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How does capital structure change during crises?

A study through 2006-2021. Starring: The Financial crisis 2008 & the Covid-19 pandemic

BSc Thesis- Industrial & Financial management

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Abstract

In this paper the changes in the capital structure in large European firms was studied through the years 2006-2021. The focus was on how the capital structure changes in a crisis. The timeline includes two crises, the financial crisis 2008 and the Covid-19 pandemic. Through the empirical research it is shown that corporations, on an aggregate level, choose to change their capital structure in different ways depending on the crisis. The analysis was performed through a regression with equity to asset as the response variable depending on size, equity to asset, return on equity and interest rate in the previous period. To isolate the crisis period and the recovery period after said crisis, two dummy variables were added. The results showed all variables to be significant except for the dummy recovery. Size and interest rate showed a negative relationship, with the equity to asset ratio, while equity to asset and return on equity showed a positive relationship.

Through the analysis on how the capital structure changes, the pecking order theory is determined to not be sufficient. Since the cost of capital was high during the financial crisis the unexplained positive net cash flow is proposed to come from divestment activities, through selling off non-current assets. A method we have named downsizing. The pecking order theory is proposed to include the option of downsizing since it cannot be assumed that external capital is available.

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1.   Introduction

Economic crises can change the way society's function and is an integral part of every aspect of it: private, government, and businesses to name a few. What the different crises derive from, how they develop and what lasting mark they leave differs and it is an important topic to explore. The last two decades have had two crises, the financial crisis 2008 and the Covid-19 pandemic, that has affected businesses and society in Europe.

1.1.   Background

In 2008 the financial crisis started as the housing market turned unstable due to a high level of default (Farlow, 2013) The reasons are unsound monetary policies by the federal reserve and inadequate regulation of the financial market (Posner, 2011). Due to Lehman Brothers being a major actor in the securitization of subprime mortgages they were greatly affected by the rising rate of defaults as the interest rate charged rose (Friedman, 2011) This led to the collapse of the investment bank in September 2008. The financial crisis rolled out in the aftermath of the bankruptcy, shaking the entire economy leading to a decline in commercial lending (Friedman, 2011).

Small businesses were especially affected and had to take actions to reduce expenses such as discharging employees, stopping development plans, and finding new revenue streams to prevent defaulting (Organization for Economic Co-operation and Development, 2009). Banks became hesitant in the crisis to approve loans for small businesses due to the higher credit risk experienced through the crisis (Farlow, 2013). Smaller banks would still approve loans but at reduced levels (Farlow, 2013). The governments and central banks in Europe used economic stimulus measures to help the continent out of the recession. But even with help of economic stimulus, the unemployment rose to almost 10% across the continent (Eurostat, 2021). An indication of the poor economic climate in Europe.

At the beginning of 2020, a global pandemic was caused by the spread of the virus Covid-19 (World Health Organization, 2020). Several countries tried to contain the spread of the virus by closing down society through mandatory quarantines and restrictions on travel (European Center for Disease Prevention and Control, 2022). These measures essentially halted the world economy since society came to a standstill. The insecurity of how the pandemic would

progress led to uncertainty on the financial market (Gössling, et al., 2020). With society halted, revenue fell short for businesses across Europe (Eurostat, 2021).

1.2. Research problem

The capital structure is an integral part of the financial management in a firm. It affects both profitability and risk, during a crisis it is especially important. In a crisis net cash flow from operations turns low, or negative, meaning that the loss of cash flow needs to be covered through other means (Hillier, 2020). Otherwise, a business might risk default on debt which could lead to bankruptcy.

A model for capital structure is the pecking order theory, it depicts how corporations act when there is a need for capital inflow (Hillier, 2020). The essay will focus on whether this theory is a sufficient model tool for corporate behavior in the event of a crisis that affects a business financially. How the hypothesized changes in capital structure correlates to the actual changes observed will conclude whether the pecking order theory is sufficient.

To make more general conclusions, regarding changes in capital structure through crises, the timeline will cover two periods regarded as crisis, the financial crisis 2008 and the Covid-19 pandemic. The two crises affected the financial markets in different ways, mainly in the availability of financing. They will give different perspectives on how the capital structure may change and how the pecking order theory holds as it faces different external environments.

The effect of different variables during the crises will be analyzed. The variables are presented in the theory chapter; they represent factors that could explain the changes in the capital structure. The research will show if these variables influence the capital structure, if the effect is significant and, in that case, how.

