Aalborg University Business School

Financial Distress and Capital Structure Adjustment: Evidence from Denmark and Sweden

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Characters

81,592 Strokes

Abstract

The thesis aims to understand how loss-making firms adjust their capital structure compared to consistently profitable firms. This thesis use evidence from publicly listed firms in Denmark and Sweden from the year of 2010 to 2025. It explores whether periods of negative net income push firm to increase or decrease leverage along with some other firm specific characteristics; such as, firm size, profitability, tangibility, business risk and a macro level volatility like Covid-19 shock. Around 6,000 firm-year observation were used to identify the key determinants of leverage decision. The empirical findings reveal that loss-making firms significantly increase their debt levels while firm size and asset tangibility are also positively associated with leverage, consistent with the trade-off theory. In contrast, business risk and the COVID-19 shock have limited explanatory power. The subset results also verify the main findings. Overall, the firm-specific characteristics' dominant role in shaping leverage decision give insights to investors, managers, and regulators aiming to understand the determinants of leverage in Nordic context.

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Contents

1. Introduction

Capital structure decisions are core to corporate finance. The mix of debt and equity financing affects firms' cost of capital, financial flexibility, and ultimately shareholder's value. Vast literature has been examined to find out the determinants of leverage. This literature primarily focused on firm-specific factors such as profitability, firm size, asset tangibility, and business risk, as well as the impact of macroeconomic shocks. However, much less attention has been paid to how firms behave when they experience persistent financial distress like consecutive years of negative net income. My thesis aims to understand whether firms adjust their capital structure differently in periods of losses particularly in the Nordic context. The focus is to understand whether a firm's capital structure decisions are affected by negative net income and, if so, in which direction the effect occurs. Sweden and Denmark host a diverse range of industries, including financial institutions, pharmaceutical, manufacturing and have faced significant disruptions during the COVID-19 crisis.

This thesis investigates how listed firms in Denmark, Sweden adjust their leverage following periods of negative net income. Specifically, it examines in loss years how firm react, do they increase or decrease their reliance on debt compared to firms that remain consistently profitable. The thesis also considers whether leverage is influenced by firm characteristics such as size, tangibility of assets, and business risk, profitability as well as external shocks like the COVID-19 pandemic.

The study makes three contributions to capital structure literature. First, it focuses explicitly on the behavior of loss-making firms. Loss making firm is a subset which is often excluded or aggregated in prior research. By comparing loss years with profitable years, the analysis provides insights into whether financial distress influence precautionary deleveraging or it creates a reliance on external debt due to liquidity needs. Second, the research covers two small but advanced open economies with developed capital markets, Sweden and Denmark where firm financing choices are shaped by both European integration and national institutional frameworks. Third, this analysis incorporates the COVID-19 pandemic as a natural experiment, it captures how an exogenous shock influenced firms' capital structure adjustments.

While capital structure determinants have been widely studied, the majority of research has focused on firms in developed economies under normal profitability conditions. Firms experiencing consecutive years of losses are often overlooked or grouped together with profit-making firms. Those firms usually face very different financing constraints. Loss-making firms may find it harder to issue equity, or they find it difficult to turn to debt to cover liquidity needs or reduce debt to avoid distress.

This gap is particularly relevant in the Nordic context (Denmark and Sweden), which is relatively underexplored compared to the US, UK, or major European economies. The COVID-19 pandemic added an unprecedented external shock. To enrich the analysis, this study also includes 20 top listed companies from Bangladesh, providing a contrast between developed and emerging markets. This allows us to capture whether any change in leverage in loss years follows similar patterns in different institutional environments. By examining other factors, this analysis tried to figure out whether financing behavior diverges sharply between advanced and developing economies.

The dataset comprises an annual unbalanced panel of 454 publicly listed firms (including financial institutions) over the period 2010–2025. The variables are constructed from Factset. The empirical analysis applies to panel data econometrics, using fixed specifications to test the relationship between leverage and key firm and macro-level determinants.

1.1 Research Questions

RQ1: *Do firms adjust their capital structure differently after experiencing consecutive years of negative net income compared to consistently profitable firms in Denmark and Sweden?*

Sub RQ2: *How do firm-specific characteristics—such as size, asset tangibility, business risk and profitability—influence leverage decisions across the markets?*

Sub RQ3: *Did the COVID-19 pandemic alter the capital structure behavior of firms in Denmark and Sweden?*

1.2 Hypothesis:

To find out the determinants of firm's capital structure decision, primary focus is on the effect of financial distress (loss-making behavior) on leverage adjustment. The hypotheses are grouped into two categories, one is main explanatory hypotheses, and another one is control-variable hypotheses. Two control variables are included in regression to *control for its influence* on the dependent variable.

1.2.1 Main Hypothesis

H1: *Firms with negative net income adjust their leverage more aggressively than consistently profitable firms.*

This is the main hypothesis of the study. It proposes that financially distressed firms, reporting negative net income, are more likely to alter their capital structure decision. Loss-making firms may increase borrowing to sustain operations or manage liquidity pressures.

1.2.2 Sub-Hypotheses (Firm-Level Determinants)

H2: *Firm size is positively associated with the level of borrowing, with larger firms relying more on leverage than smaller firms.*

H3: *Firms with higher tangible assets rely more on long-term debt than firms with lower tangible assets.*

H4: *More profitable firms use less debt financing compared to less profitable firms.*

1.2.3 Control Variables

To isolate the effects of the main explanatory variables, one additional firm-level and macroeconomic factors are incorporated as control variables:

- *Firms with higher business risk maintain lower leverage compared to firms with lower business risk.*

- *During the COVID-19 period (2020–2022), firms increased their leverage compared to the pre-COVID period.*

2. Literature Review

Memon, Tauni, and co-authors (2018) examine the effect of cash flow volatility on capital structure decisions using a large sample of Chinese listed firms. They find that higher volatility of operating cash flows is associated with significantly lower leverage. They carried on their studies on non-state-owned enterprises, since state-owned enterprises remain largely unaffected due to government backing. This finding includes firms experiencing greater volatility prefer debt of shorter maturities, reflecting attempts to reduce bankruptcy risk and financial distress costs. These findings support the trade-off theory. This study highlights how uncertainty in firm performance shapes leverage adjustments. This provides relevant evidence for my study that firms facing unstable or negative performance, such as loss-making years tends to reduce leverage or shift to safer debt structures.

Keefe and Nguyen (2023) investigate how cash flow volatility influences firms' debt maturity choices and their likelihood of maintaining zero-debt policies, using a large international dataset of 206,445

firm-year observations across 42 countries. The study finds that greater volatility reduces the probability of using long-term debt. Greater volatility increases the probability of relying on short-term debt or often relying on zero-debt policy. Specifically, a one standard deviation increase in cash flow volatility decreases the likelihood of the use of long-term debt by 2.57%. This increase in standard deviation also raises the probability of the use of short-term debt by 5.83% and increases the probability of zero-debt firms by 11.8%. These results are consistent with the screening and trade-off theories, which suggest that volatile firms are screened out of long-term credit markets and face higher costs of financial distress. This study is relevant because it highlights how financial instability pushes firms toward conservative financing strategies. It also supports the expectation that loss-making Nordic firms may also alter leverage and avoid long-term debt in the following period of consecutive negative net income.

Elfeituri and Alfitouri (2025) analyze the effects of working capital management and the COVID-19 pandemic on the profitability of UK retail firms using panel data from 27 companies between 2001 and 2022. Their results show that key working capital variables like longer inventory turnover days, receivables collection periods, and payables turnover days can significantly reduce profitability. On the other hand, excessive liquidity which is measured by the current ratio is negatively associated with financial performance. In contrast, high leverage (debt-to-equity ratio) eat away profitability due to higher financial risks and interest costs. Important thing to notice here is that the study confirms that the COVID-19 pandemic had a strong negative impact on firm's performance. This research is relevant to my thesis because it highlights how external shocks and poor financial structures amplify losses. This study supports the expectation that Nordic firms who are experiencing consecutive years of negative income may also cut leverage or restructure debt during crisis period to mitigate the loss.

Alabdulkarim, Kalyanaraman, and Alhussayen (2024) investigate how firm size influences the relationship between leverage and firm's performance in Saudi Arabia. Using a panel threshold regression model on 70 listed non-financial firms from 2010 to 2019, they find a nonlinear relationship where leverage negatively affects performance across both small and large firms. The negative impact of leverage is much stronger among small firms, especially engaging in long-term debt. The Saudi context is unique due to the fact that the Saudi capital market is characterized by an underdeveloped bond market and minimal tax advantages due to the zakat system. It minimizes the potential benefit of leverage. The study highlights that firm size plays a critical moderate role meaning larger firms are able to absorb debt costs because of their collateral base and market access, while smaller firms face heightened bankruptcy risks and performance deterioration under leverage. For my

thesis, this study is highly relevant because it shows how firm size shapes capital structure adjustments, directly addressing my sub-question on whether large and small Nordic firms respond differently to consecutive years of losses.

Gopalakrishnan, Jacob, and Mohapatra (2022) study how the COVID-19 pandemic reshaped firms' debt financing behavior using data from 61 countries and nearly 26,000 firm-quarter observations. They find that during the early pandemic quarters of 2020, the propensity to raise debt financing increased by around 2% points, with a particularly strong rise in bond issuance compared to syndicated loans. Firms in countries with stricter lockdowns were more likely to seek debt. It reflects heightened liquidity needs. Industry type also played a major role in the requirement of debt. For instance, requiring high physical presence reduced borrowing. Sector like those with intensive customer interaction raised more debt despite facing higher costs. Moreover, managerial sentiment strongly influenced financing decisions. Firms with positive outlooks issued more debt for investment opportunities, while those with negative sentiment borrowed mainly for precautionary motives. The study highlights that external shocks like COVID-19 push firms to adjust their financing structure in heterogeneous ways. This article is directly appropriate for my thesis because it shows how crisis conditions alter debt behavior. Nordic firms also faced negative net income during turbulent periods also responded differently.

