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HOW THE COVID-19 SHOCK INFLUENCED COMPANIES LISTED ON THE WSE AND HOW THEY MANAGED THEIR LIQUIDITY

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Abstract

The aim of the article is to analyze the liquidity of non-financial companies listed on the Warsaw Stock Exchange. The article addresses the liquidity of the examined group against the background of the entire market and its relationship with debt, profitability, growth and the risk of bankruptcy, including in the context of the COVID-19 pandemic. The article examines the assertion that COVID-19 influenced the practice of aggressive liquidity management in terms of indebtedness, profitability, value creation, and risk of bankruptcy. The research revealed that public companies behaved differently than the entire sector by pursuing an aggressive management policy and that the pandemic caused an even greater decrease in the static liquidity ratios while cash conversion cycle (CCC) increased. In addition, the decline in EPS growth and the increase in Z-Score during the pandemic could mean that enterprises focused on reducing the risk of bankruptcy rather than maximizing value during the pandemic shock. Before the pandemic, CCC influenced DER, and during the pandemic, static indicators began to play a more important role in the financial strategies of the surveyed companies. The research results add to liquidity theory and its impact on shaping financial strategy, especially during a financial crisis. In addition, an analysis of the impact of liquidity on earnings per share (EPS) growth and Z-Score was conducted. They represent the creation of value and the assessment of the risk of bankruptcy, making this paper particularly insightful. The results obtained provide valuable guidance to decision-makers managing liquidity and debt in corporate finance.

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Introduction

The COVID-19 pandemic influenced financial markets and companies' management strategies. Liquidity management is one of the most important factors that make up companies' strategies. Liquidity can be understood in a static way, represented by key ratios such as the current ratio (CR), quick ratio (QR) and the acid-test (AT) ratio, which measures increased liquidity. The dynamic approach is represented by the cash conversion cycle (CCC), although cash flow measures are often considered. Liquidity's relationship with debt and profitability is widely discussed in the literature, although the correlation with earnings per share (EPS) growth and Z-Score is less frequently analyzed. EPS growth determines the increase in a company's value (Danbolt et al., 2011), and the Z-Score, apart from the risk of bankruptcy, can be interpreted as an assessment of its financial condition (Altman & Hotchkiss, 2010).

A company's primary objective may be to maximize value. It can be achieved by optimizing the capital structure and maximizing earnings per share and profitability growth while limiting the risk of bankruptcy. Therefore, financial indicators such as liquidity and debt ratios, EPS growth, Z-Score, and profitability ratios were selected for the study. Liquidity, which is determined by internal and external factors, goes beyond the scope of managers' decisions alone. It also depends on the surrounding business environment, which, therefore, may affect the possibility of implementing a value-maximization strategy.

The level of liquidity is determined by several factors, including precautionary considerations, making managers maintain a higher-than-optimal level of cash. This approach can also influence value management strategies. COVID-19-related market changes should have affected managers and their approach to liquidity. Thus, the research allows us to compare companies listed on the stock exchange with the entire sector of non-financial business units operating in Poland.

At the beginning of 2020, Polish companies' liquidity remained at a good, stable level, and the sector's ability to service its liabilities remained at a safe level. However, with a weakening of the domestic and international economy in 2020, including the early effects of the COVID-19 pandemic, the financial situation of the corporate sector deteriorated. Despite the increase in sales revenue dynamics, financial results and profitability dropped significantly. Companies' liquidity ratings and ability to service debt on time worsened while the bankruptcy risk index increased. In the subsequent pandemic period, the magnitude of liquidity deterioration depended in part on the development of demand for goods and services provided by the corporate sector, the pace of unfreezing the economy and companies' 'recovery' of revenues, and the effective use of available financial assistance under the 'anti-crisis shields'.

