Araştırma Makalesi / Research Article

Trade Credit Borrowing Amidst the COVID-19 Pandemic: Evidence from Turkish Publicly Traded Firms

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Abstract
This study focuses on the effects of the COVID-19 pandemic on trade credit borrowing among publicly traded Turkish firms. Changes in the amount and duration of trade credit utilized by firms during the pandemic are investigated using panel data analysis, including Difference Generalized Method of Moments (GMM) and Fixed Effects Ordinary Least Squares (FE-OLS) methods. The findings reveal a significant increase in both the amount and duration of trade credit obtained from suppliers amidst the pandemic's economic disruptions. This trend is particularly pronounced among high-debt and low-cash firms, suggesting a heightened reliance on trade credit as a financing mechanism.

Keywords: *Covid-19 pandemic, crisis, trade credit*

Jel Codes*: G30, G31, G32*

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COVİD-19 Sürecinde Firmalararası Kredili İşlemler: Halka Açık Türk Şirketlerinden Kanıtlar

Öz

Bu çalışma, COVID-19 pandemisinin Türkiye'deki halka açık şirketler arasındaki ticari kredi borçlanması üzerindeki etkilerine odaklanmaktadır. Fark GMM ve sabit etki En Küçük Kareler (FE-OLS) yöntemlerini içeren panel veri analizini kullanarak, pandemi sırasında firmaların kullandığı ticari kredinin miktarı ve süresindeki değişiklikler araştırılmıştır. Bulgular, ekonomik dalgalanmaların yaşandığı pandemi sürecinde tedarikçilerden sağlana kredili mal alışlarında ve bu alımların süresinde önemli bir artış olduğunu ortaya koymaktadır. Özellikle, bu eğilimin yüksek borçlu ve düşük nakit rezervine sahip firmalar arasında belirgin olduğu görülmüştür, bu da kredili işlemlere olan bağımlılığın finansman mekanizması olarak arttığını göstermektedir.

Anahtar sözcükler*: Covid-19 pandemisi, kriz, kredili mal alışı*

Jel Kodları*: G30, G31, G32*

1. Introduction

The COVID-19 pandemic has wrought significant delays in global supply chain operations, precipitating a cascade of financial implications for businesses. With manufacturing facilities experiencing closures or reduced capacities due to lockdowns and safety measures, production schedules have been disrupted, leading to delays in product availability (Butt, 2022). Labor shortages, arising from illness, quarantine measures, and transportation restrictions, have further impeded workforce efficiency and contributed to delays (Meier and Pinto, 2020). Transportation challenges, including shipping delays and logistical bottlenecks, have extended lead times and increased costs. Businesses grappling with unpredictable demand patterns and supply chain disruptions have faced inventory management issues, with some dealing with excess stock due to decreased demand and others contending with shortages (Veselovská, 2020). Importantly, the financial repercussions of these delays extend beyond immediate production costs, impacting revenue streams, customer satisfaction, and overall market competitiveness. As companies grapple with the need to adapt and build resilience, there is an ongoing reevaluation of supply chain strategies to mitigate financial risks and foster greater agility in the face of future disruptions (Butt, 2022).

Recent COVID-19 studies show that firms around the globe adopted measures to deal with financial disruptions. Some, for example, turned to equity markets to raise capital by issuing new shares (Halling et al., 2020). Some companies restructured existing debt to improve terms and extend maturities reducing immediate financial pressures, and in some cases, negotiated with creditors for temporary relief or payment deferrals (Haque and Varghese, 2021; Vo et al., 2021; Tarko and Huang, 2023). How did Turkish firms navigate these difficulties? Were they able to access financial assistance from their business partners to mitigate the impacts of cash flow disruptions? These questions are crucial for understanding the unique challenges faced by Turkish businesses during the pandemic and the effectiveness of support mechanisms in place.

Trade credit (TC) from business partners plays a crucial role in companies' financial strategies, serving as a vital source of working capital support. Particularly valuable for firms facing periodic cash flow challenges, TC acts as a short-term financing tool (Abdulla et al., 2017). It enables businesses to defer immediate cash outflows, thereby preserving liquidity. This flexibility is especially beneficial for companies with significant growth opportunities but constrained cash flow, allowing them to meet operational needs without jeopardizing financial stability (Tingbani et al., 2022). Moreover, TC offers flexibility and convenience that traditional financing options may lack (Carbo-Valverde et al., 2016). Negotiable payment terms, such as extended periods or early payment discounts, provide businesses with customizable financial tools tailored to their unique needs (Abdulla et al., 2017). By leveraging these advantages, businesses can effectively manage their cash flow and maintain financial health.

The TC borrowing policies of Turkish firms during the COVID-19 pandemic are examined in this study. Specifically, changes in firms' borrowing levels during this period are investigated. Initially, the borrowing behavior of the entire sample was analyzed. However, the focus was subsequently narrowed to financially vulnerable firms, such as those experiencing liquidity shortages and depleted debt capacity prior to the pandemic. To ensure robustness, the duration of borrowing is analyzed, a critical aspect of borrowing policies. The primary methodology involves the difference GMM, which is recommended for addressing the persistence structure in the dependent variable while mitigating endogeneity and firm heterogeneity issues (e.g., Ahmad et al., 2018; Bussoli and Marino, 2018). Additionally, for methodological robustness, unit FE-OLS estimations are conducted.