1.3. Purpose

The purpose of this study is to determine how the capital structure, in large European corporations, changes through a crisis and whether the pecking order theory explains the changes. It is done first through an analysis of variables' effect on capital structure, then continued by examining the sufficiency of the pecking order theory through appropriate ratios.

1.4. Research Question

The essay will, through analysis of earlier theory and our research, answer the following questions:

- How does the variables; assets, equity to assets, return on equity, interest rate, crisis, and recovery from crisis influence changes in the capital structure?
- Can changes in corporations' capital structure during crises be fully explained by the pecking order theory and how can it be adapted to better explain observed behavior?

2. Theory

Capital Structure represents how a company finances its operations, either through equity or debt. There are theories that cover different ways to choose capital structure. The main objective is to maximize shareholder value (Hillier, 2020).

2.1. Variables

Company size

Company size is an important factor for how the business financially operates. Larger corporations tend to face more scrutiny meaning the numbers they report are more trustworthy, due to less asymmetric information (Kurshev & Strebulaev, 2015). Financing sources are more diversified since larger corporations usually have cheaper access to financial markets (Kurshev & Strebulaev, 2015). They are viewed as less probable to default compared to smaller corporations and the changes in their assets are less volatile (Kurshev & Strebulaev, 2015).

Larger firms are viewed as more reliable, giving them access to debt with better terms, lower interest rates, making the cost of debt lower. It is more advantageous for larger firms to use more debt to finance their operations than equity (Kurshev & Strebulaev, 2015). In line with the theory the hypothesis is that size has a negative impact on the capital structure.

During the analysis the size is measured through the amount of assets. The greater the size of the assets, the greater the size of the corporation, Assets are chosen, as a representation of size, instead of sales or market capitalization because assets can work as a collateral to the lenders when the corporation needs to borrow capital. Market capitalization is a measurement based on looking forward in time which is not applicable in this study (Dang et al., 2018). Sales can be based upon abstract values such as brand value, which makes assets the most appropriate measure for the purpose of this study.

The hypothesis for size, where size is expressed through assets:

$$H_0: Assets\ have\ no, or\ a\ positive, impact\ on\ the\ capital\ structure$$
$$H_A: Assets\ have\ a\ negative\ impact\ on\ the\ capital\ structure$$

Return on Equity

Profit is revenue minus expenses and expressed in absolute terms and does not account for the size of a business. It is not practical to use if the point is to compare business, size needs to be accounted for (Hirschey et al., 2019). To account for size the profit is set in terms of equity and therefore forming return on equity. It is defined as net income divided by the equity of the corporation (Hirschey et al., 2019). Return on equity is a measure of the performance of the corporation since it reflects the effect of both operational efficiency and financial leverage. A high return of equity indicates that the corporation can generate an attractive rate of return on the amount of money invested by the shareholders. High profit margins raise the return on equity, as do increased turnover in inventory and receivables (Hirschey et al., 2019).

The hypothesis for Return on Equity:

$$H_0: Return\ on\ Equity\ have\ no, or\ a\ negative, impact\ on\ the\ capital\ structure$$
$$H_A: Return\ on\ Equity\ have\ a\ positive\ impact\ on\ the\ capital\ structure$$

Equity to assets

Capital structure is how the corporation distributes its assets, through debt and equity. The equity to asset ratio measures how much of the total assets in a business is financed by shareholders equity. It is determined by dividing the total equity by total assets. Total assets consist of the total equity in the business and its total liabilities. A low equity to asset ratio indicates that assets are financed more through debt. It means an increased risk for the shareholders (Hillier et al 2020).

The capital structure is through a corporation's life kept relatively constant and can be explained by corporations having capital structure targets (Hanousek & Shamshur, 2011). Targets makes the variation in capital structure smaller as external economic conditions change (Hanousek & Shamshur, 2011). The practice of having capital structure targets is common, seen in a Swedish survey where 75.5% of firms answered that they use this tool (Lindblom et al., 2011). It is motivated to use the capital structure for previous periods as a variable to predict future periods.

