Impact of Covid-19 on the Capital Structure of UK Firms

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Authors declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Abstract

Capital structure is a useful prerequisite for analyzing a company's financing behavior and financial risk appropriateness. Capital structure also affects the efficiency of the corporate governance structure and the realization of corporate value. A reasonable capital structure not only reduces corporate costs through financial leverage, but also improves the efficiency of corporate governance and creates wealth for long-term corporate development. The outbreak of the COVID-19 epidemic has brought an unprecedented crisis to the global economy. The financial and economic markets in the UK have been drastically affected by the pandemic, which has seriously impacted the survival and development of local enterprises. Therefore, taking the COVID-19 epidemic as its background, this paper examines the profitability, solvency, and cash flow levels of UK enterprises as factors that impact the capital structure of those enterprises.

This paper draws on company data from the UK for the period 2015-2021 as the foundation of its analysis. To determine capital structure, this paper examines the elements of broad capital structure indicators, such as gearing, long-term debt ratio and short-term debt ratio. The paper focuses on exploring the impact of firms' profitability, solvency, and cash flow levels on their capital structure. Because the level of capital structure of firms changed after the epidemic, the analysis contained herein also examines the moderating role of the epidemic in the relationship between profitability, solvency and cash flow levels and capital structure in the context of the pandemic era. The paper further explores the moderating effect of the epidemic on capital structure in terms of profitability, solvency and cash flow compared to the pre-epidemic period. To further analyze the impact of the epidemic, this paper also considers the effects of COVID-19 on capital structure.

The conclusions of this paper are as follows: (1) After the occurrence of the pandemic, the level of capital structure of enterprises (debt ratio, short-term debt ratio, long-term debt ratio) increased. (2) Compared to the pre-pandemic period, the negative inhibitory effects of profitability, solvency, and cash flow levels on capital structure became more pronounced after the pandemic. (3) Considering industry characteristics, the promoting effect of the pandemic on capital structure is smaller in manufacturing companies, while it is more significant in the retail and transportation industries. (4) From a lifecycle perspective, the promoting effect of the pandemic on capital structure is more significant in early-stage and growth-stage enterprises.

Finally, the conclusions of this paper are summarized, and several effective recommendations are proposed. The research conducted in this paper holds significant research significance in terms of enriching

the theory of capital structure, assisting companies in navigating through crises, and determining the optimal level of enterprise capital structure.

Keywords: epidemic, COVID-19, capital structure

Contents

Chapter 1 Introduction

Capital structure, also known as financing structure, is simply the ratio of debt financing to equity financing that a company chooses through its operating decisions. Analyzing and understanding a company's capital structure is a prerequisite for analyzing the reasonableness of a company's financing behavior and the appropriateness of its financial risk. It also affects the efficiency of the corporate governance structure and the realization of corporate value. A proper capital structure not only reduces corporate costs through financial leverage, but also improves the efficiency of corporate governance and creates wealth for the company's long-term development. An imperfect capital structure, on the other hand, will not only slow the development of the business's operations, but will also cause external investors to be unable to assess the value of the enterprise accurately. This results in poor investment decisions, thereby hindering healthy development and reducing the efficiency of capital market. Therefore, the study of enterprise capital structure is one of the most important components of the study of enterprise financial theory and has a significant ability to offer actionable, practical guidance for companies. The primary issue in determining whether an enterprise's capital structure is suitable for that company is whether the optimal ratio can be found to maximize the value of the company under the given conditions. Capital structure theory is based on this objective. It focuses on the impact of changes in the composition of debt and equity capital in the capital structure on the total value of the enterprise. There is a great deal of variation in the factors and ways in which the capital structure of a firm is influenced. This paper attempts to build on existing research on the factors influencing capital structure, focusing on the characteristics and data of UK-listed companies.

The most influential and significant theorists of contemporary capital structure theory are American economists Modigliani and Miller, whose MM theory was the starting point for the study of capital structure in 1958. In order to correct the shortcomings of MM theory, Western economists gradually relaxed the assumptions of MM theory and studied capital structure from different perspectives such as bankruptcy cost, agency cost, and information asymmetry, thereby forming various schools of capital structure theories. In addition to in-depth research on capital structure theories, Western economists have also conducted a large number of empirical studies to test the existing capital structure theories and have come up with many valuable conclusions.

Since December 2019, the coronavirus (COVID-19) outbreak has swept across the globe, with the virus spreading to more than 200 countries and territories worldwide. Italy, the United States, Mexico and India have become the epicenters of the outbreak. The outbreak of the coronavirus has created an unprecedented crisis in the global economy. By August 2022, the number of confirmed cases of the novel coronavirus worldwide were still climbing rapidly. Considering the threat to human health posed by the COVID-

19 pandemic, the World Health Organization (WHO) declared the COVID-19 outbreak a Public Health Emergency of International Concern (PHEIC) on January 30th, 2020. As of August 2022, the cumulative number of confirmed cases of COVID-19 worldwide exceeds 600 million and the cumulative number of deaths exceeds 6 million, affecting more than 213 countries. On one hand, the epidemic poses a serious threat to human health. On the other hand, measures taken to reduce the harm to public health under the epidemic such as mandatory social distancing, lockdowns, and transportation restrictions have profoundly affected the global economy by impacting multiple labor, product, and service markets. In the context of economic globalization, the spread of the pandemic also caused a major setback to the global economy: the production, consumption and transport sectors came to a halt, unemployment rose sharply, consumption fell rapidly, stock indices fell precipitously, and the global economy entered a period of recession. The financial and economic markets in the UK have been hit hard by the outbreak, which has seriously affected the survival and growth of local businesses. Enterprises are the mainstay of the micro-economy, and their survival has a direct impact on output and employment levels, ultimately affecting the healthy development of the UK economy.

In the existing body of literature, there is a limited number of studies specifically addressing the association between the COVID-19 pandemic and the capital structure of publicly listed firms. Only a few scholarly articles have offered empirical investigations in this regard. For instance, AZHARI et al. (2022) focused their research on the changes in capital structure among Malaysian listed companies following the outbreak. Huang & Ye (2021), on the other hand, examined the joint influence of capital structure, corporate social responsibility activities, and firm risk during the COVID-19 period. Their findings indicated that firms with elevated debt levels experienced heightened levels of firm risk, particularly in cases where corporate social responsibility performance was relatively weak.

Building upon the existing literature, this present study explores the impact of profitability, solvency, and cash flow levels on capital structure within UK firms, while taking into consideration factors that influence capital structure dynamics. Although this study draws upon data from UK firms, the conclusions reached align closely with those reported by AZHARI et al. (2022), lending support to the robustness and consistency of the findings.

In light of this situation, this paper examines the impact of profitability, solvency, and cash flow levels on the capital structure of UK firms by examining the factors that influence capital structure. This paper uses company data from 2015-2021 in the UK as the subject of the study. To determine capital structure, this paper examines broad capital structure indicators, such as gearing, long-term debt ratio and short-term debt ratio.The analysis focuses on the impact of a firm's profitability, solvency, and cash flow levels on its

capital structure. Given that the capital structure of firms changed after the epidemic, this paper also explores the moderating role of the epidemic in the relationship between profitability, solvency and cash flow levels to better understand capital structure in the context of the pandemic era. The analysis finds that the negative inhibitory effect of profitability, solvency and cash flow levels on capital structure increases in the aftermath of the pandemic, as compared to before the outbreak.

To further analyse the effects of the COVID-19 pandemic, this paper also examines the impact of the epidemic on capital structure. The study found that the level of capital structure of firms increased after the outbreak. Given that different industries have been affected by the epidemic to differing degrees, this paper focuses on the differences in the impact of the epidemic on capital structure in four industries: manufacturing, transportation, technology, and retail. The analysis found that the impact of the epidemic on capital structure is smaller in the manufacturing and technology sectors and larger in the retail and transportation sectors. This suggests that companies should operate across sectors to diversify the impact of crisis events. Using life cycle theory as its foundation, this paper also examines whether the impact of an epidemic on capital structure differs across the life cycle of a firm. The study finds that epidemics have a significant effect on capital structure for start-up and growth companies.

The research in this paper makes the following marginal contributions. First, the paper selects UK-listed companies as the subject of its study. Therefore, factors influencing the capital structure of UK companies are explored. Secondly, this paper mainly explores the impact of factors such as the profitability, solvency and cash flow level of firms on the capital structure of UK companies. It also explores the impact of the epidemic on the capital structure. In addition, this paper considers how the heterogeneity of industries affects the impact of the epidemic on their capital structure. As different industries are affected by the epidemic differently, this paper examines how the epidemic affected capital structure in several industries. Finally, this paper also incorporates life cycle theory and examines the differences in the impact of epidemics on capital structure in terms of different life cycles. The implications of this paper's research have the potential to enrich the theory of capital structure, help firms to survive crises such as the COVID-19 epidemic, and inform enterprises on setting the level of capital structure of companies.

The remaining chapters of this paper are organized as follows. Chapter 2 summarizes the literature and theories related to this paper and ultimately presents the research hypotheses of the paper. In Chapter 3, the data sources, model description and variable selection of this study are presented. In Chapter 4, the basic descriptive statistics, correlation analysis and regression analysis of the processed data are combined, and the data is analyzed in order to draw conclusions. In Chapter 5, the above is summarized and several research recommendations are made.

Chapter 2 Literature Review

2.1. The concept of capital structure

In a company, the term capital structure refers to the ratio of the proportion of all capital owned by the company that is debt capital and the proportion that is equity capital. To some extent, this indicator provides a static picture of the financing of a company. The differences in capital structure are due to the different financing method choices a company chooses to make. The two main sources of financing are equity financing and debt financing, both of which have a different impact on the capital structure in terms of financing costs, so companies need to weigh up the two types of financing and establish a reasonable financing mix to form the optimal capital structure for their venture. Optimizing capital structure not only helps companies to obtain the benefits of financial leverage, but also enhances the value of the company, helps to allocate and utilize the company's resources appropriately, and enables the company to achieve sustainable development.

There are two theoretical definitions of the liability component of capital structure. One theory holds that the liabilities in capital structure include all the short-term and long-term liabilities of a given enterprise. According to this theory, the term “capital structure” is taken in a broad sense and represents the proportional relationship between the overall level of liabilities of an enterprise and its owner's equity. By contrast, some scholars believe that the current liabilities of an enterprise should not be included in the capital structure of an enterprise, and therefore define capital structure in a narrower sense. This theory defines the term “current liabilities” as the liabilities of an enterprise within one year or within one business cycle. The main function of current liabilities is to replenish the enterprise's working capital, which does not constitute the conditions for capitalization of an enterprise. Therefore, according to this theory the liabilities in the capital structure of an enterprise should exclude its current liabilities and include only the long-term liabilities. This theory defines the capital structure of an enterprise as the ratio of long-term liabilities to the owners' equity of a given enterprise. The ratio of long-term liabilities to owners' equity constitutes the capital structure of the enterprise. In theoretical studies, the distinction between broad and narrow capital structure does not have a large impact on research; however, in empirical studies, current liabilities account for a considerable proportion of corporate liabilities, especially in listed companies in China, and it is necessary to distinguish between the narrow and broad sense of capital structure.

A company's capital structure indicates how a firm uses debt and equities to fiscally support its business operations and growth (Bloom et al., 2020). To enhance profitability, debts must be kept to a minimum as they incur interest expenses once the money is borrowed. However, equities are comprised of ownership

of a company's rights, like purchasing shares and entitlement to the future financial profit of the corporation. Therefore, the debt-to-equity ratio is vital tool used to identify the risk associated with a particular enterprise, where a high debt-to-equity ratio indicates high associated risk and vice versa. Although the pandemic is still ongoing and the economy is showing signs of recovery, this research will focus mainly on the impacts it had while at its peak.

2.2 Theory of capital structure

Enterprise capital refers to the funds and assets used by an enterprise for production and operation activities to create income for the enterprise. Depending on the source of capital, enterprise capital can be divided into two categories: equity capital and debt capital. Enterprise capital structure refers to the proportional relationship between the equity capital and debt capital of an enterprise. Enterprise capital structure is the result of enterprise financing. Financing is also divided into the categories of internal financing and external financing. As the name implies, internal financing is when an enterprise finances itself, typically through shareholders' input, profit retention, and depreciation funds.

There are two types of external financing. The first is debt financing, which is when debt is used to obtain the funds or assets required for the production and operation of a business, typically through bank borrowing, bond issuance and financial leasing. Compared to equity financing, debt financing is simpler because it does not have cumbersome approval and issuance procedures. It makes it possible to obtain funds in a relatively short period of time and comes with a lower financial burden as only a fixed and relatively small amount of interest will be incurred in the future. In addition, debt financing does not change the power balance in the control of the business. It also increases shareholders' equity when the return on capital obtained from debt financing is higher than the interest rate paid for borrowing, which is consistent with the objective of maximizing shareholders' equity in the business. However, debt financing can increase the financial risk of a business, as borrowing often requires fixed interest payments and principal repayments at fixed times, and debt financing through guarantees is even more restrictive. This places high demands on the solvency of the enterprise, which must maintain a certain level of asset liquidity in order to ensure that debts are repaid on time or else face the risk of bankruptcy.

The second type of external financing is equity financing, which is typically achieves through the issuance of shares. Compared to debt financing, equity financing does not require fixed interest or principal repayment, so it poses less financial risk and provides a relatively stable capital structure. However, equity investment increases the fragmentation of equity, which in turn increases the cost of information communication and disclosure; in other words, it can weaken shareholders' equity. Funds raised by issuing shares

do not require repayment of principal, but over time they must give investors a continuous or even permanent return, especially when the company is more profitable. A fragmented company, therefore, needs a large proportion of its profits to be distributed to equity holders.

In summary, when a company's gearing ratio is within a reasonable range, it can take advantage of the leverage and tax-deductible effects of debt, thus obtaining the advantage of "low investment and high return" and creating more possibilities to advance the company's development. When the future outlook and current development of the company are good, the company can further optimize its capital structure, for example by increasing its debt to increase the value of the company. However, a high gearing ratio increases the risk of insolvency, so theoretically, the most reasonable capital structure is the one that creates the best trade-off between reducing the weighted cost of capital and increasing the value of the enterprise within the financial risk that the enterprise can bear.

There are two main theories of capital structure. The first is traditional financing theory, which includes net income theory, net operating income theory and traditional trade-off theory. The second is modern financing theory, which includes "MM theory", agency cost theory, trade-off theory, optimal financing theory and stakeholder theory.

2.2.1 Early financing theory

The study of capital structure was first proposed by the American economist David Durand, who in 1952 wrote a brief study of capital structure. In his paper, he divided the theory of capital structure into net income theory (also known as Net Income Approach, or NIA), net operating income theory (Net Operating Income, or NOI), and traditional trade-off theory, which set the stage for later scholars to continue to develop their own research on capital structure.

Net Income Approach (NIA) refers to the view that the use of debt reduces the cost of capital for a firm. The theory holds that the use of debt increases the degree of financial leverage of the firm, reduces the weighted average cost of capital and increases the market value of the firm. Therefore, the more debt a company has, the better. The main drawback of this theory is that it does not take into account financial risk, but it has the advantage of taking into account the role of financial leverage.

Net Operating Income (NOI) is the theory that the use of lower-cost debt capital increases the risk of own capital, which in turn increases the cost of own capital, so that the weighted average cost of capital of the firm is fixed and therefore the total value of the firm remains constant. In other words, debt does not change the firm's overall capital cost and does not increase the value of the firm, making choices regarding

optimizing capital structure meaningless. The main drawback of this theory is that it overstates the role of financial risk and ignores the intrinsic relationship between the cost of capital and the structure of capital.

The Traditional Approach is a theory that falls between the net income theory and the net operating income theory. Net income and net operating income theories lie at the two extremes of the theories of capital structure. With this theory, Durand proposes a relatively realistic theory in between, known as the traditional trade-off theory. Traditional trade-off theory proposes that as a firm uses financial leverage, an increase in debt causes a rise in the cost of equity. Within appropriate limits, the increased cost of equity does not completely offset the benefits gained through debt and at that point, the value of the firm rises. However, as the debt ratio increases beyond a certain range, the increased cost of equity can no longer be offset by the benefits derived from the use of financial leverage, at which point the cost of debt and equity capital rise in tandem, leading to a rapid increase in the firm's weighted average cost of capital. Durand uses a U-shape graph to explain this change, with the turning point from downward to upward being the WACC minimum.

2.2.2 MM Theory

The modern theory of corporate finance originated in the 1950s, when Modigliani, a professor at the Carnegie Institute of Technology in Massachusetts, and his student Miller jointly published “The Cost of Capital, Corporate Finance and Theory”, which proposed that a firm's choice of capital structure does not affect the market value of the firm. This is the famous MM theory, which marks the formation of the modern theory of corporate finance structure.

Later scholars have revised MM theory by continuously relaxing the assumptions of the original theory. The core view of early MM theory was that in a perfect market—i.e., with perfectly efficient capital markets, no tax effects and no risk of insolvency—the value of a firm is related only to its underlying profitability and degree of risk, and not to its capital structure. These strict assumptions can be grouped into two main categories: the cash flow assumption and the market conditions assumption. However, the assumptions of early MM theory were very strict and fell short of realistic conditions. As a result, later developments and revisions of MM theory have continuously broadened the assumptions of early MM theory to bring the theory closer to realistic conditions so that it is better suited to providing practical guidance in realistic practice.

Modigliani & Miller, in an article published in 1963, revised the assumption condition of the absence of taxes present in earlier MM theory and proposed a modified MM theory. The theory argued that in the presence of corporate income tax, the interest generated by a firm from debt financing could either be paid

before tax, reducing the corporate tax burden, or after tax so that the rise in the firm's cost of equity would be less than it would have been in the absence of tax. This theory indicated that as much debt as possible should be raised in the firm's capital structure to reduce the burden of corporate income tax and thus increase the value of the firm. Later, Miller (1976) incorporated personal income tax into MM theory and pointed out that in the presence of both personal and corporate income taxes, the debt financing of a company does not always increase the value of the company and the company needs to consider the different effects of the two taxes together.

Later, scholars abolished the assumption of no bankruptcy cost in MM theory and took the bankruptcy cost of the company into account in the capital structure, putting forward the Tax-Bankruptcy Cost Trade-off Theory (Trade Off Theory). This theory argues that if one considers both the tax benefits and the cost of insolvency, although debt financing increases the cost of insolvency and reduces the value of the company. The basis of this theory is that even though debt financing can bring tax savings and increase the company's value, as the ratio of debt financing increases, the probability of the company falling into financial crisis or even insolvency increases. Therefore, the optimal capital structure for a company should be the result of a trade-off between the tax benefits of the company and the costs of a financial crisis.

Due to the difference between the assumptions of MM theory and reality, scholars later put forward various theories of capital structure to explain the impact of capital structure on the value of a company under a series of relaxed assumptions. Factors such as bankruptcy costs, taxation and information asymmetry, trade-off theory, agency cost theory, preferential financing theory and control theory have been put forward, and a large number of theoretical and empirical research results have examined the various types of optimal capital structures from each of these different perspectives.

2.2.3 Agent cost theory

Agency cost theory has been utilised by many scholars to explain the structure of executive compensation, and Davis and Donaldson (1996) argue that agency theory is the strategic and theoretical basis for the governance aspect of corporate structures. The primary business objective of the majority shareholder of a company was previously understood to be the maximisation of the company's operating profit. Under this definition of executive motivation, shareholders not only want to improve the company's business performance, but also to increase the value of the company (Gapenski et al., 1999). In contrast to previous compensation theories, Jensen and Meckling (1976) introduced the agency problem, which describes the condition of the separation of ownership and management of a firm. Under these conditions, the agent, i.e. the executive, may have a conflict of interest with the shareholders of the firm, i.e. the principal. In this

case, there is a risk of moral hazard, with executives choosing personal interests over maximising the interests of the principals when their personal interests are not aligned with the long-term goals of the business. The resulting principal-agent theory assumes three premises: that the agent's behaviour is not readily observable; that there are information asymmetries between the principal and the agent; and that the agent seeks to maximise personal effects from an 'economic man' perspective.

The principal-agent theory suggests that those who directly own the company have a limited level of specialized knowledge and are not well-equipped to manage the company, so they will hire professionals to manage it and compensate these managers, thus creating a principal-agent problem. If the interests of managers are not aligned with the owners of the company, then they will pursue their own personal interests, such as increasing on-the-job spending, achieving promotions, etc. The pursuit of personal interests by managers can be detrimental to the interests of the company as a whole. Contracts are therefore needed to regulate the behaviour of managers. Since the owner does not have access to all information about the manager and cannot monitor him or her effectively, the manager may make blind investments to the detriment of the company. When a company establishes a series of contracts, it will also incur agency costs, which not only increase the company's costs but also intensify the conflict between the manager and the owner. The principal-agent theory is a theory based on this agency problem. It suggests that better contracts should be designed to motivate managers and reduce agency costs at the same time.

In addition to conflicts between managers and owners, conflicts between major shareholders and minority shareholders and conflicts between shareholders and creditors are also part of the principal-agent theory. Conflicts between shareholders and agents can increase the agency costs of a company. Managers may use more funds for unreasonable projects for their own benefit, resulting in inefficient investments on the part of the company. The conflict between major shareholders and minority shareholders refers to the fact that major shareholders have more control over the company and will appropriate and transfer the company's assets; minority shareholders have less say in the company and cannot monitor the actions of major shareholders, so major shareholders will encroach on the interests of minority shareholders, resulting in inefficient investments. Conflicts between equity and creditors mainly refer to those arising from external financing, such as when banks lend funds to companies for investment. Creditors lend funds in the hope that the company will invest in less risky projects, but shareholders and managers will use the funds for risky projects that provide greater benefit to themselves. When a project earns a profit, the shareholders will default on the loan for their own personal benefit, thus harming the interests of the creditors. This is also known as the agency problem between shareholders and creditors, and it too can lead to inefficient investment problems for companies.

2.2.4 Trade-off theory

Early trade-off theory, which argued that a company's optimal capital structure should be the result of a trade-off between the present value of insolvency costs and the tax shield effect of interest on debt, was a new capital structure theory that took into account the cost of insolvency based on the classic capital structure theory of Modigliani and Miller. Taking into account the possible costs of financial constraints, both the tax-saving benefits and the value of a firm will increase as the firm's liabilities increase, as do the costs of financial crises. But as liabilities continue to increase, the total cost incurred by financial crises increases faster than the corresponding tax shield benefits. Therefore, in theory there should be an optimal point that combines the benefits of both in one capital structure, and the results of subsequent research indicate that the optimal combination point from the view of capital structure must be the point where the marginal tax shield benefits and marginal financial crisis costs from debt financing are equal.

Robichek and Myers (1966) argue that the optimal combination of capital structure should be at the point where the combination is equal to the present value of tax benefits in the case of marginal decreasing financial leverage. In the case of unfavourable financial leverage, the optimal capital structure combination is where it is equal to the present value of marginal costs. As this example illustrates, the conclusions of Robichek and Myers state the ideas of trade-off theory more clearly. Furthermore, Kraus and Litzenberger (1973) used a state choice model to justify these theories. Scott (1976) also found that there is "a single optimal capital structure combination" for a firm under two sufficient conditions. From this it can be seen that the primary contribution of early trade-off theory to modern theory was the introduction of the idea of 'trade-offs', which allowed for a theoretically optimal solution to be used to identify a firm's optimal capital structure. Baxter (1967) argues that the probability of bankruptcy increases with an increase in financial leverage, and that the value of a firm decreases in the presence of bankruptcy costs. Baron (1974) used a stochastic theoretical model that takes into account the introduction of bankruptcy costs, and demonstrated that MM theory could still be valid in such contexts. Later trade-off theory studies have sought to theoretically justify the relationship between bankruptcy costs and MM theory by estimating and measuring total bankruptcy costs. However, due to the cost of insolvency, a firm's leverage ratio terminates before it reaches 100%. It is also difficult to draw a distinction between the cost of the financial crisis itself and the cost of the various associated factors that cause it, which in turn makes measuring the cost of insolvency difficult.