This study contributes to the existing literature by filling the gap in understanding the role of TC during the COVID-19 pandemic, characterized by unprecedented disruptions in global supply chains and financial markets. Previous research has explored TC's alternative financing role, aligning with

the Pecking Order Financing Theory (Abdulla et al., 2017) and the Financing Advantage Theory (Tingbani et al., 2022). Furthermore, TC's significance has been extensively discussed, notably during times of economic hardship such as the 1997 Korean financial crisis (Hyun, 2017), the 2001 currency crisis (Bastos and Pindado, 2013), and the mortgage crisis (Altunok et al., 2020). However, its specific role during the recent pandemic remains underexplored. By focusing on TC borrowing policies of publicly traded Turkish firms during the pandemic, this study offers valuable insights into how firms adjusted their financing strategies amid the crisis. The findings reveal significant increases in the amount and duration of trade credit utilized by firms during the pandemic. Particularly noteworthy is the heightened reliance on TC as a financing mechanism, especially among firms with high debt and low cash reserves, underscoring its role as an alternative funding source during crises. Overall, this research contributes to our understanding of firms' financial strategies in times of economic upheaval.

The rest of this study is as follows: the next section covers related studies, Section III describes the methodology and data used in the empirical analysis, the fourth section presents the findings, and the fifth section concludes the study.

2. Theoretical Background

The Financing Advantage Theory (Meltzer, 1960; Nadiri, 1969; Schwart, 1974) suggests that TC, provided by suppliers, gives firms a competitive edge by acting as a form of financing. This theory argues that trade credit offers several benefits over traditional financing like bank loans or equity financing. Firstly, it often costs less, with suppliers sometimes offering credit at lower interest rates or even interest-free. Additionally, trade credit provides flexibility in payment schedules, which suits firms' cash flow needs. Its accessibility is another advantage, especially for small and medium-sized enterprises (SMEs) or those with limited credit history. Moreover, trade credit strengthens relationships between buyers and suppliers, encouraging ongoing business partnerships. It also helps mitigate transaction risks by allowing buyers to inspect goods before payment.

TC, as a source of funding, is also related to the Pecking Order Theory of Financing (Myers and Majluf, 1984), which suggests that firms have a preferred hierarchy when it comes to financing. According to this theory, firms prioritize financing sources in a specific order due to asymmetric information, aiming to minimize costs and optimize their capital structure. Firms seek to cultivate close business partnerships for long-term loyalty, often by initiating programs designed to foster such relationships (Russo et al., 2016; Vanpoucke et al., 2017). This emphasis is particularly evident in relationships promising substantial future business opportunities. Unlike the

relatively impersonal dynamics often observed in interactions between banks and firms, where information asymmetry can hinder effective borrowing and lending, business partnerships thrive on mutual trust and transparency. These partners typically have a better understanding of each other's operations, financial health, and business practices (Smith, 1987; Petersen and Rajan, 1997). Through ongoing collaboration and shared goals, they engage in trade with reduced information asymmetry, facilitating smoother transactions and fostering stronger ties over time. Hence, in business-to-business relationships, mutual trust and transparency are more prevalent, significantly decreasing the likelihood of information asymmetry between the parties (Viswanathan et al., 2017; Yuan et al., 2020).

3. Hypotheses

Since Meltzer's (1960) seminal work, numerous studies have revealed empirical evidence supporting the notion that TC is taken advantage of by financially constrained firms. The concept suggests that these firms may resort to their suppliers for financial support during challenging periods. Several studies, including those by Bastos and Pindado (2013), McGuinness et al. (2018), and Carbo-Valverde et al. (2016), found that firms facing difficulties in securing bank financing tend to increase their demand for TC from suppliers during economic downturns. Love et al. (2007) investigated this issue using data from firms in emerging markets and their findings align with the redistribution perspective. Consequently, TC provided by suppliers assists buyers in navigating critical periods and sustaining their operations (McGuinness et al., 2018). Bastos and Pindado (2013) examined TC financing among manufacturing firms across emerging economies in the early 2000s, revealing that post-crisis, firms tend to depend more on TC. Similarly, Garcia-Appendini and Montoriol-Garriga (2013) observed that during the 2008 financial crisis, firms with adequate liquidity to withstand TC provision increased their supply. Lin and Chou (2015) concentrated on Chinese firms' preferences for TC versus bank financing during the 2008 crisis, noting a negative correlation between bank credit and TC demand, suggesting firms increasingly view partners as working capital fund sources. Yang (2011) analyzes quarterly data from US manufacturing firms during the subprime mortgage crisis, discovering TC's substitutive role for bank financing, with financially weak firms reducing TC provision while seeking more from suppliers. McGuinness et al. (2018) scrutinize European SME financing patterns, asserting TC significantly boosts survival odds during crises. Hence, we expect that;

H1: Firms increase borrowing from their suppliers during the pandemic.

TC is a close substitute for short-term funding (Islam et al., 2022), therefore, firms with low liquidity can potentially harness TC to navigate financial challenges and sustain operations. Flexible payment options or longer credit periods can help ensure a steady supply of essential materials or services (Chen et al., 2023). Concurrently, optimizing inventory management practices can minimize the need for immediate cash outflows, thereby conserving working capital (Ahmad et al., 2018). Therefore;

H2: Firms experiencing liquidity constraints before the pandemic tend to increase borrowing from their suppliers during the pandemic.

The link between commercial loans from financial institutions and TC appears to differ from case to case. In certain instances, it has been demonstrated that borrowing from banks and suppliers is positively correlated (e.g., Andrieu et al., 2018; Del Gaudio et al., 2021), indicating that they complement each other. However, in some studies (e.g., Carbo-Valverde et al., 2016; Abdulla et al., 2017), it has been reported that TC is negatively correlated to bank financing, suggesting that TC serves as a substitute for bank financing. The current evidence regarding the relationship between financial debt and TC is mixed. We are not committed solely to investigating this link; instead, our primary interest lies in understanding the characteristics of firms that utilized TC from suppliers during the pandemic. During such challenging times, firms that have already reached their borrowing limits are likely to turn to alternative sources for funding to avoid excessive leverage.

