000	0.476	0.000	0.000	1.000	1.000
Pgrowth	26,731	0.643	1.000	0.479	0.000	0.000	1.000	1.000
Constraint	26,731	0.347	0.000	0.476	0.000	0.000	1.000	1.000
Leverage	26,731	0.173	0.174	0.025	0.142	0.157	0.188	0.201
Group affiliation	26,731	0.903	1.000	0.295	1.000	1.000	1.000	1.000
Big four	26,731	0.699	1.000	0.459	0.000	0.000	1.000	1.000
Cash holding	26,731	0.101	0.076	0.099	0.024	0.042	0.113	0.240
Firm age	26,731	16.480	11.000	19.872	8.000	10.000	19.000	20.000
Firm size (log)	26,731	12.132	12.007	2.465	9.058	10.429	13.769	15.436
Sales growth	26,731	0.074	0.032	0.273	−0.268	−0.089	0.270	0.273
Inventories	26,731	0.240	0.246	0.124	0.067	0.137	0.309	0.383

This table reports descriptive statistics for the variables included in the regression analyses for 26,731 firm-year observations from 28 EU countries over 2008–2017. All variables are defined in Appendix A.

Given the cross-country nature of this study, Table 3 summarises the mean values of the dependent variable (Tobin's Q ratio), the main explanatory variables (TP and TR), and the firms' heterogeneity factors (Young, Pgrowth and Constraint). The descriptive statistics show that the two countries with the highest Tobin's Q ratio are Slovakia (1.556) and Spain (1.521), whereas Malta (1.451) and Czech Republic (1.454) exhibit the lowest Tobin's Q ratio. Across all the 28 countries in our sample (except Greece), firms on average offer customers more credit than they receive from their suppliers; however, there was wide variation in terms of the use and extension of trade credit across countries. The country with the highest percentage of young firms is Malta (60.3%), whereas Latvia had the lowest percentage of young firms (0.00%). All countries exhibit positive sales growth. While Table 3 underscores the descriptive macro-level variations across jurisdictions, univariate comparisons of country means (such as ANOVA or standalone *t*-tests) are omitted to avoid omitted-variable bias and inflated Type I error rates. Instead, the statistical significance

of these cross-country institutional variations is rigorously controlled for and absorbed throughout our empirical analysis via the inclusion of country fixed effects in all regression equations, with standard errors dynamically clustered at the country level. Furthermore, these geographic and institutional variations are systematically dissected via structured sub-sample regressions in Section 5.3.

Table 3. Mean values of selected variables by country.

Country	Tobin's Q	Trade Payables	Trade Receivables	Young Firms	Pgrowth	Constraint
Austria	1.493	0.089	0.117	0.235	0.674	0.235
Belgium	1.490	0.092	0.134	0.416	0.669	0.416
Bulgaria	1.475	0.073	0.097	0.458	0.646	0.458
Cyprus	1.497	0.078	0.136	0.135	0.709	0.135
Croatia	1.493	0.080	0.115	0.357	0.699	0.357
Czech Republic	1.454	0.070	0.115	0.238	0.690	0.238
Denmark	1.496	0.106	0.118	0.291	0.694	0.291
Estonia	1.473	0.060	0.114	0.190	0.780	0.190
Finland	1.481	0.117	0.123	0.256	0.687	0.256
France	1.509	0.127	0.155	0.366	0.649	0.366
Germany	1.481	0.101	0.119	0.374	0.674	0.374
Greece	1.501	0.132	0.119	0.208	0.772	0.208
Hungary	1.488	0.097	0.130	0.328	0.672	0.328
Ireland	1.493	0.092	0.130	0.187	0.639	0.187
Italy	1.518	0.129	0.184	0.257	0.643	0.257
Latvia	1.479	0.088	0.111	0.000	0.663	0.000
Lithuania	1.467	0.101	0.132	0.128	0.654	0.128
Luxembourg	1.468	0.073	0.111	0.363	0.618	0.363
Malta	1.451	0.078	0.092	0.603	0.647	0.603
Netherlands	1.505	0.094	0.125	0.345	0.677	0.345
Poland	1.508	0.117	0.157	0.403	0.576	0.403
Portugal	1.518	0.104	0.144	0.246	0.769	0.321
Romania	1.494	0.091	0.126	0.084	0.665	0.084
Slovakia	1.556	0.111	0.214	0.250	0.667	0.250
Slovenia	1.485	0.093	0.132	0.247	0.678	0.247
Spain	1.521	0.092	0.133	0.384	0.664	0.384
Sweden	1.501	0.103	0.119	0.373	0.552	0.373
United Kingdom	1.505	0.093	0.120	0.402	0.626	0.402

This table reports country means of the main dependent variable (Tobin's Q), the main explanatory variables (Trade payables and Trade receivables), and the firm heterogeneity factors (Young, Pgrowth, Constraint). All variables are defined in Appendix A.

Table 4 shows the Pearson correlation coefficients and their statistical significance for all the variables included in the regression models. The majority of correlations between the dependent variable (Tobin's Q) and the independent variables were significant at 5% and lower levels. Tobin's Q was positively and significantly associated with TP (r = 0.416) and TR (r = 0.480). There was a statistically significant and positive correlation between TP and TR (r = 0.504). Constraint was positively associated with Young (r = 0.713), suggesting that younger firms are relatively financially constrained. The correlation between these two variables is high; however, these two variables are not included in the same regression. The models are therefore not affected. In addition, Pgrowth is positively correlated with sales growth (0.788), because the former is derived from the latter. We therefore follow previous studies (Gyapong et al., 2016) and exclude sales growth from all regressions containing Pgrowth to avoid the issue of multicollinearity.

