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CAPITAL STRUCTURE ADJUSTMENTS DURING THE COVID-19 PANDEMIC: EVIDENCE FROM EIGHT INDUSTRIES

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ABSTRACT

This paper analyzes the impact of the COVID-19 pandemic on the capital structures of companies worldwide. Using a dataset covering over 38,000 companies from 96 countries between 2017-2022. The effects of the pandemic on various aspects of companies' capital structures are examined, including leverage ratios, debt maturity, and capital structure decisions, across eight different industries. The study employs a fixed effects panel regression to control for differences between companies and industries and capture the effect of COVID-19.

The study finds that larger firms tend to have higher leverage levels, while profitability negatively impacts leverage and tangibility positively affects leverage. Regarding the impact of the pandemic on capital structures, the authors find that total debt to total assets levels decreased across all industries. However, the impact on long-term debt to total assets and long-term debt to total debt levels was mixed.

This study provides valuable insights into how the COVID-19 pandemic has affected companies' capital structures across different industries and countries. It suggests that the pandemic has reduced debt levels relative to total assets, but its impact on other aspects of capital structure has been more nuanced.

INTRODUCTION

Given the unprecedented economic impact of the COVID-19 pandemic, this paper aims to investigate and evaluate the crisis's effect on companies' capital structures. The COVID-19 pandemic has significantly impacted the global economy, causing disruptions to supply chains, reducing demand, and triggering market volatility. As a result, many companies have experienced financial distress, leading to changes in their capital structures. The research problem of this study is to investigate the effects of the COVID-19 pandemic on the capital structures and capital structure determinants of companies from 96 countries worldwide. The study explores how the pandemic has affected companies' leverage ratios, debt maturity, and capital structure decisions. The study also aims to examine the effect of the COVID-19 pandemic on capital structures in eight industries.

Several studies have explored the impact of global crises on firms' capital structures. For example, Demirgüç-Kunt et al. (2020) analyzed the impact of the 2008-2009 crisis on companies' capital structures worldwide, while Moradi & Paulet (2019) examined the effects of the Euro crisis on European firms. Iqbal & Kume (2014) investigated the relationship between the financial crisis and firms' capital structure decisions. These studies found that external events, such as financial crises, significantly impact firms' capital structures. However, the COVID-19 pandemic is unique in its global scope and magnitude, and its effects on firms' capital structures require further investigation. This research problem is of particular importance because understanding how the pandemic has affected companies' capital structures can provide insights into the financial resilience of companies during crises.

The COVID-19 pandemic, first reported in late December 2019 in Wuhan, China, quickly spread across cities and neighboring countries, prompting the World Health Organization (WHO) to declare it an international health crisis on January 30, 2020, and a pandemic on March 11, 2020 (Siddiqui et al., 2022). Governments implemented lockdowns and other measures to control the spread of the virus, which had widespread adverse effects on various sectors, such as businesses, the travel industry, and tourism (Pan & Yue, 2022; Donthu & Gustaffson, 2020). The pandemic significantly impacted global unemployment rates, increasing by 1.1 percentage points in 2020 compared to 2019, and had a more widespread effect on labor markets than the 2009 global financial crisis, even in low- and middle-income countries (International Labor Organization,

2021). The pandemic also affected the financial markets, leading to a drop in most worldwide indices, with different industries experiencing varied effects on their market valuations (Jabee et al., 2022; Mazur et al., 2020). To stabilize financial markets, central banks worldwide responded by reducing interest rates and reserve requirements and relying on asset purchase programs for monetary stimulus (Kirti et al., 2022).

Although several studies on the effects of financial crises on companies' capital structures have been published, the impact of the COVID-19 pandemic on capital structures still needs to be studied, especially globally. This paper will study the effects on companies worldwide throughout 2017-2022 by finding clarity to the research question: How has the COVID-19 pandemic affected the capital structures of companies? The following hypotheses will be tested:

H1: The COVID-19 pandemic has resulted in a significant decrease in the leverage ratio of companies.
H2: Companies have shifted towards relying more on long-term debt financing to support their operations and investment activities during the COVID-19 pandemic.
H3: Changes in debt maturity structure and leverage caused by COVID-19 are statistically significant.
H4: The impact of the COVID-19 pandemic on the capital structures of companies varies between industries.

The hypotheses above will be tested by a dataset covering over 38,000 companies from 96 countries between 2017 and 2022 by a statistical method called fixed effects panel regression to analyze the impact of the COVID-19 pandemic on various aspects of companies' capital structures, including their leverage ratios, debt maturity, and capital structure decisions, across eight different industries. This approach enables controlling for differences between companies and industries that might affect their capital structures and more accurately assessing the pandemic's impact on capital structures.

This paper is divided into four main sections: the literature review, data and methodology, results, and conclusion. The first section of this paper is the literature review which provides an overview of the capital structure theories, empirical evidence on the determinants of capital structure, and changes in capital structures during crises. The second section is about data and methodology, which gives an overview of the data used, target variables, control variables, and

the methodology employed. The third section presents the study's results, including the regression results on capital structures, industries, and the robustness check. Additionally, a discussion of the results is provided in this section. Finally, the conclusion summarizes the essential findings and provides some limitations and ideas for future research. Additionally, this paper provides a list of references and appendices that provide further details on the analysis, including changes in means of total debt to total assets, long-term debt to total assets, and long-term debt to total debt between 2017-2019 and 2020-2022, industry-specific capital structure means, mean changes in total debt to total assets, long-term debt to total assets, and long-term debt to total debt on an industry level, correlation matrix, and the number of companies per industry and country.

1. LITERATURE REVIEW

1.1. Capital structure theories

The research on capital structure has been focusing mainly on the proportion of debt to equity within the balance sheet of companies. It attempts to interpret the combination of financing sources and securities that companies employ to fund their investments (Myers, 2001). The extensive research on capital structure originated from Modigliani & Miller (1958) when they proposed a theory now called capital structure irrelevance theory or M&M theory, which states that in an environment where income tax and distress costs are not a factor, the level of financial leverage does not influence companies' value (Modigliani & Miller, 1958). As the irrelevance theorem is considered to have a too simplistic view of the issue, this proposed theorem generated other researchers to devise theories that can be applied better in a realistic environment (Myers & Majluf, 1984; Kraus & Litzenberger, 1973; Jensen & Meckling, 1976; Solomon, 1963). After 65 years after Modigliani and Miller (1958) proposed their theorem, an indisputable model that would explain companies' capital structure behavior remains unfound (DeAngelo, 2022), which seems appropriate since Modigliani & Miller (1958) themselves concluded in their research with words, "Needless to say, however, much remains to be done before the cost of capital can be put away on the shelf among the solved problems."

While research on companies' capital structures may have been set in motion by Modigliani and Miller (1958), alternative theories such as trade-off theory, pecking order theory, and agency theory have emerged that consider determinants of capital structures in a more realistic setting. An overview of the general theory of capital structure determinants is provided by Harris and Raviv (1991), where they comprehensively examine the existing literature and theories on capital structure, highlighting four main categories of determinants: asymmetric information, agency issues, product and input market interaction, and corporate control considerations. Although some determinants have been identified and general principles established through empirical research, empirical evidence still needs to be explored to support the theoretical frameworks more comprehensively. Additionally, Mostafa & Boregowda (2014) gave an overview of 5 capital structure theories and introduced the traditional trade-off and pecking order theories as the most widely accepted theories of companies' capital structure decisions. The Authors also

concluded that debt issuance positively impacts share prices. In contrast, equity issuance was reported having a negative impact, and agency models suggest that leverage is positively related to the value of the firm, default probability, free cash flow, regulatory extent, liquidity value, and cost of investigating the firm's prospects, while inversely related to growth opportunities and managerial reputation (*Ibid*).

Agency theory suggests that conflicts of interest between shareholders and managers can result in managers making decisions that benefit themselves rather than shareholders (Jensen & Meckling, 1976). Therefore, this theory suggests that leverage could be utilized to mitigate such conflicts, as debt holders can exercise greater control over managers. The misalignment between principal and agent can affect companies' financing decisions, where managers may choose to pursue a capital structure that is more beneficial to them than to shareholders. The theory also suggests that managers may prefer internal or equity financing over debt financing since debt financing comes with limitations that restrict the managers' freedom. However, Ross (1977) proposes that companies might prefer debt financing over equity financing to signal information to investors and that companies could use debt financing as a costly signal to attract investments. This way, companies can reduce information asymmetry while increasing their securities' value. However, debt financing can also help align the interests of managers and shareholders since debt holders have priority in repayment, encouraging managers to make decisions that enhance the company's value. Moreover, debt financing can help to reduce the agency costs associated with free cash flow, which occurs when managers are tempted to invest in negative net present value projects to prevent returns from going to debtholders (Myers, 1984). Overall, agency theory provides insights into the determinants of firms' capital structure decisions and how these decisions can align the interests of managers and shareholders.