Sihombing, Lestari, Erlina, and Muda (2025) provide a literature-based synthesis on how profitability, firm size, and capital structure affect firm value in the manufacturing sector. Drawing on findings from multiple empirical studies, they conclude that profitability—measured through ROA or ROE—generally has a strong positive impact on firm value, as profitable firms are more attractive to investors. Capital structure also plays a crucial role: moderate debt enhances value via tax shields, but excessive leverage raises financial risk and may reduce firm value. Firm size shows mixed results, with some studies finding a positive association due to economies of scale and investor confidence, while others reveal negative or insignificant effects due to complexity and inefficiency in large firms. Importantly, the review highlights that capital structure often acts as a mediating variable between profitability, firm size, and firm value. For my thesis, this article is particularly useful because it emphasizes the nuanced and sometimes contradictory ways in which profitability, leverage, and firm size interact—mirroring my own focus on how loss-making firms in Denmark and Sweden may restructure their capital after poor performance.

2.1 Synthesis of theory and identification of literature gap

The reviewed literature highlights how different theories of capital structure like trade-off theory, pecking order theory show different prediction on firm's financial choices. The trade-off theory emphasizes that firm balance their tax advantages under financial distress and bankruptcy cost (Kraus and Litzenberger, 1973). On the other hand, pecking order theory (Myers and Majluf, 1984), argue that information asymmetry leads firms to use internal funds before going for external borrowing. These theories imply that firm's financial choices can vary depending on firm-specific factors, managerial decisions and macroeconomic shocks. Keefe and Nguyen (2023) find that higher cash-flow volatility decreases the likelihood of long-term debt and increases the probability of maintaining zero-debt policies, reflecting screening and risk-avoidance behavior. This theoretical expectation is supported at times, and other times, firm behave inconsistently. Most studies focus on developed and big economics, ignores the region of Nordic countries. Also, loss-making firm are sometimes aggregated with profitable firms, that does not purely reflect how negative income affects leverage choices. Few studies distinguish between short-term and long-term debt responses to financial distress, even though these forms of leverage serve different purposes. This thesis addresses these gaps by examining whether firms with negative net income in Denmark and Sweden adjust their capital structure differently from profitable firms and by separating short-term and long-term debt to identify the sources of leverage adjustments.

By incorporating theoretical perspectives and cross-county empirical evidence, this study contributes to a more deeper understanding on how financial distress and other firm specific factors jointly shape corporate financing behavior.

However, most studies focus on large emerging markets or global multi-country datasets. Very few explicitly examine Nordic firms, especially those experiencing consecutive years of negative net income. My study addresses this gap by analyzing how Danish and Swedish listed firms adjust their capital structures after loss-making periods Also, whether there is any relation between firm size, tangibility, and the COVID-19 shock and leverage.

3. Methodology:

3.1 Methodological Framework and Data

This chapter outlines the methodological framework and empirical foundation of this study. Later, the data collection process and data preparation process are discussed. Then, the overall research design and the structure of unbalanced panel dataset were presented.

The subsequent sections document the construction of dataset. It includes the selection of sample firms, data collection sources, screening procedures and definitions of variables. Special attention was given to the creation of dummy variables such as Loss_Dummy and COVID_Dummy.

The final dataset consists of firm-level financial information for publicly listed companies in Denmark, Sweden, and Bangladesh over the period 2010–2025. Key variables include leverage, profitability, firm size, tangibility, and business risk. Later I discussed how leverage, profitability, firm size, tangibility, business risk was calculated from Total Asset, Total long-term debt, Revenue, PPE, EBIT. This dataset is structured to facilitate regression analysis, incorporating both firm and time effect. It is designed to give insights into the determinants of capital structure across different institutional and economic contexts.

3.2 Empirical Design

This study's empirical design consists of two key components. First, a panel data methodology is employed to examine the determinants of firms' capital structure across different countries and over time. A large number of firm-year observations are included in the unbalanced panel framework accounting for both firm-specific and time-specific effects.

Secondly, fixed effects and random effects specifications are estimated to capture the role of firm-level characteristics such as profitability, size, tangibility, growth opportunities, and business risk. Dummy variables are included to capture the impact of negative profitability (*Loss_Dummy*) and the systemic shock of the COVID-19 pandemic (*COVID_Dummy*). Later Robust standard errors test is applied to ensure valid inference in the presence of heteroskedasticity.

To test the robustness of the results, additional analyses are performed by (i) excluding financial firms, (ii) splitting the sample into short-term and long-term debt components, and (iii) country-specific effects.

3.3 Panel Data Structure

The empirical analysis is conducted within a panel data framework, which combines both cross-sectional and time-series dimensions by observing multiple firms across multiple years. Panel data consist of repeated firm-level observations over time, thereby allowing for the examination of both within-firm dynamics and between-firm differences (Wooldridge, 2010). This structure allows the study to capture not only differences between firms but also how individual firms change from year to year.

A key advantage of panel data lies in its ability to control for unobserved heterogeneity through fixed effects. This study employs a two-way fixed effects specification, including firm fixed effects and year fixed effects. Firm fixed effects capture all time-invariant firm characteristics—such as industry affiliation, ownership structure, or managerial practices—by removing their influence from the estimation. This reduces omitted variable bias stemming from persistent differences across firms. Year fixed effects, in turn, account for shocks or conditions common to all firms in a given year, including global financial conditions, regional macroeconomic cycles, or regulatory changes.

Together, these fixed effects help to remove two major sources of bias; one is differences between firms that don't change over time and another is shocks that affect all firms in a given year. As a result, the analysis focuses on how leverage changes within each firm over time. This makes it possible to identify the true relationship between leverage and firm characteristics more accurately.

3.4 Data preparation

This study focuses on publicly listed firms in Denmark, Sweden as these countries represent two of the most mature Nordic capital markets with reliable availability of financial data. Their inclusion allows for analysis of firms operating in economies with similar institutional settings but differing in size and industrial distribution. In addition, a comparative extension is made by incorporating 20 of the largest firms in Bangladesh, which represents a developing economy context.

Unlike some prior studies, this analysis does not exclude financial organizations such as banks, insurance companies, and investment firms. The inclusion of financial institutions is motivated by two considerations. First, they represent a significant share of the listed sectors in the selected countries and thus provide a more comprehensive view of corporate leverage. Among 454 firms, 25 firms from Denmark and 42 firms from Sweden belongs to financial sector. Secondly, including

financials increases sample size and improves precision for economy-level estimates. Then the sample has been narrowed down to non-financials in robustness checks.

The dataset for this study was collected primarily from Factset, which provides standardized financial statement data for publicly listed firms. The sample consists of 117 Danish firms and 338 Swedish firms listed between 2010 and 2025, supplemented by 20 of the largest Bangladeshi companies to provide a qualitative comparison from a developing economy. Altogether, this yields a panel of approximately 454 firms over 15 years, resulting in more than 5,983 firm–year observations before filtering.

During the data cleaning stage, several steps were undertaken to ensure consistency and comparability.

Types of firms – All firms from Copenhagen stock exchange (CSE) and Stockholm Stock Exchange (SE) have been taken in this panel data including banks, insurance companies, and other financial institutions.

Handling missing values – In cases where critical variables such as total assets, debt, or net income were missing for a given year, the observation was dropped. If smaller gaps existed (e.g., one missing year in a continuous series), the firm was retained to preserve panel balance.

Currency conversion – Danish firms reporting in DKK and Swedish firms in SEK were converted into a common reporting base of EUR, using December 31 exchange rates from DKK to EUR and SEK to EUR for each year. Bangladeshi companies B/S and I/S was downloaded in EUR rate. This step ensured comparability across countries and over time. All monetary items were rescaled to millions to ensure unit consistency across variables.

Scaling of variables – Firm size was taken by logarithm of total asset. Leverage ratios (total debt / total assets) were directly computed from collected data, while business risk was measured using the standard deviation of EBIT/total assets over the sample period for each firm.

The panel was sorted by Firm_id then Year and exported as CSV for analysis in R.

The reason behind including only top 20 firms in Bangladesh is that the capital market is relatively small and less liquid. There are fewer firms who report consistently and who are transparent about the data. Larger firms were prioritized because they are more likely to provide accurate disclosures, maintain access to debt and equity markets, and exhibit stable financial structures.

After applying these filters and transformations, the final sample consisted of 92 Swedish firms and 25 Danish firms with at least one year of negative net income, along with the 2 Bangladeshi companies. This dataset forms the basis for the regression analysis of capital structure adjustments following periods of losses.

3.5 Financial Data construction

-The dependent variable in this study is Leverage, defined as the ratio of total debt to total assets, where total debt is the sum of short-term debt & current portion of long-term debt and long-term debt. This ratio measures the extent to which a firm is financed through debt relative to its total asset.

-The first independent variable is the Loss Dummy, which equals 1 if a firm reports negative net income in a given year and 0 otherwise. This indicator captures whether loss-making firms behave differently from profitable ones in terms of leverage.

-Firm Size is measured as the natural logarithm of total assets. Larger firms are generally expected to carry more debt due to diversification. They have better access to credit markets, and lower perceived default risk.

-The COVID Dummy takes the value 1 for the years 2020–2022 and 0 otherwise. This variable 1 isolates the potential impact of the pandemic as an exogenous shock to financing decisions.

-Business Risk is measured as the volatility of operating earnings, calculated as the coefficient of variation of EBIT (standard deviation divided by mean EBIT) for each firm over the sample period. Firms with higher earnings volatility are expected to carry less debt due to higher default risk.

-Tangibility is defined as the ratio of property, plant, and equipment (PPE) to total assets. Tangible assets can serve as collateral, which typically supports higher borrowing capacity.

-Profitability is measured as EBIT divided by total assets. This ratio indicates the efficiency of operations and internal funding capacity, with more profitable firms often relying less on external debt.

Covid_Dummy:

To capture the potential impact of the COVID-19 pandemic on firms' capital structure decisions, a binary variable was constructed from the fiscal year observations. Using a dedicated coding procedure (Appendix F), a dummy was assigned to each firm-year. The value was set to one if the observation

fell within the COVID-19 period (2020–2021), and zero otherwise. The final specification of the variable is as follows:

$COVID\_Dummy_{it} = f(X) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ *1, if firm i observation lies within the COVID-19 period (2020–2021)*
0, otherwise

This dummy variable serves as the primary exogenous shock indicator in the regression framework, capturing the systemic disruptions caused by the pandemic.