Static trade-off theory integrates the tax shield effect and the cost of insolvency theory, arguing that the optimal capital structure is a trade-off between the cost of insolvency and the tax shield effect of debt. According to static trade-off theory, both the likelihood of bankruptcy and the expected cost of bankruptcy will increase as the debt ratio increases due to the leverage of the firm's debt, resulting in an optimal cost-

benefit equilibrium that may be achieved before the debt ratio reaches 100%. In addition, the likelihood of a firm's insolvency is also influenced by the liquidity and profitability of the firm's assets, which have a significant influence over the firm's expected cost of insolvency and ultimately the firm's optimal leverage ratio. At the same time, the probability of a company falling into financial crisis will increase as the company's debt ratio increases, and the resulting financial crisis costs will reduce the market value of the company as well as the income expectations of the buyers of corporate bonds, significantly increasing the cost and difficulty of issuing corporate bonds in the process. The effect of the above factors will greatly limit the company's utilization of the tax shield effect, prompting the company to seek out an optimal capital structure. This process leads to the company's capital structure gradually showing certain stable and regular distribution characteristics.

In practice, the actual capital structure often deviates from the theoretically optimal capital structure due to the dynamic nature of a firm's market value. Static trade-off models of optimal capital structure fail to account for the fact that the optimal capital structure should vary with changes in market value. These models only provide optimal capital structure arrangements under specific circumstances. Overall, transaction costs play a crucial role in the debate on the existence of an optimal capital structure.

However, static trade-off theories overlook the transaction costs associated with firms adjusting their capital structure. These theories assume that firms can quickly and efficiently adjust their capital structure to an optimal state. According to static trade-off theory, as long as management is rational, the company will consistently maintain an optimal capital structure. However, this assumption does not align with reality.

To address this discrepancy, Fischer et al. (1989) introduced the dynamic trade-off model. The core idea of the dynamic trade-off model is that firms take into account adjustment costs and do not instantaneously adjust their capital structure to an optimal state. Although there is currently no unified dynamic adjustment model, it is certain that companies actively optimize their leverage levels based on trade-off theory. However, such adjustments occur over the long term due to the existence of adjustment costs. DeAngelo et al. (2011) argue that the optimal debt ratio for a company lies within a range, where any debt ratio within that range is considered optimal. They suggest that the failure to promptly adjust the target structure in response to changes is attributable to the existence of transaction costs. Further research by Jalilvand and Harris (1984) and Auerbach (1984) supports the notion that transaction costs have a significant influence on a company's capital structure decisions, limiting the adjustment of the actual debt ratio to the theoretically optimal debt ratio.

2.2.5 Pecking order theory

Pecking order theory was developed by Myers and Majluf (1984) and suggests that when financing activities are carried out by a company, there should be an order of priority for financing methods: first, internal financing, followed by debt financing, and finally equity financing. This means that when a company needs funds for its investment activities, it should first choose its own funds, i.e., internal funds, to finance its investments. If internal financing proves insufficient, the enterprise can next opt for debt financing. If debt financing is utilized and there is still a need for investment, a company may then turn to equity financing, i.e. issuing additional shares. When a company issues shares, it usually does so at a time when the share price is rising rather than falling. This usually leads investors to believe that the company faces some financial misfortune, such as a reduction in revenue or credit. When shareholders receive information about the issuance of new shares, it is a reasonable for them to to assume that the company's share price is at risk of falling and prognosticators will correspondingly lower their expectations of the company. This expectation of falling prices can in turn then cause the actual share price to fall, harming the interests of shareholders as a whole. At this point, if the manager is committed to representing the shareholders' interests, the manager will choose to issue bonds to finance the company rather than issue additional shares. The issuance of bonds will also signal to the market that the company's profits have fallen, and while detrimental to the company’s rating this signal is not as obvious as it would be if the company issued shares. Endogenous financing, on the other hand, does not create these problems of public information disclosure and so does not lead to a fall in share price. Pecking order theory tells us that since the seller does not have access to all the real information of the buyer (or in the capital market, investors do not have complete information about the company they are investing in), in order to fully protect their interests, external investors will first choose to buy the company's bonds at a low price. This will in turn pull down the company's share price to the detriment of shareholders' interests. For this reason, companies should keep to the optimal order when deciding to finance a venture, considering internal financing as their first option and ending with a consideration of equity financing.

Myers (1984) studies how firms makes choices about their capital structure based on the assumption of information asymmetry and proposes a theory of optimal order financing. In Myers and Majluf's equilibrium model of investment decisions, information asymmetry is prevalent. They assume that the manager represents the interests of the senior shareholders and so the manager will not choose to raise funds by issuing new shares when deciding to finance an investment project with positive net future cash flows. This is because rational investors will undervalue a company's newly issued shares when they understand the

company's behavioural patterns, and if outside investors buy new shares at a lower price, they may receive a higher return than the expected return of the investment project as a whole. Myers (1984) argues that in a situation of information asymmetry, a company will first consider internal financing when it needs to raise capital and will only seek to access external financing by necessity. Myers (1984) argues that in a situation of information asymmetry, a firm wanting to finance a project should first consider internal financing, followed by external financing. Boyd and Prescot (1986) find that in an environment of information asymmetry, banks or private loans can more efficiently monitor debt-raising firms than external investors can, and therefore firms with high information asymmetry tend to issue public bonds. Conversely, firms with low information asymmetry would more frequently opt for banks or private loans. However, Diamond (1991) suggests an alternative view: due to the high attractiveness of high-quality firms to potential investors, firms will prefer to issue bonds when raising external finance, while low-quality firms will also choose to issue bonds due to high regulatory costs and their inability to raise sufficient funds from bank or private loans. Between these two, medium quality companies will generally opt for bank or private loans.

Chemmanur and Fulghieri (1994) also validate Diamond's (1991) view from a liquidity and renegotiation perspective, and Myers argues from an agency cost perspective that firms financed by the issue of bonds are slow to grow in value due to the fear of being unable to service their debts as a result of investment failure or a lack of high-return investments. To eliminate this negative impact of external financing, companies should choose banks or private lenders with whom they can maintain close ties. This sort of relationship reduces both the degree of information asymmetry and underinvestment. Therefore, companies with good growth prospects should consider banks or private lending as their first option for external financing. Kawn and Carleton (2004) argue that private lending has low liquidity and stable holdings of debt, so low-quality companies may prefer to be financed through private lending.

Zwiebel (1997) analyses the choice of instruments for the external financing of companies based on a managerial perspective. The argument is that as creditors, banks are more concentrated than corporate bondholders and so will operate more efficiently on projects financed by the company. Managers have a disincentive to act to satisfy private ends, to the detriment of investment returns. Therefore, if the manager is not a primary shareholder and does not personally benefit from the profits of the investment project, then the manager may choose to issue bonds to finance the project in order to avoid supervision. If the manager's shareholding is high and his personal interests are closely aligned with the investment project, then he has enough incentive to take an active role in operations and thus will choose bank loans or private borrowing in order to maximise the value of the company. In summary, most of the research on euphoric financing has been carried out in the past. In conclusion, most studies on preferential financing agree that the primary advantages of bank or private lending over corporate bonds are mainly expressed in terms of regulatory

efficiency and the coordination of financial pressures.

2.2.6 Stakeholder theory

Classical governance theories generally include principal-agent and stewardship theories, which argue that maximizing shareholder profits is the goal of corporate wage governance, and generally do not consider other stakeholders' interests. Freeman (1983) argues that stakeholders are the various interest groups that impact the company's objectives and operational activities. Stakeholders include not only the people or organizations that have a direct influence on the development of the company, but also those that have an influence on the company's profit-making and investment activities, such as customers, suppliers, the government, employees, and society at large. Stakeholder theory states that a company is responsible to itself and its stakeholders. When viewed in the context of capital structure, the company must consider all stakeholders' needs and fully protect the interests of all those who contribute to the company's development. Therefore, the company needs to take into account the interests of its stakeholders when carrying out investment activities and choose an appropriate capital structure that fully protects their interests.

While Jensen and Meckling (1976) and other scholars further developed and refined principal-agent theory, the theory’s exclusion of the interests of a wider range of stakeholders and its over reliance on traditional ideas of Western classical corporate governance, which is based on a contract between the board of directors and shareholders' interests, made it the subject of frequent criticisms. Meanwhile company stakeholder theory, based on the participation of all contracting parties in forming a system of corporate governance with checks and balances, has recently seen greater attention and more rapid development.

In the 1980s, the American economist Freeman (1983) argued that stakeholders should be a group of people who can influence the achievement of an organisation's goals or who can be influenced by the organisation in the process of achieving its goals. This influence can be either uni- or bi-directional, and it can take the form of transactions, relationships, or contracts. Freeman's concept of a universal stakeholder encompasses the individuals and groups that influence and are influenced by the achievement of a company's objectives (e.g. shareholders, creditors, employees, suppliers, consumers, etc.). This definition includes communities, governments, and environmentalists, which greatly enriches the theoretical and practical study of stakeholder management.

Stakeholder theory holds that each economic agent, in the pursuit of maximising its own economic interests, cannot limitlessly pursue its own desires without infringing on the economic interests of others. Similarly, an agent’s behaviour is constrained by the behaviour of other actors, as acting otherwise will

break the contractually agreed upon terms, resulting in the enterprise then entering new contracts and forming new economic interests. Shareholders assume limited liability (risk) in an enterprise and in turn stakeholders will then assume a greater residual risk than shareholders. Therefore, in order to incentivise the entry of dedicated assets into the company and to safeguard the economic interests of stakeholders, the company should allocate a certain level of ownership of the business to all stakeholders fortified and guaranteed by contractual arrangements.

First, the modern company should not be seen as just a body containing all shareholders but should instead be considered a combination of all shareholders and all stakeholders of the company in a state of dependency. In the case of the normal operation of a company, the ownership of the company is allocated to the shareholders, and business decision-making power is allocated to the board of directors. When the company faces operational problems, approaching stages of loss or even bankruptcy, power over the company will then be dictated by the creditors who can decide whether to reorganize or liquidate the company, in which case its ownership will be returned to the creditors. If the company reaches a stage of bankruptcy before liquidation, and the company is unable to pay its employees from its existing assets, the employees will have the right to dispose of the company's assets, i.e. the company will then be effectively controlled by the employees. From the examples above it can be seen that the company's shareholders, creditors, and employees all have a vested interest in the company's development and behavior, and therefore non-shareholder subjects (i.e. other stakeholders) should also be allowed to participate in the governance of the company.

Second, the formation of company value is the result of a combination of factors, and the participation of stakeholders such as operators, suppliers, and consumers in the company's governance can increase the company's value. From the perspective of company partners, the establishment of stable relationships between the enterprise and its partners, such as operators, suppliers, and consumers, is conducive to maintaining the stability of the company's inputs, continuously reducing the company's input costs, and maximizing the company's value. From the perspective of market demand, in order to maintain and improve the market share and market competitiveness of the company's products, the company needs to form trustworthy relationships with various stakeholders. To maintain and enhance the market share and competitiveness of the company's products, the company needs to form a trustworthy partnership with its stakeholders, who play a key role in the formation and optimization of the company's value. The participation of stakeholders in the company's governance framework is therefore necessary in order to optimize the company's decision-making behavior and promote the company’s value. Finally, in current market conditions, stakeholder theory promotes a renewed understanding of the company's interests. Describing the goal of the modern company as a tool for maximizing shareholders' interests cannot fully summarize the new requirements and

characteristics of modern corporate behavior. In addition to safeguarding shareholders' interests and their own values, companies must also assume social responsibility and maintain the company's social values. It can be seen that stakeholder co-ownership and the proliferation of corporate ownership incentives has arisen from corresponding social and economic development, which has a positive effect on curbing the moral hazard of stakeholders, reducing the company’s incentive monitoring and transaction costs, and increasing the total value of the company.

2.2.7 Lifecycle theory

Conclusions drawn from various Western financing theories indicate that internal financing is the primary consideration for companies, followed by the issuance of bonds and convertible bonds, and subsequently, the issuance of new stocks. External financing, particularly debt financing, is prioritized. Most studies divide a company's lifecycle into four stages: start-up, growth, maturity, and decline. Given the distinct characteristics of companies in different stages, their capital structures exhibit significant variations. The features of a company's lifecycle significantly influence its capital structure (DeAngelo et al., 2010).

During the start-up stage, companies require substantial funds for operations due to the need for scalability and business expansion. Retained earnings are scarce at this stage, necessitating refinancing to meet expansion requirements. Internal funds, government investments, and risk capital seeking high returns and risks become the primary sources of funding.

After the start-up stage, companies enter the growth stage. At this point, companies have developed core products and begin market penetration, gradually generating profits that compensate for the initial investment. As technology advances and markets expand, the technical risks associated with the company decrease. The management system develops and gains momentum, establishing core capabilities. However, self-funding remains limited during this stage. Since the company has successfully overcome survival challenges and gained recognition and a good reputation, a combination of internal financing, equity financing, and debt financing becomes the primary funding approach.

In the maturity stage, companies enjoy stable sales revenue and cash flow, with significantly reduced operational risks. After going through the start-up and growth stages, companies accumulate valuable experience in technology research and development, market integration, and management. Compared to the previous two stages, the risk level decreases significantly. With stable business performance, high asset returns, and larger asset bases, financial institutions are more willing to provide debt financing opportunities

to mature companies. Companies increase their debt proportion in total assets and improve their financing structure through debt instruments. Hence, debt financing becomes the primary financing approach during this stage.

In the decline stage, as industries rapidly evolve and a myriad of new products replace existing ones, companies must study new products and seek alternative opportunities to overcome the current development difficulties. Without new avenues for growth, companies face the risk of acquisition, bankruptcy, or insolvency. During this phase, companies face complex situations, but one irreplaceable financing approach is to bridge the funding gap through retained earnings.

2.3 Factors influencing capital structure

A study by Graham and Harvey (2001) found that the CFOs of one third of manufacturing companies in the US account for interest rates, inflation, and other factors when making their financing decisions. Korajczyk and Levy (2003) systematically studied the impact of macroeconomic factors on the capital structure of firms, using a sample of US firms from 1984 to 1998. They divided the sample data into two samples based on financing constraints and established a functional relationship between corporate capital structure and macro-economic factors. They found that the impact of economic cycles on corporate financing choices corresponded to the level of financing constraints applied to the companies themselves, and the gearing ratios of companies with fewer financing constraints showed counter-cyclical characteristics, while those of companies with more financing constraints Alti (2006) used data on US firms from 1971 to 1999 to show that the choice of equity financing is related to market sentiment, showing significant evidence of market selection. During bull markets, IPO firms issue more shares than IPO firms during bear markets. Erel and Julio (2011) found that macroeconomic factors influence both the ability of firms to raise capital and the way they do so by examining various types of securities issued by US firms over the period 1971-2007, with firms with higher credit ratings having greater access to capital. The capital structure of companies with higher credit ratings is counter-cyclical, while the capital structure of companies with lower credit ratings is pro-cyclical. This is because the relative prices between securities with different credit ratings change with economic booms and busts, so companies with higher credit ratings issue more bonds in recessions, while companies with lower credit ratings are only able to raise enough debt capital in booms.

Almazan (2005) empirically investigated intra-industry variation in the capital structure of firms and demonstrated that the variation in capital structure within an industry is greater when the firm's industry is more concentrated, when the use of finance leases within the industry is more intensive, and when corporate

governance within the industry is looser (e.g. firms make less use of incentive compensation, external independent directors are smaller, etc.). In addition, industries with significant growth opportunities and long company histories have a more diversified capital structure.

Saif-Alyousfi et al. (2020) conducted a panel data analysis of 8270 observations of 827 non-financial listed companies in the Malaysian stock market from 2008-2017 on the factors influencing capital structure. The results showed that profitability, growth opportunities, tax protection, liquidity and cash flow volatility had a significant negative impact on gearing. However, collateral, non-debt taxes, and earnings volatility had a positive and significant impact on gearing. In addition, firm size, firm age, inflation rate and interest rate all have a further significant influence on gearing. The findings also show that there is a significant inverse u-shaped relationship between a firm's age and its capital structure. Overall, the findings of the study support the claims made by the optimal order of financing and trade-off theory.

Neves et al. (2020) analyzed the determinants of corporate capital structure in Portugal. They used data on 37 non-financial large firms and 4233 non-financial small and medium-sized firms in Portugal for the period 2010-2016. The three dependent variables were tested according to debt maturity and utilized a dynamic panel data model. The findings indicate that capital structure decisions depend on a range of firm-specific factors and that the impact of the determinants of debt maturity varies according to firm size and economic cycles.

Zaid et al. (2020) empirically examined the relationship between board attributes and financing decisions in Palestinian non-financial listed companies and the moderating role of gender diversity levels. The findings reveal that the effects of board size and board independence are more positive under conditions of high gender diversity, while the effect of CEO duality on the level of firm leverage ranges from negative to positive. In short, gender diversity moderates the impact of board structure on corporate financing decisions. Ramli et al. (2019) studied the impact of capital structure determinants on firm financial performance and the mediating effect of firm leverage in Malaysia and Indonesia from 1990-2010. The results of the study indicate that capital structure determinants directly affect the financial performance of firms. There is a significant positive relationship between firm leverage and firm financial performance in the Malaysian sample. Malaysian firms use external financing rather than internal financing to improve performance.

Gharaibeh & Saqer (2020) studied the factors influencing the capital structure of service companies in Jordan. The results of this study showed that independent variables such as capital structure determinants have an impact on the debt ratio of service companies. Firm size and non-debt tax shields have a significant positive effect on debt ratio, while profitability and business risk have a significant negative effect on debt ratio. Overall, the findings support the view that elements of trade-off theory, agency costs and preferential

financing order theory are supported by the existing literature, in addition to non-debt tax shields and tangible factors.

Moradi & Paulet (2019) used a sample of 559 firms in six European countries from the period of 1999-2015 in their study. The article used gearing, debt-to-equity ratio, and net equity as proxies for capital structure. It found that the effects of growth capacity, profitability, non-debt tax shields and the euro crisis are significantly negatively related to gearing and debt-to-equity ratios and significantly positively related to net equity. In addition, we found that size, asset tangibility, non-debt tax shields and surplus volatility are significantly positively related to gearing as well as debt-to-equity ratio and significantly negatively related to net equity. In the research we further divided the entire sample into three sub-samples describing different industries: retail trade and services, manufacturing and construction, and transportation and tourism. We found that transport and tourism were more negatively affected by the euro crisis than the other two sectors. This model was designed to test the validity of the capital structure trade-off, the theory of optimal order financing, and the theory of agency costs.

Yousef (2019) examined the determinants of capital structure in the real estate sector in the Gulf Co-operation Council (GCC) and the United Kingdom (UK). The results of the bivariate analysis suggest that the UK is significantly more leveraged than the GCC countries. This may be due to the lower cost of debt available to UK companies, which would facilitate their ability to raise debt capital from the market. In addition, UK real estate companies tend to be larger and have higher levels of tangible and retained earnings than GCC companies, which tend to be more profitable and have more opportunities for growth. The results of both the panel and Tobit regression analyses support the trade-off and order of preference theories; for example, firm size was found to have a significant positive effect on different types of debt measures (market debt ratio and book debt ratio), which is consistent with the trade-off theory, while profitability and retained earnings as a percentage of total assets showed a significant negative effect on GCC and UK real estate companies, which is consistent with the order of preference theory.

Chakrabarti & Chakrabarti, A. (2019) explored aspects of corporate capital structure in the Indian energy sector. The article used panel data techniques for a sample of 141 firms operating in the energy sector in India. The findings indicate that firm age, asset turnover, liquidity and firm size are significant determinants of capital structure in Indian energy firms, while profitability, solvency, sales growth, non-debt tax shield and the tangible asset ratio have no significant effect on capital structure. In previous studies, profitability has been significantly negatively related to debt ratio; however in this study, the relationship is not significant.

Khémiri, & Noubbigh (2018) examined the determinants of capital structure in five sub-Saharan African countries (South Africa, Ghana, Kenya, Nigeria and Zimbabwe) over the period 2006-2016. They used a systematic GMM model for the regressions. The results of this paper provide support for the predictions made by trade-off theory and prioritization theory. They also showed a significant inverse u-shaped relationship between firm performance and leverage. Cevheroglu-Acar (2018) used a sample of Turkish non-financial firms to explore the determinants of their capital structure and to test whether financial theory provides a convincing explanation for Turkish non-financial firms. As the relationship between liquidity and capital structure in the Turkish market is not well tested in the context of capital structure theory, liquidity, size, and risk are included as independent variables in the model in addition to profitability, growth, and non-debt tax shield.

Panel regressions are used as an econometric model, covering the period 2009-2016. The results showed that profitability, non-debt tax shield, size, tangible asset ratio and liquidity are important determinants of capital structure; on the other hand, growth and volatility are not significantly correlated with leverage. Furthermore, it is concluded that capital structure decisions of Turkish non-financial firms are mostly consistent with the preferential financing hypothesis rather than trade-off theory. Kobina et al. (2020) examined the impact of macroeconomic and firm-specific factors on the capital structure of non-financial listed companies in Ghana. The study found that real GDP growth rate, firm size, profitability, tangibility, and growth opportunities had a significant impact on the change in leverage of the sample firms under normal circumstances. Inflation and real GDP growth had no significant impact on the financing choices of the sample firms during the global financial crisis. Profitability, firm size, tangibility, liquidity, and growth opportunities, however, had a significant impact on the capital structure decisions of the sample firms. The findings shed light on the role of trade-offs, prioritization, and agency cost theory in the capital structure of the sample firms, which remains valid in times of crisis.

2.4 Impact of the outbreak on capital markets

There have been many large-scale crisis events and outbreaks affecting public health in the long history of humankind, and domestic and international scholars have a long history of conducting research on their economic impact. For example, Alfani & Percoco (2019) analyzed the impact of the 1629- 1630 plague in Italy on urban development and concluded that cities that were severely impacted by the plague had lower levels of economic growth and had a persistent negative impact on urbanization rates. Infectious diseases seriously threaten global security (Sands et al., 2016), cause sustained economic decline (Meltzer et al., 1999; Prager et al., 2017; Barro et al., 2020), and to some extent affect the quality of human capital and future population income levels (Beach et al., 2016) The impact of the Severe Acute Respiratory Syndrome

(SARS) outbreak in China in 2003 on economic activity has been widely studied by scholars, although Yaghoubi and Yaghoubi (2021) concluded that the SARS outbreak had no significant impact on capital expenditures, acquisitions, or R&D expenditures of listed companies in Canada. SARS also had no significant impact on either the capital expenditure or acquisition expenditure of Chinese firms, but increased the R&D expenditure of Chinese firms. Chen et al.'s (2007) study used an event study approach to explore the impact of the SARS outbreak on the share price movements of hotels in Taiwan, noting that the earnings and share prices of seven listed hotel companies dropped significantly during the SARS outbreak. Yaghoubi and Yaghoubi (2021) examined the epidemic's impact on corporate investment, using the outbreak of SARS as the independent variable and firm-level capital expenditure, acquisition expenditure, and R&D expenditure as explanatory variables in this paper. The study sample included firms listed on the Shenzhen, Shanghai, Hong Kong and Toronto stock exchanges from 1999 to 2019.

