The Impact of the COVID-19 Crisis on the Speed of Adjusting the Commercial Credit of Companies, Considering the Ability of Managers

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Abstract

Objectives: This study aims to investigate the impact of the COVID-19 crisis on the speed of adjustment of trade credit among companies listed on the Tehran Stock Exchange (TSE), with particular attention to the moderating role of managerial ability.

Methodology/Design/Approach: The research sample includes 131 listed firms observed over ten years (2013–2022), selected using the systematic exclusion method. A multivariable linear regression model was employed to test the research hypotheses. The model developed by Luo (2022) was used to measure the speed of adjustment of trade credit before and after the COVID-19 outbreak, while the model of Demerjian et al. (2012) was applied to evaluate managerial ability.

Findings: The results indicate that, on the demand side of trade credit, the speed of adjustment of accounts payable increased by approximately 17% after the COVID-19 outbreak, with capable managers further accelerating this trend. Conversely, on the supply side, the speed of adjustment of accounts receivable declined by nearly 50%. This decline is attributed to rising inflation and economic instability during the post-crisis period, which led managers—including highly capable ones—to deliberately slow the adjustment of credit sales to benefit from inventory retention and mitigate risks in inflationary conditions.

Innovation: This study extends the literature by demonstrating how crises such as COVID-19 reshape trade credit dynamics in emerging markets. It highlights the asymmetric effects on the supply and demand sides of trade credit and underscores the role of managerial ability in adapting financial policies under conditions of uncertainty and economic instability.

Keywords: Commercial Credit, COVID-19, Ability of Managers, Speed of Adjustment of Commercial Credit.

1. Introduction

Trade credit is an important source of financing for companies (Luo, 2022). Financial managers are responsible for deciding the extent to which trade credit should be used under different economic conditions. As a financing source—compared to bank financing or equity issuance—trade credit, although widely used in the market, has largely been neglected in research. It is particularly important for small and medium-sized enterprises as well as large commercial firms (Asif & Nisar, 2023). Previous studies indicate that trade credit accounts for approximately a quarter of a firm's total assets and about half of its short-term liabilities in samples of medium-sized British firms and small American firms. This information can be used to reduce information asymmetry when dealing with banks and creditors (Silaghi & Moraux, 2022).

While trade credit is a crucial source of short-term financing and plays a key role in business operations, it also reflects the level of trust suppliers and creditors place in a company. Firms with high trade credit receive goods and services from suppliers without immediate cash payments, and banks and other lenders are more likely to extendafacilities based on the firm's trade credityPrior research, such as Petersen and Rajan (1997), documented that managers decide on trade credit usage based on firm characteristics and capabilities. However, due to internal and external risks and macroeconomic shocks, a firm's observed trade credit often deviates from its target or optimal level (Kardan et al., 2016). Under these conditions, firms may not fully utilize their capabilities and must attempt to reach their target trade credit more quickly (Luo, 2022).

The unprecedented spread of COVID-19 caused significant macroeconomic shocks to labor supply, production inputs, and ultimately company operations worldwide (Shafeeq Nimr Al-Maliki et al., 2023). Luo (2022) noted that the United States was among the most affected countries, experiencing a 3.5% decrease in economic size in 2020. With no clear end to the pandemic and ongoing uncertainties in the global economy, companies have been forced to adjust their financial and operational policies. Among these, trade credit policy has

likely been the most affected, as the pandemic directly impacted cash flows and business activities for both buyers and sellers along the supply chain.

Therefore, the first objective of the present research is to answer the question: Does the spread of COVID-19 affect the speed at which companies adjust their trade credit? Policies and decisions in this area are critical for aligning trade credit with its optimal level. The role of capable and expert managers is also crucial: firms with skilled managers tend to experience an increase in received trade credit, and managerial ability has a stronger effect on accounts payable in firms with weaker credit quality or greater financial constraints. By making strategic decisions, managers can maintain trade credit policies even under critical conditions, thereby narrowing the gap between actual and optimal trade credit more quickly (Khoo & Cheung, 2022).

Consequently, the second objective of this research is to answer the question: Does managerial ability affect the speed of trade credit adjustment during the COVID-19 crisis? Considering economic challenges, internal and external risks, the impact of COVID-19, and the cost of external financing, understanding how companies can restore trade credit to its optimal level under macroeconomic shocks is essential. Furthermore, given the research gap—namely, the lack of definitive studies on the effect of COVID-19 on trade credit adjustment speed, especially in the national context—the necessity of this study is evident. The results will advance the field and clarify whether managerial ability influences trade credit adjustment speed during the pandemic.