Loss_Dummy:
To capture the effect of negative profitability on leverage, a binary variable was derived from the net income field. Using firm-level accounting data, a dummy was assigned to each firm-year observation. The value was set to one if the firm reported a negative net income in year t, and zero otherwise. The final specification of the variable is as follows:

$Loss\_Dummy_{it} = f(x) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$, 1, *if firm i reports negative net income in year t*

0, *otherwise*

This dummy variable isolates the role of financial distress by distinguishing loss-making firms from profitable ones.

3.6 Sample Selection and Screening

Unlike some prior studies, this analysis does not exclude financial organizations such as banks, insurance companies, and investment firms. The inclusion of financial institutions is motivated by two considerations. First, they represent a significant share of the listed sectors in the selected countries and thus provide a more comprehensive view of corporate leverage. Second, excluding them would have substantially reduced the number of available firms, particularly in the Bangladeshi sample, where the financial sector constitutes a core segment of the stock market.

The final dataset consists of 454 firms, covering 5,983 firm-year observations. Specifically, the sample includes approximately 150 Danish firms, 360 Swedish firms, and 20 Bangladeshi firms. For Denmark and Sweden, the inclusion of a broad set of listed firms allows for robust comparisons within developed economies.

Regression Model Specification:

Baseline model, the core regression model:

$Leverage_{it} = \beta_0 + \beta_1 * LossDummy_{it} + \beta_2 * Covid\_year_{it} + \beta_3 * Firm\ Size_{it} + \beta_4 * Tangibility_{it} + \beta_5 * Profitability_{it} + \beta_6 * Business\ Risk_{it} + U_{it}$

Where:

B_0 is the intercept term, β1, β2, β3, β4, β5, β6, are the coefficient to be estimated. μ is the error term for firm *i* at time *t.*

$Leverage_{it}$ = leverage of firm *i* at time *t*.

$Loss\_Dummy_{it}$ = dummy variable equal to 1 if firm *i* reports negative net income in year *t*, 0 otherwise.

$COVID\_Dummy_{it}$ = dummy variable equal to 1 for the pandemic years (2020–2021), 0 otherwise.

$FirmSize_{it}$ = firm size firm *i* at time *t*

$Profitability_{it}$ = Profitability of firm *i* at time *t*

$Tangibility_{it}$= tangibility of firm *i* at time *t.*

$BusinessRisk_{it}$ = business risk firm *i* at time *t, business risk is constant throughout the firm-year observation.*

μ_i = firm-specific fixed effects, controlling for unobserved, time-invariant heterogeneity.

λ_t= year fixed effects, capturing macroeconomic shocks and global events.

ε_{it}= idiosyncratic error term.

3.7 Multicollinearity:

Multicollinearity arises when the independent variables are highly correlated. To assess the presence of multicollinearity among the extraordinary variables, Variance Inflation Factors (VIF) test was implemented. If multicollinearity is present among the explanatory variables, it can inflate standard errors and reduce the reliability of coefficient estimates. A VIF value exceeding 10 is typically considered evidence of problematic multicollinearity (Wooldridge, 2010). The reason to include this diagnostic is to ensure that the explanatory variables contribute independently to the analysis and estimated coefficients are reliable.

3.8 Hausman Test:

In this thesis, we have applied the Hausman test (Hausman, 1978) to determine the appropriate panel data specification. This test checks whether fixed effects or random effects model is more appropriate in the observed panel data. The null hypothesis states that the RE estimator is consistent and efficient, implying no correlation between the explanatory variables and the unobserved firm-specific effects. The alternative hypothesis suggests that there is correlation between the explanatory variables and unobserved firm-specific factors and thus RE is inconsistent. In that case, FE model is preferred.

3.9 Heteroskedasticity and Breusch–Pagan Test

A key assumption of the classical linear regression model is homoskedasticity. Homoskedasticity means that the variance of the error term is constant across all observation. Heteroskedasticity arises when the variance of residuals differs systematically. This can lead to inefficient estimates and biased standard errors.

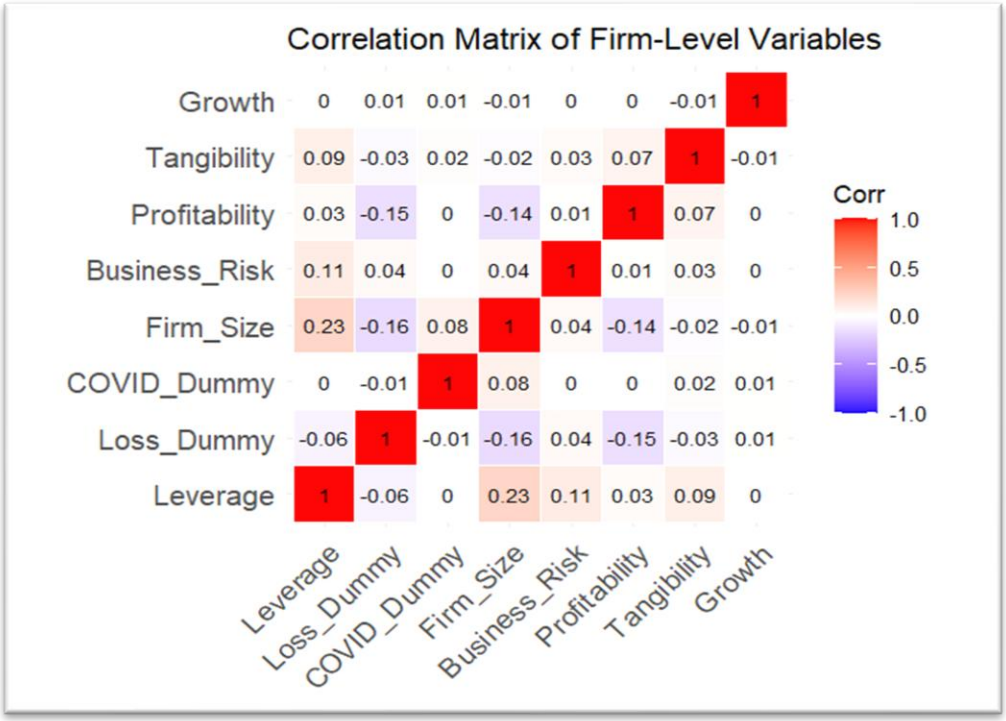
Breusch–Pagan (BP) test (Breusch & Pagan, 1979) was applied to detect the presence of heteroskedasticity. The null hypothesis of the BP test states that the error variance is constant, while the alternative hypothesis states that residuals are inconsistent across the observation.

4. *Empirical Analysis*

4.1 Variable Analysis

4.1.1 Correlation Matrix

Figure1: Correlation Matrix of key variables



Note: This figure presents the Pearson correlation coefficients among the main explanatory and control variables used in the regression analysis. Strong positive correlations are represented by values close to 1 and darker shades, while weaker or negative relationships are shown by lighter or cooler colors. The matrix provides an overview of the linear relationships between leverage, firm size, profitability, tangibility, business risk, and the COVID-19 dummy.

Correlation Analysis

The correlation analysis is based on a total of 474 firms, including the Bangladeshi firms in the sample. However, the regression analysis later uses 454 firms excluding Bangladeshi firms as this subsample is too small to draw a reliable conclusion. This descriptive correlation matrix provides an initial overview of the relationships among the main variables before the regression analysis. The correlation[1] results indicate that Firm Size has the strongest positive association with Leverage (0.23),

[1] Correlation coefficients are the statistical value between -1 to +1 where values closer to +1 indicate a strong positive linear relationship, values closer to –1 indicate a strong negative relationship, and values near 0 suggest little or no linear association.

inconsistent with the trade-off theory that where it argues that financial distress reduces the optimal debt. There are weak and positive relationships between Leverage and Business Risk (0.11) as well as Leverage and Tangibility (0.09), suggesting that riskier firms and those with more collateralizable assets are slightly more leveraged. In contrast, Profitability shows only a negligible positive correlation (0.0245).

On the other hand, Growth opportunities are negatively related to Leverage (-0.0029). The Loss_Dummy is negatively correlated (-0.0670), implying that loss-making firms avoid debt, while the COVID_Dummy shows almost no relationship with Leverage (0.0043).

There is less than 0.2 correlation between independent variables. Overall, the relatively low correlation among variables indicates that multicollinearity is not a issue here.

4.1.2 Descriptive Statistics

Table 1: Descriptive statistics of key variables and control variables

	Leverage	Loss_ Dummy	COVID _Dummy	Firm_ Size	Businss_ Risk	Profitability	Tangibility
Mean	0.332542	0.223054	0.22385	5.530188	0.4312	4.858239	0.150034
Standard Error	0.003898	0.005253	0.00526	0.027381	0.058932	0.687028	0.002581
Median	0.2834	0	0	5.5579	0.543	0.0574	0.06575
Mode	0	0	0	5.2325	0.5728	0	0
Standard Deviation	0.308936	0.416327	0.416856	2.169984	4.670497	54.44888	0.204341
Sample Variance	0.095441	0.173328	0.173769	4.70883	21.81354	2964.68	0.041755
Kurtosis[2]	93.2572	-0.22891	-0.24355	-0.11891	74.9039	345.4022	3.554053
Skewness[3]	5.181674	1.33085	1.325342	-0.02027	-1.53938	-10.8715	1.967133

Note: The descriptive statistics[4] summarize the dataset, which comprises all publicly traded firms in Denmark and Sweden, along with 20 companies from Bangladesh, covering a 15-year period. All financial values are expressed in euros for consistency and comparability. ***Leverage*** *exhibits a mean of 0.33 and a median of 0.28, indicating that firms typically finance around one-third of their capital structure with debt.*

Table 1 represents the descriptive statistics for all variables used in the regression analysis. The average leverage ratio is 0.33 and standard deviation is 0.31. It indicates moderate variation across firms. The high kurtosis value (93.26) and positive skewness (5.18) suggest that the leverage

[2] Kurtosis shows how "peaked" or "flat" the data distribution is compared to a normal (bell-shaped) curve. High kurtosis means the data have more extreme values (outliers) than normal, while low kurtosis means the data are more evenly spread and less extreme.