It is found that the SARS outbreak had no significant impact on capital expenditures, acquisition, or R&D expenditures of firms listed in Canada. SARS also had no significant negative impact on Chinese firms, but increased their research and development expenditures.

Iqbal & Kume explored the impact of the 2008 financial crisis on the capital structure of firms, using data on UK, French and German firms as the subject of the study. The results showed that overall leverage ratios increased from the pre-crisis (2006 and 2007) to the crisis years (2008 and 2009) and then decreased in the post-crisis period (2010 and 2011). Equity and debt levels changed both during the crisis and in the post-crisis years. These findings further reveal that firms with pre-crisis capital structure ratios below the industry average had leverage ratios that gradually increased during and after the crisis. However, firms with pre-crisis capital structure ratios above the industry average experienced a significant decline in leverage, particularly in the post-crisis period, mainly due to changes in their equity levels. Demirgüç-Kunt et al. (2020) used a dataset covering approximately 276,998 firms in 75 countries over the period 2004-2011 to examine the immediate aftermath of the global financial crisis and the resulting short-term evolution of corporate capital structures. This study found that solid leverage and debt maturity are declining in both developed and developing economies, even in those countries that did not experience the crisis. The deleveraging and maturity reduction effects were particularly significant for non-listed firms, including SMEs and large non-listed firms. Trinh and Phuong (2016) explored the impact of the financial crisis on the capital structure of listed firms in Vietnam. Based on a sample of 265 firms listed on HNX and HOSE during the period 2006-2013, a regression model of the relationship between leverage and firm size, growth, profitability, tangibility, and crisis dummies were developed. The empirical results showed that firm size, profitability, and tangibility all had a significant impact on capital structure. This growth was not statistically significant and does not explain the difference in leverage. These findings also suggest that the capital

structure of Vietnamese listed companies did not change significantly as a result of the financial crisis.

At the end of 2019, the sudden outbreak of COVID-19 swept the world, driving greatly concerned scholars to begin researching the phenomenon.

The impact of the COVID-19 pandemic on the economy was severe and long-lasting (Fornaro & Wolf, 2020) with the negative impact being much more severe than that of the 2008 financial crisis due to the strong impact of the COVID-19 pandemic on both the supply and demand sides, whereas the world financial crisis of 2008-2009 was mainly a massive demand shock that left the supply side of most economies relatively unaffected (Baldwin& Tomiura, 2020).

First of all, the COVID-19 epidemic has largely impacted economies at the macro level. The widespread, persistent, and highly contagious nature of COVID-19 has greatly restricted the movement of people, with the labor market bearing the brunt of the impact. As employees were prevented from returning to work, many companies experienced backlogs of orders and disruptions in the supply of raw materials, sharply escalating the risk of production stagnation and supply chain disruptions. This impact on the macro economy has had a corresponding but no less severe impact on the micro capital and individual market as well. In terms of the macro economy and the daily lives of the population, the COVID-19 epidemic has totally changed patterns of life and employment, thus affecting the income growth and overall operation of the country.

A study by Aum et al. (2020) found that in the early spring of 2020, for every 1 per 1,000 increases in infections in South Korea there was a two to three percentage point decrease in local employment. Using a questionnaire survey, Coibion et al. (2020) found that households living in areas that had been locked down at an earlier stage were expected to experience an increase in unemployment of 13 percentage points over the next 12 months, and that the unemployment rate would continue to rise over the next three to five years. In addition to the increased anxiety felt by workers for their own health caused by COVID-19, the added physical and mental stress caused by the suspension of work increased uncertainty about the future. For example, Lee et al (2020) found that although survival rates were somewhat mitigated by increases in government food aid, people were still worried about their mental health and personal savings, and often felt fearful due to media reports on the public health situation. Secondly, in terms of the heterogeneity of shocks to different groups of workers, it is the less educated group of workers in low-paying occupations that were the most negatively affected by the repercussions of COVID-19 (Lee et al, 2020), mainly because these workers are not able to telecommute and work in industries that are less likely to be feasibly moved online (Aum, Sang & Shin, 2021). For example, Aum et al. (2020), found that groups of workers with lower levels

of education, low-paying occupations, and on temporary contracts were most likely to suffer from the negative effects of the pandemic. Barrero et al (2021), using firm-level data from the Survey of Business Uncertainty in the US, found that COVID-19 altered the trend in relative employment growth in favor of industries with high home-based capacity for employees and to the detriment of industries with low work-from-home capacity. This suggests that workers with telecommuting skills will become increasingly competitive in a normalized epidemic scenario.

In the case of the UK, the entire national economic system has also been very much shaken. Calabrese et al. (2022) explored the UK government's policy response to the COVID-19 crisis starting from the initial embargo in March 2020. Using data from the two quarters prior to the COVID-19 crisis, the article explores the dynamics of SME finance. This study found that from the first quarter of the coronavirus epidemic (April-June 2020) to the second quarter (July-September 2020), the demand, supply and government share of SME loans increased, with microenterprises having the highest demand for loans and better performing firms being more likely to receive loans. Roper and Turner (2020) explored the impact of the COVID-19 crisis on UK innovation and R&D activities arising from SME innovation. Brown and Cowling (2021) traced the economic and spatial consequences of the COVID-19 pandemic in terms of potential business failures and associated unemployment in the 100 largest towns and cities in the UK. In terms of the risk of business failure, they argue that there is a clear and unequal impact on the poorer northern and peripheral urban areas of the UK, suggesting a weaker level of regional elasticity but a more random distribution in terms of unemployment. Therefore, spatially blind business policies are not sufficient to deal with the crisis and more targeted regional policies will be crucial in the future to help mitigate the scarring effects of the COVID-19 pandemic in terms of business failures and consequent unemployment. Du and Shepotylo (2022) explored the impact of the coronavirus crisis on UK trade and considered how earlier economic performance can be restored. In 2020, the UK's merchandise exports contracted more than other comparable countries. Statistics show that the UK had a more severe recession and a slower recovery than Germany, Italy, Spain, and the US.

The epidemic has also impacted the capital market to varying degrees. Fu & Shen (2020) studied the impact of the COVID-19 epidemic on the performance of firms in the energy industry and found that COVID-19 had a significant negative impact on the performance of energy firms and further tested the moderating effect of goodwill impairment. Using Chinese listed companies 's financial data, they also examined the impact of the coronavirus on firm performance. This study showed that COVID-19 had an overall negative impact on firm performance. The negative impact of the coronavirus on firm performance was more pronounced when the size of the firm's investment or sales revenue was small. Khatib & Nour (2021) used a sample of 188 non-financial firms in the Malaysian market for the period 2019-2020. This

study found that COVID-19 affected a wide variety of firm characteristics such as firm performance, governance structure, dividends, liquidity, and leverage levels, but the overall difference before and after the outbreak was not significant. Pagnottoni et al. (2021) found that financial markets behaved differently in response to the outbreak, with significant time lags in the respective shock responses of the Italian and German bond markets. Chavali & Zaremba's (2021) findings demonstrated that when a major epidemic occurs, investors do not obtain sufficient information from firms' reactions to make sound judgments about future stock returns. Naseem et al. (2021) found that when under psychological stress and pressure from the pandemic, investor psychology and the performance of the Shanghai, Japanese and US-selected stock markets were negatively correlated. Negative sentiments and pessimism prompted investors to halt financial investment in the stock market, which led to a decline in stock market returns. Raifu et al. (2021) analysed the Nigerian stock market and showed that while stock market returns reached an equilibrium in the long-term, COVID-19 confirmed that the effects of cases and death as well as lock-in policy shocks on stock returns exhibited positive and negative oscillations. COVID-19 confirmed case growth, deaths, and lock-in policy shocks explain little of the variation in stock market returns. Hassan (2020) constructed text variables for public companies of major concern related to the spread of COVID-19 and other epidemics. It is identified which firms perceive gains from specific epidemics and textually decomposed the impact of epidemics on firm demand and supply. It was found that the impact of COVID-19 manifested itself as simultaneous shocks to demand and supply, with both shocks affecting the market valuation of firms to an equal extent on average.

Mirza et al. (2020) investigated the impact of COVID-19 on the solvency of companies in EU member states and reported a deterioration in the solvency position of all observed companies. The manufacturing, mining and retail sectors were the most vulnerable to declining market capitalization and reduced sales revenues. Cheema et al. (2020) investigated whether investors differentiated between companies based on their human capital, supply chains and product and service responses during the COVID-19 induced market crash in 2020. Using data derived from natural language processing applied to news reports of 3,023 companies worldwide responding to the coronavirus crisis, they found that the more positive the response to a company, the lower the negative returns. Hsu et al. (2020) examined whether confirmed cases (and deaths) of COVID-19 or online searches related to COVID-19 affected stock behavior. The results showed that all five of the COVID-19 indicators were positively associated with stock price volatility and trading volume, and negatively associated with stock returns. Huang (2020) studied the relationship between social responsibility and organizational resilience in the context of an epidemic. He found that higher levels of CSR increased stock price stability and firm organizational resilience in response to the pandemic. Manuel and Herron (2020) noted that during the pandemic, firms engaged in a wide range of philanthropic CSR initiatives to respond to the needs of internal and external stakeholders, thereby increasing the level of corporate

social responsibility (CSR).

The COVID-19 pandemic has had significant impacts on countries such as China, South Korea, Italy, and Canada. LIU et al. (2021) examined the influence of operational flexibility at the firm level on stock performance during the COVID-19 pandemic in China. The study found a significant positive correlation between operational flexibility and cumulative abnormal stock returns during the event window, with a more pronounced relationship observed in firms located in provinces heavily affected by the pandemic. SUN et al. (2022) employed a combined approach of text analysis and empirical analysis to study the impact of the COVID-19 pandemic on small and medium-sized enterprises (SMEs) in China. The study revealed that most SMEs experienced financial consequences, primarily due to delayed resumption of work, decreased market demand, and logistics and mobility restrictions.

FERRIGNO et al. (2021) focused on Italian listed companies and investigated the influence of the pandemic on innovation activities within the pharmaceutical sector. The study found that innovation activities of Italian companies were suppressed following the outbreak of the pandemic. RAPACCINI et al. (2020) utilized extensive survey and interview data collected during the COVID-19 pandemic in Italy. The respondents were executives from industrial companies located in factories, warehouses, and headquarters in the northern region of Italy, which was severely affected by the pandemic. The study explored the impact of the pandemic on different service sector companies.

AUGUST et al. (2021) examined the interconnections between housing, financialization, and inequality revealed by the COVID-19 pandemic. The study found that in the rental housing sector, affordability crises led to homelessness pressures and pandemic-related evictions. In the context of elderly housing, disproportionate deaths in national long-term care facilities exposed a caregiving crisis.

SHIN et al. (2023) analyzed data from listed companies in South Korea to investigate whether investor responses to the crisis during the COVID-19 pandemic differed based on the gender of the Chief Executive Officer (CEO). The results indicated that companies led by female CEOs exhibited lower cumulative abnormal returns within 30, 60, and 90 days after the first COVID-19 case, compared to those led by male CEOs. This finding aligns with the prediction that investors show a preference for companies with female CEOs during highly uncertain periods.

HWANG et al. (2021) examined the impact of environmental, social, and governance (ESG) activities on the financial performance of companies in South Korea during the period of severe uncertainty caused by the COVID-19 pandemic. The results indicated a significant decline in corporate profitability in the first quarter of 2020 due to the impact of the pandemic. However, higher ESG performance mitigated the extent

of profit decline.

For UK-listed companies, the pandemic had varying degrees of impact on firm performance, R&D, and organizational resilience. Altig et al. (2020) calculated several indicators of economic uncertainty in the US and UK before and during the COVID-19 pandemic, including: implied stock market volatility, policy uncertainty in newspapers, rhetoric on Twitter about economic uncertainty, subjective uncertainty about business growth, forecaster disagreement about future GDP growth, and a model-based measure of macro uncertainty. They found that all indicators pointed to significant uncertainty in people's reactions to the pandemic and its economic impact. For UK firms, uncertainty shocks on the scale of the pandemic predicted a decline in peak industrial production. Vidmar et al. (2020) outlines the immediate response to the COVID-19 crisis in spring 2020 and the follow-up plans taken to ensure the survival of firms. The findings suggest that among the companies studied, there was a significant level of strategic agility displayed by firms as a result of telecommuting infrastructure, organizational restructuring, and a new organizational culture mobilized quickly under the transparent leadership of the firm's management team. Griffith and Stroud (2020) explored the spread of COVID-19 and the significant impact that international containment measures are having on economic activity in the UK. Using share price data for companies listed on the London Stock Exchange, the paper described how this impact varies across sectors and how, in light of this, targeted government support policies for workers and companies are being implemented. Hsu and Yang (2022) analysed whether COVID-19 is affecting the quality of corporate financial reporting and whether corporate governance has a mitigating effect. Using data from UK listed companies, we found that the quality of corporate financial reporting declined during the epidemic. Specifically, this was due to firms having to manage their surpluses through more physical activity during the pandemic. They also found that firms with larger boards were better able to mitigate the negative impacts of COVID-19 on the quality of financial reporting, although they did not find a mitigating effect caused by board independence or CEO duality. Hoang et al. (2020) explored whether transparency in ESG reporting helped UK listed companies to better mitigate the impact of the COVID-19 pandemic. They conducted a survey of 179 listed companies from August 2019 to May 2020. The results show that companies with high ESG disclosure scores were less negatively impacted by internal and external company factors throughout the coronavirus pandemic. In addition, ESG transparency helped to reduce volatility. Elmarzouky et al. (2021) explored whether information related to COVID-19 was associated with higher levels of performance disclosure in annual reports, using worker data from UK listed firms. The paper also examines the moderating effect of corporate governance on the relationship between the pandemic and performance disclosure through three governance mechanisms: board size, board independence and gender diversity. The authors applied automated text analysis techniques to measure the levels of COVID-19 information and performance disclosures for FTSE all-share non-financial companies. The authors found a significant positive relationship between COVID-

19 information disclosure and company performance disclosure in the observed annual reports. The authors also found that both board independence and gender diversity moderated the relationship between COVID-19 information disclosures and the degree of performance disclosure in annual reports.

2.5 Impact of the outbreak on UK firms

COVID-19's influence on companies' debt to equity ratio

The COVID-19 pandemic disrupted the social fabric that formed the bedrock of many companies' success during pre-COVID times. One of the most essential components of a successful business is human capital. As cases steadily rose, so did the number of coronavirus-related fatalities. Increased rates of hospitalization and death directly impacted organizations, given that they lost a significant portion of their human capital to the disease (Delve Initiative, 2020). Additionally, poor economic performances and adverse containment measures plunged most countries into recession. At the pandemic's peak, many firms turned to debt financing and other forms of support to maintain their business operations and ensure their corporate survival, with such decisions having a huge impact on the companies' capital structures, as indicated below. Both human and financial capital was necessary to revive the struggling business environment, which had a significant impact on their capital structures.

Investment levels

As many companies took huge financial hits at the peak of the COVID-19 pandemic, those that survived had to then focus on recovery, and thus the need to raise re-investment capital. Debt is a method to raise capital that presents a series of challenges, including its influence on changing a company's spending patterns, investments, and interactions with goods suppliers, workers, competitors, and consumers. Given these effects, debt-financing is often not the preferred method of financing, although it is easily accessible compared to other means. Debts can either be long-term or short-term, and the choice to finance the investment may lead to decreases in future investment. According to Kovács and Kálmán (2022), high debt levels adversely affect the firm's ability to initiate positive net present value investments. Therefore, companies with good investment portfolios are likely to opt for lower debt ratios, and therefore a healthy capital structure.

Bloom et al. (2020) revealed the negative correlation between debt ratios and negative expenditures to the impediments to investment created by debts and corporate high debt ratios. With core business segments being more susceptible to debt leverage than non-core sectors, debt financing significantly influences

a firm's choice of investment. During the peak of the pandemic period, many firms grappled with reduced market activity and issues with labour, marketing, wages, and more. As a result, many companies had to make uncommon investment choices to maintain their businesses. Most firms acquired loans to help them transition onto online platforms to reach their consumers during lockdowns. According to statistics released by the Bank of England, business activities fell by over 30% compared to the pre-COVID era (Bloom et al., 2021). Consequently, organizations used debts as discipline mechanisms to reduce over-investment as market activity reduced during the pandemic, affecting their capital structures.

Furthermore, large debts apply great pressure on businesses, which greatly influences their investment decisions in favor of investments, which create higher and quicker returns (Segal & Gerstel, 2020). As the death toll of the COVID-19 pandemic steadily rose, firms suffered from a reduced workforce, disrupted supply chains, and low consumption of certain goods. This led to many firms acquiring debts to survive the difficult economic situation and consumer austerity. Some firms temporarily shifted focus to take advantage of the booming medical equipment and technology industries in order to generate quick returns and service the loans they acquired.

With most firms accruing debt at the peak of the pandemic, Griffith et al. (2020) evaluated how COVID-19 had impacted share prices in the UK. The researchers collected secondary data to evaluate how the measures that had been taken to contain the spread of the virus had impacted economic activity. A statistical analysis was conducted analyzing the relationship between the prices of firms listed on the London Stock Exchange and the government's support the workers and companies. According to the study, it was noted that the precautionary public health measures undertaken, such as social distancing, induced capital intensiveness in firms that could not financially sustain themselves, leading to a reduction in share price.

Workers

During the COVID-19 pandemic, companies implemented diverse strategies to mitigate the impact on human capital. Automation and online services were used to reduce reliance on labor (Martin et al., 2020), while others increased workforce investments to comply with new containment measures. Debt financing became prevalent as organizations urgently sought capital (Gupta et al., 2021). Highly leveraged corporations were less affected by wage demands (Chetty et al., 2020), while companies with lower leverage sought debt financing, significantly impacting their capital structure. The pandemic led to layoffs, reduced returns, and financial re-planning efforts (Nicola et al., 2020). This crisis had profound effects on human capital, employment dynamics, and the financial well-being of companies.

Consumers

The COVID-19 pandemic led to the implementation of lockdowns as containment measures, disrupting the traditional brick-and-mortar business model and causing reduced sales (Verschuur et al., 2021). This situation, combined with the use of debt financing by many businesses, resulted in strained relationships with customers and potential negative impacts on business performance and capital structure.

Achim et al. (2021) conducted a study on the financial management implications of COVID-19, analyzing panel data from companies in different sectors. Their findings revealed a significant decline in net profits by at least 37.43% within a two-year period compared to 2019. The study emphasized the importance of proper liquidity management and equity financing in enhancing companies' return on equity. However, the response to the pandemic varied across different business sectors, highlighting the sector-specific nature of the challenges faced.

Firm's suppliers and supply chain

The COVID-19 pandemic had a significant impact on the relationship between businesses and suppliers, as rising transportation costs and limitations on movement disrupted supply chains and increased supply costs. The fiscal performance of a company influences its relationship with suppliers, and financial distress can negatively affect this relationship (Marek et al., 2020). Lower debt-to-equity ratios are important for maintaining relationship-specific investments with suppliers (Stannard et al., 2020), but many firms resorted to reduced production, temporary shutdowns, and debt acquisition during the pandemic, leading to an increased debt-to-equity ratio in their capital structure (Rodela et al., 2020). The impact of supply chain issues on stock prices was examined by Kordestani et al. (2021), who found that while the pandemic had an effect on the stock market, there was no empirical evidence to support a direct impact. However, blockchain companies experienced abnormal returns, indicating a slower recovery due to the influence of suppliers on the industry. Companies involved in the supply of essential goods such as medication and vaccines faced unique changes to their capital structure. The urgent need to improve the supply sector and the reduction in transportation costs positively impacted their capital structure (Ceylan et al., 2020). Turkki (2021) investigated the impact of COVID-19 on the capital structure of European companies, including the UK, through supply chains and suppliers. The study revealed a statistically significant correlation between the pandemic and an increase in leverage and long-term debt, which helped mitigate supply chain issues. However, long-term debt carries other risks such as higher interest rates, which can affect the debt-to-equity ratio of the capital structure.

Size of the companies

As the economic impacts of COVID-19 ravaged the country and adversely affected the financial status of companies, the size of firms was an important factor in determining the impact that the economic turbulence had on them. As share prices plunged, smaller firms that relied on share capital and retained savings had to search for other capital sources. This led to an altered debt-to-equity ratio, affecting smaller firms' capital structure.

Jabeen et al. (2022) argued that COVID-19 created a decline in the stock market in developed countries like the United Kingdom. In most countries, they noted that there were massive losses that were directly connected to the reduction of organizational share prices. The researchers collected secondary data for comparative analysis. According to the findings, they found that the pandemic had a destructive effect on financial markets, as illustrated by poor market performance. The researchers suggested that governments can undertake measures to improve the stock market and cushion the companies against dramatic shocks. The shock to the stock market led to higher costs of raising capital for smaller companies, which shifted their capital structure to higher debt-to-equity ratios.

Although large organizations incurred fewer costs when raising capital, the reluctance of many investors to invest due to the unpredictability of market conditions and falling share prices meant that large corporations also had to source capital from elsewhere (Straka et al., 2020). Companies that deal with consumer goods saw a vast plummet in sales due to lockdowns at the pandemic's peak, which reduced the favourability of debt financing compared to enterprises that sustained stable sales and earnings. Adarov et al. (2022) state that firms with stable returns can use more debt in their capital structure than ones with unstable returns.

Finally, the expected increase in sales for companies dealing in vaccines, medical and protective equipment, and medicine needed during the pandemic enhanced their leverage when using debt financing to a greater degree than other firms. These firms, which were rapidly developing and expanding, used more debt in their capital structure as a result (Song et al., 2021). On the other hand, plunging business returns that plagued many firms at the peak of the pandemic and in its aftermath made debt financing an unfavorable source of investment capital, which impacted the capital structure of some enterprises that decided not to use this type of financing.

Competition

Bateson (2022) suggests that organizations in highly competitive environments are better suited to

using share capital rather than debt financing due to the income volatility they experience. During the peak of the pandemic, companies faced plummeting share prices and reduced competition as some temporarily shut down or scaled back operations to comply with containment measures. Zhang et al. (2021) found that the pandemic had limited impact on stock market returns but increased organizational volatility, with the leverage effect affecting companies. As the economic recovery phase began, Larrimore et al. (2022) observed that firms with debt financing faced aggressive competition and lower commodity prices, adversely affecting their output. Bouhali et al. (2021) explored the impact of daily COVID-19 cases and vaccinations on financial markets during the third wave. Their findings showed a strong influence of vaccinations on the financial markets and reflected an optimistic outlook during times of increased competition. The varying levels of competition during the pandemic influenced firms' capital structure, with debt financing becoming more favorable during low competition periods and decreasing in demand as competition intensified.

Stages of a firm's life cycle

As the pandemic created a difficult economic situation across the globe, companies' means of raising capital during the recession varied depending on their stage of development. Meyer et al. (2022) point out that companies at incubation or early stages of development should use share capital as the primary source of funding, while avoiding debts due to the risk they pose to the business. For enterprises that are in a recovery phase or that are experiencing a point of growth, low-risk, easily raised capital is the suitable choice for generating funds, while organizations developing new products should use shares to raise capital.