The pecking order theory suggests that companies favor internal financing over external financing. When external financing is necessary, companies prefer to finance their investments with debt instead of equity issuance (Myers, 1984; Myers & Majluf, 1984). This theory is based on the concept of information asymmetry, where companies have better quality information about their own internal operations and future prospects than external investors. As a result, external investors may view equity issuance as a signal that the firm has negative information or that managers do not have confidence in prospects. Foundations for pecking order theory and trade-off theory were introduced when Donaldson (1961) argued that companies with higher profitability and more tangible assets have a greater debt capacity.

Additionally, he suggests that factors influencing a firm's debt policy, including its desire for financial flexibility, tax considerations, and the cost of financial distress, were also explored as companies may choose debt financing to take advantage of the tax shield provided by interest payments. However, they also need to consider the risks and costs of financial distress caused by assuming too much debt. Overall, empirical evidence supports the pecking order theory, as studies (Myers & Majluf, 1984; Shyam-Sunder & Myers, 1999) find that firms favor internal financing, debt financing, and equity financing in this order. However, studies also suggest that the pecking order theory only explains financing strategies in some companies, mainly when factors such as profitability and growth opportunities come into the equation (Huang & Song, 2006).

Unlike the pecking order theory, the trade-off theory suggests an optimal debt ratio exists, and companies gradually adjust their capital structure toward it (Myers, 1984). The optimal capital structure is the point at which the marginal benefits of debt equal the marginal costs. In trade-off theory, companies face a trade-off between the benefits and costs of debt financing, with the benefits including the tax shield from interest payments and the costs caused by financial distress costs. Kraus & Litzenberger (1973) study on optimal financial leverage and Baxter (1967) study on leverage, risk of bankruptcy, and the cost of capital both suggest that companies determine their capital structure by balancing the debt ratio to maximize the value of the company. Kraus and Litzenberger (1973) model suggests that optimal financial leverage can be determined based on the preferences of investors towards different states of the economy. The study also emphasizes the relevance of considering investors' preferences when making capital structure decisions. In contrast, Baxter (1967) study focuses on the relationship between leverage and the probability of bankruptcy, or the probability of a firm's assets being worth less than its liabilities. The study finds that as leverage increases, so does the probability of bankruptcy, which in turn will increase the cost of capital.

1.2. Determinants of capital structure

The decision of how companies should finance their operations and investment opportunities has been a topic of great interest to researchers and practitioners for decades (DeAngelo, 2022). Empirical studies have successfully identified factors that influence capital structure decisions

and preferences of companies. Such factors include profitability, size, industry, tax considerations, internal funds availability, and operations riskiness. The significance of these factors may differ based on the unique traits of the company and the prevailing market conditions. This chapter will review the empirical evidence on the determinants of capital structure and discuss their implications for them.

One of the most studied factors is the firm's profitability, which is expected to impact the use of debt financing. This relationship is supported by studies such as Rajan & Zingales (1995) and Abel (2015), which conclude a negative correlation between profitability and leverage, suggesting that profitable firms tend to have lower leverage ratios. Large firms also tend to issue less equity. They have a more substantial adverse influence on the profitability of leverage which supports the pecking order theory and oversimplified conclusions made by Myers (1984). However, the reasons for the preference of larger companies not to issue equity can be explained by factors such as the amount of internally generated funds and the quality of investment opportunities, although Rajan & Zingales (1995) admit not fully knowing why large companies avoid equity financing. Rajan & Zingales (1995) study is also supported by Huang and Song (2006), who found that leverage measured by long-term debt ratio, total debt ratio, and total liabilities ratio decreases with increasing profitability and increases as companies grow. The company's size is one of the most critical factors influencing capital structures (Frank & Goyal, 2003; Frank & Goyal, 2009). Titman & Wessel (1988) study more specifically concludes that short-term debt ratios display a negative correlation to the size of the company and speculated as the reason that decision-making regarding the source of financing in smaller companies may be influenced by relatively high transaction costs faced by smaller companies compared to larger companies when it comes to issuing long-term financial instruments.

One of the main factors that influence capital structure-related decisions is the industry in which a company operates. Frank & Goyal (2009) indeed states that industry leverage is the essential single empirical factor when explaining companies' capital structures. The asset classes and ratio of fixed assets to total assets differ between industries, such as real estate and service. When the proportion of fixed assets to total assets is large, these assets can work as collateral, diminishing potential agency costs and the risk from the lender's point of view. This leads to higher leverage in industries characterized by higher asset tangibility. According to Frank & Goyal (2009), the general principle of the pecking order theory has yet to have an obvious solution to consider factors such as asset tangibility effortlessly, unlike trade-off theory, which can explain various

factors such as size, asset tangibility, and industry leverage. Additionally, a study by Phillips & Mackay (2005) concludes that industry factors help explain a firm's financial structure, the diversity of firms in industries, and the interdependence of real and financial decisions.

1.3. Changes in capital structures during crises

Most studies on capital structures during crises, such as Demirgüç-Kunt et al. (2020), Moradi & Paulet (2019), and Iqbal & Kume (2014), show that external events such as financial crises affect the capital structures of companies, especially those relying more on external financing are vulnerable to shocks in the financial market, and credit providers dictate their preferred method of financing during financial crises. The existing literature on changes in capital structures during crises has investigated and evaluated how companies adjust their financing mix to cope with increased financial constraints and bankruptcy risk during economic downturns, as the adjustments made to capital structures during crises can have long-term consequences for the performance of companies.

Demirgüç-Kunt et al. (2020) show that mainly the use of long-term debt for financing reduced significantly within companies during the global financial crisis and its aftermath in 2008-2011. This reduction in long-term debt financing was more significant with small and medium-sized companies and companies with no access to capital. In contrast, the leverage in large and publicly listed companies did not undergo such significant changes. Authors also found that during the global financial crisis, companies' total debt to total assets, long-term debt to total assets, and long-term debt total debt all decreased compared to pre-crisis levels. However, Iqbal & Kume (2014) suggests in their study on companies from UK, France, and Germany that the leverage ratios increased in both UK and Germany during the crisis, while changes in leverage ratios in companies in France were not deemed statistically significant. The authors concluded that the increased leverage ratio for companies in the UK was mainly caused by an increase in both short- and long-term debt, while companies in France and Germany did not experience significant changes in their leverage ratios.

Some studies have also suggested that some of the determinants of capital structures might differ between the time before the crisis and during the crisis (Moradi & Paulet, 2019; Mohd Azhari et al., 2022; Harrison & Widjaja, 2014). The study by Moradi & Paulet (2019) indicates that the determinants of capital structure differed between the pre-crisis and crisis periods. Before the crisis, profitability, tangibility, and growth opportunities were significant determinants of capital structure, while only profitability and tangibility remained significant during the crisis. Mohd Azhari et al. (2022) found that asset tangibility, liquidity, and company size were significant determinants of capital structure and that profitability was an essential factor influencing total debts before and after the COVID-19 crisis. In addition, it was concluded that before COVID-19, growing enterprises tended to have more significant short-term debts; however, their potential growth did not appear to impact long-term debts. Also, Harrison & Widjaja (2014) provided empirical evidence from the 2008 crisis that tangibility and market-to-book ratio coefficients on capital structure choices became stronger during the crisis compared to the pre-crisis period. The authors added that, in contrast, the coefficient of profitability had a weaker impact on capital structure choice during the crisis than before the crisis and that the coefficient of company size was negative during the crisis, which is the opposite of the situation before the crisis.

The studies reviewed above show that a crisis can significantly impact companies' capital structures while emphasizing the importance of firm characteristics such as size, profitability, growth opportunities, and asset tangibility in determining capital structure adjustments in response to a crisis. However, these studies suggest that the determinants of capital structure can change during a crisis as firms face different financial constraints and priorities. Factors that may have been essential determinants before the crisis, such as growth opportunities, may become less relevant during a crisis. In contrast, factors that provide financial flexibility, such as liquidity and asset tangibility, may play a more prominent role during times of uncertainty.

2. DATA AND METHODOLOGY

2.1. Data

The dataset used for this paper was extracted from Orbis, a worldwide database compiled and managed by Bureau Van Dijk. The originally extracted dataset covered the period of 2016-2022 and included 130 035 companies around the world. However, after examining and cleaning the data to improve the dataset's quality and make it more manageable, the dataset used for this study covers the period of 2017-2022 and necessary annual financial data from 38 116 companies worldwide.

The primary objective of this research paper is to explore the global impact of the COVID-19 crisis on the capital structures of companies and their respective industries. As such, the data cleaning process excluded all companies with negative or zero amounts of total debt, long-term debt, fixed assets, total assets, or revenue from 2017-2022. Trimming this data was to make the dataset more suitable for this study. Additionally, the data cleaning process involved dropping duplicates based on company names, removing outliers, and imputing missing values with averages.