The structure of the study proceeds as follows: first, the theoretical foundations, hypotheses, and empirical bases are presented; next, the research methodology and operational definitions of the variables are outlined; finally, the research findings and conclusions are presented.

2. Theoretical principles and hypothesis development

As stated, trade credit is an essential source of financing for both small and large companies worldwide. Companies urgently require financial resources to take

full advantage of investment opportunities, and the allocation and use of these resources must be properly determined to support growth and profitability (Zou et al., 2023). Hasan et al. (2021) showed that companies in the introduction, growth, and decline stages use significantly more trade credit, while firms in the maturity stage rely more on internal or other credit sources.

Trade credit is an agreement between buyers and sellers, under which sellers allow buyers to pay for goods and services after a specified period (Routledge, 2023). The key advantage of trade credit is that customers do not need to pay cash at the time of purchase; instead, a receivable or payable account is recorded on the customer's balance sheet, allowing payment at a later date. In this sense, accounts receivable can be viewed as a substitute for cash, making trade credit one of the short-term investment tools (Silaghi & Moraux, 2019). Wang et al. (2023) noted that companies with high trade credit can receive necessary goods and services without immediate cash payment, and lenders can also provide financing based on the company's trade credit status. If a company's debt repayment ability is deemed low, creditors will require greater assurance and may charge higher interest rates. As a result, companies continuously strive to improve their trade credit ratings (Ma et al., 2022).

Lenders, however, remain concerned that borrowers may experience financial difficulties and fail to meet obligations, as credit decisions influence future financial flexibility and can expose companies to risk (Wu et al., 2023). Asif and Nisar (2023) investigated the impact of trade credit on corporate financial performance and found that trade credit strongly stimulates financial performance. Profitable firms with high participation in trade credit can further improve performance by optimally utilizing available credit sources.

Discussion of corporate credit status is crucial not only for firms themselves but also for stakeholders, including creditors and investors. The long-term financial health of customers is especially important when suppliers aim to maintain long-term business relationships. Many companies use trade credit both to finance purchases and inputs (accounts payable) and to provide financing to their customers (accounts receivable) (Luo et al., 2023; Abuhommous, 2021). Suppliers must consider not only customers' ability to meet short-term obligations but also their long-term financial stability, as investments in equipment or contractual commitments depend on customers' financial reliability. In practice, late payments often increase supplier concerns (Ma et al., 2022).

Luo (2022) demonstrated that companies actively adjust toward their target trade credit, covering the gap between actual and optimal trade credit at an annual adjustment rate of approximately 70% in the United States. The global spread of COVID-19 disrupted business operations, employment, and income for many firms, sometimes forcing significant workforce adjustments or reporting negative income (Salehi et al., 2020). High debt levels, risk of default, and disrupted financing further complicated operations during this period (Devi et al., 2020). Measures such as border closures, quarantines, and reduced human interaction introduced unprecedented challenges, decreasing liquidity and forcing companies to rely more heavily on short-term financial obligations. Consequently, the role of trade credit from suppliers and distributors became more critical than ever (Amnim et al., 2021).

Hasan and Alam (2022) examined the relationship between asset redeployment ability and the use of trade credit, finding that asset redeployment ability significantly impacts short-term financing decisions. Gonçalves et al. (2018) highlighted that changes in product market power affect trade credit decisions, with reduced trade credit observed during financial crises due to competitive pressures. While some businesses earned more during this period, companies facing risk relied on trade credit to manage operations. The results show that during the COVID-19 crisis, the estimated adjustment speed of trade credit significantly increased compared to pre-pandemic levels. In the United States, the adjustment speed for accounts receivable rose from 54% pre-COVID to 64% during the pandemic, while accounts payable adjustment speed increased from 61% to 78% (Luo, 2022). Based on the above, the first hypothesis of this research is formulated as follows:

H1: The average speed of commercial credit adjustment has increased in the period after the spread of COVID-19 compared to before.

One of the possible channels through which uncertainty caused by COVID-19 has affected companies' trade credit is an increase in risk. This phenomenon can be examined at both micro and macro levels, considering social, medical, and economic perspectives. The risks involved are primarily a combination of general economic conditions and firm-specific characteristics. As systematic uncertainty rises during the pandemic, liquidity risk and default risk increase significantly, which, according to research, affects the speed of trade credit adjustment (Luo, 2021).