H3: Firms with high financial leverage before the pandemic tend to increase borrowing from their suppliers during the pandemic.

4. Data and Methodology

4.1. Data

Quarterly data from publicly traded Turkish firms is utilized in the empirical investigation. This data is retrieved from DataStream. The data period covers from the first quarter of 2010 to the third quarter of 2023. Our raw sample included approximately 650 firms from 14 industries. However, we trimmed one percent from each end of the variables that entered the regressions, leaving us with 11,604 observations from 382 firms. This sample includes all nonfinancial, non-holding firms (both active and passive).

Table 1. Descriptive statistics

INFORMATION AND COMMUNICATION						
Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.4914037	.2927114	.1219717	2.4856	253	6
TC growth	.0184172	.1708756	-1.392285	1.006177	253	6
Duration	270.7664	154.5403	51.04445	810.6507	253	6
Tangible	4.50232	2.993498	.157993	19.07166	253	6
Size	21.07881	2.459135	17.15906	24.87079	253	6
ROA	.0616252	.2031409	-.6911644	.5313076	253	6
Liquidity	.7409057	.7722134	.003666	4.231901	253	6
Debt	1.504009	.7203151	.2832	4.82424	253	6
ELECTRICITY, GAS, AND WATER						
Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.5463344	.4715592	0	3.539667	466	30
TC growth	.0637793	.2367718	-1.168498	1.498684	466	30
Duration	251.8622	244.7314	4.114048	1288.853	466	30
Tangible	12.87515	14.77097	.0549823	149.0129	466	30
Size	21.80272	1.60857	17.31285	24.93828	466	30
ROA	.2116299	.2176871	-.9907186	.8351063	466	30
Liquidity	.5179725	.7573884	.0040007	7.43094	466	30
Debt	2.616503	1.866597	.243866	11.08925	466	30
EDUCATION, HEALTH, SPORTS, AND OTHER SOCIAL ACTIVITIES						
Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.8992012	.57124	0	3.65117	244	9
TC growth	.0837151	.314397	-.8835787	1.717183	244	9
Duration	327.8751	213.7637	12.131131	907.899	244	9
Tangible	3.617756	2.491548	.0892612	12.47483	244	9
Size	20.26905	1.218031	17.92983	23.22096	244	9
ROA	-.0602382	.3274768	-.9913806	.8433275	244	9
Liquidity	.2603098	.3594723	.0023149	2.248697	244	9
Debt	3.801303	2.627285	.2304538	11.34682	244	9
REAL ESTATE						
Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	1.043519	1.455704	.1248053	8.920881	80	3
TC growth	.0228435	.270279	-.9983419	1.458426	80	3
Duration	455.0702	1006.231	105.41	1585.079	80	3
Tangible	28.76818	36.9258	.1800378	140.489	80	3
Size	19.81902	1.245667	17.12772	22.33328	80	3

ROA	.118402	.4045054	-1.04161	.8308297	80	3
Liquidity	.9684381	1.737694	.0151214	7.602685	80	3
Debt	2.537826	2.700852	.2482564	11.39425	80	3

MINING AND QUARRYING

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.2647906	.2547997	.0226137	1.498773	199	6
TC growth	.0173759	.1488772	-.7789606	.8184519	199	6
Duration	158.1419	198.4466	12.61856	599.555	199	6
Tangible	4.93739	8.098128	.1133791	69.99266	199	6
Size	21.09408	1.564534	17.17311	23.65544	199	6
ROA	.3129794	.2700766	-.8133963	.7387785	199	6
Liquidity	3.287207	2.597553	.0039585	7.660239	199	6
Debt	1.077028	.8868884	.2825383	7.153186	199	6

PROFESSIONAL, SCIENTIFIC, AND TECHNICAL ACTIVITIES

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.6324147	.4746946	.0476975	2.00921	61	4
TC growth	.170322	.3640333	-.7602015	1.547525	61	4
Duration	329.5805	196.4573	26.0815	758.9924	61	4
Tangible	1.129166	1.327091	.1188817	7.882397	61	4
Size	19.33232	1.90879	16.16438	22.86502	61	4
ROA	.1228974	.1446279	-.3914515	.4204075	61	4
Liquidity	.5021384	.3822699	.0074019	1.444073	61	4
Debt	1.755213	1.138591	.2538056	6.161682	61	4

HOTELS AND RESTAURANTS

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.5029087	.3935592	.0000618	2.311085	212	13
TC growth	.056873	.2970587	-1.172393	1.715565	212	13
Duration	238.729	187.729	1	1097.723	212	13
Tangible	28.5092	34.98226	.3714581	150.2859	212	13
Size	18.884	1.382007	16.17841	23.14286	212	13
ROA	.0226136	.4042668	-1.037234	.6966405	212	13
Liquidity	.7077105	1.352276	.0015971	7.582279	212	13
Debt	2.628072	2.377874	.2429944	11.24528	212	13

AGRICULTURE, FORESTRY, AND FISHERIES

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	1.026167	.4986524	.0754219	3.198539	73	3
TC growth	.0882806	.2787394	-.6734253	1.255637	73	3
Duration	492.7314	196.7906	182.52898	1090.918	73	3

Tangible	5.891703	2.948216	.3317823	13.53822	73	3
Size	17.78318	.9903927	16.6139	20.94795	73	3
ROA	.1813796	.2117115	-.3084642	.7010689	73	3
Liquidity	.4729736	.626296	.0023065	3.065769	73	3
Debt	2.067181	1.178183	.2676707	7.788141	73	3