The hypothesis for equity to assets:

$$H_0: The\ equity\ to\ asset\ in\ the\ previous\ period\ have\ no,$$
$$or\ a\ negative, impact\ on\ the\ capital\ structure$$
$$H_A: The\ equity\ to\ asset\ in\ the\ previous\ period\ have$$
$$a\ positive\ impact\ on\ the\ capital\ structure$$

Interest rate

Interest rate is the price to borrow from a lender. Different borrowers can be charged different interest rates for similar loans, depending on the amount of risk the lenders judge they take (Megginson et al., 2008). A borrower with a higher risk of default will receive a higher interest rate than if the risk is deemed low. The interest rate forms the cost of lending, a higher interest rate will lower the level of debt taken on by the corporation (Hillier, 2020). It leads to a positive impact on the equity to asset ratio.

The hypothesis for interest rate:

$$H_0: Interest\ rate\ have\ no, or\ a\ negative, impact\ on\ the\ capital\ structure$$
$$H_A: Interest\ rate\ have\ a\ positive\ impact\ on\ the\ capital\ structure$$

Dummy variables

A dummy variable can be added to a regression to examine certain characteristics. It indicates the presence or absence of something by taking a value of either 1 or 0. To analyze the effect of crises on capital structure, dummy variables will be assigned to the regression to represent the crisis- and recovery periods (James et al., 2013). If the dummy is significant, it influences the capital structure in a way that cannot be explained by the variables alone (Ruist, 2021). If the dummy is insignificant, it cannot be determined to affect the capital structure.

Dummy crisis takes a value of 1 for periods containing crisis and 0 otherwise. In the regression performed the variable is set as 1 in December 2008 and June 2020. Dummy recovery takes a value of 1 for periods following a crisis that is deemed as recovery periods and 0 otherwise. In the regression performed the variable is set as 1 in June 2009, December 2009, and December 2020.

The hypothesis for Dummy crisis:

$$H_0: A\ crisis\ have\ no\ impact\ on\ the\ capital\ structure$$
$$H_A: A\ crisis\ have\ an\ impact\ on\ the\ capital\ structure$$

The hypothesis for Dummy recovery:

$$H_0: A\ recovery\ from\ crisis\ have\ no\ impact\ on\ the\ capital\ structure$$
$$H_A: A\ recovery\ from\ crisis\ have\ an\ impact\ on\ the\ capital\ structure$$

Summary of variables effect on capital structure

The variables effect on the capital structure, equity to assets in the next period, is analyzed to determine if it is in line with the theories. See Table 1 for a summary on how the theories present the correlation between the variables and the capital structure.

Table 1 The correlation between each variable, in the previous period, and the equity to asset ratio.

	EA	ROE	Assets	Interest rate
EA_{t+1}	+	+	-	+

2.2. Modigliani & Miller theorem

The Modigliani and Miller theorem say that the value of a company is independent of the capital structure (Megginson et al., 2008). Capital structure only affects the corporation due to differences in taxation where value rises through a tax shield. The tax shield comes from the tax system that makes cost of debt deductible and the corporations leverage is thereby more advantageous than the investors leverage (Megginson et al., 2008).

The theorem is divided into two propositions.
Proposition 1 supports the corporations' market values independence of its capital structure. It suggests that the market value can be given by dividing earnings before interest and taxes (EBIT) at the rate of the required return on a firms' assets. The rate can be viewed as the discount rate based on the variability of the EBIT and should represent the risk of the corporation. Investors expect the long run profits a given firms' equity will yield (Megginson, et al., 2008).

Expressed mathematically:

$$V = (E + D) = \frac{EBIT}{r}$$

Were,

$V = Market\ value\ of\ the\ firm$

$E = Market\ value\ of\ equity$

$D = Market\ value\ of\ debt$

$r = required\ return\ on\ assets$

Proposition 2, consider the effect on an increasing leverage on cost of equity. The suggestions are that the required return on assets and the required return on debt is constant, the required return on levered equity rises as the debt-to-equity ratio rises (Megginson, et al., 2008).

If proposition 1 holds true and capital structure is irrelevant, then proposition 2 says what the required return on equity is to maintain the firm value. The cost of equity will rise as the firm substitutes debt for equity while weighted average cost of capital and average cost of capital stays constant (Megginson, et al., 2008).

$$r_1 = r + (r - r_d)D/E$$

were,

$r_1 = required\ return\ on\ levered\ equity$

$r = required\ return\ on\ assets$

$r_d = required\ return\ on\ debt$

$D = Market\ value\ of\ debt$

$E = Market\ value\ of\ equity$

2.3.   Trade off theory

The trade off theory expands Modigliani & Millers theorem by adding financial distress cost (Kraus & Litzenberger, 1973). To maximize the value of a corporation, the capital structure needs to be optimized. A way to optimize the capital structure is to add debt until the marginal cost of debt equals marginal cost of equity (Abel, 2018). The benefit from usage of debt is called the marginal benefit of the tax shield. The marginal cost of debt includes both the interest and the financial distress cost. Financial distress cost is added through the higher

interest rate that needs to be paid as the risk of default increases. The theorem suggests that the choice between debt and equity should fall on the one with the least marginal cost (Abel, 2018).