Table 4. Pearson correlation matrix.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Tobin's Q	1.000													
2. TP	0.416 *	1.000												
3. TR	0.480 *	0.504 *	1.000											
4. Young	−0.126 *	−0.077 *	−0.179 *	1.000										
5. Pgrowth	−0.098 *	−0.089 *	−0.083 *	−0.037 *	1.000									
6. Constraint	−0.125 *	−0.076 *	−0.179 *	0.997 *	−0.037 *	1.000								
7. Leverage	0.192 *	0.173 *	0.338 *	−0.036 *	0.017 *	−0.034 *	1.000							
8. Group aff.	0.006	0.022 *	0.028 *	0.008	0.015 *	0.008	0.103 *	1.000						
9. Big four	0.015 *	−0.007	0.040 *	−0.219 *	0.006	−0.219 *	0.036 *	0.097 *	1.000					
10. Cash hold.	0.016 *	0.055 *	0.063 *	−0.005	0.025 *	−0.006	−0.033 *	0.026 *	−0.057 *	1.000				
11. Firm age	0.069 *	0.018 *	0.053 *	−0.283 *	0.051 *	−0.282 *	0.039 *	0.047 *	0.083 *	−0.010	1.000			
12. Firm size	0.022 *	−0.157 *	−0.051 *	−0.115 *	0.051 *	−0.115 *	0.212 *	0.357 *	0.191 *	0.000	0.131 *	1.000		
13. Sales gr.	−0.037 *	−0.071 *	−0.062 *	−0.027 *	0.788 *	−0.028 *	0.004	0.002	0.005	0.029 *	0.040 *	0.020 *	1.000	
14. Inventories	0.402 *	0.396 *	0.752 *	−0.701 *	−0.022 *	−0.702 *	0.243 *	0.012	0.153 *	0.061 *	0.199 *	0.023 *	−0.009	1.000

This table presents the Pearson correlation coefficients for the dependent and independent variables for 26,731 firm-year observations from all 28 EU countries. All variables are defined in Appendix A. * indicates statistical significance at $p < 5\%$ using two-sided t-statistics.

4. Empirical Results

Table 5 presents the results of the analyses that test the interaction effect of TP and TR on firms' performance, as well as the interaction effects of firms' heterogeneity on the trade credit–performance relationship.

4.1. The Interaction Effect of TP and TR on Firm Performance

As shown in Model 1, the estimated coefficients for TP and TR are statistically significant and positive (TP, β = 0.181, t = 4.29; TR, β = 0.276, t = 6.28). Our findings are consistent with previous research (Afrifa et al., 2018; Hill et al., 2012), suggesting that the reliance on suppliers' credit and the granting of credit to customers improve firms' performance separately. The TP and TR interaction term (β = 1.226, t = 5.01) is positive and statistically significant at the 1% significance level. More critically, the magnitude of the regression coefficient relating to the TP and TR interaction is larger than the sum of the coefficients of TP and TR (i.e., 1.226 > 0.181 + 0.276 = 0.457), suggesting complementarity between trade credit extension and usage affecting firms' performance.

Precisely, the results show that, for firms without TR, a 10% increase in TP only increases Tobin's Q by 1.81%; however, for firms with average trade receivables (0.133) a 10% increase in trade payables increases Tobin's Q by 18.12% [1.81 + (12.26% × 1.33)].[2] On the other hand, for firms without trade payables, a 10% increase in trade receivables only increases Tobin's Q by 2.76%; however, for firms with average trade payables (0.103), a 10% increase in trade receivables increases Tobin's Q by 15.39% [2.76 + (12.26 × 1.03)].[3] Taken together, the interaction of TP and TR has a more positive effect on firms' performance than would be the case if their individual effects are considered in isolation, suggesting that the greatest effects are observed when both TP and TR are present. Accordingly, these findings support the notion that firms that obtain trade credit from their suppliers are more liquid and are therefore in a better position to offer their customers credit (Ferrando & Mulier, 2013; Molina & Preve, 2012), which, in turn, reduce customers' financial constraints. The credit offered allows customers to buy more, because they can pay at a later date (Atanasova, 2007), leading to increased sales and, hence, greater earnings.

The higher positive value of the TP–TR interaction term support the assertion that firms simultaneously manage their TP and TR as a strategic tool (Fabbri & Klapper, 2016) to enhance their financial performance. Consistent with this evidence, several studies demonstrate that firms that obtain credit from their suppliers are increasingly likely to give customers credit (Atanasova, 2007; Fabbri & Klapper, 2016), because these firms use the credit extended by their suppliers to finance their credit sales, compensating for the liquidity shortage or financing gap (Afrifa et al., 2018; Burkart & Ellingsen, 2004).

Table 5. Baseline regression results.

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
Lagged Tobin's Q	0.217 ***	0.213 ***	0.229 ***	0.212 ***
	(9.43)	(9.36)	(10.24)	(9.35)
Trade payables (TP)	0.181 ***	0.218 ***	0.405 ***	0.218 ***
	(4.29)	(5.28)	(10.10)	(5.28)
Trade receivables (TR)	0.276 ***	0.533 ***	0.307 ***	0.536 ***
	(6.28)	(12.83)	(6.61)	(12.93)
TP × TR	1.226 ***	0.613 ***	0.611 ***	0.605 ***
	(5.01)	(2.94)	(2.88)	(2.92)
Young		−0.019 **		
		(−2.05)		
TP × Young		−0.261 ***		
		(−4.09)		
TR × Young		−0.826 ***		
		(−9.08)		
TP × TR × Young		4.044 ***		
		(9.60)		
Pgrowth			0.034 ***	
			(9.01)	
TP × Pgrowth			−0.500 ***	
			(−13.59)	
TR × Pgrowth			−0.096 **	
			(−2.43)	
TP × TR × Pgrowth			1.667 ***	
			(9.19)	
Constraint				−0.020 **
				(−2.12)
TP × Constraint				−0.264 ***
				(−4.14)
TR × Constraint				−0.833 ***
				(−9.16)