For this study, eight company-level variables were selected as the basis for analysis. The data for these variables were sourced from Orbis. These eight variables were then used to calculate a range of ratios tailored explicitly to this paper's research objectives. The eight variables selected for analysis were carefully chosen to provide a comprehensive overview of the companies under study. They include total debt to total assets, long-term debt to total assets, long-term debt to total debt, size, profitability, tangibility, growth, and liquidity. Each of these variables was deemed necessary to understand the changes in capital structures during the COVID-19 crisis. To provide further clarity and detail, Table 1 describes each of the eight variables used in this study and the COVID-19 variable.

Table 1. Variable descriptions

Abbreviations	Description	Definition
TDTA	Financial leverage	Total liabilities ÷ Total assets
LDTA	Long-term financial leverage	Non-current liabilities ÷ Total assets
LDTD	Debt maturity	Non-current liabilities ÷ Total liabilities
Log of size (millions)	Size of the company	Log × Total assets
Profitability	Return on assets (ROA)	Net income ÷ Total assets
Tangibility	Asset tangibility	Fixed assets ÷ Total assets
Log of growth	Growth opportunities	Log × (Revenue ÷ Total assets)
Liquidity	Cash ratio	Cash and cash equivalents ÷ Total assets
Crisis	COVID-19 crisis	Time dummy variable

Furthermore, changes in capital structures during the COVID-19 pandemic in eight industries were also chosen to investigate in this study. Similarly to Demirgüç-Kunt et al. (2020), the industries chosen are mining, construction, manufacturing, transportation and communication, utilities, wholesale trade, retail trade, and services. These industries are interesting industries to investigate when it comes to changes in capital structures during COVID-19, as they represent a broad range of sectors that could have been affected by the pandemic in different ways. The pandemic presented several challenges for industries like construction, manufacturing, transportation and communication, retail trade, services, wholesale trade, and utilities. These obstacles include disruptions in supply chains, reduced demand, changes in consumer behavior, and difficulties in sales and distribution channels. As a result, examining the changes in the capital structures of these industries during COVID-19 could provide valuable information about how companies responded and adapted to the pandemic. This includes any changes they made to their financing strategies and sources of capital.

2.2. Dependent variables

This paper focuses on examining 3 three dependent variables, which are total debt to total assets (TDTA), long-term debt to total assets (LDTA), and long-term debt to total debt (LDTD). These three variables were also used in previous studies successfully when crisis effects on capital structures were examined (Demirgüç-Kunt et al., 2020). TDTA is meant to provide insight into companies' financial leverage and indicate the extent to which companies rely on debt to finance their operations and assets. LDTA is meant to provide more detailed insight into capital structures and to capture more precisely how much companies rely on long-term debt to finance

their assets. LDTD aims to capture debt maturity and provide insights into companies' financial health, as long-term debt might leave a company more vulnerable to market fluctuation.

Descriptive statistics in Table 2 show that in TDTA, there was a decrease in the mean and median values during the crisis period compared to the pre-crisis period, indicating a lower proportion of assets financed by debt during the crisis. LDTA remained stable over both periods, with similar mean and median values. For LDTD, the mean value increased during the crisis period compared to the pre-crisis period, suggesting a higher proportion of total debt that is long-term debt during the crisis. The median value also increased during the crisis period. The standard deviations remained similar across both periods for all three ratios, indicating that the variability of the data did not change significantly during the crisis period. The insights we can draw from the table are that the financial ratios varied during the crisis compared to the pre-crisis period. TDTA decreased, while LDTD increased during the crisis period. However, LDTA remained stable over both periods. The standard deviations remained similar across both periods for all three ratios, indicating that the variability of the data did not change significantly during the crisis period.

Table 2. Descriptive statistics

	Total (2017-2022)			Pre-crisis (2017-2019)			Crisis (2020-2022)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
TDTA	0.579	0.600	0.237	0.590	0.615	0.236	0.568	0.585	0.239
LDTA	0.258	0.209	0.212	0.256	0.208	0.210	0.260	0.211	0.214
LDTD	0.426	0.413	0.273	0.417	0.402	0.272	0.435	0.425	0.274
(Log) size	455.183 (1.508)	4.094 (1.424)	7563.770 (2.330)	420.104 (1.445)	3.830 (1.358)	7143.658 (2.320)	490.397 (1.570)	4.386 (1.491)	7963.116 (2.339)
Profitability	0.044	0.030	0.105	0.046	0.031	0.102	0.042	0.030	0.109
Tangibility	0.420	0.396	0.262	0.423	0.399	0.263	0.417	0.394	0.261
(Log) growth	1.428 (0.035)	1.194 (0.174)	1.117 (0.943)	1.509 (0.100)	1.270 (0.236)	1.159 (0.924)	1.346 (-0.031)	1.122 (0.113)	1.067 0.957)
Liquidity	0.220	0.174	0.187	0.204	0.157	0.179	0.236	0.192	0.193

Notes: Size measured in millions, natural logarithm of size and growth in parenthesis
Source: Orbis (2023), calculated by author

Appendix 1 (see appendices) provides sets on the capital structure of various industries. Table 8 (see appendices) includes the mean values of total debt to total assets (TDTA), long-term debt to total assets (LDTA), and long-term debt to total debt (LDTD) for different industries. The range of values for TDTA, LDTA, and LDTD is quite significant across different industries, indicating that the level of leverage varies widely across different sectors. The highest mean value of TDTA is observed in the wholesale trade industry, followed by retail trade and construction.

This suggests that companies in these industries tend to have a higher level of debt relative to their assets. The highest mean value of LDTA is observed in the utility industry, followed by construction, transportation, and communication, which indicates that companies tend to rely more heavily on long-term debt to finance their assets. The highest mean value of LDTD is observed in the utilities industry, followed by mining, transportation, and communication, indicating that companies in these industries tend to have a higher long-term debt relative to their total debt.

Figures 2, 3, and 4 (see appendices) show the changes in means for the three ratios (TDTA, LDTA, and LDTD) for different industries over two periods (2017-2019 and 2020-2022). The results indicate that, on average, all industries experienced decreases in mean values for TDTA and LDTA during the crisis period, except for utilities, which saw a significant decrease in the mean value for LDTD. This suggests that companies in most industries were able to reduce their debt levels during the crisis, possibly through cost-cutting measures or government support programs. The construction and utilities industries observed the most significant decreases in mean values for TDTA and LDTA. In contrast, the wholesale trade industry observed the most significant increase in the mean value for LDTA.

2.3. Control variables

Data extracted from Orbis was also utilized to create specific factors to provide insight into company capital structure variations. These factors include the company's size, profitability, asset tangibility, growth opportunities, and liquidity. These factors have been used in the existing literature on determinants of capital structures and identified as influencing factors to companies' capital structures on some level (Demirgüç-Kunt et al., 2020; Song, 2005; Fama & Jensen, 1983; Fama & Jensen, 1983; Frank & Goyal, 2009; Huang & Song, 2006; Rajan & Zingales, 1995).

A most existing literature agrees that size positively correlates with leveraging, although for varying reasons. Song (2005) suggests that the company size could be an inverse proxy for the probability of bankruptcy as larger companies are less likely to be more diversified and, therefore, less likely to fail. This would lead to larger companies being able to issue debt with lower costs. Another explanation of why larger companies have more leverage than smaller

companies is suggested by Fama & Jensen (1983), where larger companies might have more leverage because they are more transparent and scrutinized. They provide more information to external investors; therefore, less asymmetric information is associated with large companies. Profitability, however, is expected to correlate negatively with leverage which is supported by the pecking order theory. Companies that can generate profit are more likely to use internal funds to finance their operations than to be less likely to issue debt (Rajan & Zingales, 1995; Frank & Goyal, 2009).

Like size, asset tangibility is also expected to correlate positively with leverage because tangible assets can be used as collateral when issuing debt, lowering the risk from the lender's perspective and agency costs. In addition, tangible assets often require more long-term funding (Demirgüç-Kunt et al., 2020; Frank & Goyal, 2009). Studies have suggested that growth opportunities have a negative impact on a company's leverage. This is because firms with more investment opportunities tend to avoid investments with higher leverage levels. Myers (1977) found that companies with higher growth opportunities tend to forego investments if they are highly leveraged. Empirical studies such as Titman & Wessels (1988) and Rajan & Zingales (1995) have also found evidence supporting the negative correlation between growth opportunities and leverage. Finally, liquidity, the impact of liquidity on leverage, has been investigated in empirical studies. These studies have identified a negative association between liquidity and leverage, suggesting that companies with high liquidity tend to have lower leverage ratios, as seen in Lipson & Mortal (2009).