TECHNOLOGY

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.50515	.3614562	.013751	3.291228	780	33
TC growth	.032222	.2019643	-.8352566	1.220447	780	33
Duration	285.982	420.8698	13.900717	2010.903	780	33
Tangible	1.68986	1.96885	.0259078	15.01114	780	33
Size	19.81514	1.635683	16.3275	24.80709	780	33
ROA	.1365848	.1743489	-.6432765	.7332327	780	33
Liquidity	.649978	.9341338	.0044578	7.475042	780	33
Debt	1.437354	.9327215	.2367378	6.313807	780	33

WHOLESALE AND RETAIL TRADE

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.7602983	.7974326	.0201419	9.804327	720	24
TC growth	.0522191	.2056927	-1.815097	1.569442	720	24
Duration	354.0001	677.5244	7.754725	654.44	720	24
Tangible	1.402958	3.673317	.0585172	64.12485	720	24
Size	21.07198	1.639164	16.17509	24.77091	720	24
ROA	.0358983	.107126	-.9046296	.498826	720	24
Liquidity	.2550691	.3854502	.0015889	6.246418	720	24
Debt	1.273583	1.201015	.2282579	11.49243	720	24

TRANSPORTATION AND STORAGE

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.3552679	.2403034	0	1.277222	279	10
TC growth	.0310199	.1229251	-.3544813	.9554191	279	10
Duration	178.1705	109.877	4.172299	542.9772	279	10
Tangible	5.627698	6.577956	.0380219	46.83702	279	10
Size	21.05128	1.620383	18.38958	24.8912	279	10
ROA	.1479607	.2033291	-.7216008	.7352749	279	10
Liquidity	.7073282	.8239527	.0020927	6.188301	279	10
Debt	2.086971	1.706242	.2343358	11.03993	279	10

ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.5845409	.4012904	.041665	2.047481	107	8

TC growth	.0358212	.3952518	-1.957153	.8201484	107	8
Duration	315.9413	246.6466	54.39961	947.218	107	8
Tangible	2.977378	4.240618	.0279366	29.39077	107	8
Size	19.00076	1.730633	16.27215	22.31307	107	8
ROA	.1645688	.3125042	-.7132462	.7404882	107	8
Liquidity	.6469292	.9179771	.0020974	4.568125	107	8
Debt	2.04192	1.609961	.3172098	11.51816	107	8

MANUFACTURING

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.665828	.4624607	0	4.927068	7813	222
TC growth	.0444292	.2233011	-1.739219	2.222413	7813	222
Duration	317.1017	231.0617	2.490894	1749.491	7813	222
Tangible	2.704153	3.308843	.032124	77.00397	7813	222
Size	20.09515	1.707688	16.15695	24.92685	7813	222
ROA	.0989461	.1468445	-1.009665	.8373472	7813	222
Liquidity	.3773556	.5020257	.0015667	6.713052	7813	222
Debt	1.813447	1.217736	.2260475	11.43331	7813	222

CONSTRUCTION AND CIVIL ENGINEERING

Variable	Mean	Std. dev.	Min	Max	Observations	Firms
TC	.7019893	.6891346	.0225731	7.481514	317	11
TC growth	.0568452	.264878	-1.190734	1.174222	317	11
Duration	316.8355	263.6573	19.7865	1280.723	317	11
Tangible	8.117585	12.93957	.0515143	100.5264	317	11
Size	20.17876	2.069171	16.42588	24.86455	317	11
ROA	.1559721	.2391945	-.9938182	.728743	317	11
Liquidity	.5595549	.553798	.002288	3.051044	317	11
Debt	2.824094	2.114682	.297744	11.55314	317	11

The data is collected from DatasStream. All relevant variables are normalized by net sales. Total assets are in natural logarithmic form and duration represents the days of trade debt outstanding.

Our sample consists of 382 firms from 14 industries, with 222 of those being from manufacturing, and the rest spread across 13 other industries. Firms in developing economies tend to rely more on alternative financing instruments due to the lack of a well-developed financial system (Fisman and Love, 2003). Accordingly, Turkish firms heavily rely on TC, with borrowing ratios fluctuating between less than 1 percent and a little over 100 percent of quarterly sales. Among industries, firms in real estate and mining and quarrying exhibit the highest and lowest average TC borrowing rates, at 104 percent and 26 percent of quarterly sales, respectively, while the average borrowing rate for the sample is 54 percent. However, notable variations in TC borrowing rates are observed both within and across industries, ranging

from approximately one percent to over 100 percent of sales. It is considered that this variability may be attributed to factors beyond industry dynamics.

4.1.1. The Dependent Variable

The impact of the pandemic is investgigated by focusing on quarterly growth in TC. The growth rate is calculated as follows:

$$TC\ GR = \frac{TC_t - TC_{t-1}}{Sales_{t-1}}$$

This formulation allows identifying changes in firms' borrowing behavior during the pandemic. In some of the early studies (e.g., Abdulla et al., 2017; Harris et al., 2019), the TC variable was also used in relation to assets. However, it is considered that using it in relation to sales is more insightful given the adverse effects of the pandemic on sales. Furthermore, this preference is also consistent with previous studies (e.g., Love et al., 2007; Garcia-Appendini and Montoriol-Garriga, 2013; Hyun, 2017). Firms' borrowing policies involve both the amount borrowed and the duration of credit, i.e., the time taken to repay debt. If firms seek support from suppliers to mitigate pandemic-related challenges, we expect them to increase both their borrowing amount and borrowing duration. Therefore, for robustness, we analyze the changes in borrowing duration as the alternative dependent variable, as firms may have sought extensions on payment periods to manage disruptions in cash flow triggered by the pandemic. Borrowing duration is represented as the natural logarithm of the number of days it takes for firms to pay outstanding trade debt.

$$\mathrm{Dur} = \mathrm{Log}(Days)$$

Quarterly changes in credit duration is calculated as follows:

$$\mathrm{Dur\ Gr} = \mathrm{Log}(\mathrm{Dur_t}) - \mathrm{Log}(\mathrm{Dur_{t-1}})$$

In previous studies (e.g., Ferrando and Mulier, 2013; Long et al., 1993; Niskanen and Niskanen, 2006; Oh and Kim, 2016), TC and the duration variables are used in their original form rather than in terms of growth rates. While the traditional form of TC is also considered, the difference between the coefficients was found to be negligible. However, utilizing quarterly changes in TC rather than its level better reflects the effects of the pandemic.