4.2. Firm Age and the Interaction Effect of TP and TR on Firm Performance

Model 2 shows the results of estimating the influence of firms' age on the interaction effect of TP and TR on performance. The coefficient of Young is statistically significant and negative at the 5% level (β = −0.019, t = −2.05). This is consistent with prior research (Coad et al., 2013), demonstrating that new and/or young firms have lower performance than old and/or well-established firms. The interaction of TP × Young is negative and statistically significant (β = −0.261, t = 4.09). This shows that without trade credit extension to customers, the use of suppliers' credit is value-decreasing for younger firms. The interaction term TR × Young is statistically significant and negative at the 1% level (β = −0.826, t = −9.08), indicating that, in the absence of TP, granting credit to customers is less valuable for younger firms than for older ones. This is logical since, in granting credit to customers, young firms deprive themselves of cash due to their lack of access to other sources of funding.

More importantly, the estimated coefficient of the interaction term TP × TR × Young, which predicts the incremental effect of the interaction of TP and TR on Tobin's Q for young firms, is positive and statistically significant (β = 4.004, t = 9.60). This indicates that the interaction effect of TP and TR on Tobin's Q is higher for young firms than for older ones. Specifically, the result shows that a 10% increase in the interaction of TP and TR of young firms lead to a 40.44% greater increase in Tobin's Q than of older ones. This indicates that the interaction effect of TP and TR on Tobin's Q is higher for young firms than for older ones. Viewed through the lens of the product quality guarantee motive (Long et al., 1993), younger firms suffer from information asymmetry and lack an established market

reputation. Consequently, they must utilise TR as a critical signalling mechanism to assure buyers of their product quality. Our results reveal that younger firms cannot successfully deploy this essential quality-assurance strategy in isolation; they structurally require the backing of upstream supplier credit (TP) to mitigate the financial pressure resulting from extending these guarantees. Overall, these results indicate that extending trade credit to customers is necessary, but not sufficient for young firms to achieve higher performance, unless they are able to access suppliers' credit and thereby alleviate the financial constraints.

4.3. Sales Growth and the Interaction Effect of TP and TR on Firm Performance

The results shown in Model 3 reveals the influence of sales growth on the interaction term of TP and TR on firms' performance. The coefficient of the interaction term TP × TR × Pgrowth captures the incremental impact of the interaction of TP and TR on Tobin's Q for firms with positive sales growth. The results indicate that TP ($\beta = -0.500$, $t = -13.59$) and TR ($\beta = -0.096$, $t = -2.43$) with Pgrowth are all statistically significant and negative at the 1% and 5% level, respectively. These results indicate that the effect of TP or TR on firms' performance—individually—was negative for firms with positive sales growth; however, the coefficient of the interaction effect of TP and TR on firms' performance was positive and statistically significant at the 1% level ($\beta = 1.667$, $t = 9.19$). This supports H3 and indicates that the interaction effect of TP and TR on firms' performance is higher for firms with positive sales growth.

4.4. Financial Constraints and the Interaction Effect of TP and TR on Firm Performance

Model 4 shows the effect of constraint on the interaction effect of TP and TR on firms' performance. The coefficient of constraint ($\beta = -0.020$, $t = -2.12$) is statistically significant and negative at the 5% level, suggesting that financial constraints have a negative impact on firms' performance. The result is comparable with previous research (Fowowe, 2017; Kuntchev et al., 2012). Interestingly, the coefficient of the interaction term TP × constraint is negative and statistically significant ($\beta = 0.264$, $t = 4.14$), and the coefficient of the interaction term TR × constraint is negatively significant ($\beta = -0.833$, $t = -9.16$). Taken together, the results indicate that, without suppliers' credit, financially constrained firms that decide to grant credit to their customers are likely to have lower levels of financial performance than their less financially constrained counterparts. This explains why firms that are constrained in their access to external financing reduce credit to customers when they do not have access to suppliers' credit (Molina & Preve, 2009). This confirms the importance of supplier credit as a source of external financing for financially constrained firms (Abdulla et al., 2017).

The estimated coefficient for the interaction term TP × TR × constraint, which captures the incremental effect of the interaction of TP and TR on Tobin's Q for financially constrained firms, is statistically significant and positive at the 1% level ($\beta = 4.099$, $t = 9.71$). This result supports H4 and shows that the interaction effect of TP and TR on performance is higher for firms that are more constrained in their access to external financing. Specifically, for financially constrained firms, a 10% increase in the TP–TR interaction term led to a 40.99% higher increase in Tobin's Q than for less financially constrained firms. This finding makes intuitive economic sense, because financially constrained firms have limited access to external financing (Baños-Caballero et al., 2014), and obtaining credit from suppliers helps these firms to extend more credit to their customers, thus maximising their sales and earnings.

Finally, control variables such as group affiliation, big four, firms' age, and firms' size have the right sign and statistical significance. In particular, firms' performance decreases

with group affiliation (Ma et al., 2006) and big four auditing firms, but increases with firms' age (Afrifa et al., 2018), and firms' size (Hill et al., 2012).

5. Additional Analyses

We perform four different additional tests. Firstly, we consider how the financial sector development of a country affects the interaction effect of TP and TR on firm performance. Secondly, we evaluate whether the interaction effect differs between SMEs and large firms. Finally, we examine the impact of the recent financial crisis on the interaction effect of TP and TR on firm performance.