Table 2 provides descriptive statistics for the control variables used in this paper across 2017-2022. The mean and median sizes of companies are 456.578 million and 4.154 million, respectively, with a substantial standard deviation of 7593.627. Before the crisis (2017-2019), companies' mean, and median size was slightly lower at 420.644 million and 3.887 million, respectively, with a standard deviation of 7169.312. However, during the crisis period (2020-2022), companies' mean and median sizes increased to 492.512 million and 4.440 million, respectively, with a higher standard deviation of 7969.312. Profitability, measured by return on assets, has a mean value of 0.045 and a median value of 0.031 across all years, with a standard deviation of 0.104. The mean and median profitability values are higher during the pre-crisis period (2017-2019) at 0.047 and 0.031, respectively, with a standard deviation of 0.101. However, during the crisis period (2020-2022), the mean and median profitability values decreased to 0.042 and 0.030, respectively, with the same standard deviation of 0.101. Asset

tangibility, measured by the ratio of fixed assets to total assets, has a mean value of 0.421 and a median value of 0.397 across all years, with a standard deviation of 0.262. The mean and median values are slightly higher during the pre-crisis period (2017-2019) at 0.424 and 0.399, respectively, with a standard deviation of 0.263. During the crisis period (2020-2022), the mean and median values remain relatively stable at 0.418 and 0.394, respectively, with a standard deviation of 0.263. Growth opportunities, measured by the total revenues to total assets, have a mean value of 1.422 and a median value of 1.190 across all years, with a standard deviation of 1.111. The mean and median values are slightly higher during the pre-crisis period (2017-2019) at 1.503 and 1.266, respectively, with a smaller standard deviation of 1.152. During the crisis period (2020-2022), the mean and median values decreased to 1.342 and 1.119, respectively, but the standard deviation remained at 1.152. Finally, liquidity, measured by the ratio of cash and cash equivalents to total assets, has a mean value of 0.220 and a median value of 0.174 across all years, with a standard deviation of 0.187. The mean and median values are slightly higher during the crisis period (2020-2022) at 0.236 and 0.192, respectively, with a standard deviation of 0.179.

The descriptive statistics presented in Table 2 provide valuable insights into the performance of companies during the pre-crisis and crisis periods (2017-2022). Larger companies fared better during the crisis period, with higher mean and median sizes than the pre-crisis period. However, the pandemic had a negative impact on profitability, with lower mean and median values during the crisis period. Asset tangibility remained stable, while growth opportunities decreased during the crisis, indicating that the pandemic may have hindered long-term growth. Interestingly, companies increased their liquidity during the crisis, potentially prioritizing short-term financial stability over long-term growth. These insights suggest that companies must adapt to the unprecedented challenges posed by the pandemic and make strategic decisions to ensure their survival and stability.

2.4. Methodology

Multiple regression analysis is an effective statistical method for analyzing the determinants of capital structure. It is well-suited for studying the impact of various company-level characteristics, such as size, profitability, growth opportunities, asset tangibility, and liquidity, on

the leverage ratio, typically used as the dependent variable. By identifying the most important variables affecting the dependent variable and controlling for the effects of other variables that might confound the relationship between the independent and dependent variables, multiple regression analysis can help estimate the magnitude and direction of the relationship between these variables and assess their statistical significance. This study aims to identify the significant factors that impact a company's capital structure and estimate the effect on the chosen three dependent variables, specifically in the COVID-19 pandemic, by using multiple regression analysis.

Similar to previous studies (Demirgüç-Kunt et al., 2020; Moradi & Paulet, 2019; Iqbal & Kume, 2014), the changes in capital structures during the COVID-19 crisis are being examined by an empirical model which links the leverage variables to observable characteristics, time dummies to capture the COVID-19 crisis, and fixed unobservable effects. Observable characteristics include company-level control variables size, profitability, growth opportunities, asset tangibility, and liquidity, while the COVID-19 crisis is captured by inserting a time dummy to represent the years 2020-2022 when the pandemic disrupted the economy. Fixed unobservable effects include factors that are not directly observable but are assumed to remain constant throughout the studied period, such as the company's management style, corporate culture, or institutional framework.

The equation 1 represents a panel data regression model that examines the relationship between leverage (measured by total debt to total assets, long-term debt to total assets, and long-term debt to total debt) and a set of control variables (size, profitability, tangibility, growth, and liquidity) before and during the crisis period. The model includes individual fixed effects to control unobserved heterogeneity across firms. The crisis period is represented by the dummy variable Crisis, which takes a value of one for 2020-2022 and 0 otherwise. Including this variable allows us to test whether the relationship between leverage and the control variables changes during the crisis compared to the pre-crisis period. The model also includes an intercept, which captures the average level of leverage across all firms in the sample when all control variables are held constant. The error term represents the unobserved factors that affect the leverage of the company i at time t.

A natural logarithm is used for size (total assets) and growth (revenue to total assets) because these variables are characterized by high skewness and kurtosis in their distributions. Taking the

natural logarithm of these variables makes the distribution more symmetrical and normally distributed, therefore better suited for regression analysis. Using the natural logarithm can also help to interpret the coefficients in a more meaningful way.

$$Leverage_{i,t} = \alpha + \beta Controls_{i,t} + \mu_0 Crisis + \epsilon_{i,t} \quad (1)$$

where
α – constant,
$Leverage_{i,t}$ – TDTA, LDTA and LDTD,
$Controls_{i,t}$ – log of size, profitability, tangibility, log of growth, and liquidity,
$Crisis$ – time dummy to represent the period of 2020-2022,
$\epsilon_{i,t}$ – error term.

The methodology employed in this study involved running a fixed-effects panel regression model with three leverage variables as dependent variables, five company-level control variables, and a time dummy variable representing the effect of the Covid-19 pandemic. Fixed effects were determined as the better method by conducting the Hausman test. The Beck-Katz standard errors were used to measure the uncertainty of the estimated coefficients. The model also included a constant term to capture any unobserved effects. The analysis was performed on 38116 cross-sectional units. The model's goodness of fit was assessed using measures like Durbin-Watson to test autocorrelation in the model, the LSDV R-squared, and the within R-squared for the overall fitness of the model. The robustness of the results was tested using a joint test on named regressors and a robust test for differing group intercepts. The Beck-Katz standard errors were used to address the problem of heteroscedasticity, cross-sectional dependence, overestimation of the significance of the explanatory variables, and potential type I errors. A correlation matrix was also compiled to check the dataset for multicollinearity (see Appendix 1). Overall, this fixed-effects panel regression model was appropriate for examining the relationship between the independent and dependent variables.

The primary analysis is conducted using the entire dataset. However, given the heavy domination of the dataset by two countries (see Appendix 2), a robustness analysis is necessary to assess the potential impact of excluding companies from these countries on the main findings. Therefore, the results part of this paper presents the robustness analysis results and discusses their implications for the primary analysis.

By estimating the coefficients of the control variables, we can determine their impact on leverage. The time dummies represent the effects of the pre-crisis and crisis periods on leverage,

allowing us to compare the differences between the two periods. Overall, this equation can provide insights into how changes in the control variables and time impact the leverage of a company, which can help to identify factors that contribute to changes in leverage during times of economic uncertainty, such as the COVID-19 pandemic.

3. RESULTS

This part of the paper examines the effect of the COVID-19 pandemic on the capital structures of companies worldwide and across eight industries: construction, manufacturing, mining, retail trade, services, transportation and communication, utilities, and wholesale trade. Panel dataset covering the years 2017-2022 includes variables such as total debt to total assets, long-term debt to total asset, and long-term debt to total debt as independent variables, and total assets, ROA, revenue to total asset, fixed asset to total asset, cash, and cash equivalents, and a time dummy variable to represent the COVID-19 pandemic as dependent variables. This fixed effect panel data regression analysis provides insights into how companies' capital structures have changed in response to the pandemic and sheds light on how different industries were affected. Furthermore, to test the robustness of the results, sensitivity analysis was conducted where all companies from Japan and Sweden were excluded for having a dominant presence in the dataset.

3.1. Regression results on capital structures

Table 3 shows that larger firms have higher leverage levels, as indicated by the positive coefficient of Log Size in all three debt ratio models (TDTA, LDTA, and LDTD). This finding is consistent with previous literature suggesting that larger firms have better access to capital markets and can borrow more effortlessly than smaller firms (Rajan & Zingales, 1995).

Profitability has a negative impact on leverage, which is in line with the pecking order theory that suggests profitable firms have lower debt levels (Myers & Majluf, 1984). This is supported by the negative coefficients of profitability in all three capital structure models. Tangibility, which measures the ratio of fixed assets to total assets, has a positive effect on leverage, as indicated by the positive coefficients of Tangibility in LDTA and LDTD models. This is consistent with previous literature that suggests tangible assets can serve as collateral and reduce the perceived risk of lenders, thereby increasing the likelihood of obtaining debt financing (Titman & Wessels, 1988).