4.1.2. Independent Variables

How much companies rely on their suppliers for assistance in coping with the negative impacts of the pandemic is investigated by estimating the effects of the COVID period on the growth of TC borrowing, as shown by Equation (1).

$$TC\ GR_{it} = \alpha + \ covid_t + X_{it-1} + \ \mu_i + \mathcal{E}_{it} \qquad (1)$$

Where TC GR represents the quarterly growth in the amount of borrowed TC in firm i at quarter t. The changes in the duration of TC are also incorporated for robustness analysis. Our key variable of interest is labeled $covid_t$, a dummy variable that takes the value of 1 during specific quarters: 2020 Q2, Q3, Q4, and 2023 Q1, and 0 otherwise. In Turkey, official closures began on April 10, 2020. However, the severity of these measures persisted until a significant portion of the population was vaccinated in the second quarter of 2021. During this transitional period, firms that were unprepared, particularly in terms of liquidity (e.g., low liquid assets) and had already exhausted their financial debt capacity, likely faced greater challenges. To identify these vulnerable firms, we create dummy variables. The first variable is named $covid\_cash_i$, and set to 1 for companies with a liquid assets ratio below 0.10, and 0 otherwise. The second dummy variable is $covid\_debt_i$, which takes the value of 1 for firm whose short-term debt ratio exceeds 4 when scaled by sales before and during the pandemic and 0 otherwise. While these thresholds may seem arbitrary, they represent the first quartile of liquid assets and the fourth quartile of short-term debt for all firms, respectively.

4.1.3. Control Variables

X_{it-1}in Equation (1) represents the control variables adopted from the previous studies. Firm size (Kestens et al., 2012), denoted by size, fixed assets, denoted by tangible (McGuinness and

Hogan, 2016), liquid assets (Paul and Boden, 2008), denoted liquid, short-term borrowing, denoted by debt (Kestens et al., 2012), operating profitability (Abdulla et al., 2017), denoted by ROA are the explanatory variables used in the analysis. While the size variable is measured via the natural logarithm of total assets, the rest of the variables are normalized by sales as shown in Table 2.

Table 2. Variable descriptions

Acronym	Calculation
Dependent variables	
TC GR	$(TC_{it} - TC_{it-1})/\text{Sales}_{it}$
Dur GR	$\text{Log(Account payable days}_{it})$- $\text{Log(Account payable days}_{it-1})$
Explanatory variables	
Tangible	$Fixed\ Assets_{it}/\text{Sales}_{it}$
Size	$\log(\text{Total asset})_{it}$
ROA	$Operating\ Profit_{it}/\text{Sales}_{it}$
Liquidity	$Cash\ and\ Cash\ Equivalents_{it}/\text{Sales}_{it}$
Debt	$Short\ term\ Financial\ dDebt_{it}/\text{Sales}_{it}$
Covid	=1 if t=Q1, Q2, Q3, and Q4 in 2020, 0 otherwise.

Low_cash	=1 if Liquidity < 0.10, 0 otherwise
Covid_cash	Covid* Low_cash
High_debt	=1 if Debt> 4 , 0 otherwise
Covid_debt	Covid* High_debt

The table illustrates the essential variables and their corresponding calculations employed in regression estimations.

It is expected that firm size (Size) be positively associated with TC borrowing as larger firms may have greater bargaining power and credibility, potentially allowing them to negotiate larger amounts of trade credit with suppliers. Fixed assets (Tangible) variable is likely to affect TC borrowing positively because firms with higher levels of fixed assets may be viewed as more stable and creditworthy by suppliers, leading to increased access to trade credit. On the other hand, firms with higher levels of liquid assets indicate greater financial flexibility and ability to manage short-term obligations, potentially reducing the need for trade credit borrowing and therefore, are likely to demand less TC.

Substantial empirical evidence (e.g., Atanasova and Wilson, 2003; Aktaş et al., 2012) suggests that TC is a substitute for short-term bank loans, implying that firms with higher levels of short-term borrowing may have limited access to traditional financing sources, leading them to rely more heavily on trade credit for working capital needs. As for ROA, it is expected that profitability may signal financial health and stability, potentially reducing the reliance on trade credit as a source of financing.

4.2. Methodology

Firms often maintain consistent purchasing patterns to sustain operational continuity, ensuring they have the necessary resources like raw materials and inventory to meet production or service demands (Ahmad et al., 2018). Relatively predictable demand patterns, supplier relationships, and stable market conditions are likely to contribute to this persistence. Strong partnerships with reliable suppliers and the formulation of financial strategies aimed at optimizing cash flow and capital management further reinforce persistency in credit purchases. Collectively, these factors shape firms' purchasing behavior, fostering persistency in their credit transactions over time. To account for the persistent structure in the credit purchases one-lagged dependent variable was added to the model as shown below.

$$TC\ GR_{it} = \alpha + TC\ GR_{it-1} + covid_t + X_{it-1} + \mu_i + \mathcal{E}_{it} \qquad (2)$$

Equation (2) incorporates a lagged dependent variable into the explanatory framework to capture the persistent patterns in growth rates over time (e.g., Bussoli and Marino, 2018). However, this can introduce endogeneity, indicating a potential correlation between error terms and the lagged dependent variable. The difference GMM is utilized as the main

estimation technique because it enables the use of instruments derived from lagged and differenced endogenous variables. They are strongly related to the main variables while maintaining independence from error terms (Arellano and Bond, 1991). Other regressors are assumed to satisfy the exogeneity condition and are used in their original levels as instruments for themselves. This empirical approach effectively mitigates endogeneity concerns and ensures the reliability of the empirical analysis. Another advantage of this methodology is that it addresses the effects of unobserved firm heterogeneity on the dependent variable by differencing variables.