Dao et al. (2022) provided evidence that companies with more effective internal controls settle their trade credit contracts faster than those with weaker controls. They also noted that firms with ineffective internal controls tend to demand more trade credit. Consequently, significant deviations from optimal trade credit levels expose firms to greater risk. Given the higher operational risk and reduced credit availability during disease outbreaks, the greater the deviation from the optimal level, the higher the adjustment costs for the firm. Therefore, companies are motivated to achieve their target trade credit faster to take full advantage of its benefits (Luo, 2022). Based on the above, the second and third hypotheses of the current research are formulated as follows:

H2: The COVID-19 crisis has a significant positive effect on the speed of adjusting the demand for commercial credit in the form of payable credit.

H3: The COVID-19 crisis has significantly affected the speed of adjusting the supply of commercial credit in the form of receivables.

If the increase in convergence speed during the COVID-19 period is driven by the motivation to avoid risk, risk-taking companies adjust their trade credit more quickly. However, the speed of adjustment depends not only on motivation but also on the firm's ability to execute it Managers' negotiation and bargaining power significantly impact the speed of trade credit adjustment, as larger companies can leverage their negotiation power to secure more favorable credit terms with business partners and reach their optimal trade credit faster (Choi & Kim, 2005).

As highlighted in previous literature, management involves the effective and efficient use of material and human resources in planning, organizing, mobilizing resources and facilities, guiding, and controlling activities to achieve organizational goals based on accepted values. Managers play a critical role in organizations and, as the main decision-makers, substantially influence strategic choices. Khoo and Cheung (2022) provided evidence that companies with higher managerial ability tend to receive more trade credit. Moreover, the effect of managerial ability on accounts payable is stronger in companies with weaker credit quality or more binding financial constraints.

The impact of competent managers on earnings, income, profit, and organizational success is evident in many successful firms today. The ability to respond quickly to contemporary threats and opportunities positions managers as vital resources in organizational problem-solving, underscoring the growing need for skilled managers (Salehi et al., 2021). Demerjian et al. (2012) define managerial ability as the efficiency of managers relative to competitors in converting company resources into income. These resources include inventory costs, sales, administrative and general expenses, tangible fixed assets, operating rents, research and development costs, and intangible assets. Competent managers are expected to generate higher profits after controlling for internal effects.

Therefore, companies with higher managerial ability are associated with increased trade credit. Additionally, the influence of managerial ability on accounts payable is more pronounced in firms with lower credit quality or tighter financial constraints (Khoo & Cheung, 2022). Skilled managers can navigate critical situations and maintain the company's trade credit by effectively managing risks and crises.

H4: Managers' ability has a significant positive effect on the relationship between the COVID-19 crisis and the speed of adjustment of commercial credit payables.

H5: Managers' ability has a significant and positive effect on the relationship between the COVID-19 crisis and the speed of adjustment of commercial credit receivable.

3. Research methodology
3.1. Research Population
Due to the presence of established theoretical foundations related to the investigated variables, the current research is classified as applied research in terms of its purpose. In terms of the research method, since the study does not manipulate an independent variable to measure its effect on a dependent variable, but rather examines the variables as they naturally occur, it is categorized as descriptive-causal research.

Given the historical and post-event nature of the required data, library and archival methods were used to collect the information necessary to test the research hypotheses. The statistical population of this study includes all companies listed on the Tehran Stock Exchange, excluding those whose fiscal year ends at dates other than the end of March. To ensure data comparability and homogeneity, investment companies, banks, and insurance firms were also excluded due to the distinct nature of their operations and reporting.

Finally, information from 131 companies was selected using a systematic screening approach. Data were collected over ten years, from 2013 to 2022, to obtain a sufficiently large sample consistent with similar studies. Given the mixed nature of the research data, a multivariate linear regression model was employed. After verifying data homogeneity and satisfying other preconditions for regression analysis, the hypotheses were tested using EViews 12 software, applying robust standard error techniques and appropriate statistical methods for final hypothesis testing.

