

Empirical Paper

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Trade credit policies in the construction industry: A comparative study of Central-Eastern and Western EU countries

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Abstract:

This article aims to investigate the trade credit policies in construction firms across Central-Eastern Europe (CEE) and Western Europe (WE). Utilizing financial data from construction companies in 12 European Union (EU) countries (2000–2020), sourced from the BACH-ESD database, panel data models are applied separately to each region. The analysis compares trade credit granted and obtained, as well as the impact of determinants in WE and CEE countries. The results show limited cross-regional diversity in trade credit policies and determinants, suggesting alignment with common trends and industry standards. This indicates adaptation by construction companies to minimize the impact of regional economic disparities. The study addresses a gap in the corporate short-term finance literature by offering a comprehensive comparative analysis of trade credit practices among construction firms across CEE and WE countries, revealing regional variations that have not been comprehensively explored in previous analyses.

Keywords: CEE vs. WE countries, construction industry, panel data models, trade credit

JEL Classification: L74, G32, C23

1 Introduction

Construction plays a fundamental role in the economy, as it meets the basic needs of housing and infrastructure, which are indispensable in all areas of socio-economic life. There are close links among the construction sector and other areas of the economy. Economic development depends on investment activity, which results in the demand for new buildings. Construction therefore creates a physical environment and conditions for production and service activities and satisfies the housing needs of households. By activating many different sectors of the economy, the construction sector generates impulses leading to economic growth. Construction also exerts a strong impact on the labor market. During economic growth, it creates a significant number of workplaces, including those for the low-skilled. On the contrary, during an economic slowdown, this sector contributes to an increase in unemployment. However, the construction industry is strongly dependent on other branches of the economy and business cycle fluctuations, and is characterized by a number of distinctive features that affect, among others, the financial decisions of construction firms.

Due to the capital intensity of the construction and the high-risk nature of this sector, these firms are financially constrained because their investments are limited by their inability to obtain sufficient external funding [Bukalska and Maziarczyk, 2023]. One of the basic instruments of external financing of all

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enterprises is a bank loan. However, the limited availability of this source of capital necessitates searching for other sources of financing, especially in the operational area. In the construction industry, a widely used form of financing is trade credit, considered as a substitute for bank credit [Cole, 2010]. As already mentioned, construction is characterized by specific features that distinguish it from other sectors and influence decisions of these entities in all areas of activity. The significance of these differences makes it purposeful to analyze the sector individually [Pinto et al., 2023].

The aim of this study is twofold: (1) to compare trade credit policies of construction companies among Central-Eastern Europe (CEE) and Western Europe (WE) countries and (2) to evaluate how certain factors influence these policies in the two macro-regions. To achieve the research objective, two main hypotheses require validation. According to hypothesis 1 (H1), trade credit policies of construction firms differ significantly between CEE and WE countries, whereas hypothesis 2 (H2) posits that the impact of trade credit determinants also varies between the compared macro-regions.

This study advances existing literature by analyzing trade credit policies within the construction industry across CEE and WE countries, revealing how firms adapt their financial strategies to regional economic conditions and regulatory frameworks, thus filling a significant gap in understanding sector-specific finance.

2 Specificity of construction industry in the context of trade credit

The financing structure of construction enterprises and firms from other sectors of the economy differs, as shown in Figure 1. The share of external funds in the financing structure of construction enterprises is