During GMM estimation, several tests are conducted to validate the results. One such test evaluates second-order serial correlation, typically known as AR(2). It's necessary for this test not to reject the null hypothesis of no autocorrelation, as serial correlation in residuals can lead to biased coefficient estimates. Additionally, the Hansen test examines whether instruments are uncorrelated with error terms, serving as a crucial check on instrument validity. Insights from both the AR(2) and Hansen tests guide the selection of an appropriate lag structure. Roodman (2009) suggests using the earliest lags that satisfy the orthogonality condition. Therefore, we use t-2 due to its potential for a stronger correlation with the original variable. Importantly, the instrument set meeting these criteria may differ across regressions. Multiple lags were utilized, with the furthest lag considered being t-3. For methodological robustness, fixed panel fixed effect OLS estimation of Equation (1) without the lagged dependent variable was also conducted. This method also enables dealing with unobserved firm-specific effects by demeaning the variables. All continuous variables are entered in the estimation once lagged to avoid endogeneity.

5. Empirical findings

5.1. Demand for TC

The results from the regression estimation of Equation (1) are presented in Table 2. This analysis focuses on the changes in the amount of TC, attempting to reveal the degree to which firms rely on suppliers in times of COVID-19. Our key variables are Covid, Covid_cash, and Covid_debt. The coefficients for the first variable, obtained from GMM analysis, are 0.102, 0.101, and 0.108 in the first, fourth, and fifth columns of the table, respectively. These coefficients are statistically significant at the 1 percent level and suggest that during the pandemic, firms significantly (approximately 10%) increased their borrowing from suppliers. FE-OLS analysis produces similar coefficients, ranging from 0.033 in the tenth column to 0.036 in the sixth column. These coefficients are also positive and statistically highly significant.

Table 3. Demand for TC during the COVID-19

	1	2	3	4	5	6	7	8	9	10
$TC\ GR_{it-1}$	.086**	.076**	.091**	.076**	.091**					
	(.035)	(.035)	(.035)	(.035)	(.035)					
Tangible	.015***	.015***	.014***	.015***	.014***	.004***	.004***	.004***	.004***	.004***
	(.004)	(.004)	(.004)	(.004)	(.004)	(.000)	(.000)	(.000)	(.000)	(.000)
Size	-.83***	-.82***	-.83***	-.82***	-.83***	-.06***	-.062***	-.062***	-.062***	-.062***
	(.085)	(.085)	(.085)	(.085)	(.085)	(.009)	(.009)	(.009)	(.009)	(.009)
ROA	.046***	.045***	.045***	.045***	.045***	-.015	-.015	-.015	-.015	-.015
	(.014)	(.014)	(.014)	(.014)	(.014)	(.022)	(.022)	(.022)	(.022)	(.022)
Debt	-.013	-.013	-.013	-.013	-.013	.002	.002	.002	.002	.002
	(.262)	(.262)	(.262)	(.262)	(.262)	(.004)	(.004)	(.004)	(.004)	(.004)
Liquidity	.054***	.054***	.052***	.054***	.052***	.009***	.009***	.009***	.009***	.009***
	(.014)	(.014)	(.014)	(.014)	(.014)	(.002)	(.002)	(.002)	(.002)	(.002)
Covid	.102***			.101***	.108***	.036***			.036***	.033***
	(.029)			(.029)	(.027)	(.007)			(.007)	(.007)
Covid cash		.412***		.412***			.245***		.244***	
		(.102)		(.102)			(.041)		(.041)	
Covid debt			.301***		.301***			.176***		.159***
			(.092)		(.092)			(.012)		(.012)
#firms	354	354	354	354	354	372	372	372	372	372
#obs	10,030	10,030	10,030	10,030	10,030	10,727	10,727	10,727	10,727	10,727
AR (1)	0.000	0.000	0.000	0.000	0.000					
AR (2)	0.432	0.428	0.424	0.433	0.424					
Hansen	0.865	0.860	0.858	0.860	0.858					
R^2						0.046	0.046	0.046	0.046	0.046

The table displays the differences between GMM and FE-OLS estimations of Equation (1). Robust standard errors are in parentheses. TC GR represents the growth in TC, tangible denotes tangible assets, ROA signifies operating profit, debt indicates short-term debt, and liquidity refers to cash and cash equivalents. All variables are scaled by net sales. Size represents the natural logarithm of total assets. Covid is the dummy variable for the COVID period, while Covid_cash and Covid_debt are dummy variables for low-cash and high-debt firms prior to the pandemic. ***, **, and * indicate statistical significance levels at 1%, 5%, and 10% respectively.

Our second and third key variables, Covid_cash and Covid_debt, represent the behavior of firms that had little cash and a high volume of short-term debt before the pandemic, respectively. The Covid_cash variable receives coefficients of 0.412 in the second and third columns of the table. They are both positive and significant, suggesting that firms with little cash before the pandemic borrowed more from their suppliers than the rest of the sample. The coefficients for the Covid_debt variable are 0.301, displayed in the third and fifth columns of Table 2. They indicate that firms with sizable amounts of short-term debt during the pandemic borrow 30.1 percent more TC than the average firm in the sample. These findings are supported by the outcomes of OLS regressions, presented in columns seven through ten. While the coefficients for Covid_cash are 0.245 and 0.244 in the seventh and ninth columns, for Covid_debt they are 0.176 and 0.159 in the seventh and tenth columns of the table, respectively. The coefficients for the key variables produced from both analyses are statistically highly significant. Their magnitude suggests that firms receive noteworthy support from their partners during times of economic difficulty.