Average corporate sector liquidity ratios increased strongly until mid-2020. The increase in the accumulation of liquid financial assets might have been the result of a decrease in spending on implementing investment projects and the inflow of cash from large-scale liquidity support programs launched for businesses in Poland. After several quarters of dynamic growth, in the third quarter of 2020, the liquidity ratios of the non-financial corporate sector (NFCS) stopped at very high levels, and the percentage of liquid companies reached a historically high level. The liquidity of the NFCS improved, remaining at a high, stable level until the end of 2020. The risk of bankruptcy increased slightly, while corporate debt decreased between April and December 2020.

When assessing liquidity in 2021, it can be concluded that the NFCS was characterized by a high degree of flexibility and resilience to the shocks associated with COVID-19. Government aid allowed business owners to maintain a high level of liquidity, and the cash liquidity ratio reached a historical peak. Companies adapted to the effects of COVID-19 faster than during the global financial crisis, which also meant that the negative consequences were relatively smaller. Many companies benefited from the pandemic, global supply chains were replaced by local ones, and businesses showed unexpected flexibility.

Good financial results in the NFCS led to average liquidity ratios reaching new historical highs in Q2 of 2021. Short-term investments grew dynamically for another quarter, although this was accompanied by an increasing rate of growth of short-term liabilities. Cash liquidity remained strong, and in Q3 of 2021, the synthetic current situation index rose to its highest level in ten years. The rapid recovery of the index after the shock of COVID-19 and the restrictions was mainly due to the very good liquidity situation of the corporate sector (supported by the Polish Government).

After analyzing the non-financial company market in Poland, public enterprises listed on the Warsaw Stock Exchange (WSE) were investigated to verify whether they are characterized by high levels of liquidity and how this liquidity changed and affected indebtedness, profitability, EPS growth, and the Z-Score.

The article aims to examine the liquidity of Polish public companies and how it impacts financial management in the light of COVID-19 and the entire market. The paper tests the hypothesis that COVID-19 influenced the practice of aggressive liquidity management in terms of the indebtedness, profitability, value creation and risk of bankruptcy of companies listed on the WSE. The hypothesis is tested through statistical analy-

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sis, tests for differences of means, and the Spearman correlation and Granger causality methods. The article is structured as follows: first, the literature review is presented, followed by the data, methods and results. It ends with a summary and conclusions.

Literature review

Liquidity is a key factor in the functioning of enterprises. Its characteristic feature is that it can be measured using static and dynamic ratios. Liquidity can also be analyzed in many dimensions, including payment capacity, solvency, or dynamics of operation. All of these dimensions are interrelated and make financial management not only interesting but also difficult. Liquidity's influence on company debt and profitability is widely discussed in the literature.

Zimon (2020a, 2020b) found the Polish market to be over-liquid. He demonstrated that some state-owned energy companies had conservative liquidity strategies while others were aggressive. On the other hand Trippner (2013) analyzed public companies in the long term and found that they were not over-liquid, as measured by the current ratio.

Empirical research in Poland showed the negative impact of liquidity on the capital structure (Campbell & Jarzemowska, 2001; Mazur, 2007). By contrast, Nejad and Wasiuzzaman (2013), Sibilkov (2009), as well as Shleifer and Vishny (1992) identified a positive influence of liquidity on debt and capital structure in other markets. They found that leverage is positively related to liquid assets. Analysis of liquidity is often conducted in sectors characterized by particular dependencies. The influence of liquidity on debt ratio was also analyzed by Serghiescu and Vaidean (2014), who surveyed Romanian listed construction companies. They found a negative influence of liquidity on the total debt ratio, as did Jędrzejczak-Gas (2018) for the TFL sector in Poland.

High liquidity may reduce the propensity to borrow (due to the problem of free cash flows), which was confirmed by Kuhnhausen and Stieber (2014), among others. In Croatia, the relationship between liquidity ratios and short-term leverage was stronger than between liquidity ratios and long-term leverage. The more liquid assets companies have, the less they are leveraged. Long-term leveraged companies were more liquid. Increasing inventory led to increased leverage, although increasing the cash in current assets was related to a reduction in short-term and long-term leverage (Šarlija & Harc, 2012).