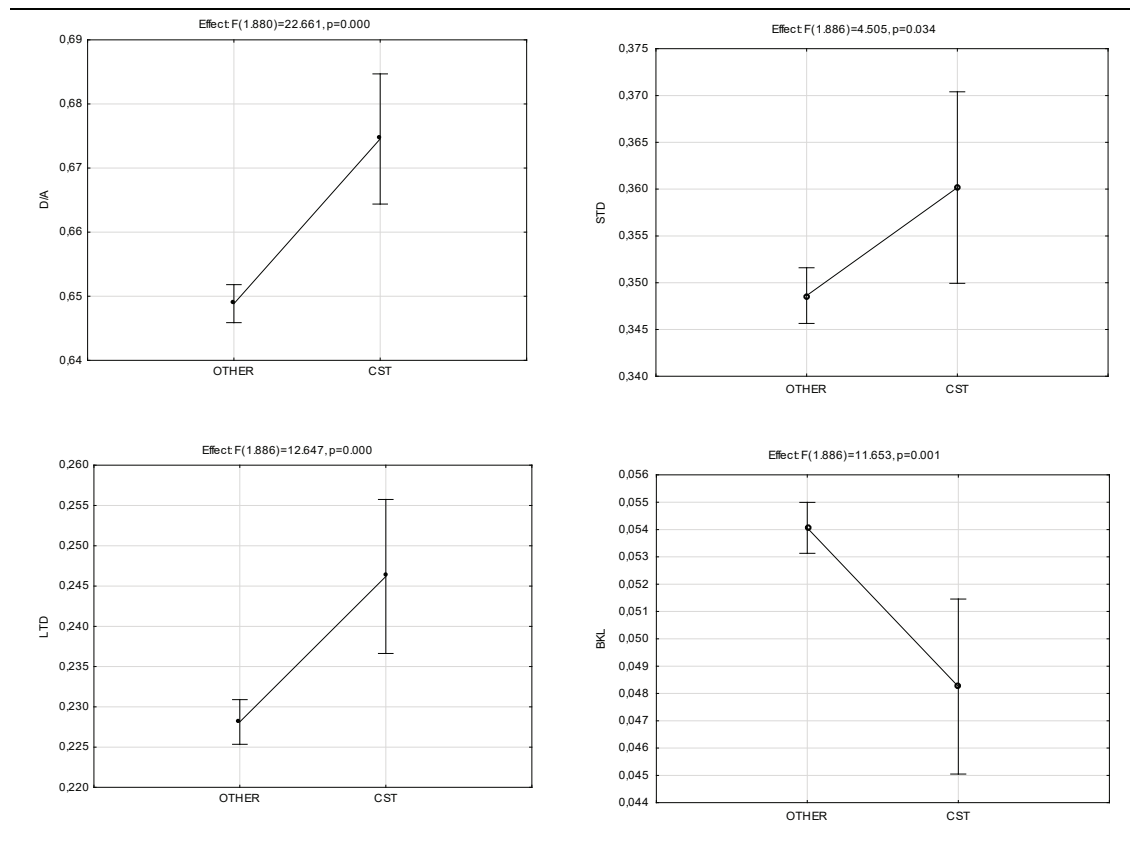


Figure 1. Expected mean values of selected financial ratios for construction industry compared with other industries.

Note: BKL, short-term bank loan to assets ratio; D/A, total debt to assets ratio; LTD, long-term debt to assets ratio; STD, short term debt to assets ratio. Vertical bars represent 0.95 confidence intervals.

Source: Authors' calculations based on [BACH, 2023].

higher than in entities from other sectors. The reasons for these differences are to be found in the specificity of construction, which affects the financial decisions of firms operating in this sector. These features are capital intensity, sensitivity to economic and seasonal fluctuations, long production cycle, unique nature of the construction product, relatively low barriers of entry, and conservative approach to construction production technology.

Capital intensity is a fundamental feature of construction [Edwards et al., 2004], which is reflected in the high share of debt in the financing structure. The high costs of construction investments make it necessary to obtain adequate financial resources by both the investor and other participants of the investment process. In practice, it often happens that despite appropriate technical, human, and organizational preparation, a construction firm is not able to compete with other entities due to a weak financial situation. Winning tenders or winning orders on the free market is also associated with the possibility of having adequate financial security in the form of, for example, bank or insurance guarantees. Regrettably, financial institutions treat construction as a high-risk sector [Badu et al., 2012]. This makes it difficult, and often even impossible, for construction companies to obtain a guarantee or loan to finance the investment. As a result, companies with weaker financial condition can only act as subcontractors of large enterprises or carry out small orders for individual investors. For these reasons, short-term liabilities, including trade credit, are of key importance for construction companies with limited access to financial markets and low creditworthiness, as they are a substitute for bank loans. This situation is illustrated in Figure 1, which shows a higher share of short-term liabilities in the financing structure of construction firms than in other sectors, and at the same time a lower share of short-term bank loans.

The construction industry is characterized by a long production cycle. It lasts, not counting minor renovation and construction works, from a few months to several or even a dozen or so years in the case of multistage infrastructure investments. Therefore, a building object becomes a finished product only after technical acceptance and commissioning. This is associated with an increased demand for current assets, for example, inventories of building materials, which is reflected in a high share of inventories in total assets [Elliehausen and Wolken, 1993]. As a consequence, this leads to the freezing of high-value capital for a long period of time and forces the need to obtain funds for current operations from various sources, primarily in the form of trade credit. It is worth noting that this form of financing is particularly important for capital-intensive infrastructure investments [Picha et al., 2016].

A construction product (object) has an individual character. A significant part of all buildings is constructed according to the typical designs. However, even in this case, they must be adapted to local conditions related, for example, to geological characteristics or material supply possibilities. Therefore, the implementation of even analogous projects may require the use of different technological or organizational solutions. Therefore construction requires the use of individual solutions, which leads to an increase in costs. A viable solution to this problem is the use of prefabricated elements. However, the transport of such large-size elements requires the use of appropriate means of transport, which generates significant costs, especially over long distances [Rytel, 2009]. Thus, in both cases, there is a need to obtain additional financial resources, which are usually provided by short-term liabilities, including trade credit.

In the construction industry, a conservative approach to technologies is often encountered. This feature is related to the long life cycle of buildings. In many cases, the renovation of old buildings and other construction objects requires a return to technologies that are not commonly employed in modern investments [Rytel, 2009]. This not only hinders the implementation of modern solutions, but also contributes to increasing the capital intensity of the investment process. Therefore, technological conservatism leads to an increase in the demand for financial resources, which can be obtained through various means, including trade credit.

The situation in the construction industry is closely related to the economic condition. This sector is the first to fall into crisis and the last to emerge from it. The high sensitivity of the construction industry to economic fluctuations results from the fact that in the period of economic downturn, investments are first abandoned, and only then current consumption and production activities are reduced. Conversely, the economic recovery is associated with a growth in investment, which translates into increased demand for construction services. The situation in the construction industry is further complicated by its connection

with the real estate market. The emergence of a recession in this market results in the most severe slumps in economic activity from the point of view of the duration and depth of the crisis [Drozdowicz-Bieć, 2012, p. 35]. As a result of economic fluctuations in the real estate market, there are changes in demand for various types of buildings and in the level of profitability of real estate, as well as significant fluctuations in their prices and values. Unfortunately, construction firms do not adapt swiftly to these changes, which further stiffens supply and prolongs the imbalance in individual market segments, often accompanied by a low level of utilization of construction production capacity [Główka, 2011]. These processes lead to an increase in risk and uncertainty in the operations of construction companies, which is manifested by high volatility of operating profit. This makes it difficult to obtain both short-term and long-term bank loans, as financial institutions perceive companies in this sector as highly risky. Therefore, especially during downturns [Castro et al., 2009], these entities often use trade credit, which is an alternative to financing provided by banks.