5.2. Robustness Check: The Duration of Borrowing TC

TC includes borrowing a certain amount of goods and services for a period of time. To enhance the reliability of our findings, we conducted additional estimations where the duration of credit borrowed was used to replace TC. If firms indeed rely on their partners to deal with the consequences of the pandemic, they are very likely to demand an extension in the duration of the credit they receive. This is particularly relevant because due to the shutdowns, firms may have had difficulties in liquidating the borrowed inventory, causing disruptions in cash flows and delays in payments.

We estimate the effects of the pandemic on quarterly changes in the duration of TC borrowed, denoted by Dur GR, and present the findings in Table 3. The first key variable, Covid, has coefficients of 0.685, 0.648, and 0.686 in the first, fourth, and fifth columns of the table. The coefficients from the OLS estimations are 0.128 and 0.129, exhibited in the sixth, ninth, and tenth columns. Although the magnitude of the coefficient differs significantly across the methodologies, it is found that both sets of coefficients are highly significant and suggest that firms extend the duration of the TC borrowing during the pandemic.

Table 4. Extensions in the duration of TC during the COVID-19

	1	2	3	4	5
$Dur\ GR_{it-1}$	-.003	-.003	-.003	-.003	-.003
	(.075)	(.075)	(.075)	(.075)	(.075)
Tangible	.003	.003	.003	.003	.003
	(.004)	(.004)	(.004)	(.004)	(.004)
Size	-.33***	-.33***	-.33***	-.33***	-.33***
	(.095)	(.095)	(.095)	(.095)	(.095)
ROA	-.24***	-.24***	-.24***	-.24***	-.24***
	(.074)	(.074)	(.074)	(.074)	(.074)
Debt	-.28***	-.28***	-.28***	-.28***	-.28***
	(.022)	(.022)	(.022)	(.022)	(.022)
Liquidity	-.029**	-.029**	-.029**	-.029**	-.029**
	(.014)	(.014)	(.014)	(.014)	(.014)
Covid	.685***			.648***	.686***
	(.078)			(.078)	(.072)
Covid _cash		.185***		.184***	
		(.052)		(.052)	
Covid _debt			.345***		.346***
			(.100)		(.100)
# firms	342	342	342	342	342

#obs	9,038	9,038	9,038	9,038	9,038
AR (1)	0.000	0.000	0.000	0.000	0.000
AR (2)	0.132	0.174	0.151	0.171	0.148
Hansen	0.016	0.021	0.033	0.027	0.030
R^2					

Table 4. Extensions in the duration of TC during the COVID-19 (continued)

	6	7	8	9	10
$Dur\ GR_{it-1}$					
Tangible	-.001	-.001	-.001	-.001	-.001
	(.000)	(.000)	(.000)	(.000)	(.000)
Size	-.011***	-.011***	-.011***	-.011***	-.011***
	(.002)	(.002)	(.002)	(.002)	(.002)
ROA	-.120***	-.120***	-.120***	-.120***	-.120***
	(.042)	(.042)	(.042)	(.042)	(.042)
Debt	-.029***	-.029***	-.029***	-.029***	-.029***
	(.008)	(.008)	(.008)	(.008)	(.008)
Liquidity	.078***	.078***	.078***	.078***	.078***
	(.008)	(.008)	(.008)	(.008)	(.008)
Covid	.128***			.128***	.129***
	(.012)			(.012)	(.012)
Covid cash		.099***		.099***	
		(.021)		(.044)	
		.468***		.469***	
			(.092)		(.092)
# firms	350	350	350	350	350
#obs	9,679	9,679	9,679	9,679	9,679
AR (1)					
AR (2)					
Hansen					
R^2	0.078	0.078	0.078	0.078	0.078

The table displays the differences between GMM and FE-OLS estimations of Equation (1). Robust standard errors are in parentheses. TC GR represents the growth in TC, tangible denotes tangible assets, ROA signifies operating profit, debt indicates short-term debt, and liquidity refers to cash and cash equivalents. All variables are scaled by net sales. Size represents the natural logarithm of total assets. Covid is the dummy variable for the COVID period, while Covid_cash and Covid_debt are dummy variables for low-cash and high-debt firms prior to the pandemic. ***, **, and * indicate statistical significance levels at 1%, 5%, and 10% respectively.

Covid_cash has coefficients of 0.185 and 0.184 from the GMM estimation displayed in the second and fourth columns and 0.099 from the OLS estimation showcased in the sixth and ninth columns. Finally, the Covid_debt variable receives coefficients of 0.345 and 0.346 from the GMM estimation and 0.468 and 0.469 from the OLS estimations. In both cases, the coefficients are statistically significant at the 1 percent level and suggest that firms lacking sufficient liquidity and firms exhausting short-term borrowing capacity, extend the duration of credit they receive from their business partners.

6. Conclusion

6.1. Summary and Discussion

This study focuses on firms' TC policies during the COVID-19 pandemic. To this end, panel data regression analyses of data from publicly traded Turkish firms were conducted. While the direct effects of the pandemic on all firms were explored, particular focus was given to low-cash and high-debt firms to observe the degree of support received from business partners in dealing with the adverse effects of the pandemic. Consistent with expectations, it was found that firms had increased their demand for TC and extended the duration of their borrowing despite a large portion of the firms reporting a decline in sales volume. However, this increase was more pronounced in low-cash and high-debt firms.