Myers and Rajan (1998) indicated that greater asset liquidity made it less costly for managers, and they could expropriate value from investors. Greater asset liquidity also makes it less costly for investors to exercise control over managers. Lipson and Mortal (2009) showed that US firms that were more liquid were fi-

nanced by internal resources to a higher degree and were, therefore, less leveraged.

D'Amato (2020) analyzed Italian small and medium-sized enterprises in response to the global financial crisis and capital structure decisions and their determinants. The results showed that credit supply shocks negatively impacted the leverage. During and after the crisis, companies significantly decreased their leverage, particularly their short-term debt, compared to the pre-crisis period. The findings revealed that riskier and more profitable firms reduced their leverage more during the crisis than during the pre-crisis period.

The comparison with the COVID-19 pandemic can help in understanding companies' behavior during the turmoil, which was related to internal decisions and market conditions. Demmou et al. (2021) analyzed how different policies affected the market during COVID-19 in 14 European countries. They showed that government support to relieve wage bills was the most effective tool to reduce liquidity shortages, followed by debt moratorium policies.

Zygmunt (2013) researched liquidity and profitability in Poland, confirming the positive impact of liquidity on profitability in Polish listed IT companies. Bolek and Wilinski (2012) found a negative impact of static and dynamic liquidity measures on profitability when analyzing the construction sector in Poland. According to Łojek (2020), who analyzed car importers, in most cases, there was a positive and strong relationship between profitability and liquidity in the automotive industry.

Pepur et al. (2021) analyzed companies listed on the Zagreb Stock Exchange and compared the second and third quarters of 2020 with the second and third quarters of 2019. They showed that an increase in the net debt-to-EBITDA ratio negatively and statistically significantly affected the current liquidity ratio. In contrast, an increase in infections had a positive impact on the current liquidity ratio. Stanic et al. (2022) analyzed medium and small companies in the Croatian market. They confirmed a statistically significant and positive impact of liquidity on profitability during the COVID-19 crisis, which means that the increase in liquidity increased profitability.

Demiraj et al. (2022) stated that to ensure much-needed liquidity to run their operations, effective working capital management is fundamental for firms to refrain from overinvesting in short-term resources for the most extreme benefit. The results show that the receivables collection period, inventory conversion period, accounts payable period, and cash conversion cycle had a significant negative impact on ROA for both the pre-pandemic and pandemic periods. Moreover, excessive inventory impairs profitability by locking up valuable cash reserves, which are vital, especially in periods of crisis.

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Oliveira and Fortunato (2006) revealed that smaller and younger firms had higher growth-cash flow sensitivities than larger and more mature firms. This is consistent with the statement that financial constraints on firm growth may be relatively more severe for small and young firms. Ali et al. (2019) found that liquidity had a strong, positive relationship with profitability in terms of ROA but no impact on profitability in terms of the quick ratio. They also showed that sales growth had a negative relationship with profitability. Lestari and Khafid (2021) analyzed the Indonesian market before COVID-19 and showed that leverage and liquidity had a positive effect on earnings quality, while profitability and earnings growth had no effect. The quality of earnings increases if a company can maintain the level of leverage and liquidity. However, the quality of company earnings will decrease when the company is large, affecting its leverage and liquidity. Fajaria and Isnalita (2018) found that profitability and high growth increase value, but liquidity and high leverage reduce it.

Looking at Indian Telecom companies, Khan and Raj (2020) found that liquidity significantly impacts the Z-Score, but the impact of profitability on the Z-Score was not significant. Susanti and Samara (2021) found that profitability, liquidity and activity can simultaneously affect financial distress, with profitability having the most dominant influence. Moch et al. (2019) found that liquidity and profitability had a significant and negative effect on the financial distress of manufacturing companies listed on the Indonesia Stock Exchange, while solvency and debt level had a significant and positive effect.

Liquidity depends on a company's internal decisions and its relationship with the business environment. Our research shows that the relationships between liquidity and debt, profitability, EPS growth, and the risk of bankruptcy measured by the Z-Score differ, depending on the paper. The theory of internal strategic dependencies in finance during market turbulence changed due to a shift in the objective of companies from maximizing value to surviving. The results below add to the literature on financial management and COVID-19's impact on liquidity strategies.