Construction is seasonal. The seasonal factor has such a large share in this sector that in many cases it makes it much more difficult to distinguish economic fluctuations [Drozdowicz-Bieć, 2012, p. 50]. Seasonality in construction is mainly related to weather conditions, as most construction works are carried out in the open space. In most European countries, climatic factors significantly complicate and sometimes even make it impossible to continue the construction process. Reducing their impact is possible thanks to the implementation of an appropriate work schedule and the use of optimal technology, for example, the use of concrete plasticizers to enable work at low temperatures. In order to ensure continuity of work, construction firms often diversify their activities by carrying out more than one construction site at different stages of advancement at the same time. However, the dispersion of work among numerous small-scale construction sites is not beneficial due to the increase in indirect costs, for example, preparation and liquidation of the construction site, supply of construction materials, and transfer of equipment or posting of workers [Rytel, 2009]. The above-mentioned costs generate an increase in short-term liabilities, which in practice most often means financing in the form of a trade credit.

The barriers to entry for new firms in the construction sector are low, as the demand for fixed assets can be covered by renting the necessary equipment and machinery. On the one hand, this lowers capital needs. On the other hand, it generates overcapacity in a sector made up of financially weak companies. This leads to unnaturally advantageous bids, often below the cost of realization. These actions are sometimes additionally forced on subcontractors by large construction concerns, which often sign contracts with investors that are unfavorable to them, based on the criterion of the lowest price or preventing the indexation of prices of production factors. In such a situation, especially smaller companies that do not have sufficient capital security rely on trade credit financing [Owusu-Manu et al., 2014]. This trend is particularly dangerous in the period of economic downturn, as it translates, among other things, into the financial results of construction companies, and in particular the decline in profitability and liquidity ratios, combined with an increase in short-term trade receivables and short-term liabilities. This creates payment backlogs, as firms face problems with getting paid for the services they have provided. Consequently, they struggle to meet their financial obligations promptly, leading them to resort to short-term loans despite the challenging circumstances. It should be emphasized that such a combination of tendencies in the financial situation signals a further deterioration or even loss of liquidity, potentially culminating in a wave of corporate bankruptcies.

Due to the aforementioned reasons, cashless transactions have become prevalent in the construction market. The low availability of bank loans motivates companies from the construction sector to seek alternative financing options. Trade credit largely satisfies these needs. Moreover, it is the most important source of financing for construction firms in many countries [Badu et al., 2012]. This applies primarily to cooperation between manufacturers and trading companies, but wholesalers cooperate with construction contractors on the same terms. On the one hand, trade credit granted by the manufacturer enables construction depots to accumulate a better and wider range of goods. On the other hand, it exposes the manufacturer to problems with debt collection. Such partnerships typically rely on trust cultivated over years of cooperation, mitigating the risks associated with extending trade credit.

The issue of trade credits granted to contractors is more problematic. In this case, a construction firm using such a loan can provide both services and materials to the investor. Moreover, the company can avoid the necessity of frequent visits to the construction depot for cash purchases. This scenario also benefits the

wholesaler, who, through such a policy, fosters stronger ties with contractors. However, the construction depot bears the greatest financial risk in such situations. This primarily concerns practices employed by dishonest contractors and situations where there are payment delays toward the contractor due to delayed acceptance of as-built structures or liquidity problems of the contractor resulting from various reasons, for example, unfavorable provisions of construction contracts. It is worth noting that problems resulting from opportunistic behavior or corruption are not exclusive to the construction industry. They affect the entire economy and have an impact on economic growth. For example, bank failures over the past 150 years in the United States have stemmed from inadequate regulations in the banking industry and a complete disregard for the Basel Agreements [Batrancea, 2021].

In the construction market, especially in the period of economic downturn, wholesalers act as a catalyst for payment delays [Roszkowska-Hołysz, 2013]. Wholesalers often meet their obligations with building material manufacturers on time themselves, while experiencing problems resulting from late payments from their customers. Prudence in matters related to trade credit is particularly important in the case of large investments, where the supply of materials entails significant financial outlay. In addition, investors may not always have honest intentions and, as practice shows, they do not always pay subcontractors or do so with a long delay [Czapla, 2020].

3 Trade credit theories and determinants

Trade credit, as a crucial component of working capital management, has been a subject of considerable theoretical exploration in the field of corporate finance. This section briefly outlines the main trade credit theories and determinants that influence the adoption and structuring of trade credit policies, setting the grounds for the comparative analysis within the construction industry across CEE and WE countries.

One of the main theoretical frameworks through which trade credit dynamics can be understood is the Transaction Cost Theory, originating from the seminal work of Williamson [1985]. According to this theory, firms extend trade credit to mitigate transaction costs associated with alternative financing mechanisms. In the construction industry, where projects often entail complex transactions and involve multiple stakeholders, the application of this theory is particularly relevant. Trade credit serves as a mechanism to streamline transactions, reducing information asymmetry and enhancing efficiency in contractual agreements.