The COVID-19 pandemic affected some firms more than others. Nevertheless, companies demonstrated a range of similar financing responses to cope with the economic challenges (Klökner et al., 2023). Consistent with our findings, the literature indicates that many firms increased their borrowing to maintain liquidity and manage cash flow amidst periods of reduced revenue, often by drawing down on existing credit lines and securing new loans (Pagano and Zechner, 2022). In instances where traditional funding avenues were inaccessible, some firms turned to peer-to-peer funding sources to bridge their financial gaps (Najaf et al., 2022). Government assistance programs, such as the Paycheck Protection Program in the United States and analogous initiatives globally, played a crucial role in providing support through forgivable loans, grants, and subsidies (Dalton, 2023). To further conserve cash, businesses adopted various cost-cutting measures, including layoffs, salary reductions, suspension of dividend payments, and the postponement or cancellation of non-essential capital expenditures (Krieger et al., 2021; Cheema-Fox et al., 2021). Previous studies portray the adaptive strategies firms employed to navigate the economic landscape brought about by the pandemic. Our finding that companies turn to their suppliers for financial support during COVID-19, aligns with the broader trends observed in the literature.

It is assessed that such critical support can be explained via the sellers' intention to maintain and even enhance their existing relationships in the future. By offering TC, a company allows its customers or business partners to make purchases on credit terms. This approach is likely to facilitate transactions, promote ongoing sales, and build a positive, long-term rapport with customers (Pike et al., 2005). This argument, although not directly tested, has found credible support in the literature (e.g., Summers and Wilson, 2002; Pike et al., 2005). By offering TC, suppliers provide buyers with a flexible payment arrangement, allowing them to manage their

finances more effectively and continue their operations. This can help maintain a steady flow of business between the two parties, fostering trust and loyalty in the relationship. Furthermore, extending TC during challenging times can demonstrate a supplier's commitment to supporting their buyers through difficult circumstances. This can strengthen the bond between the two parties and potentially lead to long-term partnerships (Garcia-Appendini and Motorial-Gorriga, 2013).

Suppliers offering favorable credit terms contribute to strengthened partnerships, potentially leading to preferential treatment, improved pricing, and collaborative opportunities (Fabbri and Klapper, 2016). For businesses, especially those in their early stages or facing financial constraints, TC serves as a lifeline, facilitating access to essential goods and services without requiring substantial upfront capital (Abdulla et al., 2017). During periods of economic hardship, the motivations for supplying TC become more pronounced as businesses navigate challenging conditions (e.g., Bastos and Pindado, 2013; Hyun, 2017; Altunok et al., 2020). Providing flexibility in payment terms during contractionary economic times is more likely to foster goodwill and loyalty, acknowledging the challenges faced by clients and reinforcing the commitment to supporting them.

Another critical motivation is to stimulate sales in the face of economic downturns. Extending TC serves as a stimulus, encouraging customers to continue purchasing goods or services even when financial constraints might otherwise impede transactions. This strategic move can also provide a competitive advantage, as businesses offering favorable credit terms may stand out in a challenging market environment. Encouraging repeat business is the key desired outcome of offering TC, as customers are more likely to choose suppliers that provide financial flexibility. This customer-centric approach becomes particularly important during economic hardships, where loyalty and sustained collaboration can be invaluable assets.

Unlike financial institutions that are licensed to provide finance to firms, suppliers have better knowledge of buyers' current situation. Hence, information asymmetry between firms may be lower compared to the information asymmetry between banks and firms(Aktaş et al., 2012). When firms engage in transactions with each other, they often have ongoing relationships and direct knowledge of each other's operations, financial health, and creditworthiness (Agostino and Triveiri, 2014). Unlike interactions with banks where lenders may have limited information about the borrower's business operations, when firms transact with each other regularly, they typically have a more intimate understanding of each other's capabilities, performance, and reliability (Petersen and Rajan, 1997). This familiarity can reduce the uncertainty associated with lending decisions, especially during challenging economic times.

In summary, the motivation for extending TC is deeply rooted in building and sustaining positive business relationships. During economic hardships, this goal gains heightened significance as businesses adapt their strategies to support customers, stimulate sales, and navigate challenging market conditions.

6.2. Implications of the Study

The findings of this study offer valuable input for business managers. Firstly, they underscore the importance of financial flexibility, highlighting how firms can benefit from maintaining strong relationships with suppliers and lenders to negotiate favorable terms and access additional liquidity when needed. Secondly, the study emphasizes the significance of collaboration and support from business partners in navigating challenges, indicating that firms able to leverage trade credit and support from their partners were better equipped to manage liquidity constraints and sustain operations. Thirdly, the identification of financial vulnerabilities among low-cash high-debt firms informs risk management strategies, enabling businesses to proactively manage risk and prepare for unexpected disruptions. Recognizing the unique challenges that came with the pandemic, policymakers and industry stakeholders can use these findings to inform targeted support programs aimed at promoting the resilience and sustainability of businesses, thus contributing to overall economic stability and growth.

6.3. Limitations of the Study

One limitation of this study is that it focuses exclusively on publicly traded Turkish firms due to data availability. Publicly traded firms often have greater access to financial markets, which can provide them with more options for managing liquidity and accessing capital during times of economic turmoil. This greater financial flexibility can influence their ability to negotiate favorable terms with suppliers and other business partners, including extending TC. In contrast, SMEs typically have less market power and may face more significant challenges in negotiating favorable terms with their counterparts. They may be more reliant on established relationships and collaborative arrangements with suppliers and customers to navigate periods of financial strain. Understanding how these dynamics play out among publicly traded firms versus SMEs can provide valuable insights into the role of market power in shaping business responses to crises. As a result, the findings may not fully capture the experiences and responses of SMEs. Future research could explore how the dynamics observed among publicly traded firms differ for SMEs, providing a more comprehensive understanding of how businesses of different sizes navigate crises such as the COVID-19 pandemic.

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