Data and methods

The financial data of non-financial companies listed on the WSE was used. The data come from 2019–2021 and cover three quarters before the outbreak of COVID-19 and three quarters in which the pandemic shock could be observed.

To compare the means for these two sub-periods, the null hypothesis about the equality of the means in both sub-periods was tested:

$$\begin{cases} H_0 : m_1 = m_2, \\ H_1 : m_1 \neq m_2 \end{cases}$$

Where: m_1 and m_2 are the means for the first and second sub-periods, respectively.

The data distribution across the subperiods was tested for normality with the Kolmogorov-Smirnov and the Shapiro-Wilk tests. The hypothesis of equality of means can be tested for normally distributed data using the Student's t-test. For different distributions of data, the non-parametric Mann-Whitney and Kolmogorov-Smirnov tests are applied. The non-parametric tests take the following form:

$$\begin{cases} H_0 : F_1(x) = F_2(x), \\ H_1 : F_1(x) \neq F_2(x) \end{cases}$$

Where: F_1 and F_2 is the distribution of variables x_1 and x_2, respectively.

The statistical significance of the differences between the Spearman correlations before and during the COVID-19 pandemic was analyzed using the Z-statistic (e.g. De Bruin & Steyn, 2020), given by the following formula:

$$Z\ observed = \frac{z_1 - z_2}{\sqrt[2]{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}} \quad (1)$$

Granger causality was verified for pairs of analyzed variables. A two-lag VAR model was estimated for both variables, and the joint significance test of the lags of a given variable was used in the equation explaining the other variable in the pair. This can be represented by the following equations:

$$y_t = \alpha_0 + \sum_{j=1}^{k} \alpha_1 y_{t-j} + \sum_{j=1}^{k} \beta_1 x_{t-j} + \varepsilon_{1t} \quad (2)$$

$$y_t = \alpha_0 + \sum_{j=1}^{k} \alpha_j x_{t-j} + \sum_{j=1}^{k} \beta_j y_{t-j} + \varepsilon_t \quad (3)$$

In this case, the null hypothesis is as follows:

$$H_0 : \beta_1 = \beta_2 = ... =: \beta_k = 0$$

The above statement means that there is no causality from the explaining variable to the explanatory variable.

The following hypotheses considering companies listed on WSE are verified:

H₀: COVID-19 influenced the practice of aggressive liquidity management concerning factors such as indebtedness, profitability, value creation, and risk of bankruptcy.

The main hypothesis is verified using specific hypotheses:

H₁: Liquidity decreased significantly during the pandemic period.

H₂: There was a significant difference between the DER and DE debt ratios, ROE and ROA profitability, EPS growth, and the Altman Z-Score before and during the pandemic.

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H₃: The relationship between liquidity and: profitability, debt level, EPS growth, bankruptcy risk during the pandemic compared to the period before the health crisis.

H₄: The influence of liquidity on strategy variables changed during the pandemic and was weaker.

The following strategy variables are analyzed in detail:

CR (Current liquidity ratio) = current assets / current liabilities;

QR (Quick liquidity ratio) = (current assets − inventories) / current liabilities;

AT (Increased liquidity ratio) = (current assets − inventories and receivables) / current liabilities;

CCC (Cash conversion cycle) = inventory cycle + receivables cycle − cycle of short − term liabilities;

DER (Debt ratio) = Total debt / assets;

DE (Capital structure ratio) = long-term debt / equity;

gEPS (EPS growth) = $(EPS_t − EPS_{t-1})/Assets_{t-1}$; where EPS is Earnings Per Share;

Z-Score = Altman Z-Score.