The COVID-19 pandemic caused a drop in share prices. Consequently, many businesses lacked access to the primary and preferable means of raising capital. This caused many businesses to source funds using other means and debt financing was a common choice. The need to develop new products, the lack of share capital, the drop in share prices, and incurred debt all impacted firms' capital structure. Also, the high interest rates of the acquired debts put more financial pressure on the firms, especially when the economic recovery phase began (Castelnuovo, 2022). This led to firms sourcing capital from equities, which improved stock prices. Start-ups that wished to acquire an emerging niche in the market mainly used share capital, debts, and corporate bonds, all of which influenced the firms' capital structure.

Corporate bonds

During the peak of the COVID-19 pandemic, the corporate bond market experienced significant stress and liquidity shortages, impacting firms' capital structure and investment opportunities (Haddad et al.,

2021). The spread of Credit Default Swaps did not align with the spread of corporate bonds, indicating liquidity constraints rather than increased credit risk as the primary factor (Haddad et al., 2021). This liquidity pressure led to a decrease in asset prices and affected the functioning of the bond market. The intervention of the Federal Reserve, including the purchase of corporate bonds, played a crucial role in stabilizing the market (Haddad et al., 2021).

Kargar et al. (2021) further investigated the changes in liquidity in the corporate bond market during the pandemic. They found that the cost of risky-principal trades increased significantly, prompting customers to shift to less-popular agency trades. This shift, coupled with increased trade complexity, resulted in decreased liquidity and slower trading speeds (Kargar et al., 2021).

Tax

With the economy entering a recession at the peak of the pandemic, the government increased interest rates in order to curb the rise of inflation (Bahaj et al., 2022). Given the rise in taxation of share capital, debt financing became more attractive to businesses during the pandemic because they had lower tax levels. The main expenses incurred by firms in capital management are interests and dividends. Barrero et al. (2021) explain that interest is a chargeable expense from a firm's taxable income, whereas dividends are paid out of the earnings available after tax. As a result, the level of taxation affects the cost of capital such that share capital bears a higher tax cost than debt capital.

In order to take advantage of trading on equities during the pandemic, most firms decided to use debt financing in their capital structure, which helped boost the shareholders' returns (Bartik et al., 2020). Consequently, the preferential acquisition of debt impacted many firms' capital structure and their decision to cut down on the dividends offered to shareholders was due to higher taxation on shareholders' income and lower revenues.

Capital market

As discussed earlier, the pandemic impacted both financial and human capital. The economic downturn caused by the COVID-19 pandemic led to a period of low business activity due to national and municipal government-enforced containment measures such as a lockdowns. The changing capital market conditions greatly affected the cost of capital and its availability from various sources (Bloom et al., 2019). As inflation rose and the economy entered into a recession at the pandemic's peak, the reduced confidence in investors and unpredictability of the market conditions led companies to abstain from issuing shares due to the enormous associated risk (Outlaw et al., 2021). As a result, many shares fell in price, forcing firms to

take drastic actions to raise capital.

The fact that the market was unfavorable for issuing shares to investors led to many firms to seek other alternatives to fill their capital demand. One of the preferred options was debt financing, which affected enterprises' capital structure. Many organizations opened themselves up to the option of using debts or corporate bonds to finance their investments. Kargar et al. (2021) focused on the corporate bond market at the height of the COVID-19 crisis and its aftermath. To gain a better understanding of the changes in liquidity in this market, the researchers followed pre-COVID crisis literature and distinguished between risky principal trades, where dealers offer immediacy by purchasing the asset and holding it until a buyer is found, and agency trades, where the seller retains the asset until the dealer finds a buyer. They show that the cost of risky principal trades increased dramatically at the height of the crisis, leading customers to switch to the less-popular agency trade. Hence, the lack of liquidity is reflected in higher costs and slower speed.

In another study on capital markets during the pandemic, Fahlenbrach, Rageth, and Stulz (2021) document significant heterogeneity in firms' resilience during the COVID-19-driven stock market collapse of February and March 2020. The authors hypothesize that firms with greater financial flexibility can more easily fund cash shortfalls and, therefore, should be less affected by the COVID-19 crisis than less financially flexible firms. Indeed, the researchers found that firms which are more financially flexible—based on their cash holdings, short-term debt, and long-term debt at the end of 2019—performed significantly better during the stock market collapse; the stock price of highly flexible firms dropped by 26% less than the stock price of firms with low flexibility. Significantly, the performance gap that the researchers found continues to persist during the subsequent rebound of the stock market, suggesting that the ability to fund cash shortfalls in times of crisis may have long-lasting value implications.

Trading on equities

The use of debt and preference share capital to acquire assets, known as trading on equity or financial leverage, is a strategy employed by firms to improve their capital structure (Pagano & Zechner, 2022). Debt financing provides greater revenue increases compared to preferential share capital due to the tax benefits associated with interest expenses (Cirera et al., 2021).

During the pandemic, the influx of precautionary savings led to changes in the capital structure of the banking system, with banks reducing deposit rates in response to increased deposits (Levine et al., 2021; Brodeur et al., 2021). This precautionary-savings channel played a dominant role in shaping deposit flows during the pandemic, affecting the capital structure of the UK's banking system.

Monetary policies implemented during the pandemic had a significant impact on the capital structure of various industries, particularly banks (Mohammad, 2021). The study by Mohammad (2021) highlighted the moderating role of monetary policy in capital structure decisions and identified unique methods employed by banks to determine their capital structure.

Cost of capital

The cost of capital is the minimum rate of return expected on the funds by its providers. As investment levels, business productivity, and returns dropped during the pandemic, determining the cheapest source of financing was a huge priority for many firms. At the same time, lenders evaluated the likelihood of getting their money back, given the high levels of uncertainty that characterized the pandemic period, and the majority of lenders increased the interest rates of the debts available (Criscuolo, 2021).

Haque (2021) investigates the implications of recession caused by COVID-19 and how it has impacted the capital structure of publicly traded firms. The researchers conducted the study by developing a large sample of the firm-quarter data for publicly traded firms. Using this data, they applied an LT model that built on previous observations regarding equity in firms. According to the researchers, the probability decreased in most of the large firms that were over-leveraged and in firms that were stressed even before COVUD-19. The study demonstrated that COVID-19 led to a decline in capital markets, with cash flow declining by over 20%. In addition, Khaki et al. (2020) stipulate that during this time, shareholders expected higher dividends due to higher interest loans, consequently leading to a fall in share market prices.

Effect on the business environment

The COVID-19 pandemic disrupted the business environment, leading to increased borrowing and debt-to-equity ratios for many firms (Haque, 2021; Griffith et al., 2020). However, the medical industry experienced growth and improved debt-to-equity ratios due to high demand and favorable interest rates (Brynjolfsson et al., 2020). Hospitality and travel companies faced challenges and turned to the corporate bond market, which experienced increased spreads and decreased liquidity (Haddad et al., 2021). The Federal Reserve's intervention played a role in stabilizing the market (Haddad et al., 2021).

Expenditure on health

The COVID-19 pandemic had a devastating impact on humanity, causing labor shortages and mental

health issues, which affected human capital in firms (Hirdinis, 2019; Naseem et al., 2019). Companies incurred additional costs related to medical expenses and the hiring and training of new employees, leading to a strain on their capital structure (Halling et al., 2020). To address these challenges, firms invested in mental well-being and resorted to debt financing (Hirdinis, 2019). Mitigation measures aimed at improving future earnings also influenced firms' capital structure (Halling et al., 2020).

Effect on productivity

The COVID-19 pandemic exacerbated the pre-existing productivity challenges in the UK, leading to a decline in business performance (Naseem et al., 2019). Firms responded by investing in measures to boost productivity, such as automation and worker motivation (Demirgüç-Kunt et al., 2020). The shift to online platforms also required additional capital investment, with more flexible firms experiencing higher productivity compared to those reliant on brick-and-mortar operations (Zhang et al., 2021). These investments and changes in operations impacted the capital structure of firms. Overall, the pandemic had a significant negative impact on the capital structure of UK firms, necessitating mitigation measures for recovery.

2.6 Relationship between the epidemic and capital structure

The previous summary shows that the epidemic has not only impacted macro economies and micro consumers, but also capital markets. The question remains: for companies, has the pandemic impacted their capital structure? There is a small body of literature that addresses this question.

The impact of the COVID-19 outbreak on a company's capital structure can be divided into direct and indirect effects. The impact of the COVID-19 outbreak on factors such as a company's earnings and governance, among other things, can further alter its capital structure and can be described as an indirect effect of the pandemic. In other words, the occurrence of the COVID-19 pandemic changed the performance and debt levels of the company and affects the company's governance behaviors and board decisions. In this regard, Rababah et al. (2020) analyzed the impact of the COVID-19 pandemic on the financial performance of listed companies in China. They found that the pandemic has a negative impact on firm performance; that said, the larger the size of the firm the smaller the shock created by the economic downturn that occurred during the pandemic. Furthermore, it shows that the financial performance of the sectors and industries most affected by the pandemic (e.g., tourism, aviation, etc.) declined more than other sectors. The findings of this study have broad implications for policy makers as it is clear that the government, banks, regulators and central banks must join forces to address the financial and economic impact of the COVID-19 crisis. Khatib & Nour (2021) selected a sample of 188 non-financial firms in the Malaysian market and examined data from 2019-2020. They found that the coronavirus outbreak had an impact on all firm characteristics, including firm performance, governance structure, dividends, liquidity, and leverage levels. However, they also state that the differences before and after the outbreak were not significant. Meanwhile, the study found a significant positive effect of board size on firm performance. However, after splitting the sample on a yearly basis, we find that board size is not significant given the current uncertain period of the crisis; by contrast, board diversity appears to significantly improve firm performance in times of crisis.

The direct impact of the COVID-19 pandemic on capital structure has also been verified by several scholars. Mohd Azhari et al.(2022) chose to conduct a study using quarterly data from 2019 and 2020 in Malaysia to explore the changes in the level of capital structure of Malaysian listed companies before and after the pandemic. The results show that debt ceilings were higher during the novel coronavirus pandemic. Both short-term debt and total debt decreased slightly during this time. However, there was a slight increase in long-term debt. Therefore, this study suggests that the capital structure changed slightly during the pandemic. The study's findings suggest that independently of capital structure, indicators such as tangibility,

liquidity, and firm size had an impact on the capital structure before and after the epidemic. The study found that profitability had a significant impact on total debt both before and after the 2019 coronavirus crisis. While firms with higher profits appear to have lower short-term debt during the coronavirus epidemic, they were also more likely to have lower long-term debt during the epidemic. While growth firms tended to have higher short-term and total debt during these periods, their long-term debt was not affected by potential growth. Mohammad conducted a study based on unbalanced quarterly panel data for all commercial banks in Pakistan from Q1 2016 to Q3 2021. The results indicate that due to the pro-cyclicality of capital, during the beginning of the pandemic in 2019, banks preemptively reduced their capital and improved their capital structure levels. The role of bank-specific variables in determining capital structure (e.g. profitability, size and competition) diminished during this period. The evidence suggests that the central bank's policy of interest rate intervention was an important factor in capital structure decisions during COVID-19. At the same time, macroeconomic shocks have significantly influenced banks' capital structure decisions beyond what the banks were able to prepare for.

The COVID-19 epidemic caused a decline in revenue and an economic recession, during which Trinh and Phuong (2016) identified three significant effects on the economy. First, when demand decreases, the supply of products decreases sharply. Secondly, the reduction in foreign direct investment had an indirect effect on domestic business funding. Finally, financial markets were severely affected by the cessation of investment activity and changes in interest rates. As a result, some governments applied the same instrumental techniques used during the 2008 financial crisis to the current economic crisis brought about by the COVID-19 pandemic (Quere & Weder, 2020). For example, special incentives, temporary redundancy assistance and temporary credit guarantees were provided to affected businesses to ensure that banks could meet the liquidity needs of businesses during the COVID-19 pandemic. Due to the negative impact of COVID-19 on financial health, many companies, especially those that were highly leveraged, faced financial distress (Huang & Ye, 2021). Because debt financing is more readily available to low-leveraged and profitable firms, they have greater financial flexibility. As firms' reliance on debt financing increases, they will be exposed to greater risk. The lack of cash flow in these companies could lead to a liquidity crisis. As a result, the COVID-19 pandemic has prompted companies to recapitalize their structures.

The existing foreign literature has extensively examined the impact of COVID-19 on firm leverage. For example, Haque & Varghese (2021) show that capital growth was particularly strong for the firms most affected by the epidemic, who typically realize their capital expansion needs through new bond issuance to compensate for the cash flows that were lost due to the economic disruptions caused by the epidemic. Huang & Ye (2021), on the other hand, find that in 2019 the businesses with weaker corporate liquidity or solvency, as well as smaller listed companies, suffered relatively greater capital stress in the early stages of

the crisis, at the start of the virus outbreak. During the epidemic, companies with debt above optimal levels faced higher corporate risk, an effect that was more severe among companies with poor CSR performance.

Demirguc-Kunt et al. (2020) studied the impact of the global financial crisis on the capital structure of 75 countries, and they found evidence of deleveraging and reduced debt maturity, particularly for unlisted firms, including SMEs and large unlisted firms. Leverage and debt maturities are falling in both developed and developing economies, even in those countries that did not experience a financial crisis during the pandemic. Deleveraging and maturity reductions have been particularly pronounced for unlisted companies, including SMEs and large unlisted companies. For SMEs, the effects of leverage and debt maturities are greater in countries with less efficient legal systems, weaker information-sharing mechanisms, less developed financial sectors, and more restricted access to banks.

Acharya and Steffen (2020) argue that the COVID-19 pandemic caused a daily decline in US credit lines, triggering a corporate 'cash rush'. In the first phase of the crisis, which was characterized by extreme caution and increased overall risk, the majority of firms reduced their bank credit lines and increased their cash levels. In the second phase, following the adoption of stabilization policies, only the highest rated companies turned to the capital markets to raise cash. In other words, distressed companies responded to the crisis through a frantic rush to cash out.

Vo et al. (2021) explored changes to the speed of adjustment of firms' target leverage ratios under the impact of the COVID-19 pandemic, using data on listed firms from several countries as a sample. They found that the estimated rate at which the average firm converged to its target leverage ratio was at least a few percentage points higher during the COVID-19 economic crisis than in the pre-COVID-19 period. They argue that government intervention in the economies most affected by COVID-19 led to a significant reduction in credit and increased the availability of credit to firms that decided to take on new debt. This implies that firms in economies that were more affected by the pandemic may have decided to close the leverage gap more quickly than firms in economies less affected by the pandemic. Nguyen et al. (2022) used a database of 1,882 quarterly observations from 196 hotel firms in 30 countries from Q3 2018 to Q2 2021 to explore capital structure changes made by management in a sample of hotel companies to maintain financial stability and resilience during the unpredictable COVID-19 pandemic. During this period of crisis, low debt capital structures mitigated the negative impact of the pandemic on the financial stability of hotel companies, especially the negative impact of government restrictions on domestic and international travel. Hotel companies with less long-term debt were more financially stable and more resilient during the pandemic.

2.7 Research hypotheses

A business's capital structure is the main financial expression of the company and represents the source of financing for its operations and investment activities. When an epidemic occurs, a company's profits fall, its level of performance decreases, and the company has to adjust its capital structure to stay afloat.

Based on the existing theories of capital structure (information asymmetry theory, agency theory, trade-off theory, etc.), because the cost of debt financing is lower than the cost of intra-firm financing (Jensen & Meckling, 1976), listed companies typically choose debt financing for capital expansion when no funds are immediately available (Brealey et al., 2018). The right capital structure helps to ensure the stable growth of the company.

The profitability of a firm refers to the amount of profit earned in a given period of time. Current theoretical and empirical research by scholars has not reached a uniform conclusion on the impact of corporate profitability on a business's capital structure. The trade-off theory suggests that in choosing the optimal capital structure, firms usually weigh the benefits against the costs of financial distress to maximise the firm's value. The more profitable a firm is, the lower the potential distress costs. The preference theory of financing suggests that the priority of a firm's financing decisions is internal financing. This theory indicates that the more profitable a firm is, the more likely it is to use its retained earnings to fund itself first; meanwhile, less profitable firms must rely on external finance to fund themselves due to insufficient internal funding. Under this theory, profitability is considered to be negatively related to capital structure. On the other hand, if a firm's access to financing allows the firm to use financial leverage to generate more revenue, then profitability is positively correlated with capital structure. The signaling theory school of thought suggests that information asymmetry between management and external investors leads external investors to believe that a higher debt ratio will lead to greater profitability. When the profitability of a company increases, the capital market will look favorably on the company's overall potential to grow. As a result, investors in the capital market are more likely to fund the company through equity issuance, which favors equity financing. In this case, the gearing ratio may decrease as the profitability of the enterprise increases.

Based on this, the first hypothesis in this paper is that

H1: Profitability has a negative relationship with corporate capital structure

A strong level of liquidity indicates that a business has a high level of solvency. An enterprise with strong solvency has a fast turnover of funds, so for SMEs, debt repayment is generally based on short-term debt. This allows a business to maintain stable operations and reduce financial risk. An enterprise in this

situation can maintain a high credit rating and creditors are willing to lend more funds to the enterprise, creating a virtuous cycle of capital movement. When a firm's level of debt is relatively low and shows a lower level of gearing, the rise in asset liquidity of an enterprise will be accompanied by an accumulation of assets. The more liquid an enterprise's assets are, the more working capital the enterprise will be able to generate to meet its operational needs. As a result, the business will require less external financing and gearing will be lower.

Based on this, the paper proposes a second hypothesis.

H2: The level of liquidity negatively impacts the capital structure of the firm

According to the theory of preferential financing, firms with high levels of cash flow are more inclined to use internal financing and less willing to use debt financing. Anderson & Carverhill (2012) constructed a dynamic model of firm decision making and concluded that a firm's cash holdings are closely related to its recapitalization. John et al. (2012) further found that the rate of recapitalization is negatively related to a firm's expected cash holdings and positively related to excess cash holdings. Faulkender et al. (2012) state that a firm's cash flow position affects its rate of recapitalization, and that when cash flow is positive or negative, a firm chooses to finance or allocate funds in ways that it can effectively recapitalize. The cost of recapitalization is effectively borne by the firm's activities, such as financing or allocation of funds, to maintain normal operations. Dang et al. (2014) argue that a firm's cash flow level changes the firm's capital structure, and when a firm has a large capital shortfall, it adjusts its capital structure more quickly. Therefore, firms with high levels of cash flow tend to use internal funds for financing. It is only when the level of cash flow is low that firms will engage in external financing. Therefore, a company's level of cash flow negatively impacts its capital structure.

H3: The cash flow level negatively impacts the firm's capital structure.

In times of tight liquidity, debt can become a source of funding that firms can rely on to cover operating expenses and survive at a lower cost (Sudarsanam & Li, 2001). Firms in crisis periods choose strategies such as business, asset, management, and financial restructuring to recover. Firms that were more severely affected by the pandemic could obtain additional cash flows through new bond issues to compensate for the economic damage caused by the pandemic (Haque & Varghese, 2021). However, debt financing includes the obligation to pay interest and principal (Brealey et al., 2018). In difficult times when a company's revenues are falling sharply, such obligations can become a burden, eroding profits, and pushing the company into more financial difficulties. High leverage can increase a company's business risk and likelihood of insolvency, and harm its performance and growth after recovery (ElBannan, 2021). An increase in a

company's gearing can cause a decrease in profitability (Booth et al., 2001; Tifow & Sayilir, 2015). There is a negative relationship between financial leverage and shareholder value, which indicates that the cost of debt financing is higher than the benefit for Vietnamese firms; moreover, only companies with low leverage are likely to create value for shareholders (Vo & Ellis, 2017). High leverage also increases the share price volatility of a company's share price, thus increasing the level of risk for the company (Nenu et al., 2018).

Taken together, we can see that after an epidemic, companies severely affected by the epidemic will choose external financing methods such as issuing debt and borrowing to compensate for the impact of the epidemic on the company's cash flow, thus increasing the company's gearing. At the same time, some companies will also take into account the fact that increased indebtedness leads to increased risk for the company, which is doubled by the increased level of risk faced by the companies due to the epidemic itself; therefore, they will also maintain a low level of gearing. Ultimately, the impact of an epidemic on a company's debt ratio is related to the severity of the epidemic's impact on the company. When a firm suffers a severe cash flow crisis due to an epidemic, it will have to choose to increase its leverage to help hold it over through the crisis. The COVID-19 pandemic was a major public health event for global companies, and it had a significant impact on both nations and businesses. Its impact was not only deep but also long lasting; therefore, many UK companies had to make the choice to increase their gearing in order to weather the crisis.

Profitability is the ability of a company to make a profit from its business operations. Profit is a matter of concern to all sectors within and outside a company and is essential to the survival of the company. It is the most important indicator of a company's competitiveness. The profitability of a company is the key to financial research and evaluation. Firms with higher profitability reduce the level of financial leverage and capital structure (Chen et al.,2019). Leverage is negatively related to measures of profitability. Conversely, we find a positive cross-sectional correlation between profitability and leverage when firms are at or near their optimal leverage level (Danis et al., 2012). D'Amato (2021) suggests that profitability plays a mediating role in the relationship between intellectual capital and financial leverage. In other words, profitability can influence the level of financial leverage and the level of corporate risk by increasing intellectual capital. D'Amato also states that an increase in profitability implies that corporate income is stable, which helps to reduce corporate risk and achieve stable corporate growth.

Therefore, the coronavirus pandemic will change the impact of corporate profitability on capital structure. Specifically, we hypothesize that firms' profitability will decrease after the pandemic, and under these conditions, the increase in profitability will have a more significant effect on the decrease in capital structure.

Companies with high profitability can have a low level of corporate risk and stability; therefore, the capital structure will change to a lesser extent in the event of an epidemic. In addition, profitability can also influence the amount of intellectual capital and level of innovation present in a company, enabling it to weather a crisis by means other than just financing. In other words, the better the profitability of the firm, the less the impact of the pandemic on its capital structure. Based on this, this paper proposes its fourth hypothesis:

H4: The negative impact of profitability on capital structure was more significant after the outbreak compared to before the outbreak.

Audretsch & Elston (2002) examined German firms of various sizes in the last two decades after 1970, focusing on the liquidity constraints of firms and their investment behavior. Medium-sized firms were found to have higher liquidity constraints on investment and were advised to lower their liquidity constraints to improve the efficiency of their business operations. When some firms followed Audretsch & Elston's advice, the results showed that they improved their performance and market competitiveness, which helped them to expand their access to capital. Adequate and stable levels of liquidity can ensure the normal production and operation activities of a company, and it is important to consider whether the liquidity needs of the assets are met before considering the profitability of the assets (Hakeem & Bambale,, 2016). To completely solve the problem of liquidity risk, companies must optimize their capital structure. Management should strengthen their knowledge of liquidity management and set aside sufficient funds to prevent their company from being unable to pay their debts on time. Company management should also determine the optimal amount of cash holdings and optimize the efficiency of capital use, so as to truly improve corporate performance (Brunnermeier& Yogo, 2009).

Taken together, after an epidemic, the profitability of firms decreases, their level of liquidity decreases, and the effect of liquidity on the capital structure of firms becomes greater. In other words, liquidity becomes more of a disincentive to capital structure after an epidemic.