5.1. Size Effect on the Interaction of TP and TR on Firm Performance

Prior research (e.g., Penrose & Penrose, 2009) suggests that SME businesses and large businesses are different species. In terms of their trade credit policy, larger firms are less financially constrained (Asselbergh, 2002) and, therefore, tend to depend less on suppliers' credit (Afrifa & Gyapong, 2017), but offer customers more credit (Petersen & Rajan, 1997). By contrast, SMEs tend to rely more on suppliers' credit as a major source of finance than larger firms do (Asselbergh, 2002; Burkart & Ellingsen, 2004; Petersen & Rajan, 1997). Given the financial constraints of SMEs, we therefore expect the effect of the interaction of TP and TR on firms' performance to be positive, and higher for SMEs than for large firms.

In order to examine the effect of firm size on the TP and TR interaction–performance relationship, we construct a dummy variable (SME), which takes the value of one if the firm is classified as an SME according to the ORBIS database, and zero otherwise. The results are reported in Table 6 (columns 1 to 2). We run separate regressions for large firms (column 1) and SMEs (column 2). The results in columns 1 and 2 show that the interaction of TP and TR is much lower for large firms ($\beta = 1.059$, $t = 3.32$) than for SMEs ($\beta = 1.256$, $t = 3.88$). This confirms the value of trade credit to firms, especially for SMEs that are considered to be more financially constrained.

5.2. Crisis Effect on the Interaction of TP, TR, and Firm Performance

Prior research (Kestens et al., 2012; Paul & Boden, 2008) suggests that the trade credit–firms' performance relationship is affected during periods of financial crisis. More precisely, the past financial crisis (2007–2009) caused a reduction in credit supply (Preve et al., 2005), liquidity shocks, payment delays (Paul & Boden, 2008), and an increased cost of financing (Garcia-Appendini & Montoriol-Garriga, 2013). Thus, given the scarcity of both institutional credit and suppliers' credit during the financial crisis period, firms that are able to access suppliers' credit may be able to enhance their performance by granting credit to customers in an attempt to increase sales. We therefore expect the effect of the interaction of TP and TR on firms' performance to be positive, and higher for the financial crisis period than the non-crisis period.

In order to examine the effect of the crisis period on the TP and TR interaction–performance relationship, we construct a dummy variable (crisis), which takes the value of one for the years 2008 and 2009,[4] and zero otherwise. The results are reported in Table 6 (columns 3 to 4). We separate the sample into non-crisis period (column 3) and crisis period (column 4). The results in columns 3 and 4 show that the interaction of TP and TR is much lower for the non-crisis period ($\beta = 1.183$, $t = 4.77$) than for the crisis period ($\beta = 1.762$, $t = 5.00$). This confirms the value of trade credit to firms, especially during periods of financial hardship. An important caveat must be noted, though, regarding potential survival bias and underlying insolvency risk: while this strategic matching of TP and TR yields premium performance benefits for surviving firms in our sample, deploying

such a strategy aggressively without tight internal governance can expose financially vulnerable firms to a dangerous liquidity trap during economic downturns.

Table 6. Firm size and crisis period effects.

Variables	(1) Large Firms	(2) SMEs	(3) Non-Crisis	(4) Crisis
Lagged Tobin's Q	0.193 ***	0.223 ***	0.191 ***	0.136 **
	(4.81)	(8.48)	(7.20)	(2.14)
Trade payables (TP)	0.377 ***	0.060	0.188 ***	0.161 ***
	(6.93)	(1.03)	(4.34)	(2.67)
Trade receivables (TR)	0.306 ***	0.285 ***	0.301 ***	0.119
	(4.91)	(5.12)	(6.73)	(1.59)
TP × TR	1.059 ***	1.256 ***	1.183 ***	1.762 ***
	(3.32)	(3.88)	(4.77)	(5.00)
Constant	−0.304	−1.128 **	1.111 ***	1.159 ***
	(−0.30)	(−2.39)	(31.70)	(14.15)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	–
AR(2) *p*-value	0.137	0.209	–	–
Hansen *p*-value	0.710	0.798	0.628	0.651
Sample size	7629	19,102	20,917	5814

This table presents the results of the interaction effect of trade payables and trade receivables on Tobin's Q based on firm size (columns 1–2) and the financial crisis (columns 3–4) for 26,731 firm-year observations from all 28 EU countries. All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

5.3. Country Level Characteristics and Their Effects on the Interaction of TP, TR, and Firm Performance

We also run several additional analyses to control for cross-country differences in European subregions, legal origins, financial sector development and financial structure.

5.3.1. Classification of EU Countries According to the United Nations Geoscheme for Europe

To test whether the interaction effect of TP and TR on firms' performance varies across various European subregions, we split our sample into four sub-samples according to the United Nations geoscheme for Europe, which is created by the United Nations Statistics Division (UNSD).[5] The scheme subdivides the continent into eastern Europe (Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovakia), northern Europe (Denmark, Estonia, Finland, Ireland, Latvia, Lithuania, Sweden, and the United Kingdom), southern Europe (Cyprus, Croatia, Greece, Italy, Malta, Portugal, Slovenia, and Spain), and western Europe (Austria, Belgium, France, Germany, Luxembourg, and Netherlands). The empirical results of this estimation are reported in Table 7. We find that the interaction of TP and TR is much higher from countries in western and eastern Europe than their counterparts in northern and southern European countries.