2.4. Pecking order theory

The pecking order theory suggests in which order financing sources should be prioritized and is presented in the form of a ladder (Hillier, 2020). The first step of the ladder is using free cash flow that currently is not being used. The second step is to use debt to cover the losses or investments needed. The third, and final, step is issuance of equity. Since equity only should be issued when the stock is overpriced, it is the final step a corporation should take. Because if equity is issued when stock is undervalued it would be sold at a discount, hurting current investors who prefer equity to be issued at a premium to give the opposite effect. This collision of interest between shareholders and company gives reason to why equity will not be issued at a discount (Hillier, 2020).

There is a psychological factor to consider. Since corporations rather issue equity when the stock is trading at a premium, investors will view the issuance of equity as confirmation that the stock is in fact valued at premium (Hillier, 2020). It will lead to a fall in the stock price and the value of the current shareholders will fall which goes against the assumption of shareholder value maximization. Issuing equity is therefore seen as a last resort (Lindblom et al., 2011).

2.5. Measurements for pecking order theory

To analyze the sufficiency in the pecking order theory as a model the ratios for equity to assets, return on equity and cash flow to equity will be used.

Equity to assets, the measure of the actual capital structure. The ratio should be optimized in accordance with the trade off theory to maximize shareholder value. As corporations are faced with a need for capital corporations are assumed to follow the pecking order theory. It can be seen through a survey performed on Swedish corporations (Lindblom et al., 2011). See Table 2 for a summary of how the equity to assets ratio changes as the different stages in the pecking order theory passes.

Cash flow to equity, the net cash flow is the change in current assets. It comes from either investment, operating or financing activities. If the ratio is negative, it means that corporations are using more free capital than what it receives and vice versa. Since the cash flow shows how capital flows in and out of the firm it will be an indication of which stage of the pecking order theory that is reached. (see Table 2)

Return on equity, the net income divided by equity. If ROE is high, it could mean both a high net income or a low level of equity. It is a way to assess the performance of a corporation. The return on equity is added to the analysis to isolate the cash flow from activities other than operations. (see Table 2)

Table 2 A description of how each stage of the pecking order theory, in theory, should affect the different ratios.

	EA	ROE	CFE
Internal financing	-	?	?
Issue debt	-	?	+
Issue equity	+	?	+

3. Method

3.1. Research strategy

The research strategy can be described as quantitative research. Quantitative research refers to the process of collecting data, processing it statistically and then analyzing the outcome (Patel & Davidson, 2019).

The source of the data collection is Thomson Reuters Refinitive Eikon, a database providing access to real time market data and news. It is a source that provides primary data from businesses financial reports and can therefore be considered as a reliable source. The data was extracted 30 November 2021 and consists of 4 978 corporations. All corporations have headquarters based in European countries. Corporations with a headquarter based in Russia were excluded. To filter out smaller corporations an arbitrary lowest total asset value was set to 50 million US dollars. No selection based on industry, or any other business characteristics were applied.

The data was collected for the timeframe 2006-2021 in semi-annual intervals and contained values for assets, equity, debt, net income after taxes and net cash flow. To capture the situation pre-financial crisis, it was decided to start from mid 2006 up to 2021 to capture as much of the pandemic as possible. Semi-annual intervals were chosen to capture clearer changes and fluctuations than yearly data could provide. If quarterly data was used there would appear a bias since all countries do not have the common practice to report quarterly. Semi-annual intervals were determined to produce a result reflecting reality as close as possible.

To find suitable literature Gothenburg Universities search engine was used with the coding method *"Financial Crisis 2008", "Covid-19 and economy", "Capital structure", "Capital structure in crisis",* "*Size and capital structure/interest rate", "Modigliani and Miller", "Trade off theory" and "Pecking order theory"*. Beside the studies found through the search engine, literature used during courses in the bachelor economics program at GU was used.