The coefficient of Liquidity, which measures the amount of cash and cash equivalents to total assets, is negative in all three debt ratio models, indicating that firms with higher liquidity levels

have lower leverage levels. This finding is consistent with the pecking order theory that suggests firms prioritize internal financing over external financing, and cash reserves serve as a source of internal financing (Myers & Majluf, 1984). The Covid-19 crisis dummy variable has a statistically significant negative coefficient in the TDTA model, indicating that companies decreased their total debt levels during the crisis. This study did not find coefficients of crisis variable statistically significant for LDTA and LDTD with p-values 0.293 and 0.204, respectively, and changes in means between 2017-2019 and 2020-2022 in LDTA was only 0.43 percentage points. However, an increase of 1.77 percentage points in LDTD means between 2017-2019 and 2020-2022. A positive coefficient can still provide some insights into the effect of the COVID-19 pandemic debt maturity while being statistically insignificant. This finding is consistent with a previous study on companies from UK, France, and Germany, finding that companies increase their leverage during economic distress Iqbal & Kume (2014), while results of a global study by Demirgüç-Kunt et al. (2020) produced different results where leverage ratios decreased during the crisis.

Table 3. Regression results on total debt to total assets, long-term debt to total assets, and long-term debt to total debt from the period 2017-2022

	TDTA			LDTA			LDTD		
	Coeff	SE	p-value	Coeff	SE	p-value	Coeff	SE	p-value
Const	0.527	0.017	0.000	0.066	0.009	0.000	0.177	0.010	0.000
Log size	0.069	0.010	0.000	0.036	0.004	0.000	0.015	0.005	0.003
Profitability	-0.308	0.046	0.000	-0.188	0.026	0.000	-0.110	0.015	0.000
Tangibility	-0.007	0.009	0.478	0.305	0.004	0.000	0.460	0.010	0.000
Log growth	0.002	0.004	0.573	-0.025	0.003	0.000	-0.047	0.005	0.000
Liquidity	-0.116	0.011	0.000	0.082	0.010	0.000	0.163	0.012	0.000
Crisis	-0.028	0.006	0.000	-0.005	0.005	0.293	0.007	0.005	0.204

Notes: R-squares for total debt to total assets, long-term debt to total assets and long-term debt total assets respectively 0.152, 0.141 and 0.121 and 228 696 observations for each model
Sources: Orbis, calculated by author

Overall, the results suggest that firm size, profitability, tangibility, Liquidity, and the Covid-19 crisis significantly impacted firms' debt levels worldwide from 2017 to 2022. These findings align with previous literature on the determinants of leverage and provide insights into how firms responded to the Covid-19 crisis.

3.2. Regression results on industries

The following subchapter presents the results of a fixed effects panel data regression analysis conducted on eight industries: construction, mining, manufacturing, wholesale trade, retail trade, transportation and communication, and services. The analysis employs a similar regression equation as the previous chapter, adding separately conducted regressions on each industry to identify the determinants of leverage (measured by TDTA, LDTA, and LDTD) and examine the impact of the COVID-19 crisis on leverage within each industry. The study sheds light on each industry's unique characteristics and how they influence the companies' leverage. The findings of this analysis will contribute to the literature on the determinants of leverage in various industries and the impact of external shocks on companies' capital structure.

3.2.1. Regression coefficients for industries

Table 4 presents the results of a fixed effects panel data regression analysis on the determinants of leverage in seven different industries: construction, mining, manufacturing, wholesale trade, retail trade, transportation and communication, and services. The analysis aims to identify the factors influencing leverage in each industry and to examine the impact of the COVID-19 crisis on leverage. The regression equations used for each industry are similar to those presented in the previous chapter, including industry-specific controls.

The findings of this study are consistent with previous research. For instance, the positive relationship between firm size and leverage aligns with the pecking order theory (Myers, 1984). The negative relationship between profitability and leverage is consistent with the trade-off theory (Jensen & Meckling, 1976). The negative effect of liquidity on leverage is also consistent with previous studies (Rajan & Zingales, 1995). Regarding the industry-specific findings, our results indicate that tangibility has a negative statistically significant effect on leverage in construction, mining, and wholesale trade. At the same time, it is positively related to leverage in retail trade, utilities, transportation, and communication. These findings align with previous studies that suggest that the relationship between tangibility and leverage may vary across industries (Titman & Wessels, 1988). Finally, the impact of the COVID-19 crisis on leverage is negative across all industries and significant in all industries except mining.

Furthermore, Table 4 shows that the crisis variable has a negative coefficient for all industries, indicating that crises are associated with lower total debt to total assets ratios. However, it is worth noting that the magnitude of the coefficient varies across industries. In particular, the coefficients are most negative for the construction and utilities industries, suggesting that crises have a particularly strong impact on these sectors. On the other hand, the coefficient for the mining industry is relatively small and not statistically significant, suggesting that crises may have a weaker impact on total debt to total assets ratios in this industry. Overall, these results suggest that crises have a negative impact on firms' capital structures, but the magnitude of this impact may vary depending on the industry in question.

Table 4. Regression coefficients on total debt to total assets per industry from the period 2017-2022

	Manufacturing	Construction	Mining	Retail trade	Service	T & C	Utilities	Wholesale trade
Const	0.474***	0.590***	0.394***	0.578***	0.528***	0.507***	0.429***	0.550***
Log size	0.060***	0.102***	0.034***	0.053***	0.047***	0.083***	0.069***	0.073***
Profitability	-0.332***	-0.309***	-0.176***	-0.334***	-0.283***	-0.339***	-0.361***	-0.348***
Tangibility	-0.016	-0.063***	-0.073*	0.064***	0.007	0.108***	0.077***	-0.043***
Log growth	0.003	-0.010**	0.014***	-0.008**	0.014***	0.001	-0.009*	-0.006*
Liquidity	-0.134***	-0.115***	-0.246***	-0.061***	-0.115***	-0.121***	-0.066**	-0.085***
Crisis	-0.020***	-0.044***	-0.006	-0.029***	-0.022**	-0.031***	-0.040***	-0.026***
Observations	50922	44496	1782	17010	56526	15960	3504	38496
R-squared	0.137	0.221	0.111	0.165	0.121	0.253	0.207	0.160

Notes: Significance levels: ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$.
Source: Orbis, calculated by author

The findings reported in Table 5 are relatively consistent with the existing literature on the determinants of capital structure. The positive effect of company size and tangibility on long-term debt is well-established in prior research (Rajan & Zingales, 1995; Frank & Goyal, 2003). The literature also widely recognizes the negative impact of profitability and growth opportunities on leverage (Myers, 1984; Titman & Wessels, 1988). The positive effect of liquidity on leverage in almost all industries is a less common result. However, it could be explained by companies taking more debt to increase their liquidity as times of uncertainty and financial distress increase the importance of liquidity. The negative relationship between liquidity and leverage in the mining industry is more consistent with the pecking order theory. The impact of the crisis on long-term debt to total assets is negative across all industries except

wholesale trade but not statistically significant except for a negative and statistically significant effect in utilities, and transportation and communication industries.

Table 5. Regression coefficients on long-term debt to total assets per industry from the period 2017-2022

	Manufacturing	Construction	Mining	Retail trade	Service	T & C	Utilities	Wholesale trade
Const	0.030**	0.074***	0.116***	0.141***	0.099***	0.033**	0.070***	0.110***
Log size	0.032***	0.036***	0.011**	0.058***	0.029***	0.082***	0.076***	0.018***
Profitability	-0.200***	-0.195***	-0.096***	-0.224***	-0.164***	-0.217***	-0.239***	-0.224***
Tangibility	0.318***	0.350***	0.120***	0.256***	0.251***	0.340***	0.227***	0.280***
Log growth	-0.030***	-0.032***	-0.002	-0.042***	-0.011***	-0.040***	-0.034***	-0.035***
Liquidity	0.094***	0.108***	-0.072**	0.042***	0.042***	0.069***	0.005	0.122***
Crisis	-0.004	-0.005	-0.003	-0.010	-0.006	-0.020***	-0.024***	0.001
Observations	50922	44496	1782	17010	56526	15960	3504	38496
R-squared	0.148	0.173	0.080	0.161	0.106	0.280	0.184	0.123

Notes: Significance levels: ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$.
Source: Orbis, calculated by author

The findings presented in Table 6 are consistent with prior literature that suggests that companies with a higher proportion of tangible assets are more likely to use long-term debt (Titman & Wessels, 1988) as tangible assets are generally considered collateralizable and provide lenders with a lower risk of default, which may explain the positive effect of tangibility on long-term debt usage. The negative impact of growth opportunities on long-term debt usage is also consistent with prior literature (Myers, 1977). Companies with better growth opportunities have a greater need for financing, but they also have a greater potential for default, which may discourage lenders from providing long-term debt. The negative effect of profitability on long-term debt usage is consistent with the pecking order theory (Myers & Majluf, 1984), which suggests that profitable companies are less likely to rely on external financing because they have greater internal financing resources. The positive effect of liquidity on long-term debt usage is consistent with the trade-off theory (Kraus & Litzenberger, 1973), which suggests that companies with greater liquidity are more likely to use long-term debt because they can make timely interest payments. The mixed impact of the crisis on long-term debt usage is also logical, as the effect of economic disruption such as COVID-19 would vary between industries.