Table 1: Descriptive statistics for the analyzed debt ratios with differences in the period before and during the pandemic

Variable	Measure	Before the pandemic	During the pandemic	Difference	% Difference
DER	Mean	1.5179	1.3900	-0.1274	8.40%
	Standard deviation	18.6272	14.0060		
	Minimum	0.0000	-0.9700		
	Maximum	415.2435	359.9660		
DE	Mean	27.5659	32.6859	5.1200	18.57%
	Standard deviation	617.3940	639.9410		
	Minimum	-62.0746	-25.6915		
	Maximum	14501.1069	13189.4489		
CR	Mean	0.0890	0.0660	-0.0230	25.53%
	Standard deviation	0.8840	0.4070		
	Minimum	0.0000	0.0000		
	Maximum	18.1540	9.0430		
QR	Mean	0.0830	0.0610	-0.0220	26.41%
	Standard deviation	0.8850	0.4070		
	Minimum	0.0000	0.0000		
	Maximum	18.1540	9.0430		
AT	Mean	0.0420	0.0230	-0.0180	44.02%
	Standard deviation	0.6760	0.2230		
	Minimum	0.0000	0.0000		
	Maximum	17.0260	6.7930		
CCC	Mean	36.5310	43.5220	6.9910	19.14%
	Standard deviation	908.2530	1038.3070		
	Minimum	-49.6370	-18.2500		
	Maximum	27500.0000	27500.0000		
gEPS	Mean	0.0010	0.0000	-0.0010	93.31%
	Standard deviation	0.1560	0.0020		
	Minimum	-3.6680	-0.0030		
	Maximum	3.6650	0.0730		
Z- Score	Mean	4.9520	5.1530	0.2010	4.07%
	Standard deviation	2.8290	2.8520		
	Minimum	0.3210	0.3210		
	Maximum	9.7840	9.7840		
ROA	Mean	1.2600%	4.0100%	2.7500%	217.47%
	Standard deviation	26.0200%	23.0800%		
	Minimum	-420.8200%	-143.6300%		
	Maximum	157.7900%	304.1700%		

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Variable	Measure	Before the pandemic	During the pandemic	Difference	% Difference
ROE	Mean	3.1400%	5.6300%	2.4900%	79.14%
	Standard deviation	39.9500%	42.7100%		
	Minimum	-466.1800%	-351.3100%		
	Maximum	267.2200%	432.8900%		

Source: Own study using PS Imago based on data from Notoria.

As the descriptive statistics show, during the pandemic period, the following variables decreased compared to the period before the pandemic: DER, CR, QR, AT and EPS growth. The following indicators increased: DE, CCC, Z-Score, ROA, and ROE.

Referring to the first hypothesis, public enterprises listed on the WSE are not characterized by excessive liquidity. This problem concerns enterprises from the SME (small and medium enterprises) sector, which are not managed from the perspective of maximizing value.

In this part of the article, the hypotheses are verified, and the research results are presented.

In the first step, the hypothesis that liquidity decreased significantly during the pandemic period is verified. The Mann-Whitney and Kolmogorov-Smirnov test was performed to determine the distribution for the following variables: CR, QR, increased liquidity ratio (AT) and CCC.

Table 2: The results of the normal distribution tests for the variables describing the liquidity

Specification		Kolmogorov-Smirnov test			Shapiro-Wilk test		
		Statistics	df	Relevance	Statistics	df	Relevance
CR	0	0.4600	1553	0.0000	0.0590	1553	0.0000
	1	0.4360	1583	0.0000	0.1140	1583	0.0000
QR	0	0.4630	1553	0.0000	0.0570	1553	0.0000
	1	0.4400	1583	0.0000	0.1090	1583	0.0000
AT	0	0.4750	1553	0.0000	0.0320	1553	0.0000
	1	0.4580	1583	0.0000	0.0660	1583	0.0000
CCC	0	0.4890	1401	0.0000	0.0180	1401	0.0000
	1	0.4880	1404	0.0000	0.0180	1404	0.0000

Where: 0 - represents the period before the pandemic; 1 - indicates the period of the pandemic
Source: Own study using PS Imago based on data from Notoria.