3.2. Data processing

Of the 4978 corporations measured over the 15-year period. In certain periods for some corporations no values were reported. They were removed from the sample because they would otherwise disturb the result of the regression. See Table 3 for the number of observations which were removed for each screening performed.

Beside there being nonvalues in some periods there were also outliers that disrupted the result and needed to be removed. For assets no outliers were identified or removed, a lower limit was set at 50 million USD and no upper limit. (see Table 3)

Cash flow to equity and return on equity cleared values outside -200% and 200%. An arbitrary limit put on the data to give a higher explanatory value in the outcome, some outliers can exist especially with a large enough population. (see Table 3)

Equity to assets dropped all values outside of 0% and 100%. It is a reasonable range due to companies with a ratio lower than 0% stands on the brink of bankruptcy. To fulfill the assumption of profit maximizing, corporations with negative equity level were excluded since they will not survive in the long run. (see Table 3)

Table 3 Screening of non-values, lower bound and upper bound.

	EA	ROE	CFE	Assets
Total	4978	4978	4978	4978
	(100%)	(100%)	(100%)	(100%)
Clearing 1	2192	2197	2197	2193
Drop of nonvalues	(44,03%)	(44,13%)	(44,13%)	(44,05%)
Clearing 2	2012	2090	2073	2193
Lower bound	(40,42%)	(41,98%)	(41,64%)	(44,05%)
Clearing 3	2003	2029	2023	2193
Upper bound	(40,24%)	(40,76%)	(40,64%)	(44,05%)
Total after clearing	2003	2029	2023	2193

3.3. Regression

Regression analysis is suited for examining correlation between variables who have a causal relationship. In a regression there are explanatory variables that are tested to see how they affect the response variable. It tests how the response variable changes in response to changes in the explanatory variables.

The regression in this essay is as follows:

$$EA = \beta_0 + \beta_1 EA_{t-1} + \beta_2 ROE_{t-1} + \beta_3 assets_{t-1} + \beta_4 r_{t-1} + \beta_5 d_{crisis} + \beta_6 d_{recovery}$$

Where Equity to Assets (EA) is the response variable. EA, ROE, assets, and interest rate for the previous period as well as dummy crisis and dummy recovery, are the explanatory variables that are tested to see if and how they affect the response variable.

$\beta_1 - \beta_6$ represents the coefficients and show the effect the individual explanatory variables have on the response variable.

d_{crisis} Takes a value of 1 when there is a crisis and 0 all other times
$d_{recovery}$ Takes a value of 1 when there is a recovery period after a crisis and 0 all other times

A statistical hypothesis test will be performed to test the hypothesis stated in the theory section. The hypothesis is created by first forming an assumption on the population based on earlier studies; the assumption will be the alternative hypothesis with the opposite of the assumption being the null hypothesis. Based on the outcome of the test, the null hypothesis will either be rejected, proving the assumption correct, or it will not be rejected, and no conclusions can be drawn.

There are two typical errors done in a hypothesis test. Type 1 error means the null hypothesis is rejected when it is true, type 2 error means not rejecting the null hypothesis when it should be. The risk for type 1 error is minimized by choosing a small significance value, the most common being 5%. The null hypothesis is rejected if the p-value is less than 5%. The risk for type 2 error is minimized by increasing the sample size. By keeping the sample size large the risk for a type 2 error is minimized.

3.4. Mean value chart

The average value in each time period for the three variables; equity to assets, return on equity, and cash flow to equity is used. They are calculated accordingly:

$$EA = \frac{Equity}{Assets} \qquad ROE = \frac{Net\ income}{Equity} \qquad CFE = \frac{Net\ cash\ flow}{Equity}$$

They are shown in charts with the timeline on the x-axis and the average value of the ratio on the y-axis, the diagrams show how the ratio changes over time. Individual changes are shown in the delta diagrams. The delta diagrams are used as supplements to deepen the analysis. Large corporations have greater impact on the delta than smaller companies, they will not completely correlate with the mean value chart.

3.5. Research Quality

There are always risks associated with the choice of method.

Analyzing mean values entail the risk of different values having different weight on the result. Using ratios helps mitigating that risk but there is a difference between the ratio diagram and the delta diagram. In the ratio figures all values have the same weight whereas in the delta figures corporations with large values will show larger absolute fluctuations. It could give a misleading result.