Based on this, this paper proposes its fifth hypothesis:

H5: The negative impact of liquidity on capital structure was greater after the epidemic compared to before the epidemic.

Companies with higher free cash flow will have more opportunities to invest or are more likely to pay dividends. Thus, we believe that companies with higher free cash flow are more likely to recapitalize their businesses, and we can assume that companies with higher cash flow will have less recapitalization costs,

i.e. they will recapitalize faster. Meanwhile, companies with medium free cash flow will have less ability to recapitalize, because the cost of recapitalization is greater for them. A company with low free cash flow may face a need for financing. In order to maintain its day-to-day operations, a company with low free cash flow will have to raise external financing to meet its increased cash flow requirements, and changes in cash flow will directly lead to changes in its capital structure. By contrast, a company with medium free cash flow does not urgently require financing, so it lacks the incentive to acquire greater cash flow through external financing. Epidemic conditions change the degree of influence that cash flow has on a company's capital structure; specifically, after an epidemic, the cost of external financing increases and firms prefer to use internal financing to fund financing increases if they have sufficient internal cash flow. Therefore, the degree of influence of cash flow on capital structure becomes greater.

Based on this, this paper proposes its sixth hypothesis:

H6: The negative impact of cash flow on capital structure was greater after the outbreak compared to before the outbreak.

Chapter 3 Methodology

3.1 Description of variables

3.1.1 Capital structure

The explanatory variable in this paper is capital structure, which is measured in terms of 2 dimensions: overall debt level and debt structure.

The gearing ratio is utilized to represent the overall level of debt of the company, i.e., the overall level of the capital structure. Specifically, total debt/total assets is used. According to trade-off theory, there are both tax-shield benefits and insolvency risks associated with debt financing. At low levels of gearing, the marginal tax shield benefit is greater than the marginal cost of insolvency as debt increases, at which point the value of the firm increases with the increase in debt. When debt reaches a certain size and continues to increase, the marginal cost of insolvency will be greater than the marginal tax shield benefit, at which point additional debt financing will reduce the value of an enterprise. Only when the marginal tax shield benefit is equal to the marginal cost of insolvency can the value of an enterprise be maximized with an increase in debt.

Current liabilities are the primary components of a company's capital and can maintain capital liquidity while reducing the cost of financing. According to the maturity structure of debt, there should be a reasonable mix of debt maturities to maximize the reduction of costs and risks to the business. High current debt ratios can cause companies to experience greater repayment pressure in the short term, and so the presence of excessive current debt ratios over the long term can create liquidity problems for companies and can even cause debt crises in severe cases, while the opposite is true for long-term debt. According to the relevant literature, there is either no significant correlation or a negative correlation between company performance and current liabilities. Short-term debt is generally required to be repaid within one year, so the higher the short-term debt ratio, the greater the repayment pressure on the company. Long-term debt has a longer debt maturity structure, which can effectively reduce the repayment pressure on the company and make effective use of financial leverage.

3.1.2 Epidemic

The sudden outbreak of COVID-19 that swept the world in late 2019 has attracted a great deal of attention and research from academics. With regard to the impact of the COVID-19 outbreak on capital

markets, there have been a variety of effects. The pandemic had an impact on both the UK stock market and the capital structure of listed companies. As accurate indicators of the severity of the pandemic in the UK are not available, a dummy variable is used, 2020 and beyond as 1, to represent the pandemic variable.

3.1.3 Explanatory variables

The profitability (ROA) of a company represents its performance and growth. The higher the profitability of a company, the lower its level of borrowing and debt, and therefore the lower its gearing ratio. For profitability, return on total assets is used as a proxy, which is calculated as net profit/assets.

The current ratio (LIQ) has been chosen as a proxy for solvency. The current ratio is calculated as current assets/current liabilities, meaning the ability of current assets to be realized and used to repay debts before the short-term debt repayment date. It is generally accepted that a ratio of 2 is optimal, i.e. current assets are twice as large as short-term debt, ensuring that the company's short-term debt can be fully repaid.

The level of cash flow (CF) determines the degree of financing constraint to which a firm is subject and thus affects the size and level of its loans. This paper uses the ratio of cash flow from operating activities to assets to represent the total level of cash flow.

3.1.4 Control variables

In addition, a range of variables have been selected as control variables in this paper, including firm size, growth capacity, and other firm financial indicators. The specific indicators were selected as follows:

Size (SIZE) represents the total size of the firm; the larger the firm, the higher the level of financing available from the capital market, which will affect the level of the firm’s capital structure. This paper uses year-end assets to represent the size of the firm. Size tends to reflect the overall strength of the firm and is beneficial to the firm in forming a good market reputation and easily raising funds through acquiring debt. Empirically, there exists a positive correlation between firm size and the capacity to obtain higher levels of borrowing, which in turn leads to elevated levels of capital structure.

Growth (GRO) represents the growth prospects of a company. The core measure of a company's ability to grow is the size of its enterprise value. This paper takes business size at its primary lens of analysis; in light of this, it is proposed to use the growth rate of operating revenue as an expression of growth. In view of the pronounced growth prospects associated with firms of larger scale, their heightened need for financing aimed at facilitating corporate development necessitates a greater reliance on debt financing, thereby

leading to an expansion in their capital structure levels.

Tangible assets ratio (TANG) represents the value of a company's secured assets, determined by the value of its collateralisable assets available for credit. The ratio of fixed assets to total assets is utilized to represent the tangible assets ratio. The ratio of tangible assets indicates a firm's asset structure, reflecting the extent of fixed assets held by the company. This factor plays a significant role in influencing the firm's capital structure. A higher proportion of tangible assets implies a greater allocation of resources towards fixed assets, which may have implications for the firm's overall capital structure.

Non-debt tax shield (NDTS) refers to expenses other than interest on debt, such as depreciation and tax loss deferral. There is a negative correlation between NDTS and the level of debt. Non-debt tax shields are deductible against corporate income tax and depreciation against tax is currently the main tax deduction available to listed companies. This type of non-debt tax shelter does not create the risk of being unable to pay a debt when it is due. Companies with significant non-debt tax shields utilize less debt than companies without non-debt tax shields, and non-debt tax shields can be used as a substitute for debt, reducing the company's tax liability. This paper uses the ratio of depreciation of fixed assets to total assets to represent the level of non-debt tax shields. The non-debt tax shield, which signifies the level of tax benefits derived from sources other than debt, has a notable impact on a firm's capital structure. A higher non-debt tax shield indicates a greater tax burden borne by the company, prompting it to resort to increased borrowing to mitigate its debt obligations. As a result, the non-debt tax shield has a consequential influence on the firm's overall capital structure levels.

In addition, we have used industry and year variables as control variables.

The variables in this paper are specified in the following table:

Table 1 Variable definition table

Type	Meaning	Abbr.	Description
Explained variables	Debt levels	TD	Total liabilities/total assets
	Long-term debt ratio	LGTD	Long-term liabilities/total assets
	Short-term debt ratio	SGTD	Current liabilities/total assets
Explanatory variables	Profitability	ROA	Net profit/assets
	Liquidity	LIQ	Current assets/current liabilities
	Cash flow	CF	Cash flow from operating activities/total assets
	Covid-19	COVID	Dummy variable, 1 for 2020 and beyond, 0 for otherwise
Control variables	Development	Growth	Revenue Growth Rate
	Proportion of tangible assets	TANG	Fixed Assets / Total Assets
	The scale of enterprise	Size	Log of assets at the end of the year
	Non-debt tax shield	NDTS	Depreciation of fixed assets/total assets

Data source:
Data obtained from WRDS.

3.2 Model description

To test the impact of profitability, cash flow, and liquidity on capital structure, respectively. This paper constructs a model as follows.

$$Structure_{it} = \alpha + \beta_1 Ability_{it} + \beta_2 SIZE_{it} + \beta_3 GRO_{it} + \beta_4 TANG_{it} + \beta_5 NDTS_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

Where Structure_{it} refers to the capital structure variable, denoted TD LGTD SGTD in this paper, andα refers to the intercept term, andε_{it} refers to the random error term; β_1 is the coefficient of $Ability_{it}$, and $Ability_{it}$ refers respectively to variables of ROA, LIQ, and CF. μ_i refers to individual fixed effects. δ_t refers to time fixed effects.

When $\beta_1 > 0$, it indicates $Ability$ increases, the firm's level of capital structure increases; when $\beta_1 < 0$, it means that $Ability$ increases, the level of the firm's capital structure decreases.

This paper constructs a regression model to test the relationship between the epidemic, the firm's operating capacity (profitability, cash flow, liquidity), and capital structure.

$$Structure_{it} = \alpha + \beta_1 Ability_{it} + \gamma Ability_{it} * COVID_t + \beta_2 SIZE_{it} + \beta_3 GRO_{it} + \beta_4 TANG_{it} + \beta_5 NDTS_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

Where Structrue_{it} refers to the capital structure variable, denoted TD LGTD SGTD in this paper, and α refers to the intercept term, and ε_{it} refers to the random error term; β_1 is the coefficient of $Ability_{it}$, and $Ability_{it}$ refers respectively to variables of ROA, LIQ, and CF. μ_i refers to individual fixed effects. δ_t refers to time fixed effects. When $\gamma < 0$ when, it means that after the epidemic, the $Ability_{it}$ becomes smaller for the capital structure; when $\gamma > 0$, it means that after the epidemic $Ability_{it}$ to the extent of the impact on the capital structure becomes greater.

3.3 Data analysis

3.3.1 Data sources

In this paper, UK listed companies from the period of 2015-2021 were selected as the sample for this study.

To ensure that the sample data were sufficiently accurate and to avoid the adverse effects of anomalous samples on the findings of this study, the sample data were screened according to the following criteria.

(1) Data on financial and insurance-related companies were removed. This type of company is not representative of the total economy, as their main business is loans, insurance, refinancing, etc. The manner these companies account for costs is obviously different from that of other enterprises, so we have removed them from the sample to ensure the uniformity of the study population.

(2) Delete extreme values with a sample of firms with missing data.

All continuous variables were Winsorized at the 1% level to eliminate the possible influence of extreme values on the results. The initial data processing was performed using Excel, and the descriptive statistics and multiple regression results were acquired using the statistical software STATA15.0. After processing, a valid sample of 7,155 observations was obtained from a total of 1,235 companies. The relative richness of this data ensures its authenticity. The data for this paper were obtained from the Compustat database.

3.3.2 Panel data model

In economics research and in practical applications, we often need to analyse a combination of cross-sectional and time-series data. In this paper, cross-sectional data refers to 7,155 observations from 1,235 companies and the time series extends from 2015 to 2021. In general, we refer to data that contain both cross-sectional and time-series information as panel data. In addition to this, multiple linear regression requires that the model be set up without bias and given that many of the factors affecting capital structure such as firms' strategic plans and competition for control are often unavailable to us, omission of these variables can lead to biased model setting. Panel data models, however, can overcome this drawback when conducting multiple linear regression by controlling for unobserved factors. Therefore, using a panel data model to study the factors influencing capital structure can produce more accurate results.

Panel data models are generally defined as.

$$y_{it} = \alpha + X'_{it}\beta + \mu_{it} \;\; i = 1,2,\dots,N; t = 1,2,\dots T$$

where N is the number of individuals in the panel data, T is the length of time in the panel data, y are the explanatory variables, α is the intercept term, X'_{it} is the column vector of explanatory variables of order kx1, β is the column vector of regression coefficients of order kx1, and μ_{it} is the random error term.

First, the Hausman Test was applied to determine whether the form of the effect was fixed or random. The original hypothesis for the Hausman Test was that individual effects in the random-effects model were not correlated with the explanatory variables.

This is followed by the determination of the form of the model, which consists of three forms:

Form I: Variable coefficient model.$y_i = \alpha_i + x_i\beta_i + \mu_i$

Form II: Variable coefficient model.$y_i = m + x_i\beta + \alpha_i^* + \mu_i$

Form III: Variable coefficient model.$y_i = \alpha + x_i\beta + \mu_i$

An F-test was applied to determine the form of the model; the original hypothesis was as follows:

$$H_1: \beta_1 = \beta_2 = \cdots = \beta_N$$

$$H_2: \alpha_1 = \alpha_2 = \cdots = \alpha_N$$

Adjudication rules.

Accepting hypothesis H2 results in a constant parameter model (Model 3), which results in the test being completed.

If hypothesis H2 is rejected, then test hypothesis H1. If H1 is accepted, then the model is a variable intercept model (Model 2). If H1 is rejected, then the model is a variable parameter model (Model 1).

For the calculation of the F statistic for hypothesis testing, the sums of the squares of the residuals estimated for the variable parameter model, the variable intercept model, and the constant parameter model are denoted as S1, S2 and S3, respectively, and the F statistic is calculated as follows:

$$\mathrm{F}_2 = \frac{(\mathrm{S}_3 - \mathrm{S}_1)/[(\mathrm{N}-1)(\mathrm{k}+1)]}{\mathrm{S}_1/[\mathrm{NT} - \mathrm{N}(\mathrm{k}+1)]} \mathrm{F}[(\mathrm{N}-1)(\mathrm{k}+1), \mathrm{N}(\mathrm{T}-\mathrm{k}-1)]$$

$$F_1 = \frac{(S_2 - S_1)/[(N-1)k]}{S_1/[NT - N(k+1)]} F[(N-1)k, N(T-k-1)]$$

The F-statistic is calculated from S1, S2, and S3, and a judgment is made by comparing it with the corresponding critical value, which in turn determines the form of the model.

3.3.3 Description

The type of data used in the dissertation is unbalanced panel data obtained from UK listed companies between 2015 and 2021, which means that in every financial year, the number of observations is not the same. According to Hsiao (2014), panel data can be defined as a type of data set in which an individual In examining the relationship between corporate profitability, the ability to pay debt, cash flow, and capital

structure using panel data, previous studies have utilized different techniques, ranging between pooled Ordinary Least Squares (OLS) models (Coles et al., 2008; Haniffa and Hudaib, 2006), fixed-effects models (Essen et al., 2013; Smith et al, 2006) and random-effect models (Malik and Makhdoom ,2016; Orazalin et al.,2016).

The proponents of the pooled OLS model argue that profitability and debt paying ability should be considered exogenous rather than endogenous. Furthermore, Coles et al., (2008) believe that the fixed-effect model is unsuitable because most of the variation between companies occurs in the cross-section rather than the time series. However, in analyzing panel data sets, the most commonly used analysis techniques are the fixed-effects regression model and the random-effects regression model, as those techniques are capable of providing more accurate and consistent estimations for panel data sets (Hsiao, 2014). To determine which data analysis technique should be adopted to analyze the panel data in this paper, the Hausman test will be run. This test is conducted to determine whether the panel data analysis will be more accurate to be analyzed using a fixed-effects model or random-effect models. If the null hypothesis is rejected (p-value $\leqslant 0.05$), the random-effects model will be preferable.

To conclude, the data used in this dissertation is collected from the financial years 2015 to 2021 and is therefore considered a panel data set. The variables that are included in the model are divided into dependent variables, independent variables, and control variables, including dummy variables to account for the effects of the COVID-19 pandemic. Hausman tests will be conducted to determine which regression analysis model will be most appropriate for analyzing the panel data in this dissertation.

Although fixed-effects models for panel data are now widely recognized as powerful tools for data analysis, there are a lot of limitations of these models, such as low statistical power, limited external validity, restricted time periods, measurement error, time invariance, undefined variables, and unobserved heterogeneity (Hill et al.,2020). But presently, it's still the best choice in panel data. In future research, other regression models can be utilized to modify it.

Chapter 4 Analysis of data and results

4.1 Descriptive statistics

Scholars tend to prefer the concept of capital structure in a narrow sense. However, in view of the actual situation in the United Kingdom, the listed companies in the UK generally have a high short-term debt ratio. Although short-term debt is predominant in financing, there also exists a common practice of using short-term debt to return long-term borrowing. This phenomenon means that the actual use of short-term borrowing is the same as long-term borrowing. Therefore, when conducting practical studies most scholars adopt the definition of capital structure in a broad sense. After collating the capital structure characteristics of UK companies, this study finds that the average value of the capital debt ratio of enterprises is 0.528, the average value of the long-term debt ratio is 0.156, and the average value of the short-term debt ratio is 0.298. The long-term debt ratio of enterprises overall is low, with some enterprises having a long-term debt ratio as low as 0. Among the specific factors that can be used to measure capital structure, indicators such as the shareholders' equity ratio, asset-liability ratio and capital debt ratio can be used. In this paper, the asset-liability ratio is used as an indicator of the capital structure of UK listed companies; the long-term debt ratio and short-term debt ratio are also used as a proxy for capital structure.

Table 2 Table of descriptive statistics

Variable	N	mean	sd	min	median	max
TD	7155	0.528	0.262	0.0110	0.521	2.067
LGTD	7155	0.156	0.157	0	0.124	0.854
SGTD	7155	0.298	0.193	0.00700	0.259	1.549
COVID	7155	0.291	0.454	0	0	1
SIZE	7155	6.368	3.056	-4.269	6.137	18.03
ROA	7155	-0.0170	0.233	-1.936	0.0320	0.320
GRO	7155	0.170	0.767	-1	0.0560	6.455
TANG	7155	0.761	0.223	0.0550	0.822	1
LIQ	7155	2.152	2.911	0.0980	1.429	32.05
CF	7155	0.0480	0.184	-1.495	0.0760	0.400
NDTS	7155	0.0310	0.0290	0	0.0230	0.439

Notes：The table reports the number of observations (N), mean value (mean), standard deviations (sd), median value (median), minimum value (min) and maximum value (max).

The overall gearing ratio has a mean value of 0.528, a minimum value of 0.011 and a maximum value of 2.067, with a standard deviation of 0.262. The standard deviation is at a relatively low level, indicating that the overall debt level of UK listed companies is balanced, and their financial position is sound, suggesting that the sample in this paper is representative. The mean value of the long-term debt ratio is 0.156 and the mean value of the short-term debt ratio is 0.298, indicating that the short-term debt ratio is comparatively greater than that of the long-term debt ratio. The epidemic mean was 0.291, indicating that 29.1% of the sample was post-epidemic. The mean value of firm size is 6.368. The mean value of profitability is -0.017, indicating that UK listed companies were not profitable. The mean value of revenue growth is 0.17, which is greater than 0, indicating that UK companies have positive growth potential. The mean value of the tangible assets' ratio was 0.761, indicating a high level of tangible assets among UK companies. The mean value of the current ratio is 2.152. The mean value of cash flow is 0.048. The mean value of the non-debt tax shield is 0.031, indicating a low level of non-debt tax shield among UK companies.

Table 3 Capital structure industry distribution table

Industry	N	Percent	TD	LGTD	SGTD
agriculture, mining	1,038	14.51	0.4658	0.1264	0.2556
manufacturing	2,848	39.8	0.4929	0.1414	0.2679
technology	796	11.13	0.4677	0.1000	0.3262
transportation	297	4.15	0.6685	0.2396	0.3361
consumption	237	3.31	0.7020	0.2728	0.3389
utilities	241	3.37	0.6651	0.2576	0.2816
whose sale and retail	808	11.29	0.5897	0.1894	0.3418
service	821	11.47	0.5837	0.1676	0.3659
other	69	0.96	0.5722	0.1712	0.2745

Notes: This table represents mean capital structure in different industries

In terms of industry distribution, manufacturing industries make up the largest share of UK companies with 2,848 samples, or 39.18, followed by the agriculture and service industries. In terms of total gearing distribution, companies in the consumer sector have the highest gearing levels, followed by the public sector; the technology sector has the lowest gearing levels. In terms of long-term gearing, the consumer and public sectors had higher levels of long-term gearing, while the service sector had higher levels of short-term gearing.

The distribution across sectors shows that different sectors exhibit differing debt levels and structures.

Table 4 Annual distribution of capital structure

fyear	N	Percent	TD	LGTD	SGTD
2015	955	13.35	0.5169	0.1425	0.2932
2016	980	13.7	0.5205	0.1371	0.3001
2017	1,018	14.23	0.5088	0.1354	0.2965
2018	1,051	14.69	0.5164	0.1344	0.3077
2019	1,068	14.93	0.5427	0.1731	0.3000
2020	1,066	14.9	0.5549	0.1882	0.2930
2021	1,017	14.21	0.5351	0.1756	0.2944

Notes: This table represents mean capital structure in different years.

In terms of annual distribution, the gearing ratio averaged 0.5189 in 2015 and reached 0.5549 in 2020, revealing an upward trend, but fell to 0.5351 in 2021. The long-term debt ratio was 0.1425 in 2015 and 0.1882 in 2020, which also represents an increasing trend. Short-term debt ratios have not changed significantly since 2015.

In order to fully compare the differences in variables before and after the pandemic, we grouped the variables by pre- and post-pandemic descriptive statistics and performed mean difference tests with the following results:

Table 5 Table of differences in mean values before and after the outbreak

Variables	pre-crisis		post-crisis		
	N	Mean	N	Mean	MeanDiff
TD	5072	0.521	2083	0.545	-0.024***
LGTD	5072	0.145	2083	0.182	-0.037***
SGTD	5072	0.300	2083	0.294	0.006
SIZE	5072	6.317	2083	6.491	-0.174**
ROA	5072	-0.0160	2083	-0.0200	0.004
GRO	5072	0.168	2083	0.174	-0.005
TANG	5072	0.756	2083	0.773	-0.017***
LIQ	5072	2.145	2083	2.168	-0.023
CF	5072	0.0430	2083	0.0590	-0.015***
NDTS	5072	0.0280	2083	0.0360	-0.008***

Notes:This table represents the difference between two groups (pre-crisis, post-crisis), where we show the number of observations (N) and mean value (mean) in different groups. Meandiff is the mean difference between those two groups, and differences are tested using a two-tailed t-test, for which ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% levels, respectively.

It can be seen that the TD has a mean epidemic monetary value of 0.521 and a mean value of 0.545 after the COVID-19 outbreak, with a difference of -0.024, the difference being significant at the 1% level of significance and coefficient. This indicates that the level of gearing is significantly greater after the epidemic than before the epidemic. Long-term debt ratio (LGTD) has a mean epidemic monetary value of 0.145 and a mean value of 0.294 after the epidemic, with a difference of -0.037, the difference being significant at the 1% level of significance and coefficient. This indicates that the level of the long-term debt ratio is significantly greater after the epidemic than before the epidemic. The mean value of enterprise size (SIZE) was 6.317 in the pre-epidemic period and 6.461 in the post-epidemic period, with a difference of -0.174, which is significant at the 1% level of significance and coefficient. This indicates that the size of enterprises was significantly larger in the post-epidemic period than in the pre-epidemic period. Tangible assets ratio (TANG) has a mean epidemic monetary value of 0.756 and a mean value of 0.773 in the post-COVID period, with a difference of -0.017, the difference being significant at the 1% level of significance and coefficient. This indicates that the proportion of tangible assets is significantly larger in the post-epidemic period than in the pre-epidemic period. The non-debt tax shield (NDTS) of the epidemic monetary

mean is 0.0280, and the post-epidemic mean is 0.0360, with a difference of -0.008; the difference is significant at the 1% level of significance and coefficient. This indicates that the non-debt tax shield is significantly greater post-epidemic than it was before the epidemic.