A complementary perspective is offered by Myers and Majluf's [1984] Pecking Order Theory, which suggests that firms prefer internal financing over external sources, prioritizing retained earnings before seeking external sources. In the context of trade credit, this theory implies that firms may resort to trade credit as an internal financing tool. Within the construction industry, characterized by cash flow fluctuations and project-based financing needs, this theory implies that trade credit may be leveraged as an internal financing tool, especially when internal funds take precedence over external debt.

Rooted in the works of Jensen and Meckling [1976], Agency Theory offers another framework through which to examine corporate trade credit policies. The theory posits that trade credit can be utilized as a mechanism to align the interests of suppliers and buyers, mitigating agency problems. In the construction sector, where relationships between contractors and subcontractors are often complex, trade credit can act as a contractual tool to align incentives, foster cooperation, and enhance project completion efficiency.

Moving to the determinants of trade credit policies, industry characteristics play a key role. The project-based nature of the construction industry, involving extended payment cycles, influences firms' reliance on trade credit to smooth financial operations. Financial health is another determinant, with financially stable construction firms being better positioned to extend favorable trade credit terms to their counterparts. Institutional factors are also worth considering, with variations in legal and regulatory frameworks across CEE and WE countries potentially impacting trade credit practices. Furthermore, economic conditions, such as interest rates and inflation, exert a significant influence on trade credit decisions. Construction firms may adjust their trade credit policies in response to economic fluctuations, impacting both suppliers and buyers.

The empirical section of this paper investigates the impact of selected variables, typically considered as determinants of corporate trade credit in previous studies in the field. The impact of these determinants will be compared across the two macro-regions.

Short-term institutional financing emerges as a commonly explored determinant, with its availability and cost influencing firms' reliance on trade credit [Lin and Chou, 2015; Bialek-Jaworska and Nehrebecka, 2016; Lawrenz and Oberndorfer, 2018; McGuinness et al., 2018]. The relationship between institutional financing and trade credit may involve substitutional or complementary effects. While firms may opt for institutional financing as a substitute for trade credit, thereby reducing dependence on suppliers, others may utilize it to strengthen liquidity and extend more favorable credit terms to customers.

Collateral also constitutes a critical determinant, with its availability and quality significantly impacting a firm's ability to secure favorable trade credit terms [Yang, 2011; Bialek-Jaworska and Nehrebecka, 2016; Lawrenz and Oberndorfer, 2018; McGuinness et al., 2018; Pinto et al., 2023]. Similarly, inventory management practices play a crucial role in influencing trade credit dynamics, with well-managed systems enhancing firms' negotiating positions by mitigating perceived risks [Lin and Chou, 2015; Bialek-Jaworska and Nehrebecka, 2016]. Conversely, inefficient inventory management may impede firms' ability to secure advantageous credit arrangements, highlighting the link between supply chain management and financial decision-making.

Furthermore, the level of cash holdings emerges as a determinant shaping trade credit reliance, with firms strategically utilizing trade credit to supplement existing cash reserves [Lawrenz and Oberndorfer, 2018; McGuinness et al., 2018]. Operating costs, such as costs of goods sold, also influence trade credit policies, with higher costs prompting firms to seek extensive credit to manage operational expenses effectively [Lin and Chou, 2015]. Additionally, a firm's level of indebtedness significantly impacts its ability to secure and manage trade credit relationships, with highly leveraged firms facing challenges in obtaining favorable credit terms [Lawrenz and Oberndorfer, 2018].

Profitability serves as another crucial factor shaping firms' approaches to trade credit, with profitable companies often enjoying greater negotiating power and more attractive credit terms [Carvalho and de Schiozer, 2015; Lawrenz and Oberndorfer, 2018; Pinto et al., 2023]. Conversely, less profitable firms may have to accept less advantageous credit arrangements, as suppliers may perceive heightened financial risk. Asset turnover, reflecting operational efficiency and the ability to derive value from assets, also influences firms' credibility in negotiating trade credit terms [García-Teruel and Martínez-Solano, 2010; Lin and Chou, 2015].

Moreover, firm size and country-specific factors further compound the complexity of trade credit determinants. Larger firms typically have greater negotiating power, enabling them to obtain better credit terms, whereas smaller enterprises may face limitations in accessing favorable arrangements [Palacín-Sánchez et al., 2019]. Additionally, the geographical location and economic conditions of a firm's operating environment significantly impact trade credit practices, with stable economic conditions and well-established financial systems facilitating easier access to trade credit [Andrieu et al., 2018].

4 Review of previous studies on trade credit in the construction industry

The majority of studies on trade credit determinants concentrate on firms across various sectors. However, the disparities between the construction industry and others are substantial. Consequently, construction firms should be analyzed separately. Despite this necessity, the topic remains relatively underexplored in the global literature.

As was found by Bărbuță-Mișu [2018], using a sample of 958 European construction firms, on average, they provided 31–36% trade credit related to total assets to their customers and received 27–29.5% trade credit related to total assets from their suppliers. This means that firms from both developed and emerging European countries offered more trade credit than received, but in firms from developed countries the shares are higher. In both groups of countries, entities reported a high level of profitability, as evidenced by their

return on equity (ROE) and return on assets (ROA), but encountered minimal liquidity issues. Additionally, these companies relied to a limited extent on long-term banking loans for funding their activities. Moreover the author analyzed the relation between trade credit receivable/payable and collection/credit period and six measures of financial performance. Trade credit offered/received affected positively ROE and firm size, and was inversely related with ROA. Trade credit offered was directly related with current liquidity and long-term banking loans. Trade credit received positively influenced liquidity ratio and was inversely related with current liquidity and long-term banking loans, whereas trade credit offered negatively affected liquidity ratio.

