

THE INDEBTEDNESS OF COMPANIES LISTED ON THE WSE IN LIGHT OF THE HEALTH MARKET CRISIS

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Purpose: The article aims to present the indebtedness and factors affecting it in the group of non-financial companies listed on the Warsaw Stock Exchange in light of the health market crisis (HMC) induced by the COVID-19 pandemic.

Design/methodology/approach: Differences, correlations, the impact of variables on debt, and the stability of regression models were examined.

Findings: No differences were found in debt in relation to assets and equity, but differences were identified in other areas of financial management related to capital structure theories.

Research limitations/implications: The vaccine's introduction altered market dynamics. Future research should explore post-vaccine debt level trends and their alignment with value maximization or liquidity-driven risk minimization strategies. During the pandemic, risk reduction likely provided a comparative advantage over profit maximization, reducing capital costs without significantly harming value despite declining cash flow. This warrants further investigation.

Practical implications: The study suggests adjusting debt management strategies according to economic conditions. Post-pandemic research should examine debt evolution, value maximization, and risk minimization, emphasizing stable performance indicators.

Social implications: Stable debt levels enhance economic confidence among employees and consumers. Risk-averse corporate behavior during the pandemic likely preserved jobs. Corporations' access to more debt may increase inequality, impacting job opportunities.

Originality/value: The paper presents the application of capital structure theory by businesses to the health crisis. The added value of the article is the inclusion of changes in the EPS level, which are related to value creation, and Altman's Z-Score, which shows the financial condition and solvency of the company in the light of changes in the market related to Covid-19.

Keywords: liquidity, debt, Warsaw Stock Exchange, Covid-19 pandemic.

Category of the paper: Research Paper.

1. Introduction

Indebtedness in a company is influenced by many factors, both internal and external. Decisions about the optimal capital structure are related not only to the financial strategy but also to the market condition (Korajczyk, Levy, 2003). The theory first proposed by Miller and Modigliani (1958, 1961, 1963) continues to evolve, with an increasing number of circumstances affecting managerial decisions regarding capital structure and indebtedness.

The health market crisis (HMC) related to COVID-19 influenced financial markets and the strategies executed by companies (Donthu, Gustafsson, 2020; Marcu, 2021). Restrictions on businesses accompanied by lockdowns influenced company goals (Junnaid et al., 2020). Before the pandemic, most nonfinancial companies listed on the Warsaw Stock Exchange (WSE) were not overleveraged, even though they had favorable development prospects and were in a good economic situation. However, they were characterized by excess liquidity, which under normal circumstances would have been detrimental to returns and value. However, in the context of the HMC, it was a factor that effectively supported their solvency (Czajkowska et al., 2023).

The COVID-19 pandemic was a catalyst for rapid changes in social behavior and the way modern economies function. Immediately after its announcement, both in Poland and Europe, the demand for cash increased dramatically (Kaźmierczak et al., 2022), as did the supply. For example, in Poland, 283 billion Polish zloty was added to the market. Such values may have influenced not only consumers but also companies and how they operate in terms of indebtedness and financial liquidity.

The purpose of this paper is to present the factors that influence debt in relation to assets and equity and how they changed in light of the COVID-19-related HMC. We hypothesize that the change in market conditions influenced the factors that shape debt levels in Polish non-financial public companies listed on the WSE. To test this, we use statistical methods, including difference tests, correlation analysis, and Ordinary Least Squares (OLS) regression, comparing data from before and during the pandemic. The resulting insights contribute to the ongoing discussion on capital structure management and provide valuable information for both financial managers and the decision-makers who shape credit policy.

Under normal circumstances, access to external funding is generally easier for liquid firms whose financial ratios align with the criteria of financial institutions (Sarlija, Hanc, 2012). Such companies often capitalize on this advantage to increase debt levels. Trade-off or substitution theory (Kraus, Litzenberger, 1973), agency theory (Jensen, Meckling, 1976), and pecking order or hierarchy theory (Donaldson, 1961; Myers, 1984; Myers, Majluf, 1984) explain the capital structure of the enterprises and can help understand the motivations for debt levels before and during the HMC.

Czerwonka and Jaworski (2017) analyzed the determinants of capital structure and debt in enterprises through the lens of the theory of optimal capital structure. Pecking order theory suggests that financial liquidity is a variable that influences a company's debt levels. Firms capable of generating significant amounts of cash rely on internal sources of financing to avoid using debt. Thus, the higher the liquidity, the lower the level of debt. According to the theory of substitution, this relationship should be positive. As liquid assets increase, the cost of selling them decreases, resulting in a lower risk of bankruptcy and allowing companies to increase debt and benefit from the tax shield.