Table 1. The selection of the statistical sample

The statistical population in 2020		546
Inactive companies	-189	
Companies with trading suspension	-36	
Companies that have changed the financial period	-57	
Companies that entered the stock market during the research period	-81	
Investment companies, banks, and holdings	-52	
Final sample		131

3.2. Regression model
The research model for payable and receivable trade credit has been tested separately.

$$
\begin{aligned}
SubscriptSTR_{it} = \ & \beta_0 + \beta_1 COVID - 19_{it} \\
& + \beta_2\ MA_{it} \\
& + \beta_3 (COVID - 19_{it}\ \times\ MA_{it}) \\
& + \beta_4 ROA_{it} + \beta_5 growth_{it} \\
& + \beta_6 LEV_{it} + \beta_7\ Inst_{it} + \beta_8\ IND_{it} \\
& + \beta_9\ Age_{it} + \varepsilon_{it}
\end{aligned}
$$

3.3. How to measure research variables
3.3.1. The dependent variable of the research: Trade credit adjustment speed (S-TR)
According to Luo (2022), the partial adjustment model is widely used in studies measuring the speed of adjustment. In this model, both actual and optimal trade credit levels should be measured in the first stage. However, since optimal trade credit cannot be directly observed, its value must be inferred using other observable variables. In this research, the observable characteristics of the firm that influence financing decisions are considered, while other factors—such as the broader economic environment and unobservable (uncontrollable) effects that also affect financing decisions but are difficult to measure—are treated as error terms in the estimator. Optimal trade credit is estimated using the following model.

$$
TR_{i,t} - TR_{i,t-1} = \lambda (TR^*_{i,t} - TR_{i,t-1}) + u_{it}
$$

Where:
TR∗ i,t+1 is the firm's target trade credit in year t. (λ) The unobservable adjustment speed towards the target is the gap between the target and the current trade credit. The target trade credit (TR∗ i,t) is unobservable but can be estimated with the following model:

$$
TR^*_{i,t} = \beta' x_{it-1} + u_{it}
$$

Where:

Xi,t-1 is the vector of explanatory variables determining the target's business credibility. According to previous studies (Petersen and Rajan 1997; Choi and Kim 2005; Luo 2021; 2022), according to the suggestions of these researchers, different variables (accounts receivable, AR, and accounts payable, AP) are determined respectively.

Xi,t - 1 For AR, the determinants include sales, sales growth, firm size, inventory, retained earnings, firm age, and short-term debt.

Xi,t - 1 for AP, includes costs, cost changes, company size, inventory, accumulated profit, company age, and short-term debt, also used in the current research to estimate the target's business credit.

Table 2. Functional variables of company characteristics in the research model

Variables	Sign	How to operate
Sales	Sale	Total sales are divided by total assets (Luo 2022; Salehi and Moghadam 2019).
Positive sales changes	Sale + Δ	If sales changes are positive, the number is one; otherwise, it is zero (Luo 2022).
Negative sales changes	Sale − Δ	If sales changes are negative, the number is one; otherwise, it is zero (Luo 2022).
Costs	Cost	The cost of goods sold is divided by total assets (Luo 2022).
Positive cost changes	Δ Cost +	If the cost changes are positive, the number is one; otherwise, it is zero (Luo 2022).
Negative cost changes	Δ Cost -	If the cost changes are negative, the number is one; otherwise, it is zero (Luo 2022).
size of the company	SIZE	The natural logarithm of total assets (Luo 2022; Salehi et al. 2018).
warehouse stock	Inventory	The ratio of total inventory to assets (Luo 2022).
accumulated earnings	RE	The ratio of retained earnings divided by total assets (Luo 2022).
Company age	AGE	The natural logarithm of the difference between the date of establishment and the desired date of the company (Salehi et al. 2017).
Short-term debt	Short debt	The ratio of short-term debt to total assets (Luo 2022).
Trade credit payable	AP	Accounts payable divided by total assets (Luo 2022).
Trade credit receivable	AR	Accounts receivable divided by total assets (Luo 2022).

By replacing the company's characteristics in Model 1, the following model will obtain the optimal trade credit received and paid.

3.3.1.1. How to calculate AR (trade credit receivable) (supply)

$$TR^{*}_{i,t} = \beta_1 SALE_{it} + \beta_2 \Delta SALE_{it} + \beta_3 size_{it} + \beta_4 Inventory_{it} + \beta_5 RE_{it} + \beta_6 AGE_{it} + \beta_7 Short\ debt_{it} + u_{it}$$

3.3.1.2. How to calculate AP (trade credit payable) (demand)

$$TR^{*}_{i,t} = \beta_1 COST_{it} + \beta_2 \Delta COST_{it} + \beta_3 size_{it} + \beta_4 Inventory_{it} + \beta_5 RE_{it} + \beta_6 AGE_{it} + \beta_7 Short\ debt_{it} + u_{it}$$