Based on the results in Table 2, it can be stated that the distribution of these variables is different than normal in both sub-periods. The analysed indicators indeed had different values in the sub-periods analysed, which also indicates that the pandemic significantly changed the values of the liquidity indicators.

The statistically significant differences between the mean values of the variables in both sub-periods were verified in the next step with the Mann-Whitney U test and the Kolmogorov-Smirnov Z-test, as presented in Table 3.

Table 3: Tests verifying the statistical significance of differences between means

Specification	CR	QR	AT	CCC
U Mann-Whitney test				
U Mann-Whitney	1206950.5000	1208229.5000	1096175.0000	964158.0000
Asymptotic significance (two-sided)	0.0789	0.0723	0.0000	0.3670
Kolmogorov-Smirnov test				
Z Kolmogorov-Smirnov	1.1228	1.1293	2.9969	1.0630
Asymptotic significance (two-sided)	0.1606	0.1560	0.0000	0.2080

Source: Own study using PS Imago based on data from Notoria.

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The results of the Mann-Whitney U test and the Kolmogorov-Smirnov Z test in Table 3 show that, according to the Mann-Whitney U test, the static liquidity ratios CR, QR and AT were significantly different in the sub-periods, while the difference between CCC values was statistically insignificant. The first research hypothesis was positively verified.

The next step verifies the second hypothesis, i.e., there was a significant difference between the DER and DE debt ratios, ROE and ROA profitability, EPS growth and the Altman Z-Score before and during the pandemic due to a change in management goals. The Mann-Whitney and Kolmogorov-Smirnov tests were performed to investigate the type of distributions for the following variables: Z-Score, EPS increase, ROA, ROE, DER and DE.

Table 4: The results of the normal distribution tests for variables describing profitability

Specification		Kolmogorov-Smirnov test			Kolmogorov-Smirnov test		
		Statistics	df	Statistics	df	Statistics	df
gEPS	0	0.4960	1157	0.0000	0.0261	1157	0.0000
	1	0.4874	1550	0.0000	0.0159	1550	0.0000
Z-Score	0	0.0617	1586	0.0000	0.9550	1586	0.0000
	1	0.0655	1590	0.0000	0.9543	1590	0.0000
ROA	0	0.2420	1419	0.0000	0.4920	1419	0.0000
	1	0.2100	1411	0.0000	0.6540	1411	0.0000
ROE	0	0.2115	1419	0.0000	0.6440	1419	0.0000
	1	0.1900	1411	0.0000	0.7090	1411	0.0000
DER	0	0.4730	1578	0.0000	0.0350	1578	0.0000
	1	0.4660	1596	0.0000	0.0480	1596	0.0000
DE	0	0.5050	1578	0.0000	0.0210	1578	0.0000
	1	0.5050	1596	0.0000	0.0250	1596	0.0000

Where: 0 - represents the period before the pandemic; 1 - indicates the period of the pandemic
Source: Own study using PS Imago based on data from Notoria.

Table 4 shows that the distribution of these variables is different than normal in both sub-periods. The indicators analysed in Table 4 significantly changed their values during the pandemic period, confirming the strong impact of the pandemic on corporate finances. In the next step, the differences between the mean values of the variables in both sub-periods were verified for statistical significance. The results of the Mann-Whitney U test and the Kolmogorov-Smirnov Z test show significant differences between the averages for EPS growth and the Z-Score in the sub-periods.

Table 5: Tests verifying the statistical significance of differences between means

Specification	gEPS	Z-core	ROA
U Mann-Whitney test			
U Mann-Whitney	906280.0000	1208926.0000	1143951.0000
Asymptotic significance (two-sided)	0.0599	0.0444	0.9290
Kolmogorov-Smirnov test			
Z Kolmogorov-Smirnov	1.4772	1.3686	1.0630
Asymptotic significance (two-sided)	0.0255	0.0472	0.2080
Specification	**ROE**	**DER**	**DE**
U Mann-Whitney test			
U Mann-Whitney	986612.0000	1232697.5000	1258503.5000
Asymptotic significance (two-sided)	0.5050	0.2897	0.9279
Kolmogorov-Smirnov test			
Z Kolmogorov-Smirnov	0.9980	1.0424	0.5885
Asymptotic significance (two-sided)	0.2720	0.2273	0.8792

Source: Own study using PS Imago based on data from Notoria.