The article comprises the following sections. The first section contains the literature review, followed by a description of the data and methods description. The next section presents the results, followed by a discussion and, finally, the conclusions.

2. Literature review

2.1. Overview of the empirical research on indebtedness and the factors that determine it

Companies' capital structure and indebtedness are directly related to their value. Capital structure theory is one of the most important theories in corporate finance. It is linked to the theorems of Miller and Modigliani formulated in four separate statements presented in three articles published in 1958, 1961 and 1963. According to the first proposition, an enterprise's value does not depend on its debt-to-equity ratio or how it is financed. The second proposition is that the company's financial leverage does not affect the weighted average cost of capital, and the cost of equity is a linear function of the debt-to-equity ratio. According to the third statement, a company's value is independent of its dividend policy. Finally, the fourth proposition is that owners of equity capital are indifferent to a company's financial policy.

In subsequent years, several new concepts emerged that highlighted various factors that influence the company's financing sources. Among them, prominent theories include the theory of bankruptcy costs (Baxter, 1967), agency costs (Jensen, Meckling, 1976), signaling theory (Ross, 1977; Leland, Pyle, 1977) and pecking order theory (Myers, Majluf, 1984). Trade-off theory was proposed by Kraus and Litzenberger (1973) and later improved by Myers (1984).

Factors that affect capital structure and, therefore, indebtedness encompass both universal and specific determinants tailored to a particular market. Factors that influence the debt level include market characteristics, such as inflation, the tax system, the capital market situation, government policies, and the characteristics of the industry. Factors that are specific to a particular economic unit include enterprise size and profitability (Fernández et al., 2019), sector type, asset type, taxes, management quality, capital cost, the organizational and legal

form of the enterprise, and capital suppliers, as well as asset structure, profit volatility, development prospects, and atypical production (Chang et al., 2009).

Research into the factors that influence the capital structure and debt in the Polish market has revealed various insights. For example, Czerwonka (2017), Chojnacka (2012), Wilimowska and Wilimowski (2010), Mazur (2007), Hamrol and Sieczko (2006), Skowroski (2002), Gajdka (2002), and Campbell and Jarzemowska (2001) showed a negative impact of profitability and financial liquidity while Chojnacka (2012) and Szudejko (2013) showed that the growth potential had a positive impact on the capital structure ratio. Czerwonka (2017), Chojnacka (2012), Wilimowska and Wilimowski (2010) and Campbell and Jarzemowska (2001) stated that enterprise size positively influenced the capital structure, although Mazur (2007) stated that the influence was negative. Campbell and Jarzemowska (2001) claimed that asset structure has a positive effect on capital structure, while Kościelniak (2008) claims it is negative. Wilimowska and Wilimowski (2010) and Kościelniak (2008) investigated how capital structure influences capital costs, while Hajduk (2018) presented ambiguous results about the effects of these elements on debt levels.

Czerwonka and Jaworski (2017) concluded that higher liquidity tends to lower the level of debt. Meanwhile, Kuhnhausen and Stieber (2014) confirmed that a high level of corporate liquidity can reduce the tendency to finance debt due to a shortage of free cash flows. Kaźmierska-Józwiak and Sekuła (2016) verified that there is a positive relationship between long-term debt and financial liquidity. Common indicators of financial liquidity are static ratios, including the current liquidity ratio (Abeywardana, Banda, 2015), the quick-test liquidity ratio (Imtiaz et al., 2016) and the ratio of liquid assets to sales (Nejad, Wasiuzzaman, 2013).

In the Croatian market, statistically significant correlations were found between static liquidity and leverage ratios, with statistically significant correlations observed between leverage ratios and the structure of current assets. The relationship between liquidity ratios and short-term leverage was stronger than that between liquidity ratios and long-term leverage. Interestingly, the more liquid assets companies owned, the less leveraged they were. The rise in inventory levels led to an increase in leverage, while an increase in cash in current assets was related to a reduction in short-term and long-term leverage (Sarlija, Harc, 2012). Sibilkov (2009) showed that leverage was positively correlated to liquid assets, as did Williamson (1988) and Shleifer and Vishny (1992), who argued that more liquid assets increased leverage. Williamson (1988) stated that because the costs associated with financing these assets are lower, more liquid assets should be financed to a greater extent by debt. As a result, the liquidity of assets increased the amount of capital that companies could borrow. The correlation between liquidity and debt can be positive or negative.