Madaleno et al. [2019] conducted a comparative analysis of net trade credit determinants considering data from eight European countries (Belgium, Germany, France, Netherlands, Romania, Bulgaria, Poland, and Hungary) during 2004–2013. The results showed that net trade credit was inversely affected by economic slowdown, forcing firms to use it less due to survival effects but imposing higher trade restrictions. However, net trade credit to sales was directly influenced by the liquidity ratio and profit margin. Negative relationships between trade credit and bank loans and collection dummies were observed, imposing credit shortenings and forcing reliance on short-term bank loans. For the overall period, firms sold more than bought on credit due to tightening trade credit, which seemed to be the result of financial crisis.

According to an analysis carried out by García-Teruel and Martínez-Solano [2010], the average values of the trade credit granted and received in construction Small and Medium-sized Enterprises (SMEs) in selected European countries are generally higher than in other sectors. In addition, these values are higher in continental European countries (Belgium, France, Greece, and Spain) than in the Scandinavian countries (Finland and Sweden) and the UK.

In Poland, construction is financed to a large extent with trade credit [Zimon and Dankiewicz, 2020]. Most often Polish small- and medium-sized construction firms try to work together as part of a group purchasing organization, which positively influences trade credit management. The importance of cashless transactions in the Polish construction industry is highlighted in the research by Wiśniewski et al. [2021]. Companies within this sector exhibited a substantial proportion of trade credit in total assets. On average, this proportion was approximately 12 percentage points higher compared with companies with a different business profile. Similarly, construction firms exhibited a trade credit liability share in total liabilities slightly exceeding that of entities from other sectors by >10 percentage points. Comparable trends were observed concerning receivables attributable to trade credit, which were slightly <9 percentage points higher in construction firms. The heightened demand for trade credit within the construction industry is linked to its unique characteristics, particularly the greater need for current assets compared with other sectors. This heightened need arises from the prolonged realization process of construction investments.

Suppliers' trade credit is treated as a strategic source of finance among Spanish construction firms [Lafuente et al., 2017]. Based on panel-data techniques on a large dataset that includes information for 3,590 Spanish firms acting in the construction sector 2004–2011, authors revealed that trade credit granted by suppliers constitutes a relevant source of liquidity and financial resources that positively impacts economic performance. Furthermore, during the economic downturn that affected Spain after 2008, construction firms that benefited from longer average payment periods from their suppliers reported better financial results. Similar conclusions were reached by Castro et al. [2009], who emphasize the importance of trade credit in construction, especially during economic recession. Authors have highlighted the role of suppliers on corporate customers' value chain in the construction sector. It becomes especially relevant in the case of large firms which often adopt supply chain integration strategies, and create strategic alliances or coalitions to develop specific projects, such as large residential projects or public infrastructures. Trade credit is an important mechanism to maintain a level of cash flow that allows construction firms to run their projects and generate economic value, in terms of ROA and labor productivity [Cuccia, 2020].

Most of the research on trade credit in construction focuses on developed countries. However, there are also some analyses of developing markets in the literature. Badu et al. [2012] provided a structured survey questionnaire to 100 construction suppliers to obtain relevant information about their trade credit motives

in Ghana. The authors proved that vendors are motivated by the associated benefits of risk distribution and sustaining business relationships. Parallel to these intentions is the liquidity quandary, which drives suppliers to trade credit extension. The importance of trade credit in the construction industry in Ghana is emphasized in the research by Owusu-Manu et al. [2014]. The authors identified seven main factors shaping the demand for trade credit among construction companies, namely, the financial profile of the contractor, parties' profit margins, asset portfolio and project particulars, trade credit repayment terms, age and experience of the contractor, contractor corporate image, and parties' cash flows.

5 Data and methods

The empirical part of this research relies on data sourced from the BACH database [BACH, 2023]. This database offers standardized annual accounting statistics for non-financial enterprises across 12 European Union (EU) countries. The countries encompass four Central-Eastern EU nations: the Czech Republic (CZ), Croatia (HR), Poland (PL), and Slovakia (SK), along with eight Western EU member states: Austria (AT), Belgium (BE), Germany (DE), Spain (ES), France (FR), Italy (IT), Luxembourg (LU), and Portugal (PT). Managed by the European Committee of Central Balance Sheet Data Offices (ECCBSO), the database provides consolidated information on corporate balance sheets, income statements, cash flow statements, and various financial indicators. Additionally, it includes data on company size and industrial categorization. This study focuses on the construction industry, that is, Section F of the Nomenclature statistique des activités économiques dans la Communauté européenne (NACE) classification, spanning 12 countries and 3 size classes (S – small, M – medium, and L – large) during the period from 2000 to 2020. For each object defined by the three dimensions corresponding to size class, country, and year, several dependent and explanatory variables were computed. The construction of these ratios is shown in Table 1.