Table 6. Regression coefficients on long-term debt to total debt per industry from the period 2017-2022

	Manufacturing	Construction	Mining	Retail trade	Service	T & C	Utilities	Wholesale trade
Const	0.122***	0.164***	0.213***	0.261***	0.236***	0.136***	0.191***	0.228***
Log size	0.017***	-0.004	0.017***	0.0457***	0.015**	0.068***	0.077***	-0.013**
Profitability	-0.120***	-0.126***	-0.027	-0.144***	-0.083***	-0.113***	-0.143***	-0.173***
Tangibility	0.509***	0.531***	0.313***	0.342***	0.387***	0.457***	0.348***	0.430***
Log growth	-0.054***	-0.054***	-0.017***	-0.062***	-0.038***	-0.058***	-0.037***	-0.053***
Liquidity	0.192***	0.203***	0.067	0.070***	0.105***	0.151***	0.086**	0.197***
Crisis	0.007	0.014**	0.002	0.001	-0.001	-0.008	-0.001	0.016***
Observations	50922	44496	1782	17010	56526	15960	3504	38496
R-squared	0.142	0.159	0.058	0.123	0.086	0.199	0.109	0.125

Notes: Significance levels: ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$.
Source: Orbis, calculated by author

3.3. Robustness check

Table 7 presents the results of a robustness check on the determinants of leverage and long-term debt usage. The table includes coefficients, standard errors, and p-values for each variable, allowing for an analysis of the statistical significance of each variable in the regression models. The table examines the impact of factors such as company size, profitability, tangibility, growth opportunities, liquidity, and the COVID-19 crisis on leverage and long-term debt usage in different industries, with companies from Sweden and Japan excluded.

Table 7. Regression results on total debt to total assets, long-term debt to total assets, and long-term debt to total debt from the period 2017-2022: Robustness check

	TDTA			LDTA			LDTD		
	Coeff	SE	p-value	Coeff	SE	p-value	Coeff	SE	p-value
Const	0.448	0.021	0.000	0.000	0.013	0.986	0.010	0.014	0.000
Log size	0.051	0.009	0.000	0.036	0.005	0.000	0.033	0.005	0.000
Profitability	-0.286	0.039	0.000	-0.137	0.018	0.000	-0.062	0.013	0.000
Tangibility	0.009	0.010	0.385	0.249	0.007	0.000	0.404	0.011	0.000
Log growth	0.012	0.004	0.001	-0.011	0.002	0.000	-0.032	0.005	0.000
Liquidity	-0.128	0.013	0.000	0.036	0.006	0.000	0.094	0.008	0.000
Crisis	-0.017	0.007	0.021	-0.003	0.007	0.724	0.003	0.010	0.798

Notes: R-squares for total debt to total assets, long-term debt to total assets and long-term debt total assets respectively 0.108, 0.102 and 0.090. 81420 observations for each model
Source: Orbis, calculated by author

Table 7 shows similar coefficients and standard errors to Table 3, indicating that the results are robust to changes in the sample, and omitting companies from Japan and Sweden does not significantly affect the model. However, there are some differences in the coefficients and p-values for certain variables. For instance, Table 7 indicates a constant term of 0.448 for TDTA, while Table 3 shows a value of 0.527. Moreover, the coefficients for tangibility are 0.009 and -0.007 in Table 7 and Table 3, respectively. Nonetheless, the log size, profitability, liquidity, and crisis coefficients are similar across both tables. The p-values for most independent variables are below 0.05 in both tables, implying that they are significant predictors of the dependent variables. The constant term's p-values are very low, indicating significant differences from zero. Overall, despite some discrepancies in specific coefficients, the general trends and significance of the independent variables remain consistent across both tables. Thus, the regression model is relatively robust to sample and model specification changes.

3.4. Discussion of the results

This paper presents the results of a series of regression analyses on the determinants of leverage and long-term debt usage across industries, as well as the impact of the COVID-19 crisis on these factors. Consistent with prior literature, the study finds that larger companies and those with more tangible assets tend to have higher leverage levels, while profitability and growth opportunities negatively impact leverage. Additionally, firms with higher liquidity levels tend to have lower leverage, consistent with the pecking order theory. These findings align with previous studies such as Rajan and Zingales (1995) and Myers (1984), who found that firms use internal funds before resorting to external financing and that tangible assets serve as collateral to secure debt financing. The study also finds that the COVID-19 crisis has had a negative impact on leverage across most industries, except for mining. This finding is consistent with studies on economic distress, such as Demirgüç-Kunt et al. (2020) which suggest that companies tend to decrease their total debt levels during economic downturns.

Moreover, the text highlights the industry-specific findings of the study. The relationship between tangibility and leverage varies across industries, with tangibility having a negative statistically significant effect on leverage in construction, mining, and wholesale trade and positively related to leverage in retail trade, utilities, transportation, and communication. These

findings align with previous studies, such as Titman and Wessels (1988), which suggest that industry-specific factors may influence the relationship between tangibility and leverage. The impact of the COVID-19 crisis on long-term debt to total assets is negative across all industries except wholesale trade but only statistically significant in utilities, and transportation and communication. These results highlight the importance of considering industry-specific factors when examining the impact of economic events on corporate finance decisions and support the findings of Moradi & Paulet (2019)

In summary, the study's findings provide valuable insights into the determinants of leverage and long-term debt usage across industries, as well as the impact of the COVID-19 crisis on these factors. The results are consistent with prior literature and highlight the importance of context-specific analysis when examining the impact of economic events on corporate finance decisions.

CONCLUSION

The paper investigates the effect of the COVID-19 pandemic on companies' capital structures worldwide. The pandemic has disrupted the global economy, leading to financial distress for many companies and changes in their capital structures. The study examines the pandemic's impact on companies' leverage ratios, debt maturity, and capital structure decisions in eight industries. The research problem is essential to understand the financial resilience of firms during crises, as external events significantly impact firms' capital structures.

The COVID-19 pandemic has affected every aspect of life worldwide since it started in late December 2019. Governments' countermeasures, such as lockdowns, have adversely affected economic sectors such as businesses, the travel industry, and tourism. The pandemic has also impacted global unemployment rates and financial markets, leading to a drop in most worldwide indices. The study's hypotheses examine the effects of the pandemic on companies' leverage ratios, debt maturity, capital structure decisions, and their impact on different industries.

The study found that larger firms have higher leverage levels, consistent with previous literature suggesting that larger firms have better access to capital markets and can borrow more effortlessly than smaller companies (Moradi & Paulet, 2019). Profitability has a negative impact on leverage, in line with the pecking order theory, which suggests profitable companies have lower debt levels (Rajan & Zingales, 1995). Tangibility has a positive effect on leverage, as tangible assets can serve as collateral and reduce the perceived risk of lenders, thereby increasing the likelihood of obtaining debt financing (Frank & Goyal 2009). Liquidity, which measures the amount of cash and cash equivalents to total assets, is negative in all three debt ratio models, indicating that companies with higher liquidity levels have lower leverage levels, consistent with the pecking order theory. The COVID-19 crisis had a negative impact on total debt to total assets levels across all industries while displaying mixed results on long-term debt to total assets and long-term debt total debt levels.

The study's findings are consistent with prior literature on the determinants of capital structure. The positive effect of firm size and tangibility on long-term debt is well-established in prior research (Tiltman & Wessels, 1988; Rajan & Zingales, 1995). The literature also widely recognizes the negative impact of profitability and growth opportunities on leverage. The

positive effect of liquidity on long-term debt to total assets and long-term debt to total debt in almost all industries is a less common result. However, it could be explained by companies taking more debt to increase their liquidity as times of uncertainty and financial distress increase the importance of liquidity. The negative relationship between liquidity and leverage in the mining industry is more consistent with the pecking order theory. The impact of the crisis on long-term debt to total assets is negative across all industries except wholesale trade but not statistically significant except for a negative and statistically significant effect in utilities, and transportation and communication.

Despite its valuable insights, the study has some weaknesses that should be considered. First, the study only examines the effect of the pandemic on eight industries, which may only be representative of some industries worldwide. Additionally, the study focuses solely on the impact of the pandemic on companies' capital structures and does not consider other factors, such as government policies or macroeconomic factors. Furthermore, the study's sample only includes companies with available financial data in Orbis from 2017 to 2022, potentially leaving out smaller companies and companies that the pandemic may have more severely impacted. Lastly, the study does not consider the long-term effects of the pandemic on firms' financial resilience and capital structures, which could be critical in understanding the future financial health of companies. Overall, the study's findings should be interpreted with caution, and additional research should be conducted to better understand the complex and evolving nature of firms' capital structures during times of crisis.

Future research could explore the impact of government support programs on companies' capital structures during the COVID-19 pandemic. Many governments worldwide introduced fiscal policies to support companies affected by the pandemic, such as grants, loans, and tax breaks. The effects of these policies on companies' capital structures still need to be fully understood, and future research could shed light on this. Moreover, the pandemic has accelerated digitalization and innovation in many industries, which could impact companies' financing decisions and capital structures. Future research could examine how these changes affect companies' leverage ratios, debt maturity, and capital structure decisions. Additionally, investigating the impact of the pandemic on the cost of capital and the availability of financing could be another area of future research. Understanding the implications of the pandemic on companies' financing decisions can provide valuable insights for policymakers and business leaders.