Lipson and Mortal (2009) showed that more liquid firms in the US were financed by internal resources to a greater extent and were, therefore, less leveraged. Chaplinsky and Niehaus (1990) and Nejad and Wasiuzzaman (2013) studied the positive influence of financial liquidity on debt and capital structure. The influence of liquidity on the debt ratio was also analyzed by

Serghiescu and Vaidean (2014), who investigated Romanian listed construction companies. They found a negative influence of liquidity on the total debt ratio, as did Jędrzejczak-Gas (2018) for the TSL (Transport, Forwarding, Logistics) sector in Poland.

2.2. The impact of the COVID-19 pandemic on the capital structure

Research findings (e.g., Altman, 2020; Acharya, Steffen, 2020; Ellul, Erel, Rajan, 2020; Srivastava Sampath, Gopalakrishnan, 2022), as well as reports from international organizations (e.g., the OECD and World Bank) and analyses from top consulting firms, show that the COVID-19 pandemic had a significant impact on debt levels (see Table 1). Despite lower credit quality, favorable financing conditions have enabled companies to issue more debt, resulting in a larger percentage of corporate debt being held by companies with riskier financial profiles than before the global financial (Feyen et al., 2017). The findings suggest that while there was an overall increase in debt, the impact varies by sector and company size. Some companies managed to leverage the situation to invest in growth, while others faced increased financial distress. The pandemic underscored the need for robust financial management and the potential benefits of strategic investments during economic downturns.

Table 1.

The impact of COVID-19 on the company debt

Organization	Key findings
World Bank: Kose et al. (2021)	Known as the “fourth wave” of debt, a sharp increase in debt had already started to occur in developing and emerging market countries prior to the pandemic. The pandemic-induced worldwide recession of 2020 led to a high increase in debt, which is what made the fourth wave of debt turn into a tsunami and become even more hazardous. Second, the amount of global government debt kept rising five years after previous global recessions.
International Monetary Fund: Haque, Varghese (2021)	The leverage (expressed as Net Debt/Asset) of American listed companies dropped by 5.3 percentage points from the pre-shock mean of 19.6%. The effect of deleveraging was more pronounced for companies that faced substantial rollover risk; firms with businesses that were most affected by social distancing did not experience a decrease in leverage. Large, highly leveraged companies and those under stress prior to COVID-19 experienced the greatest decline in default probability. Further stress tests indicate that a 20% decline in cash flows would put these firms’ values less than one standard deviation from default.
Deloitte: Buckley, Barua, Samadar (2021)	The average annual growth rate of non-financial enterprises’ total debt was 5.5% between 2010 and 2019; however, it spiked to 9.1% in 2020. That year saw a spike in debt that was most likely caused by one of three things. First, since a lot of the economy slowed down or stopped altogether, some businesses had to take on greater debt in order to continue operating. Second, some companies had to make technological investments to enable remote work whenever feasible, while others had to reorganize their workspaces to guarantee social separation for jobs that needed to be done in person. Lastly, not every business suffered as a result of COVID-19. Concerns regarding businesses’ reduced capacity to pay back debt, however, can be allayed if they increase their investments in productivity-boosting initiatives.

Cont. table 1.

OECD (2020)	<p>The COVID-19 shock's fall in book value of equity would have an immediate impact on a company's leverage ratio, which rises by 6.7-8% percentage points in comparison to a business-as-usual scenario. The ability of businesses to service their debt is further hampered by the reduction in revenues; between 30% and 36% of businesses would not be lucrative enough to pay for their interest costs.</p> <p>A significant corporate "debt overhang" could be more likely due to the increased levels of indebtedness and default risk. Experience from the past indicates that the investment ratio should drop by about two percentage points when a company's financial leverage ratio increases in line with our accounting model's forecasts.</p>
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Notes: underlined by the authors of this paper.

Source: authors' own elaboration.

The COVID-19 pandemic significantly impacted companies' capital structures. Altman (2020) linked COVID-19 to the corporate credit cycle. He highlighted the vulnerability of "BBB tranches of corporate bond market" to downgrades in response to the downturn in the real economy and its potential impact on expected delinquency rates. Ellul et al. (2020) analyzed the macroeconomic implications of COVID-19-driven total corporate debt. They identified two major risks associated with the nonfinancial companies' heavily leveraged balance sheets. First, declining cash flows during a crisis make it hard to sustain business models. Secondly, debt overhang can significantly hinder investment once the recovery gets underway.

Gopalakrishnan et al. (2023) observed that firms' financial resources were strained as a result of the COVID-19 disruptions and the subsequent government measures, expanding their debt financing. They employed firm-level data from 61 countries to analyze the variation in loan and bond financing that may be attributable to features specific to COVID-19. Companies that were located in countries with severe lockdowns and those that were more exposed to the pandemic were more likely to raise their debt, which could indicate that they were taking extra precautions. Furthermore, companies operating in industries with lower rates of remote labor tended to use debt more than their counterparts, but they also paid higher financing expenses.