5.3.2. Classification of EU Countries According to Their Legal Origins

Our study also controls for cross-country differences in terms of their legal origins on the effect of the TP and TR interaction–performance relationship by dividing EU countries into English (Cyprus, Ireland and the United Kingdom), French (Belgium, France, Greece, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Romania, and Spain), German (Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Latvia, Poland, and

Slovakia), and Scandinavian (Denmark, Finland, and Sweden). Results, as reported in Table 8, show that the interaction of TP and TR is much higher for firms in countries with French and German legal origins. This appears to provide considerable support for the above results in that Western and Eastern European countries tend to have French and German legal tradition.

Table 7. The interaction effect of TP and TR on firm performance across European subregions.

Variables	(1) Eastern Europe	(2) Northern Europe	(3) Southern Europe	(4) Western Europe
Lagged Tobin's Q	0.110 *	0.185 ***	0.337 ***	0.211 ***
	(1.92)	(4.78)	(6.34)	(5.21)
Trade payables (TP)	0.332 ***	0.232 ***	0.180 **	0.039
	(4.50)	(3.18)	(2.30)	(0.58)
Trade receivables (TR)	0.319 ***	0.315 ***	0.331 ***	0.134 *
	(3.66)	(4.19)	(4.47)	(1.73)
TP × TR	1.150 ***	0.774 *	0.928 **	2.133 ***
	(2.89)	(1.81)	(2.31)	(5.92)
Constant	−1.475	−3.503 ***	1.710	0.425
	(−0.84)	(−4.98)	(1.52)	(0.64)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.289	0.030	0.756	0.049
Hansen *p*-value	0.994	0.420	0.001	0.091
Sample size	3724	9882	4592	8519

This table presents the interaction effect of trade payables and trade receivables on firm performance across European subregions. All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

5.3.3. Classification of EU Countries According to Their Financial Sector Development

We also investigate how a country's financial sector development affects the interaction effect of TP and TR on firms' performance. The previous literature suggest that financial sector development reduces liquidity constraints (Alessandrini et al., 2009), facilitates the use of institutional debt (La Rocca et al., 2010), and hence affects the provision and use of trade credit (Di Patti & Gobbi, 2001; Petersen & Rajan, 1995). According to Deloof and La Rocca (2015), trade credit plays a crucial role in countries with weak financial sector development. Fisman and Love (2003) found that trade credit dependence leads to higher growth for a firm operating in a country with a weak financial sector. It is also suggested that the provision of trade credit complements the financial sector development of a country (Demirgüç-Kunt & Maksimovic, 1999). These arguments indicate that firms operating in countries with well-developed financial sectors depend less on trade credit because of the availability of cheaper sources of finance (Deloof & La Rocca, 2015). Thus, with a well-developed financial sector, suppliers and customers alike are increasingly likely to rely on institutional credit because of the inherently expensive nature of trade credit, and reliance on trade credit is likely to be value-decreasing. We therefore expect the interaction effect of TP and TR to be less for firms operating in countries with well-developed financial sectors. Following previous studies (Abubeker et al., 2020), we define financial sector development as the percentage of domestic credit given to the private sector by banks to GDP.

After separating our firms into two subgroups, firms operating in countries with financial sector development below (underdeveloped) and above (developed) the sample mean financial sector development, the results in Table 9 columns (1) and (2) show that the interaction of TP and TR is much higher for firms operating in countries with under-

developed financial sectors (β = 1.595, t = 6.76) than for firms operating in countries with well-developed financial sectors (β = 0.697, t = 1.99). This confirms the importance of trade credit in determining firms' performance, especially for firms operating in countries with weak financial sectors.

Table 8. The interaction effect of TP and TR on firm performance across countries with different legal origins.

Variables	(1) English	(2) French	(3) German	(4) Scandinavian
Lagged Tobin's Q	0.168 ***	0.277 ***	0.166 ***	0.217 ***
	(3.07)	(7.04)	(4.02)	(3.98)
Trade payables (TP)	0.257 ***	0.173 ***	0.076	0.256 **
	(3.17)	(2.98)	(1.15)	(2.57)
Trade receivables (TR)	0.341 ***	0.277 ***	0.200 ***	0.267 **
	(4.29)	(4.37)	(2.74)	(2.49)
TP × TR	0.710 **	1.405 ***	1.908 ***	0.687
	(2.14)	(4.92)	(5.27)	(1.12)
Constant	−3.174 ***	0.447	−0.586	−4.250 ***
	(−3.32)	(0.60)	(−0.68)	(−3.96)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.129	0.182	0.689	0.155
Hansen *p*-value	0.350	0.027	0.261	0.824
Sample size	5877	9125	7249	4043

This table presents the interaction effect of trade payables and trade receivables on firm performance across countries with different legal origins. All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

5.3.4. Classification of EU Countries According to Their Financial Structure

Prior research suggests that cross-country differences in institutional characteristics shape firms' behaviour, including their ability to access external finance (Alsabah & Alshehabi, 2026b; Fiechter & Novotny-Farkas, 2017). In bank-based economies, banks are the dominant source of finance to firms, whereas banks and market are the dominant providers of finance to firms in market-based economies (Aldousari & Alsabah, 2025; Bats & Houben, 2020; Crouzet, 2018).

As such, firms operating in market-based countries will have access to varied sources of finance than those operating in bank-based countries (Becker & Ivashina, 2014). Recent evidence from Afrifa et al. (2023) also suggests that the relative reliance on trade credit versus bank credit varies systematically with firm type and the institutional environment in which firms operate. This suggests that the value relevance of the interaction of TP and TR is expected to be less for firms operating in market-based economies, given the expensive nature of TP and the likelihood of customers to seek cheaper alternative source of credit other than TR. The results are reported in Table 10 columns (3) and (4) and show that the interaction of TP and TR is much higher for firms operating in bank-based economies (column 3) (β = 1.502, t = 4.59) than for firms operating in market-based economies (column 4) (β = 1.105, t = 3.26). This suggests that firms operating in bank-based economies are more likely to benefit from the use of both credits. Overall, our results confirm the importance of trade credit in determining firm performance, especially for firms operating in bank-based economies.