The methods employed in the study match the primary objective, which is to investigate whether corporate trade credit policies in the construction industry and the factors affecting these policies vary across WE and CEE countries. To evaluate the similarity of trade credit policies, the first stage of the analysis involved examining basic descriptive statistics of trade credit variables across countries. Furthermore, to

Table 1. Definition of variables employed in the analysis

Variable character		Symbol	Specification
Dependent		NTC	Net trade credit = (Accounts receivable – Accounts payable)/Assets
		REC	Trade credit supplied = Accounts receivable/Assets
		PAY	Trade credit obtained = Accounts payable/Assets
Explanatory	Firm-specific financial ratios	BKL	Short-term bank loan = Current amounts owed to credit institutions/Assets
		COL	Collateral = Fixed assets/Assets
		INV	Inventory = Inventories/Assets
		CSH	Cash at hand = Cash and available bank amounts/Assets
		CGS	Costs of goods sold = Costs of goods sold, materials and consumables/Net turnover
		LEV	Debt ratio = Debt/Equity
		ROA	Return on assets = Net operating profit/Assets
		TAT	Total asset turnover = Net turnover/Assets
	Dummy variables	SIZE	Size groups of firms (S, M, L)
		CT	Countries (AT, BE, CZ, DE, ES, FR, HR, IT, LU, PL, PT, SK)
		YEAR	Years (2000, ..., 2020)

NTC, Net trade credit; PAY, Trade credit obtained; REC, Trade credit supplied; ROA, return on assets.

Source: Authors' own compilation.

verify whether the identified differences are statistically significant, that is, to validate H1, the one-way analysis of variance was employed.

The verification of H2, concerning the diverse impact of trade credit determinants across the WE and CEE countries, was based on the panel data regression results that were performed independently for the two regions. The model is represented by formula (1):

$$TC_{cst} = \beta_0 + \beta_1 BKL_{cst} + \beta_2 COL_{cst} + \beta_3 INV_{cst} + \beta_4 CSH_{cst} + \beta_5 CGS_{cst} + \beta_6 LEV_{cst} + \beta_7 ROA_{cst} + \beta_8 TAT_{cst} + \beta_9 SIZE_s + \beta_{10} CT_c + \beta_{11} YEAR_t + \xi_{cst}, \quad (1)$$

where TC_{cst} denotes one of the three trade credit measures (NTC, REC, PAY) specified in Table 1 for country c , firm size s in year t . The formula includes structural parameters β_{1-11} , a random error term ξ , and explanatory variables described in Table 1. Since there are three dependent variables, the model has three corresponding versions: (1a) with the net trade credit as the dependent variable, (1b) with trade credit supplied, and (1c) with trade credit obtained.

In the modeling process, pooled Ordinary Least Squares (OLS), fixed-effects (FE), and random-effects (RE) panel data models were considered. First the models (1a–c) were estimated using pooled OLS approach for the complete dataset, followed by stepwise removal of the insignificant variables. Panel specification tests were employed to identify the most suitable model. Appropriateness of the pooled OLS model was assessed through joint significance testing and checks for individual effects. The Hausman test distinguished between FE and RE, demonstrating the suitability of the FE model in most cases. Then the models were reestimated with dummy variables included. Finally, a Wald test was performed for size, country, and year dummy variables. The findings are discussed in the following section.

6 Results and discussion

As outlined in the methodology section, the preliminary analysis was aimed at comparing trade credit ratios across WE and CEE countries. This involved assessing basic statistics for construction companies. Visual analysis of mean trade credit values in the cross-country section shown in Figure 2 reveals that the differences in these values are not striking, especially when considering the average values for the macro-regions represented by the first two clusters of bars.

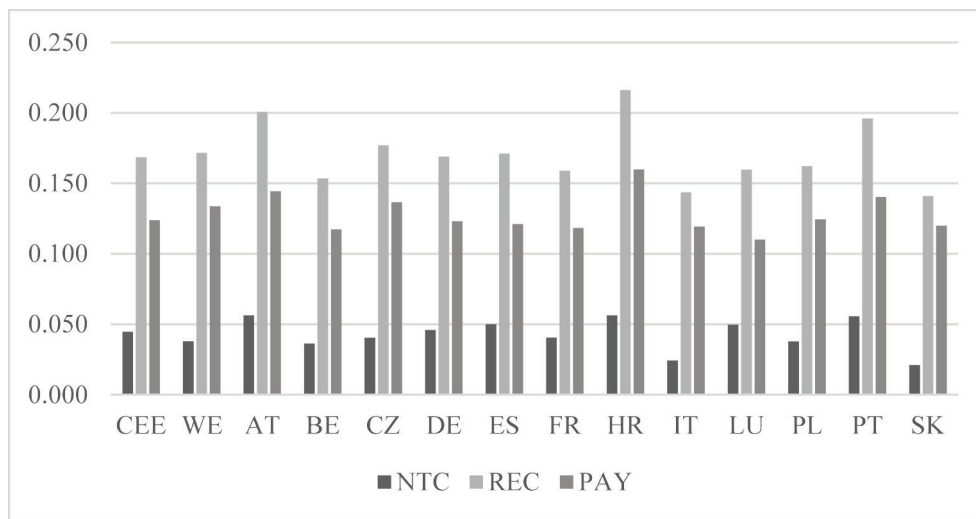


Figure 2. Mean values of trade credit ratios in the construction industry across countries.

Note: The mean values are calculated for all size groups of construction firms (S, M, L) and for all years available for a given region or country in the period 2000–2020.

Source: Authors' calculations based on [BACH, 2023].