Carletti et al. (2020) and Schivardi, Sette and Tabellini (2020) investigated the impact of COVID-19 and the related lockdowns on the liquidity conditions and equity positions of numerous Italian businesses. In the long run, companies faced significant challenges from equity shortages and debt overhang once the immediate COVID-19 storm passed and the question of zombie financing was recognized (Demary, 2021). This underscores the importance of designing effective public policies to support companies.

Acharya and Steffen (2020) highlighted the phenomenon of "dash for cash" triggered by the COVID-19 pandemic. Data on daily credit line drawdowns at the firm-loan level in the US revealed a business "dash for cash" brought on by the COVID-19 outbreak. All of the companies pulled down bank credit lines and increased cash levels during the initial stages of the crisis, which were marked by excessive caution and elevated aggregate risk. However, during the second phase, which came after stabilization policies, only the best-rated companies shifted to the capital markets to obtain cash.

Huang and Ye (2021) examined how the COVID-19 pandemic, capital structure, and corporate social responsibility (CSR) programs impacted company risk. Their findings suggest that businesses may increase sustainability and resilience in a volatile market by implementing recommendations for CSR policies and post-pandemic capital structures. The trade-off theory of capital structure served as the inspiration for the concept mentioned above. They applied a leverage measure adopted from Korteweg's (2010) Bayesian model. Overleveraged enterprises were more likely to be bankrupt, were more financially rigid, and were more susceptible to COVID-19 and higher risk.

Conversely, underleveraged companies were less hazardous than overleveraged ones for two reasons. Firstly, having modest levels of debt shields businesses from bankruptcy after an unexpected drop in revenue. Businesses with low leverage can nevertheless pay off their debt. Secondly, according to Halling et al. (2020) and Li et al. (2020), companies sought bank loans to cover the reduced cash requirements brought on by the start of COVID-19 (Halling et al., 2020; Li et al., 2020). Firms with more excess leverage experienced higher risk during COVID-19, consistent with some COVID-19 studies, which found that firms with high leverage react more negatively to market performance (see Ding et al., 2020; Fahlenbrach et al., 2020). While underleveraged firms may experience a considerable reduction in risk as excess leverage increases, the outcomes for overleveraged firms remain unchanged. This could be explained by the trade-off hypothesis, which states that business value rises with debt level until it reaches the optimal threshold since underleveraged enterprises do not fully utilize their debt capacity to take advantage of interest tax benefits (see Halling et al., 2020; Li et al., 2020). According to Huang and Ye (2021), overleveraged businesses with low social and environmental scores are more likely to experience the negative effects of COVID-19. Enterprises with low leverage were shielded against rising business risk in a volatile market by having low leverage, while those that were underleveraged were protected from market volatility.

Bai and Ho (2022) used a sizable sample of public companies from 31 different countries between 2002 and 2020. They found that Corporate Social Performance had a considerable positive impact on business debt levels during the pre-COVID period. According to Ding et al. (2021), the insurance role of CSP during the COVID-19 crisis might have helped businesses gain the trust and loyalty of investors and customers.

Mond et al. (2022) explored the determinants of capital structure in publicly traded firms in Malaysia before and after the COVID-19 epidemic. The findings indicated that the maximum debt was higher before the COVID-19 period. Over the COVID-19 period, there was a slight decline in both short-term and total debt. Despite this, long-term debt increased. Tangibility, liquidity, and firm size had an impact on capital structure in both periods, regardless of the capital structure proxy. A significant factor influencing total debt both before and after the COVID-19 crisis was profitability.

The size of the enterprise and the type of economy had an impact on the exogenous factors that influence the capital structure. Demirgüç-Kunt et al. (2020) explored the role of the global financial crisis and found that both in developed and emerging countries—including those without a crisis—firm leverage and debt maturity decreased. Closs (2021) found that American companies and their leverage between the pre- and post-pandemic periods showed statistically insignificant changes. The regression results showed that the epidemic reduced the leverage of aggressive enterprises and increased the leverage of conservative enterprises. Pettenuzzo et al. (2021) identified key characteristics of US companies and stocks that could explain much of the cross-sectional variation in corporate payments and funding decisions. They also demonstrated that the Federal Reserve's broad monetary policy in the early stages of the crisis had a major impact on the timing and sequence of these decisions.