[3] Skewness tells us whether the data are more stretched out on one side than the other. If a variable has positive skewness, it means there are a few very high values pulling the average up. If it has negative skewness, there are a few very low values pulling the average down.

[4] Descriptive Statistics shows the average values, variation, and distribution of the main economic variable.

distribution is heavily right-skewed. It means that while most firms maintain moderate debt levels, a small number have extremely high leverage.

The Loss_Dummy and COVID_Dummy both have mean values around 0.22, implying that about 22% of firm-year observations report losses or fall within the COVID-19 period. Firm Size has a mean of 5.53 and displays very low skewness (–0.02) and kurtosis (–0.12), suggesting that the variable is approximately normally distributed. The average Business Risk is 0.43, but its high standard deviation (4.67) and strong kurtosis (74.90). It means that few companies show extremely volatile earnings. Profitability shows a mean of 4.86, but the standard deviation (54.45), negative skewness (–10.87), and very high kurtosis (345.40) suggest a highly non-normal distribution. It shows that few firms with exceptionally large profits or losses. Finally, Tangibility averages 0.15 with a low standard deviation (0.20), showing little variation across firms.

Overall, the descriptive statistics highlight the heterogeneous nature of the dataset. While variables such as firm size remain relatively stable, others such as profitability and leverage, are heavily skewed with long tails. These descriptive results provide the foundation for the regression analysis presented in the following section, where the determinants of firms' capital structure are examined in greater detail. The following section presents the baseline panel regression results using firm fixed effects.

4.2 Regression Result

4.2.1 Panel Regressions with Firm Fixed Effects

Table 2: Significant Firm Fixed Effects Regression

Variable	Coefficient[5] (β)	Std. Error[6]	t-value	p-value[7]	Significance[8]
Loss_Dummy	0.0408	0.0048	8.462	< 0.001	***
COVID_Dummy	-0.032	0.0036	-1.168	0.366	
Firm_Size	0.0227	0.0019	11.256	< 0.001	***
Business_Risk	0.0005	0.0008	0.641	0.5822	
Profitability	-0.0001	0.00005	-2.648	0.013	*
Tangibility	0.2576	0.0178	14.444	< 0.001	***
Model Fit Statistics					
R-Squared	0.074521				
Adj. R-Squared	0.0019345				
F-statistics	77.6496				

Note: This table presents the results of the firm fixed effects regression using an unbalanced panel of 454 firms across Denmark and Sweden (observations = 5,983) over the period 2010–2025. The dependent variable is Leverage. Firm-level financial data were obtained from the FactSet database. To reduce the influence of outliers, (Leverage) was

[5] The coefficient tells how much dependent variable changes when independent variable changes by 1 unit, holding other things constant.

[6] Standard Error (SE) shows the level of uncertainty around the coefficient estimate

[7] while the p-value indicates the probability of observing such a result if the true effect were zero

[8] Statistical significance levels are denoted as *** p < 0.001, ** p < 0.01, and * p < 0.05. Variables with p-values below 0.10 are considered marginally significant and denoted by ".".

*winsorized at the 1st and 99th percentiles. The model includes firm fixed effects to account for unobserved, time-invariant firm-specific characteristics, while standard errors are robust and clustered at the firm level. The R-squared statistic indicates the proportion of variation in leverage explained by the model, and the F-statistic tests the joint significance of all explanatory variables. Statistical significance levels are denoted as *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$. Variables with p-values below 0.10 are considered marginally significant and denoted by ".".*

Firstly, the fixed effects estimation is used on an unbalanced panel of 454 firms across Denmark and Sweden, from the period of 2010-2025, with 5,983 firm-year observations. Among the explanatory variables, Loss_Dummy ($\beta = 0.0408$, $p < 0.001$) is positively and significantly associated with leverage. This result indicates that firms experiencing losses tend to increase their debt levels. This is because it helps to finance ongoing operations or cover liquidity shortfalls. Also, Firm Size ($\beta = 0.0227$, $p < 0.001$) has a significant positive relationship with leverage. This result is consistent with the trade-off theory. Larger firms face lower expected bankruptcy costs and have more stable cash flows. Likewise, another explanatory variable Tangibility ($\beta = 0.2576$, $p < 0.001$) also shows a strong positive relationship. It also confirms that firms with more tangible assets use them as collateral to secure higher levels of debt.

On the other hand, Profitability ($\beta = -0.00011$, $p \approx 0.05$) is negatively related to leverage. This finding aligns with the pecking order theory, which suggests that more profitable firms rely less on external financing and prefer internal funds. However, the magnitude of the coefficient is negligible in practical terms. This small magnitude indicates that the effect can be statistically significant but is economically trivial. ($\beta = -0.00011$) means that, change in profitability contributes slight change to the variation in leverage which is economically negligible.

Surprisingly, Business Risk ($p = 0.522$), the COVID_Dummy ($p = 0.243$) are does not show any significant results meaning earnings volatility and the pandemic period did not much impact the capital structure decisions among Danish and Swedish firms.

This model generates R-squared value of 0.074521 meaning approximately 7.45% of the variation in firms' leverage can be attributed to the explanatory variables. Although the explanatory power is low, but this is common in firm-level panel studies. The explanation of low R-squared is discussed in Discussion part. Moreover, The F-statistic is highly significant ($p < 0.001$), it confirms the overall validity of the model.

After examining firm-fixed effects, the analysis extends to include both firm and time effect to control for year-to-year macroeconomic variation.

4.2.2 Panel Regression with Firm and Year fixed Effects

Table 3: Significant Firm + Year Fixed Effects Regression

Variable	Coefficient (β)	Std. Error	t-value	p-value	Significance
Loss_Dummy	0.0403	0.0049	8.286	< 0.001	***
Firm_Size	0.0236	0.0022	10.728	< 0.001	***
Business_Risk	0.0005	0.0008	0.633	0.527	
Profitability	-0.0001	0.00005	-2.7	0.013	*
Tangibility	0.2518	0.0179	14.031	< 0.001	***
Model Fit Statistics					
R-Squared	0.068297				
Adj. R-Squared	-0.0087				
F-statistics	84.6216				

*Note: This table presents the results of the firm fixed effects regression using an unbalanced panel of 454 firms across Denmark, Sweden, and Bangladesh (observations = 5,983) over the period 2010–2025. The dependent variable is Leverage. Firm-level financial data were obtained from the FactSet database. To reduce the influence of outliers, (Leverage) was winsorized at the 1st and 99th percentiles. The model includes firm fixed effects to account for unobserved, time-invariant firm-specific characteristics. The R-squared statistic indicates the proportion of variation in leverage explained by the model, and the F-statistic tests the joint significance of all explanatory variables. Statistical significance levels are denoted as *** p < 0.001, ** p < 0.01, and * p < 0.05. Variables with p-values below 0.10 are considered marginally significant and denoted by ".".*

Secondly, two-way fixed effects regression was conducted on 5,983 firm-year observations. The model incorporates both "firm" and "time" effects to control for unobserved heterogeneity. The explanatory power is modest with an R-squared value of 0.068. The F-statistic is highly significant ($p < 0.001$), indicating that the model overall is statistically valid.

The results show that financial distress, firm size and firm's tangibility are positively associated with leverage. The estimated coefficients are broadly consistent with those obtained from the firm fixed effects model. Specifically, financial distress, firm size, and tangibility maintain a positive and significant relationship with leverage, while profitability ($\beta = -0.00013$, $p \approx 0.01$) continues to exhibit a statistically significant but economically negligible negative association. In summary, the inclusion of year effects does not materially alter the main results. It supports the idea that firm-specific characteristics like loss experience, firm size, and asset tangibility are the primary drivers of leverage decisions. On the other hand, business risk, profitability, and the pandemic dummy show limited explanatory power.

To further enhance robustness, the model is extended to incorporate country-level heterogeneity to capture differences in institutional and financial environments across Denmark and Sweden.

4.2.3 Panel Regression with Firm, Year and Country Fixed Effects

Table 4: Significant Firm + Year + Country Fixed Effects Regression

Variable	Coefficient (β)	Std. Error	t-value	p-value	Significance
Loss_Dummy	0.0403	0.0082	4.926	< 0.001	***
Firm_Size	0.0236	0.0076	3.107	0.002	***
Tangibility	0.2598	0.0585	4.308	< 0.001	***
Business_Risk	0.0005	0.001	0.502	0.616	
Profitability	–0.0001	0.0001	–1.397	0.013	*

*Notes: The table reports the results of a three-way fixed effects regression model with firm-, year-, and country-level effects. ***, *, and * denote significance at the 1%, 5%, and 10% levels, respectively.*

Thirdly, I conducted three-way fixed effect model on 5,983 firm-year observation. The results show that Loss_Dummy ($\beta = 0.0403$, $p < 0.001$) is positive and highly significant. Likewise other models, this model also provides strong support for the idea that loss-making firms rely more on external debt to finance operations or address liquidity shortfalls. The three-way fixed effects regression model, controlling for firm-, year-, and country-level heterogeneity capture slightly higher co efficient magnitude and (Adjusted $R^2 = 0.8185$).

4.2.4 Panel Regression with Random Variation across Firm

Table 5: Random Effect Regression Results

Variable	Coefficient (β)	Std. Error	z-value[9]	p-value	Significance
Intercept	0.1332	0.0154	8.6663	0	***
Loss_Dummy	0.0364	0.0049	7.5042	0	***
COVID_Dummy	-0.0037	0.0035	-0.2312	0.3032	
Firm_Size	0.0244	0.0021	11.7981	0	***
Business_Risk	0.0013	0.0007	1.7703	0.16346	
Profitability	-0.0001	0.00005	-1.935	0.036	*
Tangibility	0.2556	0.0182	14.0704	0	***
		Model Fit Statistics			
R-Squared	0.072745				
Adj. R-Squared	0.071856				
Chisq	490.318				
p-value	0.001				

*Notes: The table reports results from a random effects regression using an unbalanced panel of 454 firms and 5,983 firm-year observations***, *, and * denote significance at the 1%, 5%, and 10% levels, respectively. Variables with p-values below 0.10 are considered marginally significant and denoted by ".".*

Lastly, Random effect model is used on current firm-year observations. The results of the model are broadly consistent with those obtained under the fixed effects specification. Both models produced very similar results. The signs and significance of key variables such as loss dummy, firm size, tangibility, and profitability remain unchanged, confirming the robustness of the findings. The

[9] The z-statistic tests whether the coefficient is significantly different from zero

similarity of results across both estimators suggests that firm-level heterogeneity does not substantially bias the estimated relationships between leverage and its determinants. The overall model is statistically significant, as confirmed by the Wald Chi-square test ($\chi^2 = 490.318$, $p = 0.001$). It suggests that the explanatory variables collectively have a significant impact on firms' leverage decisions.