Table 9. The interaction effect of TP and TR on firm performance across financial sector development and financial structures.

Variables	(1) Underdeveloped	(2) Developed	(3) Bank-Based	(4) Market-Based
Lagged Tobin's Q	0.206 ***	0.227 ***	0.159 ***	0.255 ***
	(6.86)	(6.11)	(4.20)	(8.52)
Trade payables (TP)	0.141 ***	0.258 ***	0.097	0.222 ***
	(3.10)	(4.17)	(1.57)	(3.94)
Trade receivables (TR)	0.245 ***	0.310 ***	0.278 ***	0.275 ***
	(5.01)	(4.79)	(4.37)	(4.53)
TP × TR	1.595 ***	0.697 **	1.502 ***	1.105 ***
	(6.76)	(1.99)	(4.59)	(3.26)
Constant	0.017	−4.480 ***	−1.004	−1.775 ***
	(0.03)	(−6.52)	(−1.33)	(−3.12)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.576	0.156	0.721	0.625
Hansen *p*-value	0.772	0.035	0.673	0.133
Sample size	15,406	11,325	9520	15,878

This table presents the interaction effect of trade payables and trade receivables on firm performance across countries with different financial sector development levels (columns 1–2) and financial structures (columns 3–4). All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 10. Alternative measure of dependent variable: ROA.

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
Lagged ROA	0.212 ***	0.214 ***	0.217 ***	0.213 ***
	(9.95)	(10.09)	(10.47)	(10.07)
Trade payables (TP)	0.151 ***	0.194 ***	0.362 ***	0.194 ***
	(3.81)	(5.00)	(9.56)	(5.00)
Trade receivables (TR)	0.255 ***	0.490 ***	0.293 ***	0.492 ***
	(6.00)	(12.06)	(6.53)	(12.13)
TP × TR	1.196 ***	0.611 ***	0.610 ***	0.604 ***
	(5.21)	(3.12)	(3.06)	(3.10)
Young		−0.023 **		
		(−2.50)		
TP × Young		−0.260 ***		
		(−4.42)		
TR × Young		−0.733 ***		
		(−8.37)		
TP × TR × Young		3.710 ***		
		(9.55)		
Pgrowth			0.034 ***	
			(9.13)	
TP × Pgrowth			−0.470 ***	
			(−13.44)	
TR × Pgrowth			−0.103 ***	
			(−2.64)	
TP × TR × Pgrowth			1.576 ***	
			(9.16)	
Constraint				−0.023 **
				(−2.57)

Table 10. *Cont.*

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
TP × Constraint				−0.263 ***
				(−4.47)
TR × Constraint				−0.740 ***
				(−8.46)

This table presents the results of the interaction effects of trade payables and trade receivables on firm performance (ROA), and the moderating effects of firm characteristics on this relationship. All variables are defined in Appendix A. Coefficients are reported with heteroscedasticity-robust t-statistics in parentheses, clustered by country and year. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

6. Robustness Checks

6.1. ROA: An Alternative Measure of Firms' Performance

Similar to prior research (Afrifa et al., 2018; Aktas et al., 2015), we re-estimate the same models in Table 5 (each model includes the same variables) by utilising an alternative measure of firms' performance. In particular, Tobin's Q is replaced with an operating performance measure, ROA, which is calculated as the profit for the period divided by total assets. The results reported in Table 10 are quite similar to those reported in Table 5, indicating that our results in Table 5 remain robust with an alternative measure of firms' performance.

6.2. Alternative Scaling of TP and TR

In order to mitigate any scale effects and following the previous literature (Aktas et al., 2015; Mateut et al., 2015), the models in Table 5 (each model includes the same variables) are re-estimated using a different scaling of variables. Specifically, TP and TR are deflated by sales revenue instead of total assets. The results reported in Table 11 resemble those reported earlier in Table 5. Once again, the results (column 1) show that the interaction effect of TP and TR on firms' performance is greater than the sum of the individual effects. These results show that our main findings, illustrated in Table 5, are not sensitive to an alternative measure of TP and TR.

Table 11. Alternative measure of trade credit (scaled by sales).

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
Lagged Tobin's Q	0.200 ***	0.193 ***	0.208 ***	0.193 ***
	(9.12)	(8.96)	(9.78)	(8.96)
Trade payables (TP)	0.511 ***	0.677 ***	0.561 ***	0.680 ***
	(14.36)	(20.60)	(15.43)	(20.80)
Trade receivables (TR)	0.001	0.026	0.206 ***	0.025
	(0.02)	(0.61)	(4.86)	(0.58)
TP × TR	1.244 ***	0.975 ***	0.652 ***	0.972 ***
	(7.30)	(5.75)	(4.33)	(5.75)
Young		−0.049 ***		
		(−6.24)		
TP × Young		−0.509 ***		
		(−11.30)		
TR × Young		−0.051		
		(−0.81)		
TP × TR × Young		1.558 ***		
		(7.33)		
Pgrowth			0.039 ***	
			(12.65)	
TP × Pgrowth			−0.134 ***	
			(−5.72)	

Table 11. *Cont.*

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
TR × Pgrowth			−0.452 ***	
			(−11.17)	
TP × TR × Pgrowth			1.304 ***	
			(12.04)	
Constraint				−0.050 ***
				(−6.41)
TP × Constraint				−0.515 ***
				(−11.37)
TR × Constraint				−0.048
				(−0.77)
TP × TR × Constraint				1.582 ***
				(7.39)
Constant	−0.011	−0.396	0.244	−0.379
	(−0.03)	(−1.03)	(0.61)	(−0.98)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.983	0.963	0.998	0.963
Hansen *p*-value	0.484	0.616	0.012	0.631
Sample size	26,731	26,731	26,731	26,731