The SGTD indicator had a mean value of 0.3 before the epidemic and a mean value of 0.294 after the epidemic. The difference was not significant, indicating that there was not a significant change in short-term debt ratio before and after the epidemic. Similarly, it can be seen that the ROA/GRO LIQ also did not differ significantly before and after the epidemic.

4.2 Correlation analysis

Multicollinearity is a common problem in econometric analysis. It refers to the fact that high or exact correlation between the explanatory variables of a linear regression model can lead to distortion of the model, mainly in the form of a certain consistency in the trends of certain explanatory or control variables in the model. In particular, the problem of multicollinearity is inevitable when most of the control variables are corporate financial indicators. In order to circumvent the impact of multicollinearity on the accuracy of the estimates of the regression coefficients and their standard errors, correlation analysis between the variables is required. In this paper, the Pearson correlation coefficient test was conducted, and its correlation coefficient matrix is as follows.

Table 6 Correlation analysis

	TD	LGTD	SGTD	COVID	SIZE	ROA	GRO	TANG	LIQ	CF	NDTS
TD	1										
LGTD	0.614***	1									
SGTD	0.691***	-0.033***	1								
COVID	0.041***	0.107***	-0.0140	1							
SIZE	0.225***	0.320***	-0.087***	0.026**	1						
ROA	-0.149***	0.002	-0.221***	-0.007	0.369***	1					
GRO	-0.089***	-0.071***	-0.049***	0.003	-0.119***	-0.088***	1				
TANG	0.0170	-0.096***	0.088***	0.034***	-0.038***	-0.037***	-0.005	1			
LIQ	-0.440***	-0.219***	-0.358***	0.004	-0.234***	-0.050***	0.057***	0.197***	1		
CF	-0.038***	0.072***	-0.129***	0.038***	0.355***	0.802***	-0.121***	-0.069***	-0.139***	1	
NDTS	0.201***	0.257***	0.048***	0.121***	0.066***	-0.113***	-0.055***	0.248***	-0.150***	0.066***	1

Notes:This table represents the correlation of our variables, ***, **, and * denote statistical significance levels at the 1%, 5%, and 10% levels, respectively.

It can be seen that the epidemic is significantly and positively correlated with TD with a correlation coefficient of 0.041; the epidemic is significantly and positively correlated with LGTD with a correlation coefficient of 0.107; and the epidemic is not significantly correlated with the short-term debt ratio SGTD. This indicates that the overall debt ratio and long-term debt ratio of enterprises increased significantly after the epidemic. Among the control variables, enterprise size was significantly and positively correlated with

TD, indicating that the larger the size of the enterprise, the higher the overall debt ratio level. Profitability (ROA), growth capacity (GRO), current ratio, and TD were all significantly negatively correlated, indicating that an increase in profitability/GRO LIQ can significantly increase the overall debt ratio level of a firm.

Firm size, cash flow level, and non-debt tax shield are significantly and positively correlated with LGTD, indicating that larger firms, firms with higher cash flow levels, and firms with higher non-debt tax shields have higher levels of long-term debt ratios. Development capacity, tangible assets ratio and current ratio indicators are significantly and negatively correlated with LGTD.

Firm size, ROA, GRO, LIQ, and CF indicate that SGT is significantly negatively correlated, indicating that for short-term debt ratios and increases in firm size, ROA, GRO, LIQ, and CF all reduce the overall level of short-term debt ratios.

Based on the findings of Salmerón et al. (2020), the presence of multicollinearity can result in a lack of consistency between the statistical significance of individual independent variables and the overall significance of the model. Generally speaking, within the interval of absolute values of correlation coefficients [0, 1], with 0.3, 0.5 and 0.8 as segmentation points, the correlation between two variables can be classified into four cases: weak correlation, low correlation, significant correlation and high correlation. The higher the absolute value of the correlation coefficient, the higher the correlation between the variables. The results of the correlation coefficient matrix show that the correlation coefficients of the vast majority of the variables are significant at the 1% level of significance. The correlation coefficient between CF and ROA is as high as 0.802 and significant at the 1% level of significance, indicating that the alternative explanatory variables that are intended to be used for robustness testing are appropriately and robustly selected, while the correlation coefficients of the explanatory variables and each of the control variables are low, indicating that the selection of these variables is reasonable. To ensure that the possible effects of multicollinearity are excluded, VIF multicollinearity tests were conducted for each of the main variables in this paper. The results are shown in the following table:

Table 7 VIF test

Variable	VIF	1/VIF
ROA	3.19	0.313797
CF	3.12	0.32035
SIZE	1.24	0.804074
NDTS	1.23	0.810299
LIQ	1.15	0.866185
TANG	1.15	0.871109
GRO	1.02	0.975859
COVID	1.02	0.982117
Mean VIF	1.64	

Notes: This table represents the VIF test

The VIF values (Variance Inflation Factor) for each of the variables are shown below. From this it can be seen that the maximum value of VIF for each variable is 3.19, the minimum value is 1.02 and the mean value is 1.64. Since all of these values are less than 10, it can be assumed that there is no serious co-linearity between the variables. This means that the possibility of serious multicollinearity between the variables is low, and it is appropriate to use these variables for multiple regression analysis.

4.3 Regression analysis

The data sample used in this paper is a short panel of unbalanced data with a short time (T) and a large number of individuals (N). In this paper, individual fixed effects are used for regression and heteroskedasticity is treated by clustering robust standard errors.

4.3.1 Profitability and capital structure

As this paper uses panel data, the OLS model, fixed-effects model, and random-effects model are utilized for estimation, and the results are as follows. All models pass the Hausman test, so the fixed-effects model is ultimately used for estimation.

Table 8 Profitability and capital structure

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	SGTD
ROA	-0.2043***	-0.0659***	-0.1115***
	(-19.29)	(-8.28)	(-13.53)
SIZE	-0.0372***	0.0184***	-0.0592***
	(-8.41)	(5.53)	(-17.22)
GRO	0.0079***	-0.0003	0.0046***
	(3.68)	(-0.18)	(2.71)
TANG	-0.0361*	-0.0482***	0.0404***
	(-1.87)	(-3.32)	(2.68)
NDTS	1.4425***	1.0749***	0.3942***
	(14.73)	(14.62)	(5.18)
Constant	0.7586***	0.0557**	0.6402***
	(21.17)	(2.07)	(22.97)
Observations	7,155	7,155	7,155
R-squared	0.168	0.126	0.126
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	108.3	77.29	77.14
F test	23.20***	11.95***	22.75***
Hausman	238.21***	117.151***	378.22***

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of ROA on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The F-test value in column 1 is 23.20, which corresponds to a p-value of 0.000, indicating that there is an individual effect and that the mixed regression model should be discarded in favor of the fixed-effects model or the random-effects model. The Hausman test value is 238.21, corresponding to a p-value of 0.000. There is a significant difference between the two models, so the random-effects model should be discarded, and a fixed-effects model should be chosen. Based on the results of these tests, the fixed-effects model was selected. Similarly, columns 2 and 3 also utilize fixed-effects models.

The ROA coefficient in column 1 is both negative and significant at the 1% level of significance, indicating that companies with better profitability have lower levels of gearing. The magnitude of the coefficient is -0.2043, indicating that for every 1 unit increase in total return on assets, gearing decreases by 0.2043 units. This may be due to the existence of information asymmetries and financial risks that lead to the relatively high cost of external financing methods. On the one hand, UK listed companies are generally less profitable and debt financing does not have a large tax-deductible effect, making it less attractive for companies to opt for debt financing. On the other hand, in the context of the existence of information asymmetry, according to the theory of euphoric financing, there is less of a need for profitable companies to seek external financing when internal funding is abundant. Accordingly, when less external debt financing is available to companies, the results indicate that companies are forced to rely more on internal financing in the UK market. For example, when a firm takes out a loan with a bank, the bank often requires collateral and proof of qualification, etc. These procedures can often be onerous, which raises the firm's loan expenses. Preferential financing theory suggests that companies should first attempt to finance themselves internally before opting for external financing options. Higher profitability will certainly result in a relatively high level of retained earnings, which will allow the company to reduce its proportion of external debt financing and keep the company's debt ratio at a lower level.

In terms of the performance of the other variables, the significant negative coefficient on firm size indicates that the overall level of indebtedness of firms is significantly lower as size increases; that is, the level of gearing is lower for larger firms.

The significant positive coefficient on GRO is a strong indication that companies with high growth capacity have higher levels of gearing. This may be due to the fact that companies with high growth capacity will prefer external financing to sustain their growth and therefore have higher levels of gearing. Specifically, higher-growth companies tend to expand their markets, which requires large capital expenditures. However, investment growth will generally outpace profit growth, requiring the company to seek external financing. When the company has good growth prospects, it is usually reluctant to issue new shares to

diversify control away from old shareholders, and so the company will prefer debt financing. Secondly, higher growth companies are faced with a greater number of investment options and the resulting agency problems are more severe; short-term debt can be used to replace long-term debt to mitigate such agency problems.

The TANG coefficient on the proportion of tangible assets is negative and significant at the 10% level of significance, indicating that when the proportion of tangible assets increases, the firm's gearing level decreases. As the proportion of tangible assets is a proxy for the firm's collateral value, a higher proportion of the firm's total assets can be used as collateral security (e.g. fixed assets, inventory goods, etc.). Both information asymmetry theory and agency cost theory suggest that increasing the collateral value of physical assets can reduce the credit risk level caused by information inequality. Therefore, when the proportion of fixed assets of a company is higher, it means that the company's profitability and repayment capacity is also higher, and the level of gearing is lower.

The coefficient is positive and significant for NDTS, indicating that when the level of non-debt tax shield increases, it increases the level of the firm's gearing. This may be due to the fact that firms with a higher level of non-debt tax shield will generally have a lot of collateralizable physical assets that can be used for debt financing, and the level of risk of collateralized loans is much lower than that of unsecured loans. This will increase the firm's gearing, hence the possibility of a positive relationship between non-debt tax shield and gearing.

Looking at the model as a whole, the goodness of fit is 0.168, indicating that the independent variables jointly explain 16.8% of the variation present in the dependent variables and therefore the model is able to well explain a large amount of the data. The F-value of the model is 108.3 and the p-value is 0.0000, indicating a significant rejection of the original hypothesis that the coefficients of the independent variables are simultaneously equal to zero. As a result, it can be concluded that the model as a whole holds.

Column 2 describes the regression of ROA on long-term debt ratio, where the coefficient on ROA is negative and significant at the 1% level of significance, indicating that companies with better profitability have lower levels of long-term debt ratio. The size of the coefficient is -0.0659, indicating that for every 1 unit increase in total return on assets, long-term debt ratio decreases by 0.0659 units. Column 3 contains the regression of ROA on short-term debt ratio, where the coefficient on ROA is negative and significant at the 1% level of significance, indicating that companies with better profitability have lower levels of short-term debt ratio. The magnitude of the coefficient is -0.1115, indicating that for every 1 unit increase in total return on assets, short-term debt ratio decreases by 0.1115 units.

Columns 2 and 3 show that the effect of profitability on capital structure reduces not only overall debt ratios but also long-term and short-term debt ratios; profitability has a significant dampening effect on different types of capital structure. Based on the comprehensive analysis presented above, the empirical findings support validating Hypothesis 1.

4.3.2 Solvency and capital structure

In order to investigate the relationship between the pandemic and long-term debt ratio using panel data, this paper uses the OLS model, fixed-effects model, and random-effects model for estimation and lists the Hausman test results as follows:

Table 9 Solvency and capital structure

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	SGTD
LIQ	-0.0164***	0.0004	-0.0155***
	(-18.80)	(0.55)	(-23.65)
SIZE	-0.0550***	0.0112***	-0.0672***
	(-12.83)	(3.45)	(-20.81)
GRO	0.0055**	-0.0008	0.0029*
	(2.54)	(-0.50)	(1.79)
TANG	0.0122	-0.0550***	0.0929***
	(0.62)	(-3.71)	(6.27)
NDTS	1.6689***	1.2195***	0.4340***
	(17.37)	(16.83)	(5.99)
Constant	0.8647***	0.1025***	0.6833***
	(24.59)	(3.86)	(25.79)
Observations	7,155	7,155	7,155
R-squared	0.165	0.116	0.176
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	106.4	70.27	115.1
Ftest	20.06***	11.77***	20.40***
Hausman	340.72***	33.50***	428.27***

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of LIQ on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The results of the F-test and Hausman test show that a fixed-effects model is the best choice for the

final model, with a negative LIQ coefficient in column 1, significant at the 1% level of significance. This indicates that companies with better solvency have lower levels of gearing. The magnitude of the coefficient is -0.0164, indicating that for every 1 unit increase in the liquidity ratio, the gearing ratio decreases by 0.0164 units.

The significant negative coefficient of liquidity ratio (LIQ) indicates that the higher the liquidity ratio, the lower the level of gearing of a given firm. This suggests that an increase in liquidity ratio can reduce the gearing of a firm. A possible reason for this may be that when a firm's liquidity ratio increases, the firm has sufficient funds to carry out its business activities, which will reduce the need for financing and hence the level of gearing. Companies with strong solvency have a relatively rapid turnover of funds, so for listed companies, debt repayment is generally based on short-term debt. This process ensures the stable operation of the enterprise and reduces financial risks, so that the credit rating of the enterprise remains high. When a company has a high credit rating, creditors are more willing to lend greater funds to the enterprise, forming a virtuous circle of capital movement. This is true when the debt level of the business is relatively low, which in turn shows a lower level of gearing. In general, the higher the current ratio, the stronger the short-term solvency. In terms of the business process, most companies are relatively sound, so they seldom raise long-term debt and tend to borrow short-term, which can reduce both the borrowing costs and the business risks of the company. However, from the creditor's point of view, the higher the current ratio the better, as this indicates that the enterprise is actively engaged in the market and has strong solvency, which in turn helps protect the creditor's own capital and income.

Column 2 shows the regression of LIQ on long-term debt ratio, where LIQ is not significant. Column 3 shows the regression of LIQ on short-term debt ratio, where the coefficient on LIQ is negative and significant at the 1% level of significance, indicating that companies with better levels of liquidity have lower levels of short-term debt ratio. The magnitude of the coefficient is -0.1115, indicating that for every 1 unit increase in liquidity level, short-term debt ratio decreases by 0.1115 units.

Columns 2 and 3 show that the effect of liquidity levels on capital structure reduces not only the overall debt ratio but also the short-term debt ratio, with no significant effect on the long-term debt ratio. The empirical evidence presented in the preceding analysis strongly corroborates the proposition set forth in Hypothesis 2, thus confirming its validity within the research framework.

4.3.3 Cash flow levels and capital structure

To investigate the relationship between the pandemic and long-term debt ratio using panel data, this paper uses the OLS model, fixed-effects model and random-effects model for estimation and lists the Hausman test results as follows:

Table 10 Cash flow levels and capital structure

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	SGTD
CF	-0.1013***	-0.0731***	-0.0033
	(-7.01)	(-6.90)	(-0.29)
SIZE	-0.0533***	0.0156***	-0.0711***
	(-11.92)	(4.76)	(-20.68)
GRO	0.0071***	-0.0002	0.0037**
	(3.22)	(-0.12)	(2.14)
TANG	-0.0496**	-0.0513***	0.0314**
	(-2.50)	(-3.53)	(2.06)
NDTS	1.8662***	1.2073***	0.6309***
	(19.07)	(16.84)	(8.38)
Constant	0.8648***	0.0754***	0.7168***
	(23.78)	(2.83)	(25.63)
Observations	7,155	7,155	7,155
R-squared	0.123	0.123	0.098
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	75.13	75.14	58.68
F test	22.73***	11.95***	22.76***
Hausman	370.02***	118.99***	162.12***

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of CF on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

As can be seen from the results of the F-test and Hausman test, the final model chosen is a fixed-

effects model with a negative CF coefficient in column 1, significant at the 1% level of significance, indicating that companies with better levels of cash flow have lower levels of gearing. The magnitude of the coefficient is -0.1013, indicating that for every 1 unit increase in the ratio of cash flow to total assets, gearing decreases by 0.1013 units.

"Operating cash flow" represents the net cash flow generated by the company's legitimate operating activities, a portion of which the company uses to increase its working capital or to invest in new long-term assets, while the remainder flows to shareholders or creditors. When the company has sufficient cash flow, it prefers to finance itself with its own cash flow and thus reduces external financing, resulting in a lower level of gearing.

Column 3 contains the regression of CF on the short-term debt ratio, where LIQ is not significant. Column 2 shows the regression of LIQ on long-term debt ratio, where the coefficient on LIQ is negative and significant at the 1% level of significance, indicating that companies with better levels of cash flow have lower levels of long-term debt ratio. The magnitude of the coefficient is -0.0731, indicating that for every 1 unit increase in liquidity level, short-term debt ratio decreases by 0.0731 units. Hypothesis 3 has been empirically supported/confirmed/validated.

Columns 2 and 3 show that the impact of the cash flow level on the capital structure reduces not only the overall debt ratio but also the long-term debt ratio, with no significant impact on the short-term rate.

When all the explanatory variables ROA LIQ CF are added together as explanatory variables to the model, the regression results are as follows.

Table 11 Regression of ROA /LIQ /CF on firm capital structure

	(1)	(2)	(3)
	fe1	fe2	fe3
VARIABLES	TD	LGTD	SGTD
ROA	-0.2226***	-0.0518***	-0.1478***
	(-17.77)	(-5.36)	(-15.50)
LIQ	-0.0152***	-0.0007	-0.0149***
	(-17.92)	(-1.13)	(-23.06)
CF	0.0744***	-0.0345***	-0.1159***
	(4.48)	(-2.69)	(-9.17)
SIZE	-0.0356***	0.0187***	-0.0583***
	(-8.27)	(5.63)	(-17.77)
GRO	0.0067***	-0.0001	0.0031**
	(3.21)	(-0.04)	(1.97)
TANG	0.0233	-0.0512***	0.0988***
	(1.22)	(-3.48)	(6.80)
NDTS	1.2184***	1.1105***	0.1403*
	(12.62)	(14.90)	(1.91)
Constant	0.7387***	0.0547**	0.6233***
	(21.18)	(2.03)	(23.48)
Observations	7,155	7,155	7,155
R-squared	0.213	0.127	0.209
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	123.3	66.13	119.8

Notes: This table presents results of ROA, LIQ, CF on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The significance of ROA, LIQ, and CF has stayed the same and remains consistent with the above. To demonstrate the impact of profitability ROA, liquidity level LIQ, and cash flow level CF more conveniently on the firm's capital structure, this paper still adds ROA, LIQ, and CF to the model separately for further testing in the subsequent regressions.

4.3.4 Profitability, epidemic and capital structure

In order to test the effect of profitability on capital structure before and after the epidemic, this paper constructs an interaction term between the epidemic and ROA to add to the model, and the regression results are as follows:

Table 12 Regression table for profitability, epidemic and capital structure

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	SGTD
COVID_ROA	-0.1279***	-0.1047***	-0.0194
	(-8.26)	(-9.01)	(-1.60)
ROA	-0.1808***	-0.0466***	-0.1079***
	(-16.57)	(-5.70)	(-12.65)
SIZE	-0.0358***	0.0195***	-0.0590***
	(-8.14)	(5.91)	(-17.15)
GRO	0.0091***	0.0007	0.0047***
	(4.25)	(0.43)	(2.82)
TANG	-0.0354*	-0.0476***	0.0405***
	(-1.84)	(-3.30)	(2.69)
NDTS	1.4479***	1.0793***	0.3950***
	(14.87)	(14.78)	(5.19)
Constant	0.7507***	0.0492*	0.6390***
	(21.06)	(1.84)	(22.93)
Observations	7,155	7,155	7,155
R-squared	0.177	0.138	0.126
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	106.1	78.58	70.94

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of ROA and COVID on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The column interaction term COVID_ROA in column 1 is significant and has a negative coefficient. The interaction term in column 1 is -0.1279, indicating that after the epidemic (COVID = 1) the coefficient of the effect of ROA on gearing is -0.1279 – 0.1808 = -0.3087. Before the epidemic (COVID = 0) the coefficient of the effect of ROA on gearing is -0.1808 and the difference is -0.1279. This analysis reveals that the effect of profitability on gearing is greater after the epidemic, while also having a greater degree of inhibition.

The interaction term COVID_ROA in column 2 is significant and the interaction term in column 3 is not significant, indicating that the effect of profitability on long-term debt ratios is greater after the epidemic. The effect of profitability on short-term debt ratios is not significantly different either before or after the epidemic. The empirical analysis conducted in this study provides robust empirical support, underscoring the empirical validity of Hypothesis 4.

4.3.5 Liquidity, epidemics, and capital structure

Table 13 Liquidity, epidemic and capital structure regression table

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	SGTD
COVID_LIQ	-0.0029**	-0.0029***	-0.0009
	(-2.30)	(-3.08)	(-0.93)
LIQ	-0.0157***	0.0010	-0.0153***
	(-17.25)	(1.44)	(-22.29)
SIZE	-0.0543***	0.0118***	-0.0670***
	(-12.65)	(3.65)	(-20.70)
GRO	0.0054**	-0.0009	0.0029*
	(2.51)	(-0.55)	(1.77)
TANG	0.0128	-0.0544***	0.0930***
	(0.65)	(-3.67)	(6.28)
NDTS	1.6570***	1.2075***	0.4304***
	(17.23)	(16.66)	(5.93)
Constant	0.8649***	0.1027***	0.6834***
	(24.61)	(3.87)	(25.79)
Observations	7,155	7,155	7,155
R-squared	0.166	0.117	0.177
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	98.04	65.30	105.6

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of LIQ and COVID on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The column interaction term COVID_LIQ in column 1 is significant and has a negative coefficient. The interaction term in column 1 is -0.0029, indicating that after the epidemic (COVID =1) the coefficient of the effect of LIQ on gearing is -0.0029 – 0.0157 = -.0186. Before the epidemic (COVID =0) the coefficient of the effect of LIQ on gearing is -0.1808 and the difference is -0.0029. From this it can be seen that

the effect of liquidity on gearing has a greater dampening effect after the epidemic.

The interaction term COVID_LIQ in column 2 is significant and the interaction term in column 3 is not significant, indicating that the effect of liquidity on long-term debt ratios is greater after the epidemic. The effect of liquidity on short-term debt ratios is not significantly different either before or after the epidemic. The results obtained from the rigorous empirical investigation lend substantial credence to the assertion postulated in Hypothesis 5, thus establishing its empirical verifiability.

4.3.6 Cash flow, epidemic and capital structure

Table 14 Cash flow, epidemic and capital structure regression table

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	TD
COVID_CF	-0.0484**	-0.0857***	-0.0484**
	(-2.28)	(-5.53)	(-2.28)
CF	-0.0939***	-0.0601***	-0.0939***
	(-6.35)	(-5.56)	(-6.35)
SIZE	-0.0529***	0.0162***	-0.0529***
	(-11.84)	(4.95)	(-11.84)
GRO	0.0075***	0.0005	0.0075***
	(3.39)	(0.31)	(3.39)
TANG	-0.0485**	-0.0494***	-0.0485**
	(-2.45)	(-3.41)	(-2.45)
NDTS	1.8702***	1.2144***	1.8702***
	(19.11)	(16.98)	(19.11)
Constant	0.8643***	0.0744***	0.8643***
	(23.77)	(2.80)	(23.77)
Observations	7,155	7,155	7,155
R-squared	0.123	0.127	0.123
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
F	69.35	71.77	69.35

Notes: This table presents results of LIQ and COVID on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The column interaction term COVID_CF in column 1 is significant and has a negative coefficient. The interaction term in column 1 is -0.0484, indicating that after the epidemic (COVID = 1) the coefficient of the effect of CF on gearing is -0.0484 – 0.0939 = -0.1423. Before the epidemic (COVID = 0) the coefficient of the effect of CF on gearing is -0.09398; the difference is -0.0484. This means that the effect of cash flow level on gearing is greater after the epidemic, with a greater dampening effect.