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Based on Table 5, it can be concluded that the decrease in EPS growth and the increase in Z-score were statistically significant. EPS growth decreased by as much as 93.31%, while the Z-Score increased by only 4.07%. No statistically significant difference can be found between the averages for ROA, ROE, DER and DE. The second research hypothesis was partially con-firmed; only the change in EPS and Z-Score were significant.

Table 6 presents Spearman's rho correlation coefficients for the variables in the periods before and during the COVID-19 pandemic, together with a comparison of the significance of these changes.

Table 6: The correlation coefficients and the difference in significance between the coefficients

The correlation coefficient before the COVID-19 pandemic						
Specification	DER	DE	gEPS	Z Score	ROA	ROE
CR	-0.571**	-0.204**	0.041	0.634**	0.250**	0.121**
QR	-0.557**	-0.208**	0.034	0.535**	0.194**	0.068*
AT	-0.363**	-0.090**	0.025	0.392**	0.204**	0.137**
CCC	-0.295**	-0.072**	0.007	0.320**	0.000	-0.077**
The correlation coefficient during the COVID-19 pandemic						
Specification	DER	DE	gEPS	Z Score	ROA	ROE
CR	-0.620**	-0.217**	0.065*	0.706**	0.397**	0.254**
QR	-0.599**	-0.220**	0.079**	0.600**	0.335**	0.196**
AT	-0.427**	-0.103**	0.069**	0.507**	0.329**	0.235**
CCC	-0.319**	-0.121**	0.003	0.293**	0.033	-0.065*
Z-statistic for differences between correlations before and during the COVID-19 pandemic						
Specification	DER	DE	gEPS	Z Score	ROA	ROE
CR	**-1.377**	-0.365	-0.616	**-2.016**	**-4.040**	**-3.534**
QR	-1.181	-0.337	-1.150	**-1.821**	**-3.876**	**-3.401**
AT	**-1.790**	-0.364	-1.115	**-3.207**	**-3.421**	**-2.594**
CCC	-0.635	**-1.296**	0.092	0.711	-0.874	0.308

Significance levels for the parameters are given in the table: *** – $p < 0.01$, ** – $p < 0.05$, * – $p < 0.1$.
The statistical significance of differences between correlations is shown in bold (alpha = 0.10)
Source: Own study using PS Imago based on data from Notoria.

Comparing the correlation between the indicators for the two sub-periods shows that the changes in the correlation are small, as they do not exceed 0.150. The largest difference in the correlation index between the pre-pandemic period and the pandemic period was demonstrated for the ROA and CR pair of indicators. Their correlation increased during the COVID-19 pandemic. Comparing the change in the correlation between the debt and liquidity ratios in the two sub-periods, the largest difference for the DER and AT ratios was equal to 0.064. The analysis of the Z statistics allows us to demonstrate a significant change in the correlation in the two analyzed periods for the DER, CR, and AT indices. In the case of the DE ratio, no significant change in the correlation with statistical liquidity ratios was found, although the correlation with CCC changed significantly. Research hypothesis 3 was confirmed based on the correlation analysis, as a significant difference between the correlation of liquidity and profitability ratios, debt level, EPS growth, and the Z-Score changed during the pandemic.

Granger causality tests were performed for the two subgroups, and the p-values are presented in Table 7.