This table presents the results of the interaction effect of trade payables and trade receivables (scaled by sales) on Tobin's Q, and the firm heterogeneity effect on this relationship. All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

6.3. Country-Adjusted Regression

Countries differ in terms of access to credit, some countries in Europe are market-dominant (Martínez-Sola et al., 2013), whereas others are bank-dominant (Martínez-Sola et al., 2014). Specifically, there are country-specific factors such as financial sector development (Kearney, 2012; Faccio & Xu, 2016) that can have a notable effect on our dependent variable, causing important differences between countries. As per a robustness test, we therefore follow similar cross-country studies (Croci & Del Giudice, 2014; Guo & Ma, 2011) and estimate the country-adjusted Tobin's Q as the dependent variable in regression models (1) and (2) with the same independent and control variables as in Table 5. This is achieved by first computing the average Tobin's Q per country. Second, we subtract the average Tobin's Q from each individual firm year's Tobin's Q.

The results (shown in Table 12) are qualitatively similar to those reported in Table 5. Specifically, the results in column 1 show that the interaction effect of TP and TR is higher than the sum of their individual effects. The results also show that the effect of the interaction of TP and TR is higher for younger firms (column 2), growing firms (column 3) and financially constrained firms (column 4). Overall, these results further corroborate our main results in Table 5, demonstrating that cross-country differences do not change the tenor of the results.

6.4. Industry-Adjusted Regression

It is suggested that industry belonging can have a notable impact on corporate behaviour and performance (Caloghirou et al., 2004; Chang & Singh, 2000; Fernández et al., 2019). In order to take into account any possible industry differences, we follow prior studies (e.g., Croci & Del Giudice, 2014) and use the industry-adjusted Tobin's Q as the dependent variable in regression models (1) and (2) with the same independent and control variables as in Table 5. This is used as a robustness test to examine whether the interaction

effect of TP and TR reported in Table 13 is sensitive to cross-industry differences. Conceptually, this complementary effect is highly potent in sectors like Fast-Moving Consumer Goods (FMCG) and Retail, where inventory turnover is rapid and asset liquidity is high, whereas it faces natural boundaries in capital-intensive heavy infrastructure sectors where supplier power is highly concentrated. The industry-adjusted Tobin's Q is calculated by first estimating the average Tobin's Q per industry, using the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2). Second, the average Tobin's Q of each industry is subtracted from each firm year's Tobin's Q.

Table 12. Country-adjusted dependent variable.

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
Lagged Tobin's Q	0.213 ***	0.214 ***	0.216 ***	0.214 ***
	(10.09)	(10.26)	(10.59)	(10.25)
Trade payables (TP)	0.174 ***	0.208 ***	0.397 ***	0.207 ***
	(4.22)	(5.12)	(10.18)	(5.13)
Trade receivables (TR)	0.264 ***	0.525 ***	0.296 ***	0.527 ***
	(6.05)	(12.64)	(6.43)	(12.75)
TP × TR	1.251 ***	0.636 ***	0.651 ***	0.628 ***
	(5.22)	(3.12)	(3.18)	(3.10)
Young		−0.022 **		
		(−2.36)		
TP × Young		−0.244 ***		
		(−3.87)		
TR × Young		−0.827 ***		
		(−9.15)		
TP × TR × Young		4.004 ***		
		(9.58)		
Pgrowth			0.035 ***	
			(9.34)	
TP × Pgrowth			−0.503 ***	
			(−13.93)	
TR × Pgrowth			−0.101 ***	
			(−2.58)	
TP × TR × Pgrowth			1.683 ***	
			(9.44)	
Constraint				−0.023 **
				(−2.48)
TP × Constraint				−0.247 ***
				(−3.91)
TR × Constraint				−0.834 ***
				(−9.24)
TP × TR × Constraint				4.058 ***
				(9.70)
Constant	−2.511 ***	−2.947 ***	−2.161 ***	−2.933 ***
	(−5.71)	(−6.82)	(−4.94)	(−6.78)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.674	0.571	0.723	0.568
Hansen *p*-value	0.394	0.153	0.044	0.157
Sample size	26,731	26,731	26,731	26,731

This table presents the country-adjusted Tobin's Q results. All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 13. Industry-adjusted dependent variable.

Variables	(1) Baseline	(2) Firm Age	(3) Firm Growth	(4) Fin. Constraints
Lagged Tobin's Q	0.215 ***	0.214 ***	0.218 ***	0.214 ***
	(10.20)	(10.22)	(10.68)	(10.21)
Trade payables (TP)	0.148 ***	0.205 ***	0.373 ***	0.205 ***
	(3.51)	(4.95)	(9.36)	(4.95)
Trade receivables (TR)	0.251 ***	0.485 ***	0.286 ***	0.487 ***
	(5.68)	(11.47)	(6.15)	(11.52)
TP × TR	1.413 ***	0.774 ***	0.791 ***	0.766 ***
	(5.69)	(3.66)	(3.71)	(3.65)
Young		0.005		
		(0.51)		
TP × Young		−0.325 ***		
		(−5.06)		
TR × Young		−0.822 ***		
		(−9.00)		
TP × TR × Young		4.137 ***		
		(9.74)		
Pgrowth			0.035 ***	
			(9.29)	
TP × Pgrowth			−0.509 ***	
			(−13.79)	
TR × Pgrowth			−0.107 ***	
			(−2.72)	
TP × TR × Pgrowth			1.739 ***	
			(9.53)	
Constraint				0.005
				(0.51)
TP × Constraint				−0.329 ***
				(−5.12)
TR × Constraint				−0.830 ***
				(−9.08)
TP × TR × Constraint				4.193 ***
				(9.85)
Constant	−2.578 ***	−2.943 ***	−2.218 ***	−2.927 ***
	(−5.83)	(−6.74)	(−5.04)	(−6.70)
Firm-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
F-statistic *p*-value	0.000	0.000	0.000	0.000
AR(1) *p*-value	0.000	0.000	0.000	0.000
AR(2) *p*-value	0.670	0.602	0.707	0.600
Hansen *p*-value	0.374	0.164	0.071	0.173
Sample size	26,731	26,731	26,731	26,731