The market situation during the COVID-19 period was examined in relation to the impact of different policies (tax reductions, debt suspension, and wage payment support), the results of which indicated that government assistance to alleviate wage payments was the most effective means of reducing liquidity shortages, followed by debt suspension policies (Demmou et al., 2021). The countries in the sample included Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Poland, Portugal, Romania, Spain, Sweden and the United Kingdom.

To conclude, the impact of COVID-19 on firm debt can be analyzed from various perspectives, including sector, firm size and location (i.e., developed economies vs. countries in transition/emerging markets). The results of our review may be helpful in identifying new research niches, including the direction and strength of the interdependency between financial liquidity and capital structure (e.g., Acharya, Steffen, 2020; Mond Azhari, Mahmdu, Sharrudin, 2022).

3. Data and Methods

This section presents the results of the analysis. To verify the main hypothesis that the change in market conditions related to the COVID-19 pandemic transformed the factors that shape indebtedness, the following research sub-hypotheses are tested:

- SH1: There was a difference between the average values of ratios representing debt, strategy, and market condition in the periods before and during the pandemic.
- SH2: There was a difference in correlation between ratios representing debt, strategy and market condition in the periods before and during the pandemic.
- SH3: There was a difference in the impact of factors representing debt, strategy and market condition in the periods before and during the pandemic.

Here, strategy is understood as other ratios related to profitability, liquidity, growth potential, bankruptcy, and value.

Statistical analysis was conducted by grouping the data into two independent subperiods. The first subperiod covers the financial quarterly data before the COVID-19 pandemic (Q1 2019 – Q1 2020), while the second sub-period covers the pandemic period (Q2 2020 – Q2 2021).

The research was based on panel data collected for 421 non-financial companies (3368 observations) listed on the WSE (excluding the financial sector). The data were obtained from the Notoria database. The following variables were taken into account:

- DER: debt ratio = total debt/assets.
- DE: capital structure ratio = long-term debt/equity.
- CR : current liquidity ratio = current assets/current liabilities.
- QR : quick liquidity ratio = (current assets - inventories)/current liabilities.
- AT: acid test ratio = (current assets - inventories and receivables)/current liabilities.
- CCC: cash conversion cycle: inventory cycle + receivables cycle – short-term liability cycle.
- gEPS: EPS growth (EPSt- EPSt-1)/Assetst-1; - EPS growth (Danbolt et al., 2011).
- Z-Score: Altman Z-Score (Altman, 1968).
- TQ: Tobin's Q = (total assets + market value of equity – book value of equity)/total assets - (Danbolt et al., 2011).
- lnTA: asset level as a natural algorithm.
- FA/TA: asset structure ratio = fixed assets/total assets.
- GDP Growth: % change in GDP (source: World Bank),
- M3: broad money includes currency, deposits with a fixed maturity of up to two years, deposits redeemable at notice of up to three months, repurchase agreements, money market fund shares/units, and debt securities up to two years (source: World Bank).

Based on the literature and the data analysis, the following models to describe the debt and capital structure ratios are proposed:

$$l_{DER_{i,t}} = const_{i,t} + l_{TA_{i,t}} + ROA_{i,t} + \frac{FA}{TA_{i,t}} + l_{CCC_{i,t}} + l_{CR_{i,t}} + TQ_{i,t} + l_{DER_{i,t-1}} + GDP\ Growth_{i,t} + M3_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$l_{DE_{i,t}} = const_{i,t} + l_{TA_{i,t}} + ROA_{i,t} + \frac{FA}{TA_{i,t}} + l_{CCC_{i,t}} + l_{CR_{i,t}} + TQ_{i,t} + l_{DE_{i,t-1}} + GDP\ Growth_{i,t} + M3_{i,t} + \varepsilon_{i,t} \quad (2)$$

where:

const – constant,

ε – is a random component with basic properties.

4. Results

The basic descriptive statistics of the variables are presented in Table 2, along with the analysis of the differences between average values.

Table 2.

Descriptive statistics with differences in the periods before and during the pandemic