As mentioned, the partial adjustment model obtains the optimal trade credit adjustment speed. In this research, the partial adjustment model of Fama and French (2002) is used as follows:

$$\Delta TR_{it} = \lambda\left(TR^{*}_{i,t} - TR_{it-1}\right) + v_{it}$$

Where in ΔTRit, the difference between the real commercial credit of the current year and the real commercial credit of the previous year; TRit, target trade credit; TR_(it-1), real trade credit of the previous year; λ is the speed of adjustment, and v_it is the one-way error component that includes firm-unique fixed effects (u_it Model 2) and the error component (e_it).

This model allows the named company to reduce the gap between its actual and target trade credit by one each year. The range of coefficient 1 is between zero and one, and a value close to one indicates a higher adjustment speed and vice versa. For the final calculation of the adjustment speed of the above two patterns, the following pattern is obtained by merging.

$$TR_{it} = \emptyset_1 SALEE_{it} + \emptyset_2 \Delta SALE_{it} + \emptyset_3 size_{it} \\ + \emptyset_4 Inventory_{it} + \emptyset_5 RE_{it} \\ + \beta\emptyset_6 AGE_{it} + \emptyset_7 Short\,debt_{it} \\ + (1-\lambda)TR_{it-1} + v_{it}$$

$$TR_{it} = \emptyset_1 COST_{it} + \emptyset_2 \Delta COST_{it} + \emptyset_3 size_{it} \\ + \emptyset_4 Inventory_{it} + \emptyset_5 RE_{it} \\ + \beta\emptyset_6 AGE_{it} + \emptyset_7 Short\,debt_{it} \\ + (1-\lambda)TR_{it-1} + v_{it}$$

The above model states that managers usually adopt strategies that reduce the gap between their current received and paid business credit position and their desired position. In addition, this relationship assumes that all companies adjust their trade credits at the same rate (Fama and French 2002). Therefore, subtracting the estimated coefficient for 〚TR〛_(it-1) from the number one will determine the speed of trade credit adjustment. Commercial credit adjustment speed = 1-(1-λ)

3.3.2. Independent variable: COVID-19
COVID-19 started at the beginning of December 2019 in Wuhan, China, and this disease was officially announced in Iran at the end of 2018. This disease spread worldwide several months ago, and its consequences will affect the country. It was not until the official announcement of the government that this variable was dummy (0 and 1),

which was assigned code (1) in the years 2019, 2018, and 2019, and code (0) in the previous years.

3.3.3. Moderator variable: managers' ability (MA)
The model by Demerjian et al. (2012) will be used to measure managers' abilities. After performing the regression test, the management efficiency is determined through the residual value (ε_t) in each year-company as follows: calculated through the residual of the regression model, a positive residual value means high efficiency, and a negative residual value means less efficient management.

3.2.3.1. Coverage analysis to measure management efficiency
Demerjian et al. (2012) calculated the results of managers' ability using a series of data envelopment analyses, and this data analysis is based on a series of optimizations using linear programming, also referred to as a non-parametric method. Demerjian et al.'s 2012 model will be used in this research to measure management ability. Coverage analysis is used through equation 1 to measure the company's efficiency.

$$\max_v \theta = \frac{Sales}{v_1 CoGS + v_2 SG\&A + v_3 NetPPE + v_4 OpsLease + v_5 R\&D + v_6 Intan}$$

Table 3. Definition of the variables used in the above equation

Model input	Variable	Sign	Operational definition
Output variable	Sales	Sales	The amount of company sales
Input variables	Cost	CoGS	The total cost of goods sold
	Net fixed assets	NetPPE	Net property, machinery, and equipment
	Operating lease cost	OpsLease	The financial statements do not identify research and development costs and information related to rents, so the effects of these two variables are removed from the models.
	Research and development costs	R & D	
	Intangible assets	Intan	Net intangible assets

The calculated efficiency score of a company ranges from zero to one. Companies with an efficiency score below one are considered to be below the efficiency frontier and must move toward the frontier by either reducing costs or increasing revenues. The purpose of calculating a company's efficiency is to measure managerial ability.

However, since the inherent characteristics of a company also influence efficiency calculations, managerial ability cannot be measured accurately; the score may be higher or lower than its true value due to these characteristics.