Several robustness checks are performed in the next section to test whether the main findings remain consistent under alternative model specifications and sample restrictions.

4.2.5 Robustness check excluding financial organization

Table 6: Robustness Check – Excluding Financial Organizations

Variable	Coefficient (β)	Std. Error	t-value	p-value	Significance
Loss_Dummy	0.0469	0.009	5.222	< 0.001	***
COVID_Dummy	0.0089	0.0066	1.338	0.181	
Firm_Size	0.0025	0.0035	0.714	0.476	
Business_Risk	0.0008	0.0014	0.583	0.56	
Profitability	–0.0001	0.00008	–1.177	0.239	
Tangibility	0.2374	0.0312	7.601	< 0.001	***
		Model Fit Statistics			
R-Squared	0.018803				
Adj. R-Squared	0.108463				
F-statistics	15.9627				

*Note: The model is estimated to use a two-way fixed effect specification after excluding financial organizations from the sample. Statistical significance levels are denoted as *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$. Variables with $p < 0.10$ are considered marginally significant and denoted by ".".*

To ensure that the results are not driven by the unique characteristics of financial institutions, a fixed effects regression was re-estimated after excluding all banks, insurance, and other financial firms. This adjustment reduced the sample to 413 non-financial firms, yielding 5,417 firm-year observations.

The results, reported in table 6, remain consistent with the baseline model. Loss_Dummy ($\beta = 0.047$, $p < 0.001$) and Tangibility ($\beta = 0.237$, $p < 0.001$) continue to exhibit strong positive associations with leverage. In contrast, firm size and Profitability lose statistical significance, which is expected given that financial firms are typically large and profitable and they were removed from the sample. Financial firms typically operate under regulatory capital constraints that make their leverage behavior structurally different from that of non-financial firms. Bank for International Settlements, 2017, says that, under Basel III, banks must maintain a minimum leverage ratio (Tier 1 capital over total exposures) independent of risk-weighting.

After excluding financial institutions, the model's explanatory power decreased slightly ($R^2 = 0.0188$ compared to 0.0745 in the full sample), reflecting reduced variation in leverage among non-financial firms. The exclusion of financial institutions led to a reduction in the number of statistically significant variables from four to two, which is consistent with expectations. Removing them refines the sample to reflect purely market-driven financing decisions, thereby improving the model's theoretical validity.

Beyond excluding financial institutions, another robustness test is conducted using alternative definitions of leverage which is short-term and long-term debt structures.

4.2.6 Robustness check (Controlling for short-term vs long-term)

Table 7: Robustness check for alternative definition of leverage

Variable	Short-Term Leverage		Long-Term Leverage	
	β	**p-value**	**β**	**p-value**
Loss_Dummy	0.0236	< 0.001 ***	0.0155	< 0.001 ***
Firm_Size	–0.0116	< 0.001 ***	0.0197	< 0.001 ***
Business_Risk	0.0007	0.402	–0.0002	0.727
Profitability	–0.00001	0.91	–0.00007	0.088 .
Tangibility	–0.0103	0.582	0.2322	< 0.001 ***

*Notes: Both models are estimated using two-way fixed effects controlling for firm- and year-specific heterogeneity. Statistical significance levels are denoted as *** p < 0.001, ** p < 0.01, and * p < 0.05; variables with p < 0.10 are denoted by ".". Short-term leverage is defined as short-term debt (including current portion of long-term debt) divided by total assets and long-term leverage is defined as long-term debt divided by total assets.*

To test robustness, panel regression analysis was re-run using two alternative leverage ratios. They are short-term leverage (short-term debt plus the current portion of long-term debt to total assets) and long-term leverage (long-term debt to total assets). Both models were estimated with firm and year fixed effects to control unobserved heterogeneity.

The results show that Loss_Dummy remains positive and highly significant across both specifications. It means that firms with negative net income rely more on debt financing. Firm_Size exhibits a negative effect on short-term leverage but a positive and significant effect on long-term leverage. This is a significant finding that larger firms shift their debt structure toward long-term borrowing, consistent with the trade-off theory that suggests that size lowers default risk and improves access to capital markets. Tangibility is insignificant in short-term debt and is strongly positive in the long-term debt model. It reinforces the idea that tangible assets serve as collateral for long-term debt, while Profitability remains weakly negative and economical significance is negligible. Business_Risk is statistically insignificant in both cases.

Robustness tests strength the credibility of the results, the next step involves testing for the presence of heteroskedasticity to assess whether the underlying model assumption holds.

4.2.7 Robust standard error

Table 12: Robust[10] two-way fixed effects regression results based on 454 firms

Variable	**Coefficient**	**Robust SE**	**t-value**	**p-value**	**Significance**
Loss Dummy	0.0403	0.00815	4.938	0.000001	***
Firm Size	0.0236	0.00759	3.114	0.0019	**
Business Risk	0.0005	0.00099	0.503	0.615	
Profitability	-0.00013	0.00009	-1.4	0.162	
Tangibility	0.2518	0.0583	4.318	0.000016	***

Since the Breusch–Pagan test indicated heteroskedasticity, robust standard errors were applied to ensure valid inference. This adjustment corrects the bias in standard errors without altering the estimated coefficients.

Table 12 reports the results of the two-way fixed effects regression estimated with robust standard errors to correct for heteroskedasticity. The results remain consistent with the two-way fixed effects model. It confirms that *Loss Dummy*, *Firm Size*, and *Tangibility* continue to exert a positive and significant effect on leverage. The use of robust standard errors ensures the reliability of inference without altering the core conclusions, discussed earlier.

4.2.8 Nonlinear relationship between firm size and leverage: Quadratic Firm size specification

Table 13: Quadratic Firm size

Variables	Coefficient	Std.Error	t-value	P-value	Significance
Loss_Dummy	0.04	0.0049	8.1408	0	***
Firm_Size	0.0015	0.0043	0.3528	0.7243	
Firm_Size²	0.0025	0.0004	6.1195	0	***
Business_Risk	0.0005	0.0008	0.6354	0.5252	
Profitability	-0.0001	0.00005	-2.451	0.0143	*
Tangibility	0.2602	0.0184	14.1318	0	***
		Model Fit Statistics			
F-statistics			76.9288		
P-value			0.005		
We reject null hypothesis					
R-Squared			0.077321		
Adj. R-Squared			-0.024083		

[10] Robust standard error/ White-standard error is held to correct the heteroskedasticity problem.

*Notes: The model is estimated using a two-way fixed effects specification controlling for firm and year effects. Standard errors are clustered at the firm level. Statistical significance levels are denoted as *** p < 0.001, ** p < 0.01, and * p < 0.05; variables with p < 0.10 are considered marginally significant and denoted by ".". The inclusion of the quadratic term (Firm_Size²) captures potential nonlinearity in the relationship between firm size and leverage.*

The quadratic model highlights the nonlinear relationship between firm size in leverage. The linear term of firm size is statistically insignificant. But the squared term of firm size suggests some curvature in the relationship. But the economical significant is trivial with a co-efficient value of 0.0025. So, we cannot conclude that the squared term of firm size has any meaningful impact on leverage.

We compared the two models by conducting F-test to evaluate whether the inclusion of the quadratic term for firm size provides additional explanatory power beyond the linear specification in the two-way fixed effects model. The result show F-statistic of 76..92 , p-value 0.001<0.05. Since p-value is below 5% threshold, we cannot reject the effect of squared firm size effect on leverage.

The quadratic model show that the relationship between firm size and leverage may not be linear. There is a curvature relationship, meaning, firm tends to increase their leverage at a higher size level.

4.2.9 The interaction between loss dummy and firm size

Table 14: *Firm Size × loss_dummy*

F-statistics	16.904
P-value	0.005 (P-value< 0.05)
We reject null hypothesis	

We ran the regression using specification with *firm size × loss_dummy* and compared with the baseline two-way fixed effect model. The comparison between two-way fixed effect model and specification with Firm Size × loss_dummy interaction result is given above. The result produce p-value of 0.005. (P-value<0.05). Therefore, we reject the null hypothesis. In other words, the interaction term (*Firm Size × loss_dummy) si*gnificantly improve the model. The effect of firm size on the relationship between loss-making and leverage is statistically significant.

Table:15

Variable	Coefficient (β)	Std. Error	t-value	p-value	Significance
Loss_Dummy	0.0873	0.0124	7.018	< 0.001	***
Firm_Size	0.0287	0.0025	11.373	< 0.001	***
Profitability	–0.00010	0.00005	–2.151	0.031	*
Business_Risk	0.00045	0.0008	0.567	0.571	–
Tangibility	0.2578	0.0185	13.969	< 0.001	***
Loss_Dummy × Firm_Size	–0.00875	0.0021	–4.111	< 0.001	***

The regression result shows an interesting discovery. Individually, *Loss_Dummy* and *Firm_Size* are positively related to leverage. But, in interaction model, when these two variables combine, the relationship changes direction. Both effect decreases the leverage by 0.0875% which is less than 1%, It means that the interaction effect exists, but magnitude is very low. The bottom line is it does not

drastically change the leverage decision of large firm when they are under financial distress. The possible reasoning behind it can be larger companies usually have internal reserves or alternative funding options such as retained earnings. or equity issues.