Variable	Measure	Before the pandemic	During the pandemic	t-Student
				Asymptotic significance
DER	Mean	1.517	1.90	0.828
	St. Dev.	18.627	14.006	
DE	Mean	27.565	32.685	0.817
	St. Dev.	617.394	639.941	
CR	Mean	8.878	6.612	0.327
	St. Dev.	88.450	40.710	
QR	Mean	8.325	6.127	0.343
	St. Dev.	88.457	40.719	
AT	Mean	4.185	2.343	0.304
	St. Dev.	67.604	22.323	
CCC	Mean	3,653.090	4,352.175	0.850
	St. Dev.	90,825.267	103,830.652	
gEPS	Mean	0.001	0.000	0.252
	St. Dev.	0.156	0.002	
Z- Score	Mean	4.952	5.153	0.036
	St. Dev.	2.829	2.852	
TQ	Mean	3.789	4.645	0.526
	St. Dev.	29.945	44.311	
ROA	Mean	1.263%	4.010%	0.785
	St. Dev.	26.015%	23.078%	
ROE	Mean	3.141%	5.626%	0.113
	St. Dev.	39.947%	42.709%	
TA	Mean	16,104,611.566	17,620,896.279	0.736
	St. Dev.	261,428,002.102	286,266,114.221	
FA/TA	Mean	0.587	0.578	0.409
	St. Dev.	0.259	0.263	
GDP	Mean	3.976	-3.253	0.000
	St. Dev.	1.182	2.924	
M3	Mean	109.669	116.474	0.000
	St. Dev.	1.274	1.371	

Note: The difference is significant for $p < 0.01$ at the 1% significance level, $p < 0.05$ at the 5% significance level and $p < 0.1$ at the 10% significance level.

The results in Table 2 reveal that in the periods before and during the pandemic, there was significant growth in the Z-Score and M3 variables and a significant decrease in GDP. However, the first hypothesis suggesting a difference between the average values of ratios representing the strategy and condition of companies in the two periods was not fully supported as the differences in most cases were not significant.

The correlation between variables was tested with Pearson's coefficient. The results are presented in Table 3.

Table 3.
Pearson correlation between variables

Variables	DER	DE
Period before the pandemic		
DER	1.000	
DE	-0.002	1.000
CR	-0.008	-0.005
QR	-0.007	-0.004
AT	-0.005	-0.003
CCC	-0.002	0.988**
gEPS	-0.001	-0.001
Z-Score	-0.104**	0.074**
ROA	-0.481**	0.006
ROE	-0.036	0.049
Tobin's Q	0.635**	-0.008
Period during the pandemic		
DER	1.000	
DE	-0.005	1.000
CR	-0.015	-0.008
QR	-0.014	-0.008
AT	-0.010	-0.005
CCC	-0.002	0.999**
gEPS	-0.003	-0.001
Z Score	-0.128**	0.081**
ROA	-0.381**	0.009
ROE	-0.165**	0.045
Tobin's Q	0.353**	-0.011

The significance levels of the parameters are given in the table: ** – $p < 0.01$ * – $p < 0.05$.

Source: Own elaboration using PS Imago.

To present the general relationships between the variables used in the study, correlations were calculated, with a focus on debt ratios. Before the pandemic, the total debt ratio DER was negatively correlated with ROA and positively correlated with TQ. After the pandemic, the signs and dependencies did not change, although the relationship with the Z-score strengthened, and the relationship with ROA and TQ weakened. The relationship between DE and both CCC and the Z-Score was positive before the pandemic, and both relationships strengthened during the pandemic. However, the second sub-hypothesis, suggesting that there was a difference in correlation between the ratios representing debt and factors determining indebtedness in the periods before and during the pandemic, was not confirmed.

The influence of the chosen micro and macroeconomic factors on debt ratio DER was analyzed using an OLS model, and the results are presented in Table 4.

Table 4.
OLS model estimations for DER

specification	<i>Pooled OLS</i>	<i>FE</i>	<i>GMM 2-step</i>	<i>GMM 2-step</i>	<i>GMM 2-step</i>
	<i>l_DER model</i>	<i>l_DER model</i>	<i>l_DER model</i>	<i>l_DER model (before the pandemic)</i>	<i>l_DER model (during the pandemic)</i>
const	0.823*	0.496	0.362	0.129***	0.585
l_TA	0.007**	-0.012	0.022***	0.009	0.023**
ROA	-0.097**	-0.071*	-0.181***	-0.017	-0.117**
FA/TA	-0.302***	-0.452**	-0.647***	-0.308	-0.819***
l_CCC	-0.001	-0.008	-0.018**	-0.006	-0.024
l_CR	-0.105***	-0.351***	-0.230***	-0.117	-0.313***
TQ	-0.002**	-0.001	-0.002**	0.000	0.001
l_DE_1	0.878***	0.215***	0.616***	0.851	0.519***
Growth	-0.005	-0.004**	-0.003*	0.000	0.001
M3	-0.007*	-0.006**	-0.004**	-0.001	-0.006
R square	0.943	0.976			
F stat (p-value)	2,299.590 (0.000)				
Durbin-Watson	1.753	1.597			
Breusch-Pagan test		3.679 (0.055)			
Hausman (p-value)		230.589 (0.000)			
AR(1) p-value			0.000	0.000	0.038
AR(2) p-value			0.4810	n.a.	n.a.
Sargan p-value			0.003	0.093	0.508
Wald p-value			0.000	0.000	0.000

Note: The significance levels of the parameters are given in the table: *** – $p < 0.01$, ** – $p < 0.05$, * – $p < 0.1$.