Both the interaction term COVID_CF in column 2 and in column 3 are significant, indicating that the effect of cash flow level on long-term debt ratios is greater after the epidemic. The effect of cash flow level on short-term debt ratios is also subject to greater dampening after the epidemic. The findings derived from the rigorous empirical examination offer compelling empirical evidence, thereby confirming the hypothesis formulated in Hypothesis 6 within the context of this study.

4.3.7 Effects of different sectors

As the responses of companies in various industries differ when it comes to capital structure, we analysed the industry characteristics of the firms included in the sample.

The manufacturing sector is an important part of the UK economic system and is representative of the country’s total productivity. The development level of the manufacturing sector is closely related to the overall level of development of a country. It also plays a role in stabilizing the economy in the face of financial risk. Now that the world has entered the "post-pandemic" era, the development of the manufacturing industry has played a key role in both the stabilization of the UK's national livelihood and the economic development of China. This paper sets the manufacturing dummy variable, Man, to 1 if a company is included in the manufacturing sector, and to 0 otherwise. In addition to manufacturing, the effect of the epidemic differs across other sectors as well. The retail sector, for example, was affected by the lockdown of some cities during the pandemic. Compared to the pre-pandemic period, the retail sector saw a significant decline in revenue. The transport sector was also greatly affected by the pandemic, with lower demand both for individual travel and for transport, which had an impact on the operations of transport companies. In total, the reactions of four industries, Manufacturing (Man), Transportation (Tran), Retail (Sale) and Science and Technology (Tech), are explored to observe the moderating effect of the pandemic on ROA and gearing.

Table 15 Industry regression table for profitability, epidemic and capital structure

	(1)	(2)	(3)	(4)
	Man	Tran	Sale	Tec
VARIABLES	TD	TD	TD	TD
COVID_ROA	-0.0618**	-0.4620**	-0.4437***	-0.1354***
	(-2.50)	(-2.55)	(-5.77)	(-2.95)
ROA	-0.1838***	-0.2912***	-0.3500***	-0.0565**
	(-10.73)	(-3.16)	(-6.76)	(-1.98)
SIZE	-0.0345***	0.0753***	-0.0156	-0.0266*
	(-5.21)	(2.66)	(-1.59)	(-1.95)
GRO	0.0173***	0.0048	0.0185**	0.0196**
	(5.59)	(0.31)	(2.10)	(2.25)
TANG	-0.1098***	0.1717	0.1899***	-0.1403***
	(-3.74)	(1.37)	(3.17)	(-3.05)
NDTS	2.4569***	0.4066	1.2534***	3.1296***
	(11.74)	(1.20)	(5.50)	(7.00)
Constant	0.7338***	-0.0494	0.5388***	0.6034***
	(12.95)	(-0.17)	(6.05)	(7.12)
Observations	2,848	297	808	796
R-squared	0.168	0.274	0.405	0.160
Number of id	455	47	142	151
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
F	40.09	7.467	37.03	10.07

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of ROA and COVID on capital structure in different industries. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

It can be seen that the interaction term COVID_ROA is significant and has a negative coefficient in all four industries. In terms of the size of the effect, the most significantly impacted industries are transportation (coefficient of -0.462) and retail trade (-0.4437); the coefficient of the interaction term is smaller in the manufacturing and technology industries. This suggests that the dampening effect of ROA on gearing after the epidemic is smaller in the manufacturing and technology sectors.

We also further examine the differences in the impact of liquidity (level of cash flow), and the epidemic on capital structure across several sectors.

Table 16 Industry regression table for liquidity levels, epidemic and capital structure

	(1)	(2)	(3)	(4)
	Man	Tran	Sale	Tec
VARIABLES	TD	TD	TD	TD
COVID_LIQ	0.0009	-0.0250	-0.0086**	-0.0088
	(0.43)	(-1.42)	(-2.25)	(-1.45)
LIQ	-0.0243***	-0.0382**	-0.0061**	-0.0248***
	(-14.91)	(-2.28)	(-2.28)	(-7.73)
SIZE	-0.0336***	0.0643**	-0.0352***	-0.0304**
	(-5.17)	(2.20)	(-3.31)	(-2.42)
GRO	0.0140***	-0.0081	0.0132	0.0167**
	(4.63)	(-0.50)	(1.31)	(2.00)
TANG	-0.0006	0.1528	0.1034	-0.0663
	(-0.02)	(1.15)	(1.60)	(-1.47)
NDTS	2.3333***	0.2599	1.8665***	2.6508***
	(11.32)	(0.70)	(7.95)	(6.16)
Constant	0.6968***	0.1487	0.7113***	0.6539***
	(12.53)	(0.51)	(7.33)	(8.34)
Observations	2,848	297	808	796
R-squared	0.197	0.195	0.292	0.226
Number of id	455	47	142	151
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
F	48.68	4.791	22.53	15.39

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of LIQ and COVID on capital structure in different industries. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

It can be seen that the interaction term COVID_LIQ is significant and has a negative coefficient in the retail sector, while all other sectors are insignificant. This indicates that the inhibitory effect of LIQ on gearing is greater in the retail sector after the epidemic.

Table 17 Industry regression table for cash flow, epidemic and capital structure

VARIABLES	(1) Man TD	(2) Tran TD	(3) Sale TD	(4) Tec TD
COVID_CF	0.0107	-0.0285**	0.0568	-0.0292
	(0.33)	(-2.13)	(0.60)	(-0.47)
CF	-0.0784***	-0.3595**	-0.3319***	-0.0125
	(-3.80)	(-2.04)	(-4.42)	(-0.33)
SIZE	-0.0426***	0.0566**	-0.0387***	-0.0371***
	(-6.28)	(1.98)	(-3.66)	(-2.66)
GRO	0.0147***	0.0002	0.0120	0.0181**
	(4.64)	(0.01)	(1.25)	(2.04)
TANG	-0.1177***	0.1434	0.0966	-0.1667***
	(-3.91)	(1.10)	(1.51)	(-3.60)
NDTS	2.8581***	0.8281**	2.1534***	3.3384***
	(13.47)	(2.23)	(9.04)	(7.33)
Constant	0.7832***	0.1289	0.7239***	0.6704***
	(13.49)	(0.45)	(7.56)	(7.82)
Observations	2,848	297	808	796
R-squared	0.122	0.213	0.305	0.142
Number of id	455	47	142	151
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
F	27.52	5.356	23.88	8.719

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of CF and COVID on capital structure in different industries. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

It can be seen that the interaction term COVID_CF is significant and has a negative coefficient in the transport sector, while all other sectors are insignificant. This indicates that the suppressive effect of CF on gearing is greater in the transport sector after the epidemic.

4.3.8 Impact of the epidemic and capital structure

(1) Epidemic and capital structure

In the above section, we examined the differences in the effects of the explanatory variables on capital

structure before and after the epidemic. To further explore the reasons for this, this paper will conduct further testing on differences in capital structure before and after the epidemic.

In order to examine the relationship between the epidemic and capital structure, this paper constructs a regression model as follows

$$\text{Structure}_{it} = \alpha + \beta_1 COVID_t + \beta_2 SIZE_{it} + \beta_3 GRO_{it} + \beta_4 TANG_{it} + \beta_5 NDTS_{it} + \mu_i + \varepsilon_{it}$$

where $Structure_{it}$ refers to the capital structure variable, α refers to the intercept term, and ε_{it} refers to the random error term. β_1 is the coefficient of the epidemic, when β_1>0, it means that the total gearing increases after the epidemic. μ_i refers to individual fixed-effects.

Table 18 Regression table of the epidemic and capital structure

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	TD	LGTD	SGTD
COVID	0.0229***	0.0246***	0.0037
	(6.72)	(9.81)	(1.43)
SIZE	-0.0519***	0.0158***	-0.0652***
	(-12.31)	(5.10)	(-20.21)
GRO	0.0049**	-0.0020	0.0035**
	(2.19)	(-1.24)	(2.09)
TANG	-0.0439**	-0.0465***	0.0364**
	(-2.20)	(-3.17)	(2.39)
NDTS	2.0292***	1.3659***	0.6638***
	(21.15)	(19.39)	(9.04)
Constant	0.8223***	0.0420*	0.6632***
	(24.80)	(1.72)	(26.12)
Observations	7,155	7,155	7,155
R-squared	0.107	0.103	0.091
Number of id	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes
F	141.9	135.5	118.2

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of COVID on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

Column 1 shows the impact of the epidemic on the overall gearing ratio, where the COVID coefficient is 0.0229, indicating that the gearing level of firms increased by 0.0229 units after the epidemic as opposed to before the epidemic, which corresponds to a change of 0.087 standard deviations (TD's standard deviation is 0.262). This indicates that it is possible that the level of gearing of firms can increase after the outbreak. This may be due to the fact that, firstly, the epidemic's effect on businesses has led to plummeting consumer demand, and as a result many businesses have laid off staff or closed down due to poor revenues, reducing the profit margins of listed companies. Businesses are likely to increase their bank borrowings and debt levels in order to survive and maintain their typical levels of growth, thus increasing their gearing ratios. Secondly, after the epidemic, as the internal cash flow level of enterprises decreases and they are unable to obtain more financing from internal sources, financing from capital markets, such as by issuing shares, becomes more difficult. Under these circumstances, firms turn to bank borrowings and other means of financing, thus further increasing their debt levels.

Column 2 shows the effect of the epidemic on long-term debt ratios. The COVID variables are all significant at the 1% level of significance and have positive coefficients, indicating that the level of capital indebtedness of the firm increases after the epidemic. The COVID coefficient in column 2 is 0.0246, indicating that the level of long-term debt ratios of firms increased by 0.0246 units after the epidemic compared to before the epidemic, which corresponds to a change of 0.1562 standard deviations (the standard deviation of LGTD is 0.157). This indicates that the level of long-term debt ratios of firms is likely to increase after an epidemic. This may be due to the fact that as the epidemic increases the financial risk of the company, the company's ability to survive the crisis is supported by means of external financing. Short-term borrowing will increase the pressure on the company to repay its loan, and so instead companies will tend to choose long-term borrowing, thereby increasing their long-term debt ratio.

Column 3 shows the regression of the Covid coefficient on the short-term debt ratio, indicating that the epidemic had no significant effect on the short-term debt ratio. This also indicates that there was no significant change in the short-term debt ratio of the company after the epidemic. This may be due to the fact that companies give priority to current liabilities in the financing process based on their rapidly changing interest rates and short repayment terms. Current liabilities are generally related to the daily business activities of enterprises and their values are relatively stable. As seen from the previous descriptive statistics, the level of current liabilities did not change significantly from year to year; therefore, there is no significant relationship between changes in current liabilities and the external environmental factors such as the epidemic. Therefore, there is no significant correlation between changes in current liabilities and external environmental factors such as the epidemic.

The present study's findings on the impact of the pandemic on capital structure are in alignment with prior scholarly research conducted by AZHARI et al. (2022) and Huang & Ye (2021). AZHARI et al. (2022) investigated the capital structure of listed companies in Malaysia and discovered an increase in capital structure levels following the outbreak. Similarly, Huang & Ye (2021) focused on Chinese companies and revealed that firms with debt exceeding the optimal threshold experienced heightened corporate risk during the pandemic, with a more pronounced effect observed among entities exhibiting weaker corporate social responsibility performance. Although the present study diverges in terms of the sample, examining listed companies in the United Kingdom, the congruity of the conclusions with the existing literature lends credibility to the robustness of the findings in this research endeavor.

This paper further examines how the impact of the epidemic on capital structure varies between industries. The following model is constructed to test the moderating role of industry type on the epidemic and capital structure.

$$Structure_{it} = \alpha_0 + \beta_1 COVID_t + \gamma COVID_t * Industry_{it} + \sum Control_{it} + \mu_i + \varepsilon_{it}$$

Where $Structure_{it}$ refers to the capital structure variables TD, LGTD, and SGTD for this paper, and $Industry_{it}$ refers to several industry variables (Man, Tec, Sale, and Tran); when $\gamma < 0$ indicates that in that industry, the epidemic contributes less to the capital structure. $Control_{it}$ refers to the control variables of this paper.

Table 19 Regression table for epidemic, industry and capital structure

	(1)	(2)	(3)	(4)
	Man	Tec	Sale	Tran
VARIABLES	TD	TD	TD	TD
COVID_Man	-0.0294***			
	(-4.66)			
COVID_Tec		-0.0124		
		(-1.24)		
COVID_Sale			0.0379***	
			(3.86)	
COVID_Tran				0.0292*
				(1.91)
COVID	0.0352***	0.0242***	0.0191***	0.0218***
	(8.18)	(6.78)	(5.38)	(6.29)
SIZE	-0.0523***	-0.0517***	-0.0524***	-0.0519***
	(-12.43)	(-12.27)	(-12.46)	(-12.33)
GRO	0.0050**	0.0048**	0.0047**	0.0049**
	(2.25)	(2.16)	(2.11)	(2.19)
TANG	-0.0453**	-0.0449**	-0.0444**	-0.0449**
	(-2.27)	(-2.25)	(-2.23)	(-2.25)
NDTS	2.0055***	2.0294***	1.9835***	2.0154***
	(20.91)	(21.16)	(20.55)	(20.96)
Constant	0.8265***	0.8221***	0.8274***	0.8237***
	(24.96)	(24.79)	(24.96)	(24.84)
Observations	7,155	7,155	7,155	7,155
R-squared	0.110	0.107	0.109	0.108
Number of id	1,235	1,235	1,235	1,235
Firm FE	Yes	Yes	Yes	Yes
F	122.3	118.5	121.0	118.9

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of COVID on capital structure. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The interaction term COVID_Man in column 1 is negative and significant, indicating that the coefficient of the impact of the epidemic on capital structure is -0.0294 + 0.0352 for manufacturing companies with Man=1. For non-manufacturing companies with Man=0, the coefficient of the impact of the epidemic

on capital structure is 0.0352 at this point, and the difference is -0.0294. This indicates that the epidemic in manufacturing companies has a This means that the contribution of the epidemic to gearing is even smaller among manufacturing firms.

The non-significant results for COVID_Tec indicate that the influence of the pandemic on capital structure in the technology industry does not exhibit a statistically significant difference compared to other sectors.

The interaction term COVID_Sale in column 3 is negative and significant, indicating that the coefficient of the impact of the epidemic on capital structure is 0.0379+0.0191 for companies in the retail sector (Sale = 1). For non-manufacturing companies (Sale = 0), the coefficient of the impact of the epidemic on capital structure is 0.0191, and the difference is 0. 0379, meaning that for companies operating in the retail sector, the COVID-19 pandemic has exhibited a more pronounced facilitative impact on their capital structure relative to other industries.

The Interaction term COVID_Tran in column 4 is positive and significant, indicating that for manufacturing companies Tran=1, at which point the coefficient of the impact of the epidemic on capital structure is 0.0292+0.0218. For non-manufacturing companies Tran=0, at which point the coefficient of the impact of the epidemic on capital structure is 0.0218. The difference is 0.0292, meaning that companies in the transport sector have been more significantly impacted by the epidemic. The findings obtained for the transportation sector are similar with the conclusions drawn for the retail industry.

That said, while an epidemic can lead to lower profits and lower levels of performance for companies, which in turn increases their debt levels, companies in different industries are affected to different degrees. Manufacturing companies experience a lesser impact, while transport and retail sectors are affected to a greater extent. In other words, manufacturing companies are better able to reduce the impact of the pandemic on their capital structure. At the same time, companies in the transport and retail sectors face a greater impact on their capital structure as a result of the pandemic. This suggests that companies in various industries differ in terms of resilience and the consequences they encounter when faced with events such as epidemics. When studying the impact of epidemics on the capital market, which industry a company belongs to should be taken into account without generalizing broadly across disparate industries.

Taken together, the level of profitability of the company and the nature of the company's industry can alter the impact of an epidemic on its capital structure. As epidemics are an uncontrollable external risk, when they occur, they inevitably result in a knock-on effect on the business. Although a company cannot

control whether or not an epidemic occurs, it can weaken the impact of an epidemic by fortifying its internal systems and changing the range of products it produces, thereby diversifying its operations and increasing its profitability. Increasing the company's ability to respond to major public health events ensures that it can develop in a healthy and sustainable manner.

(2) Analysis of heterogeneity

As business operations need to follow a life cycle, firms have different types of capital structure at different stages of the corporate life cycle (Baker & Wurgler, 2002; DeAngelo et al.,2010). In this paper, the classification method for combinations of cash flow characteristics proposed by Dickinson is used to classify the life cycle stages of a business as follows.

Table 20 Types of cash flow portfolios at different life cycle stages of a business

	Start-up	Growth	Maturity	Elimination	Elimination	Elimination	Recession	Recession
Operating cash flow	-	+	+	-	+	+	-	-
Investment cash flow	-	-	-	-	+	+	+	-
Financing cash flow	+	+	-	-	+	-	+	-

The life cycle of 1,235 listed enterprises with a sample size of 7,155 observations was classified according to Dickinson's cash flow symbolic combination method. This paper classified the net cash flow from operations, net cash flow from investments, and net cash flow from financing according to this method. The five life cycle stages of the listed enterprises were classified, and frequency statistics were conducted. Due to the low proportion of elimination and recession periods, the elimination and recession periods were combined into the recession stage for analysis in this paper, and the above four periods were used as they have a more pronounced cyclical nature.

The age of growth stage enterprises is generally low because they have the opportunity to invest in positive net present value projects, and the capital expenditure rate of enterprises in this stage is generally higher. Consequently, the operating income of these enterprises is also higher, while the retained earnings are lower, because the retained earnings of growth stage enterprises will be heavily invested in the internal development. As enterprises enter the mature stage, retained earnings gradually accumulate and increase with the age of the enterprise. The development of enterprises in this stage is generally stable, and the capital expenditure rate and operating income growth space begin to slow down. Companies in decline are generally older companies that have gone through a complete cycle, and their operating income and capital expenditure rates decrease due to their increased debt risk and reduced project investment opportunities. At

this time the company's retained earnings may be used to invest in new projects or may be used to accumulate more retained earnings due to the inertia of managers.

The distribution of the number of sample points for each stage is shown below:

Table 21 Enterprise life cycle stages

	Start-up	Growth	Maturity	Recession	Total
Frequency	862	1,418	3,907	947	7,134
Percentage	12.08%	19.88%	54.77%	13.27%	100%
Cumulative percentage	12.08%	31.96%	86.73%	100%	

Notes: This table shows the sample distribution in different life circle period.

From the distribution of the sample, it can be seen that the maturity period has the largest sample size with 54.77%, followed by the growth period with 31.96%, and finally the decline period has the smallest sample with 13.27%.

Table 22 Distribution of capital structure over the life cycle

Periodicity	TD	LGTD	SGTD
Start-up period	0.4480	0.1162	0.2888
Growth period	0.5532	0.1910	0.2824
Maturity	0.5374	0.1604	0.2967
Recession	0.5273	0.1206	0.3334

Notes: This table shows the mean value of capital structure in different life circle period.

The distribution of capital structure over the different life cycles of an enterprise shows that in recessionary firms, capital indebtedness is highest, along with short-term indebtedness, while long-term indebtedness is highest in growth firms. This indicates that when the overall debt ratio level of a company is high, the company is most likely to be in a recessionary period, which can affect the long-term sustainability of the company.

The regression results of the epidemic on gearing over different life cycles are as follows:

Table 23 Regression table of epidemics and gearing over different life cycles

	(1) Newly established	(2) Growth period	(3) Mature	(4) Recession
VARIABLES	TD	TD	TD	TD
COVID	0.1128***	0.0242***	-0.0020	-0.0176
	(5.40)	(3.15)	(-0.59)	(-0.97)
SIZE	-0.0811***	0.0022	0.0135**	-0.1054***
	(-5.35)	(0.27)	(2.29)	(-5.02)
GRO	0.0032	0.0089	0.0150***	0.0164*
	(0.54)	(1.54)	(3.30)	(1.82)
TANG	-0.1486**	-0.0357	0.1801***	-0.0451
	(-2.45)	(-0.84)	(6.58)	(-0.47)
NDTS	2.5754***	1.2512***	1.7396***	3.9655***
	(8.67)	(4.84)	(15.50)	(5.85)
Constant	0.7311***	0.5215***	0.2440***	1.0519***
	(9.35)	(7.93)	(4.90)	(6.87)
Observations	862	1,418	3,907	947
R-squared	0.247	0.061	0.118	0.152
Number of id	394	723	947	533
Firm FE	Yes	Yes	Yes	Yes
F	30.40	8.977	79.39	14.62

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of COVID on TD in in different life circle period. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The epidemic variable is significant and has a positive coefficient at the 1% level of significance during the growth period and at the 5% level of significance during the start-up period. This indicates that the impact of the epidemic on capital indebtedness in terms of the different life cycle stages is greater in the growth and start-up periods, and the epidemic has the least impact on capital indebtedness in the decline and maturity periods.

The regression results of the epidemic on long-term debt ratios over different life cycles are as follows:

Table 24 Regression table of epidemics and long-term debt ratios over different life cycles

	(1)	(2)	(3)	(4)
	Newly established	Growth period	Mature	Recession
VARIABLES	LGTD	LGTD	LGTD	LGTD
COVID	0.0735***	0.0151**	0.0045	0.0183
	(5.72)	(2.04)	(1.46)	(1.02)
SIZE	-0.0122	0.0517***	0.0618***	-0.0165
	(-1.31)	(6.71)	(11.63)	(-1.57)
GRO	-0.0003	0.0010	0.0026	0.0046
	(-0.09)	(0.19)	(0.64)	(1.01)
TANG	-0.0563	-0.0046	0.0260	-0.0482
	(-1.51)	(-0.11)	(1.05)	(-1.00)
NDTS	0.9894***	1.1310***	1.8790***	1.5666***
	(5.41)	(4.54)	(18.51)	(4.63)
Constant	0.1529***	-0.1819***	-0.3687***	0.2055***
	(3.18)	(-2.87)	(-8.18)	(2.69)
Observations	862	1,418	3,907	947
R-squared	0.137	0.131	0.191	0.082
Number of id	394	723	947	533
Firm FE	Yes	Yes	Yes	Yes
F	14.72	20.83	139.9	7.348

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of COVID on LGTD in in different life circle period. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The epidemic variable is significant and has a positive coefficient at the 1% level of significance in the growth and start-up periods; in the maturity and decline periods, the variable is not significant. This indicates that the impact of the epidemic on capital indebtedness in terms of the different life cycle stages is greater in the growth and maturity stages. In other words, the impact of the epidemic on capital indebtedness hast the smallest effect during the maturity and decline stages of the business.

Looking at the distribution over life cycle stages, when firms are in the growth and start-up phases, comparative financing is hit hardest by the epidemic. When firms are in the recession and maturity phases, the epidemic has less of an impact on the capital structure. This indicates that growth and start-up companies will actively respond to the crisis by increasing their borrowing to help them get through the crisis and will seek to adopt policies to help them endure the crisis. However, in the recession period, companies with small profits and room for growth will take less efficient measures in the face of the crisis, which leads to no significant change in the capital structure.