4.2.10 The interaction effect between firm size and profitability on Leverage

Table 16: Interaction effect: *Firm Size × profitability*

F-statistics	0.046989
P-value	0.8612 (P-value> 0.05)
We fail to reject null hypothesis	

We ran the regression using specification with *firm size × profitability* and compared with the baseline two-way fixed effect model. The comparison between two-way fixed effect model and specification with Firm Size × Profitability interaction result is given above. The result produce p-value of 0.861. (P-value>0.05), which is far above the significance level. Therefore, we cannot reject the null hypothesis. Therefore, the result indicate that the inclusion of the interaction term does not improve the model fit and the joint effect does not meaningfully affect leverage in Denish and Swedish firms. Profitability affects leverage independently of firm size, and vice versa.

4.3 Breusch-Pagan test

Table 8: Breusch–Pagan Test for Heteroskedasticity

Breusch-Pagan Statistics	102.38
Degree of Freedom	6
P-value	0.005

The Breusch–Pagan test was conducted to examine whether the variance of the residuals is constant across observations or not. The test produced a statistic of 102.38 with 6 degrees of freedom and a p-value of 0.005. Since the p-value <0.05 threshold, we rejected the null hypothesis (homoskedasticity)[11]. This indicates the presence of heteroskedasticity[12] in the model meaning the error term is not constant over time or across firms. This violation may distort the efficiency of the estimated coefficients and result in biased standard errors. To mitigate these, robust standard errors (White–type HC1)[13] are applied in the subsequent regression analyses.

[11] *Homoskedasticity refers to the uniformity of residual distribution across all values of the predictor variables*
[12] *Heteroskedasticity refers to the variation of residuals that fluctuates in accordance with the value of the independent*
[13] *White-type HC1 modify standard errors in the context of heteroskedasticity*

4.4 Hausman Test:

The Hausman[14] test is used to choose between a fixed-effects and a random-effects model.

Hausman Test result for model specification:

Table 9: Hausman Test result for model specification

Statistics	Value
Chi-squared	16.071
Degrees of freedom	5
p-value	0.00664

Note: Preferred model is Fixed Effects Model

The null hypothesis implies an absence of correlation between firm effects and regressors. The alternative hypothesis implies that correlation exists between firm effects and regressors, so the fixed effects model is preferred. A p-value of less than 0.05 rejects the null hypothesis. A greater Chi-squared value typically signifies a more substantial disparity between the two models, implying that their assumptions yield significantly different outcomes.

The Hausman test assesses the suitability of the Random Effects (RE) model in relation to the Fixed Effects (FE) model. It specifically evaluates the null hypothesis that the individual effects are uncorrelated with the regressors, indicating that the random effects model is both consistent and efficient.

Hausman test result exhibit that Chi-squared is 16.071 with 5 degrees of freedom, and the p-value is 0.0067 (significant at the 1% threshold), we reject the null hypothesis. This result suggests that the random effects model is inconsistent. The results indicate that firm-specific effects are correlated with explanatory variables. Therefore, the Fixed Effects model is chosen for analysis.

[14] *It examines whether the unobserved firm-specific characteristics are correlated with the explanatory variables. If they are correlated, the fixed-effects model gives more reliable results. If not, the random-effects model can be used.*

4.5 Variance Inflation Factor (VIR)

The Variance Inflation Factor[15] (VIF) assesses the degree to which the variance of a coefficient estimate is inflated due to collinearity with other explanatory variables.

Table 10: variable inflation factor for the multicollinearity assessment

Explanatory variables	Variance Inflation Factor
Loss Dummy	1.062354
Covid Dummy	1.007285
Firm Size	1.067158
Business Risk	1.004548
Profitability	1.056823
Tangibility	1.006800

Notes: The Variance Inflation Factor (VIF) values are calculated from a linear regression model including all explanatory variables. All VIF scores lie close to 1, far below the conventional threshold of 10, indicating that multicollinearity is not a concern among the independent variables. So, the explanatory variables used in the model are sufficiently independent for reliable estimation.

In this study, VIF values were calculated for the six explanatory variables, and all were found to be close to 1. These results are far below the critical threshold. It shows that multicollinearity is not present in the model. This means that each variable explains variation in leverage on its own without overlapping strongly with others. The findings support the choice of variables and confirm that multicollinearity does not affect the reliability of the regression result.

5. Hypotheses Evaluation

H1: Firms with negative net income adjust their leverage more aggressively than consistently profitable firms.

Supported. The coefficient for Loss Dummy is positive ($\beta = 0.0403$) and highly significant ($p < 0.001$). This indicates that loss-making firms increase their leverage compared to profitable firms. This result is consistent with the view that financial deficits lead firms to rely more on debt to sustain operations.

H2: Firm size is positively associated with the level of borrowing, with larger firms relying more on leverage than smaller firms.

Supported. Firm Size is positively and significantly related to leverage ($\beta = 0.0236$, $p < 0.001$). This confirms that larger firms are more leveraged. This result is consistent with the trade-off theory which argues that size lowers default risk and gives the firm more access to debt markets.

[15] A VIF value of 10 or higher is often taken as a sign of serious multicollinearity. Multicollinearity means when multiple regression models have independent variables that are highly correlated, and it can produce unreliable results.

H3: Firms with higher tangible assets rely more on long-term debt than firms with lower tangible asset.

Supported. Tangibility has a strong positive and significant effect on leverage ($\beta = 0.251$, $p < 0.001$). This shows that tangible assets provide collateral. It enables firms to obtain higher levels of long-term borrowing.

H4: More profitable firms use less debt financing compared to less profitable firms (consistent with the pecking order theory).

Supported. Profitability is negatively related to leverage ($\beta = -0.000113$) and partially significant where ($p \approx 0.047$). This result is statistically insignificant. It means that profit slightly alters leverage, the practical impact of profit is very weak.

These findings highlight firm-specific factors particularly loss experience, firm-size, asset tangibility, and profitability in shaping capital structure decision. On the other hand, these findings give us insights on the influence of business risk, and COVID-19 shocks. It appears to have no measurable influence on this dataset.

6. Discussion

The two-way regression result discovers several insights into the determinants of leverage in Denmark, Sweden. The finding supports the relevance of capital structure theory but also highlights insightful factors that played role in determining capital structure decisions.

6.1 Loss-Making Firms and Leverage

The two-way regression result indicates that firms with financial distress increase their leverage. This finding oppose with the trade-off theory, which predicts that when a firm is under financial pressure , the expected cost of financial distress rises, so the optimal level of debt decreases.((Titman & Wessels, 1988). Frank and Goyal (2009), argue that weaker firms often turn to external borrowing when internal funds are insufficient.

In practice, the reason behind increased leverage among loss-making firms can vary depending on contexts. In Denmark and Sweden, financial market is well developed, and firms are transparent, creditors rights are strong. So, the firms experiencing losses find it feasible to maintain or increase leverage due to good institutional frameworks and stable banking relation. {need to add tax shield and low interest rate context}

6.2 Firm Size

Firm size has a positive and highly significant effect on leverage, consistent with the trade-off theory's prediction that larger firms face lower bankruptcy risks and can borrow more easily (Harris & Raviv, 1991). It is also the case that relatively large firms tend to be more diversified and less prone to bankruptcy. These arguments suggest that large firms should be more highly leveraged. (Titman & Wessels, 1988). The size effect on leverage confirms theoretical predictions, it also show that lower bankruptcy risk and higher access to debt market increase the leverage ratio in Danish and Swedish firms.

6.3 Tangibility

Tangibility also shows a positive and highly significant association with leverage. It confirms the importance of collateral in debt financing. According to trade-off theory, tangible assets provide security to lenders, reducing credit risk and enhancing borrowing capacity (Rajan & Zingales, 1995).

From the contextual standpoint, in Denmark and Sweden, while financial markets are well established, tangible assets can still play a crucial role during the period of uncertainty. Tangible asset signal financial stability to the investors and creditors. Tangibility reduces lender's risk of default as they can recover value from asset of the firm fails to pay. Tangible assets are easier to measure and thus information asymmetry is lower than valuing the intangible assets like goodwill and patents. So, firms with higher tangible assets are prone to rely more on debt.

6.4 Business Risk

Contrary to theoretical expectations, business risk is statistically insignificant. The trade-off framework suggests that riskier firms should borrow less due to higher expected costs of financial distress (Titman & Wessels, 1988). The lack of significance here suggests that volatility in earnings does not systematically influence leverage once firm and time effects are controlled for.

One possible explanation of the insignificant effect of business risk is that the advances in credit risk management, lenders rights etc. have lowered the relationship between business risk and leverage. Denmark's and Sweden's advanced economics, developed market, transparency, strong and effective legal framework likely to shield lenders against firm-specific volatility.

6.5 Profitability

Profitability is negatively related to leverage and the result is marginally significant, which aligns with the pecking order theory (Myers & Majluf, 1984). This suggests that profitable firms prefer internal financing more and rely less on external borrowing. Rajan and Zingales (1995) and Frank and Goyal (2009) also report similar negative relationships between profitability and leverage.

The overall pattern supports the pecking order logic, as in Denmark and Sweden, firms have access to internal funds and external funds equally, profitability reduces the pressure to borrow to fund operational activities.

6.6 COVID-19 Effect

The COVID-19 dummy is statistically insignificant, suggesting that the pandemic did not significantly alter leverage decisions once firm and time effects were controlled for. Although global evidence shows a temporary increase in drawdowns during the pandemic (Acharya & Steffen, 2020). One explanation may be that Danish and Swedish firms benefited from deferral tax and VAT payment. Many firms relied less on traditional borrowing because government liquidity support programs provided cash substitutes.

***6.7** Discussion on the Low R-squared Value*

The regression models in this thesis produce low R-squared values (ranging between 0.018 and 0.07) It indicates that only a small proportion of the total variation in firms' leverage is explained by the included explanatory variables. This outcome is not unusual in firm-level panel data studies. Since capital structure decisions are influenced by wide range of factors. Such as managerial preferences, strategic considerations, ownership structure, and market timing. Those factors are difficult to quantify empirically (Frank and Goyal, 2009). Lemmon, Roberts, and Zender's (2008), Journal of Finance paper, "Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure" argues that majority of the variation in capital structure is time-invariant and that much of the variation is unaccounted for by existing empirical specifications. A low R-squared does not necessarily imply that the model lacks validity or usefulness. In corporate finance research, the primary focus is on the sign, direction, and statistical significance of the estimated coefficients rather than on the overall fit of the model. When the estimated relationships are statistically significant and economically meaningful, they still provide valuable insights into the impact on dependent variable.