To control for the effect of a company's inherent characteristics, Demerjian et al. (2012) divided the company's efficiency into two distinct components: efficiency attributable to inherent company characteristics and managerial efficiency. They controlled for five firm-specific characteristics—firm size, market share, cash flow, stock exchange listing age, and foreign sales (exports). These intrinsic characteristics can influence management decisions, assist managers in making better choices, or, conversely, constrain managerial ability.

The five firm-specific characteristics controlled in the model presented by Demerjian et al. (2012) are as follows:

$$Firm\ Efficiency_{j,t}$$
$$= \alpha_0 + \alpha_1 Size_{j,t} + \alpha_2 Marketshare_{j,t}$$
$$+ \alpha_3 FreeCashFlowIndicator_{j,t} + \alpha_4 Age_{j,t}$$
$$+ \alpha_5 ForeignCurrencyIndicator_{j,t} + \varepsilon_{j,t}$$

Where:

Size$_{j,t}$ is the size of company j in year t and is equal to the natural logarithm of the company's total assets.

MSH$_{j,t}$ = the market share of company j in year t, and is equal to the ratio of the company's sales to the total industry sales.

FCFI$_{j,t}$ = shows the increase (decrease) in the operating cash flow of company j in year t, which is equal to one if the operating cash flow is positive and zero if it is negative.

Age$_{j,t}$ is company j's life in year t and is equal to the natural logarithm of the number of these years.

FCI$_{j,t}$ = The export of company j in year t; for companies that have exported, it is considered equal to 1 and, otherwise, zero.

ε$_{j,t}$ = the remainder of this pattern indicates the level of management ability.

3.3.4. Research control variables

Following previous studies such as Luo (2022), to control possible unwanted effects affecting the speed of adjustment of companies' leverage, the following options have been used as control factors:

Return on assets (ROA): Net profit divided by total assets

Growth: Sales revenue minus the sales of the previous period divided by the sales of the previous period

Financial Leverage (LEV): The ratio of the total liabilities of the company to the total assets of the company at the end of each financial period

Institutional shareholders (Inst): The percentage of shares owned by institutional investors, including institutional investors such as banks and insurance companies, and individuals who own more than 5% of the company's shares.

Board independence (IND): The ratio of non-executive board members to total board members.

Firm Age: the natural logarithm of the difference between the company's founding year and the target year.

4. Research findings
4.1. Descriptive statistics of research variables

The research findings include descriptive and inferential statistics, which are first presented in the table below descriptive statistics.

Table 4 presents the descriptive statistics of the research variables. Descriptive statistics illustrate the dispersion of data, mean, and standard deviation, which are two key indicators in this context. According to the table, the average speed of adjustment of trade receivables is 0.27, while the average speed of adjustment of trade payables is 0.48, indicating a notable difference between these two components of trade credit.

The highest standard deviation is observed for institutional shareholders (31.2), while the lowest is for managers' ability, at 0.12. The maximum company size is 19.61, and the minimum is 11.03. Skewness and kurtosis, which reflect the dispersion of data frequency, indicate that the variables do not follow a normal distribution, based on the positive and negative values obtained.

Table 4. Descriptive statistics of quantitative research variables

Variable	Sign	Mean	Median	Max.	Min.	Standard deviation	Skewness	Kurtosis
Payment adjustment speed	STR(AP)	0.480	0.480	0.980	0.053	0.190	0.190	3.710
Received adjustment speed	STR(AR)	0.270	0.170	0.980	0.011	0.250	1.840	5.030
Return on assets	ROA	0.140	0.120	0.650	-0.240	0.150	0.610	3.520
The ability of managers	MA	0.005	0.009	0.420	-0.400	0.120	-0.030	3.650
financial leverage	LEV	0.540	0.540	0.990	0.096	0.200	-0.053	2.420
Institutional shareholders	INST	57.160	67.490	99.900	0.000	31.280	-0.720	2.150
Independence of the board of directors	IND	0.660	0.600	1.000	0.000	0.180	-0.270	3.190
Sales growth	growth	0.360	0.280	2.870	-0.380	0.500	1.870	9.110
Firm age	Age	3.600	3.660	4.240	2.300	0.370	-0.620	2.690

4.2. Descriptive statistics of the speed of adjustment of commercial credit before and after the outbreak of COVID-19)

The results show that the speed of adjustment of payable trade credit after the COVID-19 period is being adjusted faster. Using the standard deviation of the table, after the spread of COVID-19, there is less dispersion between the speed of adjustment of commercial credit received and paid by companies in the market.