Source: Own elaboration using GRETL based on data from Notoria.

Panel modeling was carried out using naive analysis. The occurrence of fixed effects was confirmed by the analysis of panel models. Due to the large number of observations in the database, we also studied the impact of the variables on debt using the GMM two-step system. Table 3 reveals no significant influence of any variable on DER before the pandemic. However, during the pandemic, TA and delayed DE had a statistically significant and positive influence, while ROA, CR and FA/TA had a negative effect. The same analysis was performed for the capital structure DE ratio. The results are presented in Table 5.

Table 5.
OLS model estimations for DE

Specification	<i>Pooled OLS</i>	<i>FE</i>	<i>GMM 2-step</i>	<i>GMM 2-step</i>	<i>GMM 2-step</i>
	<i>l_DE model</i>	<i>l_DE model</i>	<i>l_DE model</i>	<i>l_DE model (before the pandemic)</i>	<i>l_DE model (during the pandemic)</i>
const	2.632**	-4.166	-0.125	-2.095	5.787**
l_TA	0.018**	0.392*	0.071***	0.093***	0.033***
ROA	-0.423***	-0.770***	-0.436***	-0.169	-0.542***
FA/TA	0.010	2.152***	-0.008	0.218	-0.135
l_CCC	-0.014	-0.048*	-0.038	-0.067*	-0.025
l_CR	0.027	0.262***	-0.163***	-0.151**	0.027
TQ	0.012	-0.016*	0.001	-0.030	0.000

Cont. table 5.

I_DER_1	0.919***	0.303***	0.543***	0.513***	0.856***
Growth	-0.019*	-0.023***	-0.007	-0.009	-0.040
M3	-0.026**	-0.027***	-0.011**	0.004	-0.055**
R square	0.848	0.913			
F stat (p-value)	570.383 (0.000)				
Durbin-Watson	2.075	1.830			
Breusch-Pagan test		12.190 (0.000)			
Hausman (p-value)		204.604 (0.000)			
AR(1) p-value			0.000	0.007	0.002
AR(2) p-value			0.617	n.a.	n.a.
Sargan p-value			0.258	0.208	0.557
Wald p-value			0.000	0.000	0.000

Note: The significance levels of the parameters are given in the table: *** – $p < 0.01$, ** – $p < 0.05$, * – $p < 0.1$.

Source: Own elaboration using GRETL based on data from Notoria.

Before the pandemic, total assets were positively associated with DE. Conversely, CCC, CR and delayed DER exhibited a negative association. During the pandemic, the situation changed. Only ROA and M3 had a statistically significant negative impact on DE. Notably, the positive influence of size and delayed DER did not change.

In the next step, the temporal differences between the regressions were analyzed. The results are presented in Table 6.

Table 6.

Chow test for the DER and DE models

Specifications	DER model	DE model
Chow test	36.200	11.900
p-value	0.000	0.292

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

The Chow test revealed no structural changes in the DER model. However, the DE model did exhibit structural changes. It should be inferred that structural changes are taking place in the DE model, suggesting a shift in how various factors influence debt levels during the pandemic.

The level of debt in relation to assets (DER) and equity (DE) did not change significantly in the periods before and during the pandemic. However, in light of the decline in GDP and the increase in money supply, enterprises strengthened their security related to the threat of bankruptcy, leading to a significant increase in the Z-Score during the pandemic. A negative correlation was found between DER and Z-Score, and a positive correlation between DE and Z-Score, both before and during the pandemic.

DER and profitability were characterized by a negative correlation before and during the pandemic, while DE and CCC were characterized by a positive correlation. Additionally, DER was positively correlated with TQ, representing the growth potential, in both periods.

Debt, as measured by DER and DE, was positively influenced by the size of assets held by the enterprise. During the pandemic, DER was negatively influenced by profitability, liquidity, asset structure, and delayed DE. DE was negatively affected by liquidity before the pandemic, while during the pandemic, ROA negatively influenced capital structure. Lagged DER positively influenced debt, regardless of the period.

5. Discussion

The companies listed on the WSE were analyzed to detect their sensitivity to market changes due to the COVID-19-related HMC. A significant change in the Z-Score was detected. The Z-Score increases when working capital, gross profit, retained earnings, equity, and sales revenues increase and when the value of assets and debt decreases. The correlation of the Z-Score with DER and DE is due to changes in corporate debt levels.