6.8 Loss making firms increases debt

In our regression analysis, we can see that loss-making firms increase their leverages. The robust analysis using alternative leverage definitions provides more evidence that loss-making firms tend to rely on debt. The finding from robust analysis reveals that firms increase both short-term and long-term borrowing. This finding refines the interpretation of the baseline results. This finding is contrary to the pure trade off theory. Trade off theory argues that higher distress risk should reduce debt capacity due to expected bankruptcy cost. So, here, the coefficient is stronger for short-term debt than long-term debt. So, the result suggests that firms under financial pressure rely more on short-term borrowing like credit lines, trade credit to cover liquidity shortfalls rather than taking on long-term obligations.

Loss making firm often struggle to capture equity financing because negative earning reduces investors' confidence and make equity issuance costly. Under this circumstances, short-term credit line and working capital loans become essential tools to survive the loss period in terms of paying wages, financing inventory and managing operating expenses.

The finding also reveals that loss-making firms increase their long-term borrowing. Mostly, firms that maintain valuable collateral or moderate to high credit rating can secure long-term financing despite current losses.

These behaviors reflect the real-world financing choices which often deviate from theoretical expectations. Rather than strictly optimizing according to trade-off principles, firms under distress balance between financial necessity and survival-driven decision-making. Firms' loss status and borrowing highlight the different nature of capital structure decisions during downtowns.

7. Implication

Theoretical Implications

The result from the dataset find both trade-off theory and pecking order theory relevant to leverage decision making. Firm size and tangibility were positive and significant across the models which support the trade-off view that large and tangible asset-heavy firms face low bankruptcy risk and borrow more from the debt market. At the same time, the result shows negative relationship between profitability and leverage supporting the pecking order theory. Pecking order theory states

that firms with strong internal cashflows tend to rely less on external support. Surprisingly, business risk and external effect were insignificant in the dataset. It questions some agency theory prediction and suggests that these variables may not play significant role across different institutional settings in different period of time.

Practical Implications

When making leverage choices, corporate managers and financial officers need to keep in mind the importance of firm characteristics. The result from the different models highlights that firm characteristics can affect significantly the choice of leverage. Firms experiencing consecutive losses were seen to increase leverage to cover the short-term downfalls. However, it raises long-term solvency risks. Managers should be careful while making debt choices and need to balance debt reliance during the period of financial shortfalls. For investors and creditors, the results provide insights into identifying firms with higher debt tendencies. The investor can keep in mind that bigger firms and firms with more tangible asset can rely more on debt, and they should not stress it. Also, investors and creditors should not worry about business risk in Nordic firms and Bangladeshi firms, since it is not significant in the current debt-equity ratio. During the covid period firms did not tend to borrow more, which can provide the sign of stability in the institutional settings, which provides a positive mark for the investors and creditors.

Policy Implications

In Denmark and Sweden, the stable financial system reduces the effect of business risk on leverage. During covid-19, the leverage changes were not significant. This gives a clear indication that government support program played effective role in stabilizing firm financing in the developed market.

8. Summary of findings

The empirical results from multiple models provide consistent evidence regarding the explanatory factors influencing firm's capital structure decision in Denmark and Sweden. Negative net income was identified as statistically significant and positive correlation with leverage. Likewise, firm size and tangibility were identified as positive and significant factors influencing leverage. On the other hand, profitability was found to have inverse relationship with leverage, although the result was

marginally significant in two-factor model. Growth opportunities and business risk did not exhibit significant effect on leverage across most of the model specification.

The Hausman test rejected the null hypothesis. This supports fixed effect model as the more appropriate model specification. The Breusch–Pagan test revealed heteroskedasticity, which was addressed through the use of robust standard errors. Variance inflation factor (VIF) confirmed that multicollinearity was not a concern since all the values were below the critical threshold (VIF<10). We incorporated the quadratic specification of firm size with leverage. This test showed a non-liner effect on leverage.

The quadratic specification of firm size indicated a non-linear effect on leverage. It suggests that leverage increases at an accelerating rate as firms become larger.

To ensure the robustness of the results, the regression analysis was re-estimated after excluding financial institutions, as it could bias the findings. This approach helped the study to focus more accurately on the impact of the main hypothesis on non-financial firms and to assess whether the core relationships remained consistent.

In addition, sub-sample analyses were conducted using short-term debt and long-term debt ratios to identify whether firms' leverage primarily arises from short-term or long-term financing sources.

In terms of hypothesis testing, the study provided strong support for H1, H2, H3, and H4. So, the findings confirm that the loss experience, firm size and tangible assets influence capital structure choices, but the impact of profitability is negligeable. On the other hand, business risk and COVID-19 period played a little to no significant role in capital structure decision.

The results showed that the COVID-19 period (2020–2022) did not significantly alter firms' leverage behavior. This finding is different from some other prior global studies that reported a sharp increase in debt financing during the pandemic. The probable reasoning behind the fact that the effect may have been mitigated by government intervention and support programs in the Nordic contest.

9. Limitation

This study is not without limitations. The dataset is restricted to publicly listed firms in Denmark, Sweden and a smaller sample of Bangladeshi firms. Therefore, we cannot generalize the current results from the finding to the private firms and other emerging economics. The exclusion of

industry-specific effects limits the finding from addressing the sectoral differences in the capital structure. This thesis is confined to CSE, SE and DSE listed companies. Thus, the conclusion from this study may not be applicable to other markets. Especially in other emerging markets where institutional difference, investor behavior, economic and political condition can vary. Also, qualitative approaches could add more value to the study by exploring managerial perceptions of capital structure decision in the crisis period.

Suggestion for future research:

This thesis provides valuable insights into the factors that can influence the capital structure decision across Denmark, Sweden, Bangladesh. Further exploration in this area is possible. |Firstly, one can incorporate broader macroeconomic factors such as inflation, GDP growth, or financial market volatility etc. This could strength the linkage between firm-level financial decisions and overarching economic conditions.

Secondly, one can examine the predictive power of alternative profitability measures other than return on asset. Indicators such as return on equity, current ratio or cash holding, age of the firm can be included to uncover more internal determinants of leverage decision. Thirdly, expanding the research to more geographical region in developed and developing markets would provide a richer basis for comparison. Cross-country analysis could help determine whether pattern observed in this study is universal or whether they differ on different regions based on different institutional framework, financial market or managerial decision on debt financing.

10. Conclusion

This thesis examines how firm specific factors and external shocks shake the leverage decision among the publicly traded companies in Denmark, Sweden and Bangladesh. The main research question focuses on whether firms with losses adjust their capital structure differently and how characteristics such as size, tangibility, profitability, growth, and business risk and COVID-19 shape leverage decision.

Firms experiencing negative net income were found to borrow more. This indicates that financial shortfalls push them to go for debt financing. Also, firm size and asset tangibility showed a positive relationship with leverage. It also indicates the role of scale and collateral in access to credit. Test

confirmed that the fixed effect model was the most suitable. The pattern found by this study aligns with the established capital structure theories, but the insignificant role of business risk and growth also points out the unique regional differences and different managerial mindsets. By bringing together evidence from two Nordic countries and Bangladesh, the study offers a broader understanding of how firms balance their financing choices in different economic and institutional contexts.

11. Reference

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12. Appendix

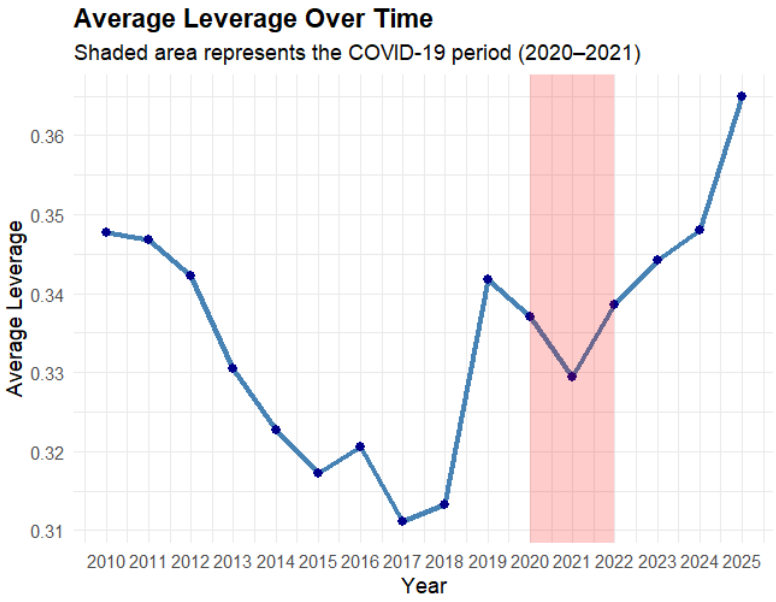
Appendix A: Variable Definition and Measurement

Variable	Category	Definition	Unit/Format
Leverage	Dependent variable	Leverage is defined as the ratio of total debt to total assets, where total debt is the sum of short-term debt & current portion of long-term debt and long-term debt. This ratio measures the extent to which a firm is financed through debt relative to its total asset.	Ratio
Loss Dummy	Independent Variable	Loss Dummy, which equals 1 if a firm reports negative net income in a given year and 0 otherwise. This indicator captures whether loss-making firms behave differently from profitable ones in terms of leverage.	Binary
Firm Size	Independent variable	Firm Size is measured as the natural logarithm of total assets.	Log Scale/ No unit
COVID Dummy	Control variable	The COVID Dummy takes the value 1 for the years 2020–2022 and 0 otherwise. This variable 1 isolates the potential impact of the pandemic as an exogenous shock to financing decisions.	Binary
Business Risk	Control variable	Business Risk is measured as the volatility of operating earnings, calculated as the coefficient of variation of EBIT (standard deviation divided by mean EBIT) for each firm over the sample period. Firms with higher earnings volatility are expected to carry less debt due to higher default risk.	Standard Deviation
Tangibility	Independent variable	Tangibility is defined as the ratio of property, plant, and equipment (PPE) to total assets. Tangible assets can serve as collateral, which typically supports higher borrowing capacity.	Ratio between 0 to 1
Profitability	Control variable	Profitability is measured as EBIT divided by total assets. This ratio indicates the efficiency of operations and internal funding capacity, with more profitable firms often relying less on external debt.	Ratio (can be negative)