Table 2. One-way ANOVA results with the grouping factor as the classification of country as the CEE or WE EU member; values of *F* statistics and *p*-value are in parentheses

Size	Dependent variable		
	NTC	REC	PAY
Small	2.823 (0.094)	1.626 (0.204)	0.144 (0.704)
Medium	1.676 (0.197)	1.252 (0.264)	0.341 (0.560)
Large	5.932 (0.016)	1.586 (0.209)	17.84 (0.000)
All size groups	2.432 (0.119)	0.161 (0.688)	3.184 (0.075)

CEE, Central-Eastern Europe; EU, European Union; WE, Western Europe.

Note: The values of *F* statistics were **bolded** for $p < 0.05$.

Source: Authors' calculations based on [BACH, 2023].

When considering individual countries separately, the differences are clearer. Notably, Slovakia stands out with the lowest percentage of net trade credit, a characteristic not commonly shared among other CEE countries. Conversely, Croatia, within the same category, exhibits the highest level of this ratio. Remarkably, Croatian construction firms are distinguished by having the highest levels of both obtained and offered trade credit. Additionally, Slovakian and Italian companies in the sector appear as the most restrictive in offering trade credit. By contrast, construction companies in Luxembourg face the lowest mean level of trade credit obtained. Based on the information presented in Figure 2, it can be concluded that trade credit divergence is rather weak among individual countries, and even weaker between the CEE and WE countries considered jointly. This conclusion gains additional support from the one-way analysis of variance (ANOVA) results shown in Table 2.

The table suggests that the impact of a firm's location (CEE or WE) on its trade credit policy depends on both the firm's size and the specific trade credit measure under consideration. No such effect is noted for trade credit offered, regardless of firm size. However, for net trade credit and trade credit obtained, some variability in trade credit policies emerges between the compared regions, although only in the case of large firms. By contrast, small- and medium-sized construction companies appear to handle their short-term liabilities and receivables in a relatively uniform manner.

To compare the impact of trade credit determinants among the two groups of countries, the results of panel data regressions were examined. Tables 3 and 4 display the estimation results of the models (1a–c) for CEE and WE countries, respectively. As can be inferred from the comparative analysis of the estimation results, in the majority of cases, the impact of trade credit factors exhibits uniformity across all three trade credit metrics. However, several variations in this impact emerge when comparing macro-regions. Specifically, the influence of short-term bank loan as a determinant of trade credit is largely insignificant, except for a cross-regional difference in the impact on net trade credit. While proving insignificant in CEE countries, it has a significantly positive impact in WE countries, suggesting a complementary relationship between trade credit and short-term institutional financing.

Contrary to short-term bank loans, collateral's impact is uniform across regions and trade credit measures, consistently exhibiting a significantly negative influence. Similarly, liquidity impact is generally similar and homogeneous across regions, though not consistently across all metrics. While it does not significantly affect net trade credit, it has a negative impact on the other two trade credit metrics.

Divergence in impact is observed in the case of inventory level, with a significantly negative influence on most trade credit measures in both groups of countries, except for trade credit received in CEE where the relation is insignificant. The only variable showing a different impact across all three trade credit measures is costs of goods sold, which has no significant relation with net trade credit in CEE, while it is significantly negative in WE. The opposite is the case for trade credit granted, which means that the impact was found to be significantly negative for trade credit offered in CEE, but insignificant in WE. No significant relation was found for trade credit obtained in CEE, but the impact was positive in WE.

Table 3. Estimation results of panel regressions for construction industry in CEE countries

Variable	Model (1a) NTC		Model (1b) REC ^a		Model (1c) PAY	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
Const.	0.243***	0.039	0.550***	0.110	0.178***	0.020
COL	−0.272***	0.048	−0.537***	0.076	−0.217***	0.019
INV	−0.349***	0.056	−0.421***	0.082		
CSH			−0.423**	0.203	−0.284***	0.081
CGS			−0.077***	0.028		
LEV			−0.094*	0.053		
ROA	0.091**	0.040				
TAT	−0.049***	0.010	0.046**	0.023	0.080***	0.007
SIZE	No		No		S***	
CT	SK*		No		HR***, SK*	
YEAR	2016***		2012*		2017*	
No. obs.	210		210		210	
R ²	0.535		n/a		0.871	
AIC	−806.5		−722.2		−918.4	
Panel specification tests						
Joint sign. of diff. group means	F(11, 193) = 2.8 [0.002]		F(11, 195) = 4.1 [0.000]		F(11, 195) = 6.0 [0.000]	
Breusch-Pagan	LM = 4.7 [0.030]		LM = 25.3 [0.000]		LM = 55.9 [0.000]	
Hausman test	H = 15.4 [0.009]		5.5 [0.137]		8.6 [0.035]	
Joint significance robust <i>F</i> test						
Size	n/a		n/a		41.0 [0.000]	
Country	3.74 [0.079]		n/a		8.6 [0.006]	
Year	12.67 [0.004]		4.3 [0.000]		3.2 [0.100]	

AIC, Akaike Information Criterion; CEE, Central-Eastern Europe; FE, fixed-effects; LM, Lagrange Multiplier; RE, random-effects; ROA, return on assets.

^aThe model was Estimated as RE, otherwise as FE. Interpretation of parameters in relation to medium firms and the Czech Republic.

*Significant at the 10% level.

**Significant at the 5%.

***Significant at the 1%.

Note: For dummy variables, only the items in terms of specific size groups, countries, and years were provided for which the parameters were statistically significant.

Source: Authors' calculations based on [BACH, 2023].