Table 5. The descriptive statistics of the speed of adjustment of commercial credit before and after the outbreak of COVID-19)

Variable	Sign	Mean	median	Max.	Min.	Standard deviation
Payment adjustment speed before COVID-19	STR(AP)	0.460	0.470	0.980	0.053	0.200
Payment adjustment speed after COVID-19	STR(AP)	0.540	0.510	0.980	0.140	0.140
The speed of adjustment received before COVID-19	STR(AR)	0.300	0.160	0.980	0.011	0.290
The speed of adjustment received after COVID-19	STR(AR)	0.200	0.170	0.950	0.011	0.120

4.3. Frequency distribution of years for COVID-19

The disease of COVID-19 is a two-value qualitative variable (0 and 1) whose frequency distribution is presented in the table below.

As shown in Table 6, the number of 393 cases, equivalent to 0.30% of the years during the outbreak of COVID-19, and 917 cases, equivalent to 0.70% of the years, are in the period before the outbreak of COVID-19.

Table 6. Distribution of the frequency of COVID-19

Description	Sign	Value	Frequency	Frequency percentage
Spread of COVID-19)	COVID-19	1.000	393	0.30
No spread of COVID-19	COVID-19	0.000	917	0.70
Total	-	-	1310	100

4.4. Stationary test of variables

According to the results obtained in Table 7, the significance level of the variables in the significance test is less than 5%, indicating the variables' significance.

Table 7. Stationary test (Levin, Lin, and Chu) research variables

Variable	Sign	Test statistic	Significance level	Result
The adjustment speed of commercial credit payable	STR(AP)	-14.935	0.000	Stationary
The adjustment speed of commercial credit receivable	STR(AR)	-13.398	0.000	Stationary
Return on assets	ROA	-8.741	0.000	Stationary
The ability of managers	MA	-10.174	0.000	Stationary
financial leverage	LEV	-13.858	0.000	Stationary
Institutional shareholders	INST	-4.504	0.006	Stationary
Independence of the board of directors	IND	-3.580	0.000	Stationary
Sales growth	growth	-3.402	0.000	Stationary
Firm age	Age	-83.700	0.000	Stationary

4.5. The result of testing the second to fifth research hypotheses

The results presented in Table 8 indicate that COVID-19 has a positive and significant effect on the speed of adjustment of trade payables, with a coefficient of 0.15 and a significance level below 5% (0.0000). Therefore, the second hypothesis of the research is accepted at the 5% error level. Among the control variables, return on assets, institutional investors, and company age show a significant relationship with the dependent variable, with significance levels below 5%.

Furthermore, the interaction of managers' ability with COVID-19 has a positive coefficient (0.41) and a significance level below 5% (0.0002), affecting the speed of adjustment of trade payables. Hence, the third hypothesis of the research is also accepted at the 5% error level. The coefficient of determination (R^2) is 39%, indicating that the independent and control variables in the model explain 39% of the variation in the dependent variable. The Durbin-Watson statistic is 1.65, which lies between 1.50 and 2.50, showing no strong autocorrelation in the residuals. The collinearity statistics are below 5, indicating no severe multicollinearity between the research variables. Additionally, the F-test with a significance level below 5% confirms that the research model fits the data well.

Regarding the adjustment speed of trade receivables (left side of Table 8), COVID-19 has a negative and significant effect on this variable, with a significance level below 5% (0.000). Therefore, the second hypothesis is also accepted at the 5% error level. Moreover, the interaction between managers' ability and COVID-19 significantly affects the speed of adjustment of trade receivables, with a significance level below 5% (0.0046), confirming the fifth hypothesis at the 5% error level.

Among the control variables, company sales growth, company age, and return on assets show a significant relationship with the dependent variable, all with significance levels below 5%. The coefficient of determination (R^2) is 75%, indicating that the independent and control variables explain 75% of the variation in the dependent variable. The Durbin-Watson statistic is 2.10, again showing no significant autocorrelation in the residuals, and the collinearity statistics are below 5, confirming no strong multicollinearity. The F-test, with a significance level below 5%, further confirms that the model fits the data well.