In conclusion, the COVID-19 pandemic has significantly impacted companies' capital structures worldwide, with changes in leverage ratios, debt maturity, and capital structure decisions across different industries. The study's findings suggest that larger companies have higher leverage levels, profitability negatively impacts leverage, and tangibility positively affects leverage. Liquidity has a negative relationship with leverage, except in the mining industry, which is consistent with the pecking order theory. The pandemic had a negative impact on total debt to total assets levels across all industries, while the impact on long-term debt to total assets and long-term debt to total debt levels was mixed. Despite the study's valuable insights, there are limitations, and further research is necessary to fully understand the complex and evolving nature of companies' capital structures during times of crisis. Future research could explore the impact of government support programs on companies' capital structures, the effects of digitalization and innovation on financing decisions, and the implications of the pandemic on the cost of capital and financing availability.

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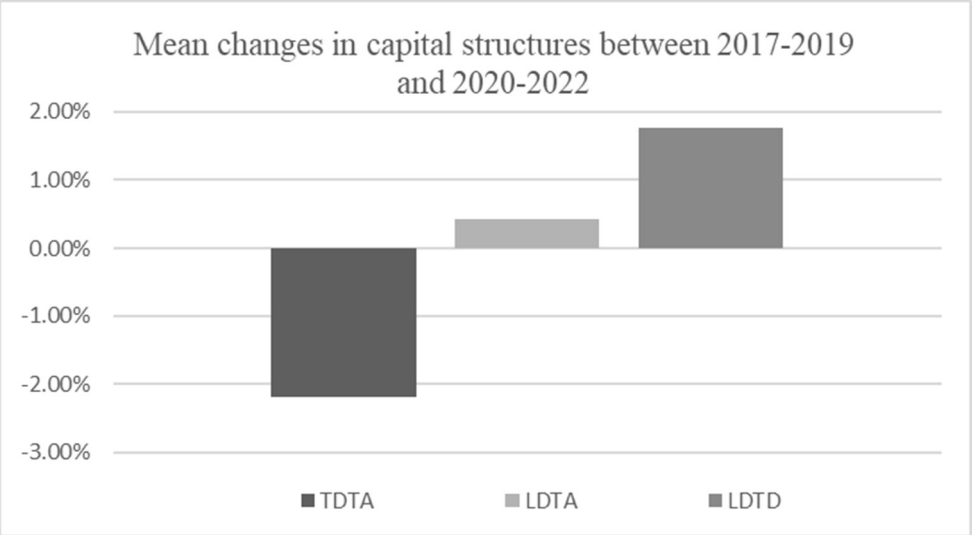
APPENDICES

Appendix 1. Additional descriptive statistics

Figure 1. Changes in means of TDTA, LDTA and LDTD between 2017-2019 and 2020-2022



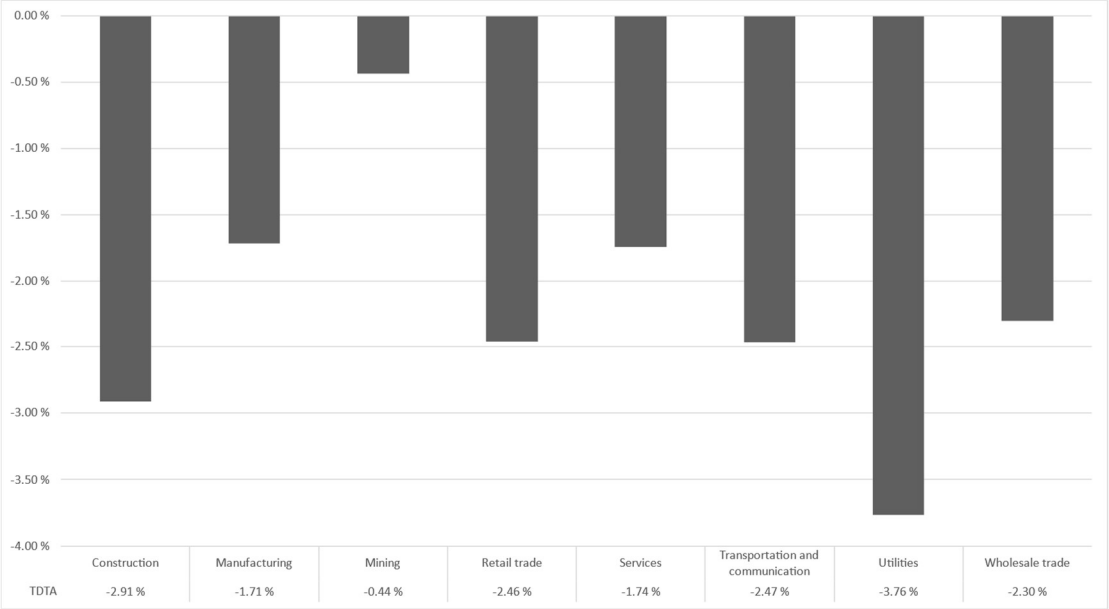
Source: Orbis (2023), created by author based on Table 2

Table 8. Industry specific capital structure means 2017-2022

Industries	TDTA	LDTA	LDTD	No. of companies	Sic
Construction	0.589	0.246	0.398	7416	15-17
Manufacturing	0.566	0.251	0.413	8487	20-39
Mining	0.419	0.217	0.490	297	10-14
Retail trade	0.608	0.276	0.426	2835	50-51
Services	0.521	0.253	0.473	9421	70-89
Transportation and communication	0.600	0.303	0.485	2660	40-48
Utilities	0.594	0.389	0.621	584	49
Wholesale trade	0.632	0.236	0.356	6416	52-59

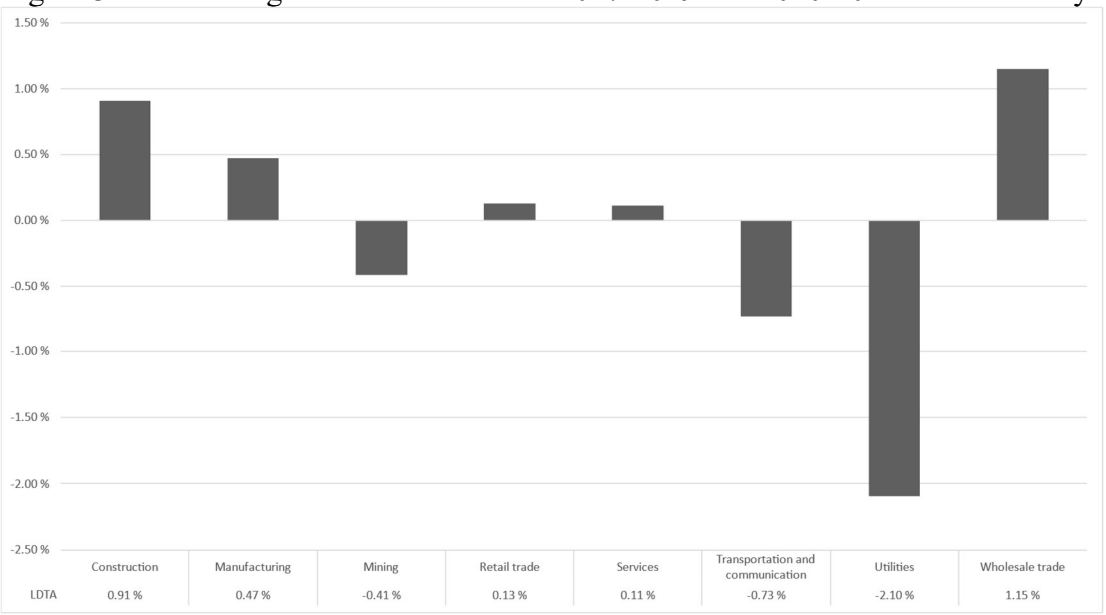
Source: Orbis (2023), calculated by author

Figure 2. Mean changes in TDTA between 2017-2019 and 2020-2022 on an industry level