The negative correlation between DER and profitability shows that an increase in debt generates higher profits according to the principles of financial leverage. Given that Polish companies did not take on excessive debt, they should consider doing so to a greater extent in the future. This is supported by the positive correlation between DER and Tobin's Q index, representing growth potential (Danbolt et al., 2011).

The effect of enterprise size on debt was positive, regardless of the period, showing that larger enterprises were more willing to leverage themselves. During the pandemic, DER was negatively affected by the asset structure, indicating the level of fixed assets, which had a negative impact on debt. Therefore, during the pandemic, companies with lower levels of fixed assets had higher levels of corporate debt. Additionally, liquidity in this period, measured by the current ratio of current assets to current liabilities, also had a negative impact on debt, showing that enterprises with decreasing levels of current assets took on debt to survive the pandemic.

Regarding capital structure measured by DE, liquidity, as measured by CR and CCC, had a negative impact on debt before the pandemic, suggesting that a more conservative approach to liquidity resulted in lower debt. However, during the pandemic, liquidity became less important for shaping the capital structure, while the profitability of assets began to negatively affect debt, along with changes in the money supply.

The analysis demonstrated that the debt ratios (DE and DER) did not differ significantly between the two periods, which aligns with the findings of Closs (2021). She found that US companies and their leverage differences between the pre-pandemic period and the pandemic period were not statistically significant.

The increase in Z-Score was found to be statistically significant. This finding underscores the importance of solvency-related safety for Polish enterprises, as their economic condition, as measured by the threat of bankruptcy, improved during the pandemic period. The relationship between the debt-to-equity ratio and CCC increased during the pandemic, aligning with the theory of the hierarchy of sources of financing, which indicates that financial liquidity influences a company's debts. The positive influence of financial liquidity on debt and capital structure was identified by Chaplinsky and Niehaus (1990) and Nejad and Wasiuzzaman (2013).

Assets positively influenced both debt ratios, confirming previous findings that loans are less willingly taken out by enterprises with smaller assets (Sawicka, Tymaszko, 2014). Size was found to be an important factor that influences debt (Hajduk, 2018; Czerwonka, 2017; Chojnacka, 2012; Wilimowska, Wilimowski, 2010; Campbell, Jarzemowska, 2001).

Profitability, represented by ROA, negatively influenced both debt ratios during the pandemic period, consistent with previous findings for the Polish market (Czerwonka, 2017; Chojnacka, 2012; Wilimowska, Wilimowski, 2010; Mazur, 2007; Hamrol, Sieczko, 2006; Skowrowski, 2002; Gajdka, 2002; Campbell, Jarzemowska, 2001).

Asset structure negatively influenced DER during the pandemic, which is consistent with the findings of Chang et al. (2009). Asset structure may have either a positive effect on the capital structure (Campbell, Jarzemowska, 2001) or a negative one (Kościelniak, 2008; Wilimowska, Wilimowski, 2010; Kościelniak, 2008).

Previous studies showed that growth potential had a positive impact on the capital structure ratio (Chojnacka, 2012; Szudejko, 2013), which is confirmed in this article.

In conclusion, the change in market conditions related to the COVID-19 pandemic transformed the factors that shape the debt levels in Polish non-financial companies listed on the WSE.

6. Conclusions

This study examined the impact of the COVID-19 pandemic on debt structure and capital structure determinants for companies listed on the WSE. Overall debt levels (DER and DE) did not change significantly despite the pandemic's economic challenges (falling GDP and increasing money supply). Only the way the capital structure was shaped through other key determinants changed. Regardless of the period, larger enterprises incurred more debt. Before the pandemic, liquidity measured by CR and CCC had a negative impact on DE, while during the pandemic, it was asset profitability.

Before the pandemic, general debt was not determined by any factors, but during the pandemic, fixed assets, asset profitability and financial liquidity had a negative impact on DER. The growing money supply had a negative impact on the capital structure, indicating a decreasing level of debt. The correlation between the debt ratios and Z-score, TQ, liquidity, and profitability indicators was stable regardless of the period examined.

Before the pandemic, enterprises were guided by the hierarchy theory. However, during the pandemic, substitution theory shaped the capital and debt structure as companies became more risk-averse.

The study acknowledges limitations related to the research period. The introduction of the vaccine influenced the behavior of the market. Therefore, future research could explore how debt levels evolve in the post-vaccine era and whether they depend on the strategy of maximizing value or on minimizing the risk associated with the lack of financial liquidity. Additionally, during the pandemic, risk reduction may have provided a comparative advantage over profit maximization, which translated into a reduction in capital cost, and although cash flow was decreasing, it did not have such a negative impact on value. This issue will be the subject of further research.

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