Table 8. The test results of the first and second hypotheses

Variable	The adjustment speed of commercial credit receivable			The adjustment speed of commercial credit payable		
	Coefficients	Significance	VIF	Coefficients	Significance	VIF
COVID-19	0.150	0.000	1.430	-0.027	0.000	1.430
The ability of managers	-0.260	0.000	1.950	-0.012	0.570	1.950
The interaction of managers' ability and COVID-19	0.410	0.000	1.800	-0.085	0.004	1.800
Return on assets	0.140	0.050	2.060	0.100	0.000	2.060
Financial Leverage	0.082	0.110	1.130	0.026	0.130	1.130
Institutional investors	0.002	0.000	1.850	-0.0002	0.470	1.850
Independence of the board of directors	-0.018	0.720	1.070	-0.0005	0.970	1.070
Sales growth	0.014	0.084	1.080	0.008	0.004	1.080
Firm age	-1.820	0.000	1.021	-0.240	0.000	1.021
Intercept	6.600	0.000	-	1.430	0.000	-
AR(1)	-	-	-	0.420	0.000	-
Coefficients of determination		0.390			0.750	
Durbin-Watson		1.650			1.590	
F statistic		5.423			22.551	
Significance level		0.000			0.000	
F-Limmer test	4.300	0.000		9.526	0.000	
Hausman test	9.910	0.000		386.500	0.000	
Serial autocorrelation	43.722	0.000		0.000	544.900	
Variance heterogeneity	201.940	0.000		0.000	136.740	

5. Discussion and conclusion

Deciding on trade credit is one of the most important responsibilities of managers in organizations and companies. Trade credit is a mutual agreement between suppliers and buyers: when a purchase or sale occurs, and payment or receipt is delayed, trade credit is utilized. Considering companies' high cost of capital and the potential risk of being unable to fulfill obligations, trade credit is often a more reasonable method of financing production inputs compared to debt financing. Trade credit is reflected in accounts receivable and accounts payable, representing the supply and demand sides of credit.

Using trade credit is not only a method of financing but also a strategic tool for companies to retain customers and compete in the market. Companies often design marketing strategies to promote the use of trade credit and offer attractive terms to customers to enhance their competitive advantage. However, this strategy entails risks, including potential bad faith from the other party.

In recent years, an additional challenge has emerged with the outbreak of COVID-19. The pandemic has had destructive effects on the global economy: while a few businesses have profited from unique opportunities, many others have suffered recessions due to repeated closures and reduced demand, leading to business shutdowns and job losses. These effects are particularly pronounced in emerging and underdeveloped markets.

In such circumstances, securing external financing has become even more difficult, and companies must rely on alternative financial policies, especially in the short term. Trade credit has emerged as a critical financing mechanism worldwide. As observed in the hypothesis testing, both types of trade credit—payable

and receivable, representing the supply and demand of credit, have been utilized by companies to maximize their short-term financing capacity. To achieve this, companies aim to reach the optimal level of trade credit, and the process of closing the gap between actual and target trade credit is referred to in the literature as the adjustment speed. This adjustment speed indicates how quickly and efficiently a company can optimize its use of trade credit.

During the COVID-19 pandemic, companies increased their demand for trade credit and tried to accelerate the adjustment of commercial credit toward its optimal level to make maximum use of this financing method in a chaotic market. Capable managers played a key role in this process by identifying effective ways to manage trade credit and negotiating contracts with suppliers, acting as problem-solvers during the uncertainty caused by the pandemic.

However, as the hypothesis test results also indicate, credit suppliers were less willing to maximize trade credit provision during this period. They sought to reduce the supply of target trade credit due to market chaos and concerns about companies' ability to meet obligations on time. Furthermore, the rapidly increasing inflation and periodic price fluctuations during the pandemic reduced the affordability and real value of future payments, leading to a decrease in the supply of receivable trade credit. In response, operational policies implemented by competent managers became more influential than financial policies in managing trade credit.

The results regarding the adjustment speed of payable trade credit and its increase during the COVID-19 outbreak are consistent with the findings of Luo (2022), Asif and Nisar (2023), and Abuhommous (2021). However, the observed decrease in the adjustment speed of receivable trade credit contrasts with Luo's (2022) results. To provide a more comprehensive understanding, future research should further investigate this issue, considering different industries and comparing the results with those of the current study.

6. Practical implications

Since there is still no clear outlook for the end of the COVID-19 pandemic and considering the damage it has caused to the global economy, companies can reduce their financial risks by planning their contract policies. By achieving the optimal level of trade credit, creditors can secure their claims, which in turn contributes to commercial stability and prosperity in the capital market.

Owners and major shareholders have sought to employ managers with higher ability and experience in company operations, enabling them to maximize the company's credit capacity and achieve the target trade credit at a faster pace.

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