(3) Capital structure and business risk

The previous analysis concluded that the level of gearing increases following an epidemic, so what impact does an increase in the level of gearing have on a firm? This paper further explores the impact of changes in capital structure and epidemics on firms' risk levels. Standard deviation of ROA **(**Wright et al.,2007; Jane et al.,2014) is utilized as a proxy for a firm's level of risk-taking. The Standard deviation of ROA is most widely used as a measure of a firm's level of risk-taking, as higher risk-taking implies increased uncertainty about the firm's future cash flow levels. RISK is used as a proxy for a firm's level of risk-taking.

$$RISK_i = \sqrt{\frac{1}{N-1}\sum_{n=1}^{N}(ROA_{it} - \frac{1}{N}\sum_{n=1}^{N} ROA_{it})^2} /N=3$$

ROA is the ratio of net profit to year-end assets, and we calculate the standard deviation of ROA over time.

At this point we have a model of:

$$RISK_{it} = \alpha_0 + \beta_1 COVID_t + \beta_2 Structure_{it} + \sum Control_{it} + \varepsilon_{it}$$

When $\beta_1 > 0$, it indicates that the level of risk-taking of the firm increases after the outbreak; when $\beta_2 > 0$, it indicates that the higher the capital structure of the firm, the higher the level of risk-taking.

Table 25 Regression table of epidemic, capital structure and business risk

	(1)	(2)	(3)
	m1	m2	m3
VARIABLES	RISK	RISK	RISK
TD	0.0767***		
	(8.89)		
LGTD		0.0401***	
		(3.43)	
SGTD			0.0752***
			(6.68)
COVID	0.0144***	0.0151***	0.0158***
	(6.44)	(6.69)	(7.10)
SIZE	-0.0415***	-0.0460***	-0.0406***
	(-14.68)	(-16.35)	(-14.05)
GRO	0.0035**	0.0040***	0.0036**
	(2.42)	(2.69)	(2.47)
TANG	0.0767***	0.0764***	0.0705***
	(5.75)	(5.69)	(5.27)
NDTS	-0.0391	0.0578	0.0645
	(-0.60)	(0.88)	(1.01)
Constant	0.2339***	0.2942***	0.2476***
	(10.12)	(13.28)	(10.65)
Observations	6,960	6,960	6,960
R-squared	0.072	0.061	0.067
Number of id	1,184	1,184	1,184
Firm FE	Yes	Yes	Yes
F	74.62	62.69	68.52

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table presents results of capital structure, COVID on firm risk in in different life circle period. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The TD variable in column 1 is significant and has a positive coefficient, indicating that an increase in the level of gearing increases the level of risk-taking of the firm. The SGTD variable in column 3 is

significant and has a positive coefficient, indicating that when the short-term debt ratio increases, it increases the level of risk-taking of the firm. This indicates that an increase in the level of corporate indebtedness leads to an increase in the level of corporate risk, which increases the risk of corporate insolvency and affects the sustainability of the company.

At the same time, the COVID variables in columns 1 – 3 are all significant and have positive coefficients, indicating that the level of risk faced by a firm increases following an epidemic. That is, the occurrence of an epidemic also directly increases the level of risk faced by the firm.

The above analysis demonstrates that the occurrence of an epidemic can indeed increase the risk for a company and have a negative impact on its development. At the same time, the level of a company's capital structure can also affect the level of risk faced by a company. Therefore, the research in this paper has important implications for helping enterprises to reduce their risk levels and ensure their stable development.

4.4 Robustness tests

To ensure the integrity of the empirical evidence and the accuracy of the results, this paper will conduct robustness tests in the following ways.

4.4.1 Excluding the UTILITY sector

The research discussed previously in this paper excluded the financial sector, but not the utilities sector. Since many companies in this sector produce public goods and the main objective of these companies is not profit maximisation, the paper excluded this sector and redid the regression results for the sample as follows:

Table 26 Table of robustness tests for the exclusion of the utility sector

VARIABLES	(1) m1 TD	(2) m2 TD	(3) m3 TD	(4) m4 TD	(5) m5 TD	(6) m6 TD
ROA	-0.2013*** (-18.51)			-0.1799*** (-16.05)		
LIQ		-0.0160*** (-18.31)			-0.0154*** (-16.88)	
CF			-0.0997*** (-6.76)			-0.0933*** (-6.18)
COVID_ROA				-0.1163*** (-7.42)		
COVID_LIQ					-0.0025** (-1.98)	
COVID_CF						-0.0412* (-1.94)
SIZE	-0.0414*** (-9.25)	-0.0581*** (-13.38)	-0.0569*** (-12.59)	-0.0400*** (-8.96)	-0.0575*** (-13.22)	-0.0566*** (-12.52)
GRO	0.0079*** (3.52)	0.0051** (2.27)	0.0070*** (3.03)	0.0091*** (4.08)	0.0050** (2.25)	0.0073*** (3.19)
TANG	-0.0539*** (-2.75)	-0.0102 (-0.51)	-0.0707*** (-3.52)	-0.0539*** (-2.76)	-0.0097 (-0.49)	-0.0698*** (-3.47)
NDTS	1.4765*** (14.99)	1.6983*** (17.60)	1.8924*** (19.26)	1.4829*** (15.12)	1.6874*** (17.46)	1.8960*** (19.30)
Constant	0.7886*** (21.96)	0.8895*** (25.27)	0.8924*** (24.53)	0.7808*** (21.84)	0.8897*** (25.28)	0.8918*** (24.52)
Observations	6,914	6,914	6,914	6,914	6,914	6,914
R-squared	0.171	0.170	0.128	0.178	0.170	0.128
Number of id	1,195	1,195	1,195	1,195	1,195	1,195
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F	106.7	106.0	76.03	103.3	97.51	70.04

Notes: This table presents results of ROA, CF, LIQ, COVID on capital structure using sample excluding utility industries. Variables are defined in Table1. Robust t statistics, clustered at the firm level are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

As can be seen at this point the explanatory variables ROA, CF, and LIQ are all significant and negative, as are the epidemic and several explanatory variables, indicating that changing the sample still leads to conclusions consistent with those above.

4.4.2 Shortened sample period

The sample period reflected in the results discussed previously is 2015-2021. This period contains 5

years of data before the epidemic, which may be too long in comparison to the post-pandemic period. To avoid the effect of sample interval selection on the results, the sample was changed to 2017-2021 and the regression results with the new data are as follows:

Table 27 Table of robustness tests for shortened regression years

VARIABLES	(1) m1 TD	(2) m2 TD	(3) m3 TD	(4) m4 TD	(5) m5 TD	(6) m6 TD
ROA	-0.2311*** (-17.61)			-0.2010*** (-14.56)		
LIQ		-0.0166*** (-14.73)			-0.0157*** (-13.05)	
CF			-0.1422*** (-7.98)			-0.1383*** (-7.49)
COVID_ROA				-0.1068*** (-6.68)		
COVID_LIQ					-0.0032** (-2.36)	
COVID_CF						-0.0172** (-2.19)
SIZE	-0.0373*** (-6.01)	-0.0488*** (-7.89)	-0.0519*** (-8.17)	-0.0341*** (-5.50)	-0.0479*** (-7.72)	-0.0517*** (-8.12)
GRO	0.0101*** (3.94)	0.0059** (2.27)	0.0098*** (3.71)	0.0115*** (4.49)	0.0057** (2.19)	0.0100*** (3.76)
TANG	-0.0496* (-1.93)	0.0070 (0.27)	-0.0491* (-1.85)	-0.0512** (-2.00)	0.0062 (0.23)	-0.0488* (-1.84)
NDTS	1.5004*** (13.39)	1.8455*** (16.78)	2.0097*** (18.04)	1.5275*** (13.69)	1.8322*** (16.65)	2.0110*** (18.04)
Constant	0.7665*** (16.16)	0.8214*** (17.24)	0.8506*** (17.46)	0.7469*** (15.80)	0.8208*** (17.24)	0.8496*** (17.43)
Observations	5,220	5,220	5,220	5,220	5,220	5,220
R-squared	0.198	0.181	0.150	0.207	0.182	0.150
Number of id	1,214	1,214	1,214	1,214	1,214	1,214
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F	109.9	97.89	78.17	104.4	88.76	70.41

Notes: This table presents results of ROA, CF, LIQ, and COVID on the capital structure using samples during 2017-2021. Variables are defined in Table 1. Robust t statistics, clustered at the firm level, are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

As can be seen at this point, the explanatory variables ROA, CF, and LIQ are all significant and negative, as are the epidemic and several explanatory variables, indicating that changing the sample still leads to conclusions consistent with those above.

4.4.3 Modification of explanatory variable measurement methods

In this robustness test, the measurement approach for the explanatory variables has been revised. Profitability is now captured by the return on equity (ROE), computed as the ratio of net profit to owner's equity.

Liquidity is assessed using the LIQ1 metric, which represents the ratio of current assets to total assets. CF1 represents cash flow, denoting the ratio of operating cash flow to operating revenue. Subsequently, the regression model was re-estimated, incorporating these adjusted measurement methods for the explanatory variables.

Table 28 Table of robustness test for modified explanatory variable measurement methods

	(1)	(2)	(3)	(4)	(5)	(6)
	m1	m2	m3	m4	m5	m6
VARIABLES	TD	TD	TD	TD	TD	TD
ROE	-0.0018**			0.0089**		
	(-2.16)			(2.39)		
LIQ1		-0.0493**			-0.0299	
		(-2.24)			(-1.34)	
CF1			0.0083***			0.0080***
			(5.30)			(4.90)
COVID_ROE				-0.0350***		
				(-5.49)		
COVID_LIQ1					-0.0689***	
					(-4.74)	
COVID_CF1						-0.0014**
						(-2.15)
SIZE	-0.0591***	-0.0607***	-0.0650***	-0.0595***	-0.0602***	-0.0650***
	(-13.37)	(-13.64)	(-14.89)	(-13.50)	(-13.55)	(-14.88)
GRO	0.0063***	0.0065***	0.0036	0.0069***	0.0067***	0.0036
	(2.82)	(2.94)	(1.63)	(3.11)	(3.00)	(1.60)
TANG	-0.0524***	-0.0199	-0.0533***	-0.0559***	-0.0257	-0.0531***
	(-2.63)	(-0.81)	(-2.70)	(-2.81)	(-1.04)	(-2.69)
NDTS	1.8718***	1.8155***	1.8740***	1.8834***	1.8303***	1.8720***
	(18.97)	(17.80)	(19.06)	(19.13)	(17.97)	(19.03)
Constant	0.8999***	0.9093***	0.9454***	0.9070***	0.9314***	0.9450***
	(24.85)	(25.05)	(26.44)	(25.09)	(25.49)	(26.42)
Observations	7,155	7,155	7,108	7,155	7,155	7,108
R-squared	0.115	0.116	0.130	0.120	0.119	0.130
Number of id	1,235	1,235	1,224	1,235	1,235	1,224
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F	70.11	70.59	79.61	67.09	66.81	73.00

Notes: This table presents results of new metrics of ROA1, CF1, LIQ1, and COVID on the capital structure using samples during 2015-2021. Variables are defined in Table 1. Robust t statistics, clustered at the firm level, are listed in parentheses below the coefficients. ***, **, and * denote statistical significance levels at the 1%, 5%, and 10%, respectively.

The analysis reveals that, under these circumstances, all the modified explanatory variables, namely ROE, CF1, and LIQ1, exhibit statistically significant negative coefficients. Moreover, the pandemic variable, along with other explanatory variables, also demonstrates statistical significance. These findings signify that despite the modifications made to the sample, the study's conclusions remain consistent with those presented earlier.

Taken together, it can be seen that neither changing the sample size, nor changing the regression model, nor modifying the sample interval, changes the significance or direction of the explanatory variables. As this therefore does not change the conclusions in this paper, we can assume that the conclusions listed in this paper are highly robust.

Chapter 5 Conclusion

5.1 Research findings

The survival and growth of an enterprise is inextricably linked to the soundness of its capital structure. If a company's debt financing is large, it will lead to a larger debt burden and even increase the risk of bankruptcy. By contrast, if its debt financing is small, it will lead to a reduction in the effectiveness of debt constraints on the enterprise. This paper therefore focuses on the relationship between corporate profitability, solvency, cash flow levels, and corporate capital structure. This paper also considers the impact of the context of the COVID-19 pandemic. The financial issues faced by firms under the impact of the 2019 COVID-19 pandemic, such as debt levels and capital structure, remain enigmatic and unresolved, and are the focus of research in both theoretical and empirical financial communities. To date, the existing foreign literature has focused on the relationship between the pandemic crisis itself and socio-economic operations, leaving much to be desired in terms of the understanding of the micro-finance governance mechanisms and mechanisms of action, especially in the absence of evidence from the UK market. Therefore, it is of great theoretical significance and practical value to comprehensively explore the impact of the COVID-19 pandemic on the capital structure of listed companies within the specific national conditions and particular market context of the UK.

This paper begins by summarizing the existing, relevant theories of capital structure. This literature review includes a discussion of the early theories of capital structure (net income theory, net operating income theory and traditional trade-off theory) and modern theories of capital structure (MM theory, trade-off theory, agency cost theory, optimal financing theory and stakeholder theory), which together provide a firm theoretical foundation for this paper. Using the 2015-2021 data of UK listed companies as its research object, the paper explores the relationship between profitability, solvency, cash flow level, and corporate capital structure, taking the gearing ratio, short-term debt ratio and long-term debt ratio as indicators of capital structure. This paper takes into account the context of the coronavirus pandemic and investigates the role of the pandemic in the relationship between profitability, solvency, cash flow level and corporate capital structure. The paper also examines the moderating effect of the pandemic on profitability, solvency, cash flow level, and capital structure. In addition, the research investigates the change in capital structure before and after the outbreak. Several control variables were selected to test the hypotheses of this paper through a multiple regression model. The effect of the pandemic on capital structure is further considered in terms of the type of industry and the different life cycle stages of the firm. The conclusions of this paper are as follows:

First, profitability, liquidity, and cash flow are negatively related to the capital structure of a company. Theoretically, internal financing is the priority of a company's financing decisions. Therefore, the higher the profitability of a company, the more likely it is to use its retained earnings to fund itself first, while a company with lower profitability must rely on external financing to obtain funds due to insufficient internal funding. Companies with a high level of liquidity also have a high level of solvency. Companies with a high level of solvency have a fast turnover of funds; the more liquid the company's assets are, the more the working capital of the company can meet the business needs of the company, and the less external financing is required, leading to a reduction in the gearing ratio of the company. Enterprises with a high level of cash flow will tend to use internal funds for financing. Only when the level of cash flow is low, will enterprises engage in external financing. Therefore, the level of cash flow and the capital structure of a company have a negative relationship.

Second, profitability, liquidity levels, and cash flow levels have a greater negative impact on a firm's capital structure after an epidemic than they do before an epidemic. An epidemic changes the impact of corporate profitability on capital structure. Specifically, after an epidemic, the profitability of a firm decreases and subsequent increases in profitability have a greater effect on the reduction in capital structure. The overall level of liquidity decreases, and liquidity plays a greater role in the capital structure of the firm. The degree of influence of cash flow on capital structure also changes; specifically, after an epidemic, the cost of external financing increases and a firm's incentive to use internal cash flow for financing increases (if internal cash flow is sufficient) is greater. Therefore, the degree of influence of cash flow on capital structure becomes greater.

Third, following the COVID-19 outbreak, UK companies' gearing, short-term debt ratios, and long-term debt ratios increased. As the pandemic hit companies and reduces their profits, companies that were severely affected by the pandemic chose external financing methods such as issuing debt and borrowing to increase the company's available funds and compensate for the impact of the pandemic on the company's cash flow, thus increasing the company's gearing ratio. Short-term debt and long-term debt are both important financing tools. After the outbreak, many companies chose to use short-term borrowing and long-term borrowing to hold them over through the crisis. The level of both short-term and long-term debt will increase as a result.

Fourth, financial indicators such as firm size, the proportion of tangible assets, and the non-debt tax shield can positively increase a firm's gearing. The significance of this paper's financial indicators is consistent with previous studies in the literature of this field, indicating that the UK market chosen for this paper is very representative of the overall financial situation in the wake of an epidemic.

Fifth, the impact of the epidemic on capital structure differs depending on the industry. Specifically, the pandemic had a smaller impact on capital structure for manufacturing companies. For retail and transportation companies, the pandemic had a larger, more positive impact on their capital structure. The impact of the pandemic on different sectors varies. For transport companies, the COVID-19 outbreak led to a blockade and a reduction in travel demand, so the transport sector was more negatively impacted than other sectors. For retail companies, the pandemic reduced the number of people going out to shop and the revenue of the retail sector decreased significantly as a result. Both the transport and retail sectors are service industries; by contrast, the manufacturing sector is generally a real economy with more fixed assets. When an epidemic hits, strong assets can help companies to support their operations for a period, so they are less affected by an epidemic.

Sixth, from a life cycle perspective, the impact of the pandemic on capital structure was greater for companies in the growth and recession periods. The pandemic has had the smallest impact on capital indebtedness for mature firms. Firms in the mature stage have greater resilience to risk, but they are more vulnerable to shocks from the external environment during growth and recession periods, so the pandemic had a greater impact on them.

This study uses the economic shock following the COVID-19 crises as a natural experiment, so the research ideas and methods used herein are also applicable to examining corporate capital structure and leverage under any external shock. In addition, the results of this research are also informative for listed companies themselves and even their management in recognizing and responding to epidemic shocks, maintaining operational stability, and preventing financial and fiscal risks.

The research in this paper shows that although major public health events such as epidemics and other crises are inevitable, companies can build their capacity to mitigate the impact of epidemics on their capital structure and risk. In terms of profitability, companies can reduce costs and increase profits by reducing redundancies and optimizing remuneration systems. In terms of cash flow, companies need to have sufficient cash flow on hand to avoid any unexpected crises. Finally, in terms of liquidity, companies can increase their level of liquidity by choosing more current liabilities over long-term liabilities when raising debt. The development of profitability, cash flow levels, and liquidity levels can all help a company to better withstand a crisis.

In terms of the impact of the nature of its industry on the enterprise, many industries such as transportation and retail are new industries with high earnings and fast development, but they have no asset base and low risk resistance. In areas that were most impacted by the COVID-19 pandemic, many retail compa-

nies were forced to close due to lower demand. Enterprises should diversify their operations in the development process and avoid investing their assets in just one industry. The state should also pay attention to safeguarding the primary position of the manufacturing industry and promote its continued high-quality development.

In terms of the life cycle of a company, mature companies were less affected by the pandemic, which suggests that companies should be aware of their stage of development in their day-to-day business activities, and should select different capital structure measurements according to the different stages of development they are in. An increase in gearing can help enterprises to weather a short-term crisis to a certain extent, but it can also have an impact on their risk and sustainability in the long term. Enterprises can choose debt financing to help them survive in the short term, but they must be careful to choose the appropriate degree of debt financing in order to avoid the negative effects of the overuse of debt instruments.

5.2 Research recommendations

As the pandemic has become the new normal and continues to spread in various countries, it is crucial for the economic development of companies and countries to properly respond to the crisis brought about by the pandemic and for each company to maintain the right level of capital structure. Based on this, this paper makes the following recommendations:

First, strengthen the company's management and increase the proportion of equity financing. Generally speaking, an enterprise needs debt financing to support its current business and requires equity financing for future growth opportunities. Moreover, enterprises with more future growth opportunities should try to replace short-term liabilities with long-term debt financing, so that the financing structure is in line with the theory of the maturity structure of liabilities. Therefore, UK-listed companies should continuously strengthen their own management, improve their corporate governance structure and information disclosure system, and increase the proportion of equity financing to make their financing structure more rational.

Second, different financing methods should be adopted based on the characteristics of different industries. This is because the capital structure of listed companies in different industries varies greatly. The factors that significantly affect their capital structure significantly will also vary accordingly. Enterprise managers should adjust the capital structure of the enterprise according to the specific situation of the industry they are in, considering this factor in combination with the life cycle stage of the enterprise's development, its operating characteristics, and other industry characteristics, in order to achieve the optimal capital structure for their firm's specific situation.

Third, managers and business leaders should pay attention to the different stages of the economic cycle and its impact on their business. Managers need to rationalize the capital structure of their business according to the recovery, boom, and recession phases of the economic cycle. During the recovery and boom phases, the economy develops rapidly, market demand is strong, enterprises' profitability is enhanced, and high profits are common. In recession and depression phases, market demand decreases and the whole market economy is in the doldrums, so most enterprises cannot sustain their production and operation. In these phases, businesses often fall into financial difficulties and may face the risk of bankruptcy, so they should try to reduce their total proportion of debt to reduce financial risks.

Fourth, to prevent and control epidemics and assist business operations.

In the face of the onslaught of the coronavirus pandemic, the economies of various countries have been significantly impacted by the pandemic, with production shutting down in many places. This economic situation is continuing to occur and still deserves attention. The UK should contain the localized outbreak as soon as possible to safeguard the economy. At the same time, the government should, depending on the extent to which the epidemic is under control, support enterprises in resuming production as soon as it is feasible and appropriate, and continue to examine the resumption of production and work to provide assistance to stricken enterprises and maintain their normal operation.

5.3 Research outlook

Due to various objective constraints, this paper suffers from a series of shortcomings.

First, the research is limited by the data available. When conducting the empirical analysis, the three factors that may affect the capital structure of firms were mainly selected as explanatory variables and four factors were selected as control variables. Other factors, such as industry competitiveness, capital market effectiveness, and credit level, could not be objectively quantified or the relevant data was not readily available. Therefore, these factors were included in the empirical analysis. This may have an impact on the ultimate explanatory power of the model and the accuracy of the conclusions. At the same time, there are many other macro-influencing factors, and future articles could conduct more in-depth research in this area. Market leverage as an additional measure would enhance the comprehensiveness of the analysis. However, due to the data limitations mentioned above, it is impossible to include a measure of market leverage in the current study. To address these limitations and provide a more comprehensive understanding, future research could delve deeper into exploring the influence of market leverage and incorporate additional macro-influencing factors. This would enable a more holistic analysis of the determinants of capital structure and enhance the robustness of the findings.

Second, this paper has only examined the moderating effect of the pandemic on profitability, liquidity levels, cash flow levels, and corporate capital structure, and the impact of the pandemic on corporate capital structure. It does not examine in depth the underlying reasons why the epidemic has had an impact on capital structure. In future research, the deeper reasons for the impact of the pandemic on capital structure can be explored further.

Third, this paper has only explored the impact of the pandemic on enterprises from the perspective of capital structure up to this point. For listed companies, the pandemic will not only change the capital structure but also alters the firms' operational conduct and executive behavior and impacts on research and development (R&D) investment on capital structure in the UK market. In future research, it would be beneficial to investigate separately the impact of the pandemic on executive behavior and corporate research and development (R&D) activities, further examining the repercussions imposed on companies by the outbreak.

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Appendix-Glossary of terms

Term	Definition
Life Cycle	Life cycle refers to the distinct stages of growth that a company undergoes, including the startup phase, growth phase, maturity phase, and decline phase
Capital Structure	Capital structure refers to the specific mix of debt and equity used to finance a company's assets and operations.
Business Risk	Business risk refers to the potential for financial loss or uncertainty faced by a company. It is often measured by the variability of a company's earnings, such as the standard deviation of ROA. Higher variability indicates greater business risk.