Appendix B: Geographical and Industry Distribution of Sample Firms

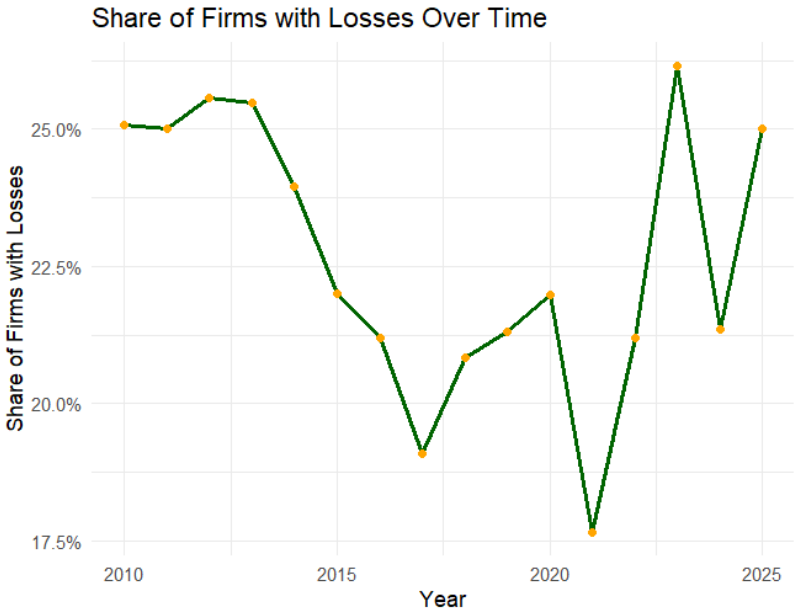
Country	Sector	Number of firms
Sweden	Basic Materials	27
	Consumer Discretionary	56
	Consumer Staples	11
	Energy	6
	Financials	47
	Health Care	58
	Industrials	96
	Real Estate	53
	Technology	37
	Telecommunication	13
	Utilities	1
Denmark	Consumer Discretionary	17
	Consumer Staples	7
	Energy	4
	Financial	26
	Health Care	18
	Industrial	34
	Real Estate	8
	Technology	9
	Telecommunication	1
	Utilities	1
Bangladesh	Pharmaceuticals	3
	Telecommunication	1
	Chemicals	3
	Financial Institution	5
	Consumer Goods	1
	Engineering	1
	Fuel & Energy	3
	Electronics	1
	Hospitality & Tourism	1
	Telecommunication Infrastructure	1
	Total	**474**

Figure A: Average Leverage Over Time (2010–2025)



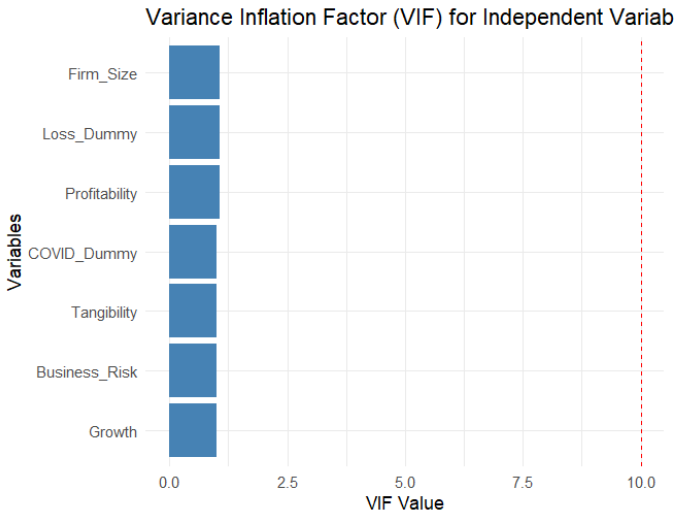
Note: The figure illustrates the trend in firms' average leverage ratios from 2010 to 2025, highlighting the changes before, during, and after the COVID-19 period. The average leverage overtime ranges from 0.31 to 0.37 from 2010 to 2025.

Figure B: *Share of Firms with Losses Over Time (2010–2025)*



Note: This figure represents the proportion of firms reporting negative net income each year, providing an overview of loss-making trends from the year of 2010 to 2025.

Figure C: *Variance Inflation Factor (VIF) for Independent Variables and control variables*



Note: This figure shows the Variance Inflation Factor (VIF) values for all independent variables and control variable included in the regression models. All VIF values are well below the conservative threshold of 10, indicating that multicollinearity is not a concern here.

Appendix F: R coding

```
library(plm)
library(ggplot2)
library(dplyr)
library(lmtest)
library(sandwich)
library(car)
library(modelsummary)
library(fixest)
library(corrplot)
library(Hmisc)

#Load and prepare data
df <- read.csv("C:/Users/Bruger/Desktop/Capitalstructure.csv")

head(df)
str(df)
summary(df)
pdata <- pdata.frame(df, index = c("Firm_ID","Year"))

#Firm fixed effect
FE_model <- plm(Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                  Business_Risk + Profitability + Tangibility ,
                data = pdata, model = "within", effect = "individual")
summary(FE_model)

#Two-way fixed effect (Firm + Year)
twfe_model <- plm(Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                    Business_Risk + Profitability + Tangibility ,
                  data = pdata, model = "within", effect = "twoway")
summary(twfe_model)

#Random Effect model
random_model <- plm(Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                      Business_Risk + Profitability + Tangibility ,
                    data = pdata, model = "random")
summary(random_model)


#Three-Way Fixed Effects (Firm + Year + Country)
threefe_model <- feols(Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                         Business_Risk + Profitability + Tangibility |
                         Firm_ID + Year + Country, data = pdata)
summary(threefe_model)

#Diagnostic Tests
#Variance Inflation Factor (VIF)
lm_model <- lm(Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size + Business_Risk +
                 Profitability + Tangibility , data = df)
vif_values <- vif(lm_model)
print(vif_values)

#Breusch-Pagan Test
bp_test <- bptest(lm_model)
print(bp_test)
```

```r
#Hausman Test
hausman_result <- phtest(twfe_model, random_model)
print(hausman_result)

#Roboust Standard Error
coeftest(twfe_model, vcov = vcovHC(twfe_model, type = "HC1", cluster = "group"))

#Quadratic and Interaction Tests
twfe_quad_model <- plm(Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                         I(Firm_Size^2) + Business_Risk + Profitability +
Tangibility,
                       data = pdata, model = "within", effect = "twoway")
pFtest(twfe_quad_model, twfe_model)
summary(twfe_quad_model)

twfe_interact_model <- plm(Leverage ~ Loss_Dummy + COVID_Dummy +
                             Firm_Size * Profitability + Business_Risk +
Tangibility,
                           data = pdata, model = "within", effect = "twoway")
pFtest(twfe_interact_model, twfe_model)
summary(twfe_interact_model)
twfe_interact_model_2 <- plm(Leverage ~ Loss_Dummy * Firm_Size + COVID_Dummy +
                           + Profitability + Business_Risk + Tangibility,
                           data = pdata, model = "within", effect = "twoway")
pFtest(twfe_interact_model, twfe_model_2)
summary(twfe_interact_model_2)


#Descriptive and correlation matrix
cor_matrix <- cor(df[, c("Leverage", "Loss_Dummy", "COVID_Dummy",
                         "Firm_Size", "Business_Risk", "Profitability",
                         "Tangibility", "Growth")], use = "complete.obs")

corrplot(cor_matrix, method = "color", type = "upper",
         tl.col = "black", tl.srt = 45, addCoef.col = "black")

#Visualization
#Leverage trend over time
leverage_trend <- pdata %>%
  group_by(Year) %>%
  summarise(Average_Leverage = mean(Leverage, na.rm = TRUE))

ggplot(leverage_trend, aes(x = Year, y = Average_Leverage)) +
  geom_line(color = "steelblue", size = 1.2) +
  geom_point(color = "darkblue", size = 2) +
  annotate("rect", xmin = 2020, xmax = 2022, ymin = -Inf, ymax = Inf,
           alpha = 0.2, fill = "red") +
  labs(title = "Average Leverage Over Time",
       subtitle = "Shaded area represents the COVID-19 period (2020-2022)",
       x = "Year", y = "Average Leverage") +
  theme_minimal()


#Share of firm with losses over time
loss_share <- aggregate(Loss_Dummy ~ Year, data = df, mean, na.rm = TRUE)

ggplot(loss_share, aes(x = Year, y = Loss_Dummy)) +
  geom_line(color = "darkgreen", size = 1) +
  geom_point(color = "orange") +
```

```
  scale_y_continuous(labels = scales::percent) +
  labs(title = "Share of Firms with Losses Over Time",
       x = "Year", y = "Share of Firms with Losses") +
  theme_minimal()


library(ggplot2)

ggplot(df, aes(x = Firm_Size, y = Leverage)) +
  geom_point(alpha = 0.3) +
  geom_smooth(method = "lm", formula = y ~ x + I(x^2), color = "blue") +
  labs(
    title = "Quadratic Relationship between Firm Size and Leverage",
    x = "Firm Size (log of total assets)",
    y = "Leverage"
  ) +
  theme_minimal()

#Robustness check (Short term vs long term)
# Create short-term and long-term leverage ratios
df$ShortTerm_Leverage <- df$ST.Debt...Curr..Portion.LT.Debt/ df$Total_Assets
df$LongTerm_Leverage  <- df$Long_Term_Debt / df$Total_Assets

# Convert to panel data
pdata <- pdata.frame(df, index = c("Firm_ID", "Year"))
# Short-term leverage model
short_model <- plm(ShortTerm_Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                     Business_Risk + Profitability + Tangibility,
                   data = pdata, model = "within", effect = "twoway")

# Long-term leverage model
long_model <- plm(LongTerm_Leverage ~ Loss_Dummy + COVID_Dummy + Firm_Size +
                    Business_Risk + Profitability + Tangibility,
                  data = pdata, model = "within", effect = "twoway")

# Summaries
summary(short_model)
summary(long_model)
```