Financial leverage shows slight cross-regional variability, predominantly proving an insignificant factor in terms of trade credit. An exception is its negative relation with trade credit offered in CEE. Profitability and asset turnover generally exert a positive influence, with comparable impact across the two regions, although varying depending on the trade credit measure. The only difference identified in the area of dummy variables relates to the significance of time effect. Some significant year effects were found for all trade credit measures except for trade credit granted in CEE.

In summary, the findings reveal only limited and unremarkable differences among regions regarding the impact of trade credit determinants. The cross-regional homogeneity in trade credit policies and their factors can be attributed to the industrial specificity of construction firms, where the unique characteristics of companies operating within this sector appear to outweigh country-specific determinants.

Table 4. Estimation results of panel regressions for the construction industry in WE countries

Variable	Model (1a) NTC ^a		Model (1b) REC		Model (1c) PAY	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
Const.	0.249***	0.044	0.447***	0.035	0.175***	0.021
BKL	0.279**	0.120				
COL	−0.320***	0.030	−0.532***	0.038	−0.214***	0.024
INV	−0.341***	0.046	−0.404***	0.038	−0.112***	0.032
CSH			−0.411***	0.103	−0.214***	0.069
CGS	−0.047**	0.019			0.066***	0.012
ROA	0.250**	0.103				
TAT	−0.037***	0.011	0.047***	0.011	0.067***	0.007
SIZE	S*, L*		S***		S***	
CT	No		PT***		LU**	
YEAR	2001*, 2010*		2016**		No	
No. obs.	480		480		480	
R ²	n/a		0.834		0.809	
AIC	−1876.2		−1777.5		−2066.1	
Panel specification tests						
Joint sign. of diff. group means	F(23, 451) = 1.9 [0.008]		F(23, 451) = 7.4 [0.000]		F(23, 451) = 12.5 [0.000]	
Breusch-Pagan	LM = 7.1 [0.008]		LM = 183.0 [0.000]		LM = 393.4 [0.000]	
Hausman test	1.6 [0.895]		18.5 [0.001]		30.5 [0.000]	
Joint significance robust <i>F</i> test						
Size	1.6 [0.208]		99.3 [0.000]		41.0 [0.000]	
Country	8.7 [0.000]		8.4 [0.008]		8.6 [0.006]	
Year	46.0 [0.000]		5.3 [0.030]		30.5 [0.000]	

FE, fixed-effects; RE, random-effects; ROA, return on assets; WE, Western Europe.

^aThe model was Estimated as RE, otherwise as FE. Interpretation of parameters in relation to medium firms and Austria.

*Significant at the 10% level.

**Significant at the 5%.

***Significant at the 1%.

Note: For dummy variables, only the items in terms of specific size groups, countries, and years were provided for which the parameters were statistically significant.

Source: Authors' calculations based on [BACH, 2023].

7 Conclusions

The aim of this research involved two primary aspects: first, to compare the trade credit strategies adopted by construction firms across CEE and WE countries, and second, to assess the impact of specific factors on these strategies within the respective macro-regions. Given the persistent economic disparities noticeable between the regions, the two corresponding research hypotheses assumed significant diversity of both trade credit policies and their determinants.

Nevertheless, our findings provide only limited and fragmentary support for H1 regarding significant variations in trade credit policies among construction firms across the two macro-regions. Specifically, such support was found only in relation to net trade credit and trade credit obtained by large-sized firms. In

the remaining cases, the analysis fails to reveal significant cross-regional differences, consequently leading to the rejection of H1.

To test H2, concerning the varied impact of trade credit determinants among the two groups of countries, the results of panel data regressions were examined. Again, only limited and unremarkable differences identified among regions regarding the impact of trade credit determinants do not robustly support the hypothesized expectations.

The observed low cross-regional diversity in trade credit policies among construction companies in CEE and WE countries, as outlined in the study, may be attributed to several factors. One possible justification for the lack of significant variations in trade credit policies assumed by H1 could be the increasing globalization and convergence of business practices across European regions. Economic integration and harmonization efforts within the EU may have led to a more standardized approach to trade credit management among construction firms, mitigating the expected cross-regional differences. Additionally, the construction industry's exposure to similar market conditions, competitive forces, and regulatory frameworks may contribute to the observed homogeneity in trade credit policies.

Furthermore, the limited and unremarkable differences identified in the impact of trade credit determinants among the two macro-regions, which contradict H2, may reflect the presence of common industry-specific factors that outweigh regional disparities. Factors such as industry best practices, technological advancements, and global economic trends might exert a more universal influence on trade credit policies, overshadowing the expected regional variations. These findings are in line with previous studies on trade credit factors in European countries [Bărbuță-Mișu, 2018; Madaleno et al., 2019]. On the other hand, García-Teruel and Martínez-Solano [2010] diagnosed small differences between the values of trade credit granted and received among continental European countries versus Scandinavian countries and the UK.

In conclusion, the low cross-regional diversity in trade credit policies among construction companies in the CEE and WE countries can be rationalized by the increasing integration of business practices, common industry-specific factors, and the adaptability of firms to prevailing economic conditions. These insights contribute to our understanding of both regional disparities and trade credit management within the European construction industry.

This study enriches the trade credit literature by showing how regional economic conditions influence trade credit policies in the construction industry, supporting the Transaction Cost Theory and highlighting the importance of understanding regional characteristics for financial policies. Policymakers and construction firms can use these insights to tailor financial regulations and negotiate trade credit terms. Despite relying on quantitative data, future research could explore qualitative factors and include non-EU countries for a broader perspective on global trade credit dynamics.

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