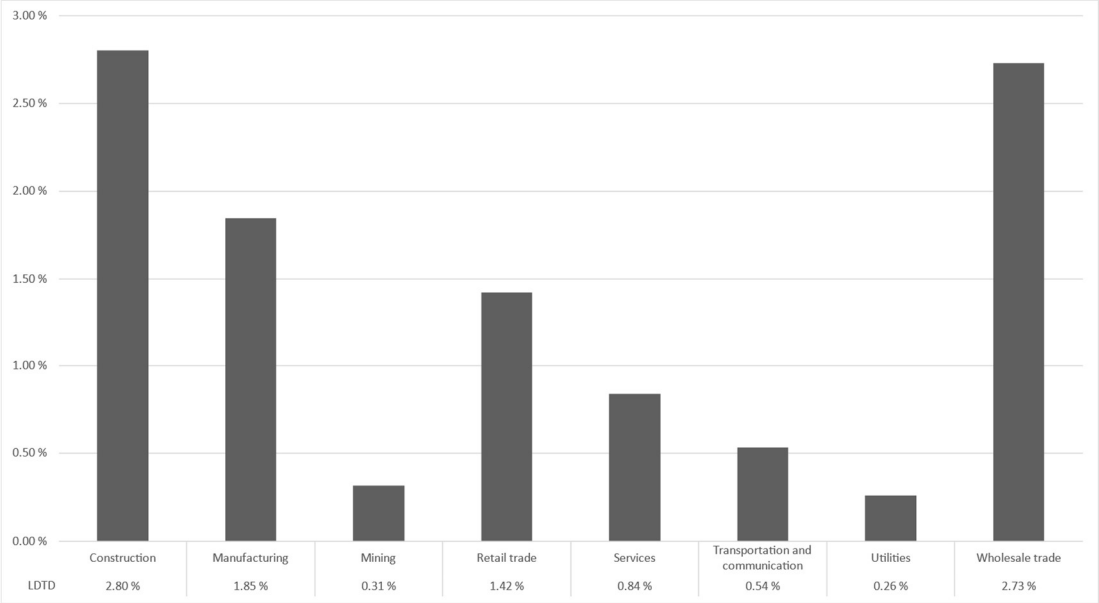
Source: Orbis (2023), created by author

Figure 3. Mean changes in LDTA between 2017-2019 and 2020-2022 on an industry level



Source: Orbis (2023), created by author

Figure 4. Mean changes in LDTD between 2017-2019 and 2020-2022 on an industry level



Source: Orbis (2023), created by author

Table 9. Correlation matrix

	TDTA	LDTA	LDTD	Log size	Profitability	Tangibility	Log growth	Liquidity	Crisis
TDTA	1.000	0.605	0.169	-0.021	-0.222	-0.062	0.233	-0.196	-0.046
LDTA	0.605	1.000	0.822	-0.082	-0.204	0.330	-0.173	-0.156	0.010
LDTD	0.169	0.822	1.000	-0.084	-0.142	0.474	-0.377	-0.122	0.033
Log size	-0.021	-0.082	-0.084	1.000	-0.062	0.099	-0.112	-0.194	0.027
Profitability	-0.222	-0.204	-0.142	-0.062	1.000	-0.135	0.141	0.170	-0.021
Tangibility	-0.062	0.330	0.474	0.099	-0.135	1.000	-0.465	-0.476	-0.011
Log growth	0.233	-0.173	-0.377	-0.112	0.141	-0.465	1.000	0.123	-0.069
Liquidity	-0.196	-0.156	-0.122	-0.194	0.170	-0.476	0.123	1.000	0.086
Crisis	-0.046	0.010	0.033	0.027	-0.021	-0.011	-0.069	0.086	1.000

Source: Orbis, calculated by author

Appendix 2. Number of companies per industry and country

Countries	Construction	Manufacturing	Mining	Retail trade	Services	Transportation and communication	Utilities	Wholesale trade	Total
Argentina	-	18	-	1	1	-	1	3	24
Australia	51	181	105	88	428	79	15	110	1057
Austria	-	12	1	1	7	6	3	7	37
Bahamas	-	-	-	-	1	1	-	-	2
Bahrain	-	1	-	-	-	-	-	-	1
Bangladesh	1	85	1	7	10	8	9	7	128
Barbados	-	-	-	1	-	-	-	-	1
Belgium	42	92	1	20	94	26	1	79	355
Bermuda	2	10	4	-	3	3	-	-	22
Bolivia	-	1	-	-	-	-	-	-	1
Brazil	-	2	-	-	-	-	-	-	2
Bulgaria	-	10	-	-	-	2	-	4	16
Canada	1	24	13	5	11	8	1	2	65
Cayman islands	8	25	-	6	25	4	-	1	69
Chile	3	4	1	1	1	1	6	1	18
China	-	1	-	-	-	-	-	-	1
Croatia	-	2	-	-	3	-	-	-	5
Curacao	-	-	1	-	-	-	-	-	1
Cyprus	-	-	1	-	-	-	-	-	1
Czech republic	23	28	-	4	17	4	3	11	90
Denmark	1	22	-	-	3	2	1	-	29
Egypt	-	17	1	-	3	2	-	1	24
Estonia	13	17	1	13	41	12	1	17	115
Fiji	-	1	-	-	-	1	-	1	3
Finland	407	319	29	210	608	320	25	193	2111
France	266	324	11	278	470	114	42	318	1823
Germany	1	16	1	3	11	-	3	5	40
Ghana	-	3	-	-	-	-	-	1	4
Greece	1	9	-	3	7	1	1	7	29
Guernsey (united kingdom)	-	-	1	-	1	-	-	-	2
Hong kong sar, china	-	4	-	-	3	-	-	1	8
Hungary	-	4	-	1	2	1	-	4	12
Iceland	2	3	-	3	6	-	-	2	16
India	-	7	-	-	1	-	-	1	9
Indonesia	-	1	-	-	1	1	-	-	3
Ireland	-	9	-	-	3	-	-	1	13
Islamic republic of iran	8	29	-	-	3	1	-	1	42
Isle of man (united kingdom)	-	-	-	-	1	-	-	-	1
Israel	-	3	-	-	4	-	-	-	7
Italy	91	491	3	107	581	125	31	372	1801

Jamaica	-	5	-	1	4	2	-	1	13
Japan	4110	3936	20	831	2261	444	205	3960	15767
Jersey (united kingdom)	-	2	-	-	-	-	1	1	4
Jordan	-	-	-	-	1	-	-	-	1
Kenya	-	4	-	-	-	1	-	-	5
Kuwait	-	2	-	1	-	3	-	-	6
Latvia	3	6	-	-	5	4	2	5	25
Liberia	-	-	-	-	-	1	-	-	1
Lithuania	4	13	-	3	3	4	2	8	37
Luxembourg	-	4	-	-	5	-	-	1	10
Malawi	-	1	-	-	-	-	-	-	1
Malaysia	11	92	1	7	16	6	-	8	141
Malta	-	-	-	-	2	-	-	-	2
Marshall islands	-	-	-	-	-	2	-	-	2
Mauritius	-	6	-	-	2	1	-	3	12
Mexico	-	1	-	-	-	-	-	-	1
Mongolia	-	-	1	1	-	-	1	-	3
Namibia	-	1	-	-	-	-	-	-	1
Nepal	-	2	-	-	1	-	3	-	6
Netherlands	-	8	1	-	12	-	-	8	29
New zealand	6	32	3	14	21	25	14	18	133
Nigeria	-	3	-	1	-	-	-	-	4
Norway	24	25	-	19	91	11	-	22	192
Oman	-	1	1	-	4	-	-	-	6
Pakistan	2	178	8	1	8	5	4	3	209
Panama	-	1	-	1	-	1	-	1	4
Philippines	-	2	-	1	3	-	-	3	9
Poland	-	3	-	-	4	1	-	4	12
Portugal	1	22	-	1	19	2	-	11	56
Qatar	-	2	-	-	1	2	-	-	5
Republic of korea	99	162	2	7	28	8	2	68	376
Reunion (france)	-	1	-	2	2	3	1	-	9
Romania	-	-	1	-	-	-	-	-	1
Russian federation	-	3	-	-	-	-	-	-	3
Saudi arabia	-	2	1	-	2	-	-	-	5
Singapore	17	42	1	7	29	20	1	18	135
Slovakia	75	106	2	85	301	44	10	94	717
Slovenia	-	-	-	-	1	-	-	-	1
South africa	2	27	5	9	11	4	-	3	61
Spain	8	26	2	6	15	4	2	10	73
Sri lanka	-	1	-	-	-	-	-	-	1
Sweden	1904	1218	40	964	2604	1165	121	763	8779
Switzerland	-	9	-	3	5	16	3	2	38
Taiwan, china	-	2	-	-	-	-	-	-	2
Thailand	-	20	1	2	4	3	-	2	32
Trinidad and tobago	-	1	-	1	1	-	-	-	3

Turkey	-	12	-	-	-	-	-	-	12
Uganda	-	1	-	-	-	-	-	-	1
United arab emirates	2	2	-	-	1	1	-	1	7
United kingdom	212	349	17	81	1484	113	45	226	2527
United states of america	15	355	13	32	118	42	21	22	618
Uruguay	-	2	-	-	1	-	-	-	3
Uzbekistan	-	3	-	-	-	-	-	-	3
Vietnam	-	9	2	1	-	-	3	-	15
Virgin islands (british)	-	2	-	-	-	-	-	-	2
Zimbabwe	-	5	-	1	1	-	-	-	7
Total	7416	8487	297	2835	9421	2660	584	6416	38116

Source: Orbis, calculated by author

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