This table presents the industry-adjusted Tobin's Q results. All variables are defined in Appendix A. Coefficients are reported with heteroscedastic-robust *t*-statistics in parentheses (clustered by country and year). *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Our results in Table 13 show close resemblance to those reported in Table 5. In particular, the results in column 1 show that the interaction effect of TP and TR is higher than the sum of their individual effects. The results also show that the effect of the interaction of TP and TR is higher for younger firms (column 2), growing firms (column 3) and financially constrained firms (column 4). Overall, the results confirm the main results in Table 5 and indicate that industry effects do not change the tenor of our main results in Table 5.

7. Conclusions

This research empirically examines the interaction effect of TP and TR on firms' performance. Using a sample of 26,731 firm/year observations from 28 European countries

during the period of 2008–2017, we find that the interaction of TP and TR affects firms' performance differently compared to either TP or TR alone. Precisely, the coefficient of the TP–TR interaction term is larger than the sum of the coefficients of TP and TR. In particular, our results show that TP and TR interactively have a more positive effect on firms' performance than would be the case if their individual effects are considered in isolation; thus, the two types of trade credit are complementary strategies (i.e., not substitutive).

We also find that the interaction effect of TP and TR is stronger for young firms, firms with positive annual growth, and financially constrained firms. We further find that the interaction effect of TP and TR is stronger for firms domiciled in countries with relatively underdeveloped financial sectors, SMEs, and during the financial crisis. These relationships suggest that the two types of trade credit should be taken into consideration simultaneously, since they affect each other in determining firms' performance. Finally, our results remain robust under alternative definitions, scaling of variables, model specifications, and after controlling for endogeneity.

The findings of this study have important theoretical implications for examining the interaction between TP and TR. The existing literature has examined these two variables widely, but in isolation (e.g., Afrifa & Gyapong, 2017; Goto et al., 2015; Guariglia & Mateut, 2016; Hill et al., 2012; Martínez-Sola et al., 2014). Our findings show that the two types of trade credit interact with each other, and the interaction determines firms' performance. More importantly, our study integrates three theoretical perspectives (financing theory, liquidity theory, and transaction cost theory) to investigate the interaction, and the paper thus provides a clearer picture of how reliance on both credit from suppliers and credit to customers synergistically interact with each other to improve firms' performance.

This study also has important managerial implications. It sheds light on the fact that managers should adopt a trade credit policy that considers these two types of credit simultaneously, since they mutually affect each other in determining firms' performance. It also helps firms to design an affordable strategy for financing a liquidity shortage, which leads to significant performance differentials. In order to maximise their firms' performance, business managers should consider the interaction of TP and TR in establishing their strategy—an important issue in general management. If the two types of trade credit are used to determine a firm's performance, the optimal level of trade credit will lie somewhere along a continuum determined by the interaction of the two variables. Firms may not achieve the optimal level of trade credit, but they may approach it along the continuum; thus, further research in this area is still needed to shed light on the threshold of trade credit at which a firm's performance begins to decline as a result of the interaction between the two variables.

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Appendix A. Variable Definitions

Variable	Definition
Dependent variable	
Tobin's Q	Total assets − book value of equity + market value of equity, scaled by total assets.
Main variables	
Trade payables (TP)	Trade payables scaled by total assets.
Trade receivables (TR)	Trade receivables scaled by total assets.
Firm-level controls	
Firm age	Number of years between incorporation and the calendar year end of each firm.
Annual sales growth	One-year growth rate of sales at time t − 1: (SALEt – SALEt − 1)/SALEt − 1.
Firm size	Natural log of total assets of firms.
Leverage	Long-term debt scaled by total assets.
Group affiliation	Dummy equal to one if the firm is a business group member, and zero otherwise.
Big four	Dummy equal to one if a firm is audited by a big four audit firm, and zero otherwise.
Cash holding	Cash and cash equivalent scaled by total assets.
Young	Dummy equal to one if the firm is 10 years or younger, and zero otherwise.
Pgrowth	Dummy equal to one for firms with positive sales growth, and zero otherwise.
Financial constraint	Whited–Wu (WW) index: −0.091 CF − 0.062 DIVPOS + 0.021 TLTD − 0.044 LNTA + 0.102 ISG − 0.035 SG, where CF is cash holdings/total assets; DIVPOS = 1 if the firm pays dividends and 0 otherwise; TLTD is long-term debt/total assets; LNTA is the natural log of total assets; ISG is industry sales growth; SG is firm sales growth. A higher WW index indicates higher financial constraint.
Bank credit	Ratio of short-term debt to total assets.

Notes

1 We also divided our sample in two subgroups using different age categories and found qualitatively the same results as those tabulated.
2 The descriptive statistics are presented in Table 2.
3 See note 2 above.
4 Although the past financial crisis period was from 2007 to 2009, our sample period starts from 2008.
5 The UNSD notes that "the assignment of countries or areas to specific groupings is for statistical convenience and does not imply any assumption regarding political or other affiliation of countries or territories."

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