Table 7: Granger test results

Variable	P-value	
	Before the COVID-19 pandemic	During the COVID-19 pandemic
CR ⇏ DER	0.9994	0.9939
CR ⇏ DE	0.9968	0.9941
CR ⇏ ROA	0.9762	0.8838
CR ⇏ ROE	0.7711	0.6545
CR ⇏ qEPS	0.3124	0.9876
CR ⇏ Z-Score	0.4104	0.0663

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Variable	P-value	
	Before the COVID-19 pandemic	During the COVID-19 pandemic
QR ⇏ DER	0.9994	0.9942
QR ⇏ DE	0.9972	0.9944
QR ⇏ ROA	0.9738	0.8822
QR ⇏ ROE	0.7404	0.6786
QR ⇏ qEPS	0.2978	0.9879
QR ⇏ Z-Score	0.4148	0.0675
AT ⇏ DER	0.9959	0.9892
AT ⇏ DE	0.9154	0.0000
AT ⇏ ROA	0.9963	0.9899
AT ⇏ ROE	0.9034	0.9899
AT ⇏ qEPS	0.9318	0.9997
AT ⇏ Z-Score	0.5608	0.5290
CCC ⇏ DER	0.0091	0.9946
CCC ⇏ DE	0.9920	0.9949
CCC ⇏ ROA	0.9650	0.6082
CCC ⇏ ROE	0.9778	0.8221
CCC ⇏ qEPS	0.9793	0.5273
CCC ⇏ Z-Score	0.9740	0.4842

Source: Own study using EViews based on data from Notoria.

Based on the Granger test results in Table 7, it can be concluded that only one causality of CCC influencing DER was demonstrated before the pandemic. However, Granger causality was demonstrated during the pandemic, showing the influence of CR on the Z-Score, QR on the Z-Score, and AT on DE. Therefore, research hypothesis 4 was positively verified.

Conclusions

The results of earlier research on the Polish market were confirmed, and it was found that both before and during the pandemic, liquidity had a negative impact on the capital structure. Comparing non-financial companies listed on the WSE with the sector as a whole, it can be concluded that their average DER decreased during the pandemic, but DE increased even though the debt of the entire sector decreased. The static liquidity of public companies decreased, but the dynamic measure of CCC increased in light of sector liquidity deterioration. Public companies increased their profitability, while in the sector, it fell, and the risk of bankruptcy in WSE-listed companies decreased, while it increased in the sector. It can therefore be concluded that public companies behaved differently during the pandemic shock than the entire sector of non-financial enterprises in Poland. Public enterprises listed on the WSE were not characterized by excessive liquidity. This problem mainly concerns enterprises from the SME sector, which are not managed from the perspective of value maximization.

The results of the analysis allow us to refer to the sub-hypothesis. The non-financial companies listed on the WSE demonstrated aggressive liquidity management policies. The static liquidity ratios decreased during the pandemic shock, and it was a statistically significant change. The decrease in current assets may have been caused by a decrease in receivables due to a decrease in sales, a decrease in inventories because of their consumption as a result of the interruption of supply chains, and the use of cash. On the other hand, the CCC value increased, but this increase was not statistically significant. However, there was a slowdown in operating activities during the pandemic. Only the decrease in EPS growth and the increase in Z-Score were statistically significant, indicating a change in management goals during the COVID-19 pandemic shock. Before the pandemic, the impact of CCC on DER was significant, but after the outbreak, CR and QR influenced the Z-Score, and AT influenced DER. Summing up, the shock in the first months after the outbreak of COVID-19 had an impact on liquidity and its relationships with other areas of financial management.

It can be concluded that companies listed on the WSE are well-managed and relatively resistant to economic crises. On the other hand, various companies, including SMEs, are not effectively managed. The most important conclusions are that Polish public companies pursue an aggressive liquidity management policy, which is negatively related to debt, positively related to profitability for static liquidity ratios, and negatively

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related to CCC in the case of ROE. In addition, there is a positive relationship with the EPS growth and Z-Score, which changed during the pandemic, indicating a change in the main goal of enterprises from maximizing value to decreasing bankruptcy risk.

The study's limitations are related to the research period. The introduction of the vaccine in 2021 influenced market behavior, which can provide avenues for future research on liquidity and capital structure. The ideal capital structure may depend not on maximizing value but on minimizing the risk associated with the lack of liquidity. The results obtained provide valuable guidance to decision-makers managing liquidity and debt in corporate finance.

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