Data processing is another issue. There is a bias towards larger corporations since all corporations with an asset level lower than 50 million US dollar were not included in the population. It could be viewed as strengthening the performed analysis since smaller corporations can be assumed to be less knowledgeable and unable to maximize shareholder value. The bias could be seen as a screening through the assumption of maximizing shareholder value.

With the method used, the variables are not collectively exhaustive meaning that other variables can explain the variability in the data. The variables were chosen as qualified guesses on what should impact the capital structure but that includes a risk of error since capital structure is a complex issue.

The reliability in a quantitative study can be connected to the data and method used to process it. If someone else could use the same methods as used in this study and receive the same result, then the data can be considered reliable (Patel & Davidson, 2019). How the data is processed in this essay, where it is collected from, and how it is screened, are clearly

defined. Since the data consists of historical numbers, they will not change as time passes. The only subjective judgment seen in the data processing is the limits put on the corporations and the variables. For the variables the point of removing outliers was to strengthen the result to make it more reliable so that a few corporations having extreme values compared to the rest will not disrupt the analysis ability to represent the population.

The validity of the study is tied to whether the data collected is relevant to the purpose (Patel & Davidson, 2019). In the theory section, the use of the theories and variables to realize the purpose is motivated. Every bit of information, every theory and variable are used to reach the conclusion. In the data processing the goal was to use data that reflected reality as closely as possible, another reason for why outliers needed to be removed so that some values with heavy leverage did not disrupt the result.

4. Empirical findings

4.1. Regression

Changes in capital structure between 2006-2021 and how variables affect capital structure during the time period was analyzed through a regression on the equity to assets ratio. Equity to assets is responsive to the previous periods: equity to assets, return on equity, assets, and interest rate. Periods of crisis and recovery are represented through the dummy variables.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,870189893
R Square	0,75723045
Adjusted R Square	0,691020572
Standard Error	0,004289819
Observations	29

	Coefficients	Standard Error	t Stat	P-value
Intercept	0,326674563	0,088998579	3,670559	0,001342
EA *t-1*	0,374268633	0,175999893	2,126528	0,044919
ROE *t-1*	0,236265398	0,083866134	2,817173	0,010036
Assets *t-1*	-2,53191E-12	1,11569E-12	-2,26937	0,033398
Interest rate *t-1*	-0,253821808	0,084802428	-2,9931	0,006701
Dummy Crisis	-0,011156353	0,003667312	-3,04211	0,00598
Dummy Recovery	0,00858795	0,005498983	1,561734	0,132622

Figure 1. The regression output, the values used in the analysis are typed in bold. R^2 says how much of the variation in the data is explained by the variables, the coefficient shows how the response variable change when the variable change, P-value is used to decide if the null hypothesis can be rejected.

In the regression statistics R^2 takes a value of 0.76 implying that around 76% of the fluctuations in the data can be explained by the variables. They can be determined to have a high explanatory power for predicting movements in the capital structure.

As observed in the *P-value* column, all variables are significant except for the dummy recovery. The data cannot reject the null hypothesis that the recovery period has no effect on the capital structure. The coefficient of dummy crisis is negative implying that equity to assets fall when there is a period of crisis.

Equity to assets and return on equity have a positive coefficient indicating that they have a positive effect on the capital structure. A 0.01 percentage point increase in equity to assets

will increase the next period's equity to assets with 0.37 percentage points. Similarly, a 0.01 percentage point increase in return on equity will increase the next period's equity to assets with 0.24 percentage points.

Assets and interest rates have a negative coefficient, indicating that they have a negative effect on the capital structure. An increase of 1 billion dollars in assets will decrease the equity to assets ratio by 2.5 percentage points the following period. A 1 percentage point increase in the interest rate will decrease the equity to asset ratio by 0.25 percentage points.

Only one significant inter-variable correlation is observed. Return on equity and equity to assets have a correlation of 0.57. It implies that if either variable increase, the other tends to follow the same direction.

4.2.   Equity to assets

The first two periods are stable closer to 49% before decreasing to 47%, it takes a year to reach this point, the period of December 2008 represents when the financial crisis started in Europe. After the minimum point, the equity to asset ratio recovers to its initial ratio in shorter time than the initial drop and continues to go up to a maximum of 49.5%. Through the 2010s equity to assets fluctuated around a positive trendline with rising average level from 49% up to 49.5%. (see Figure 2)
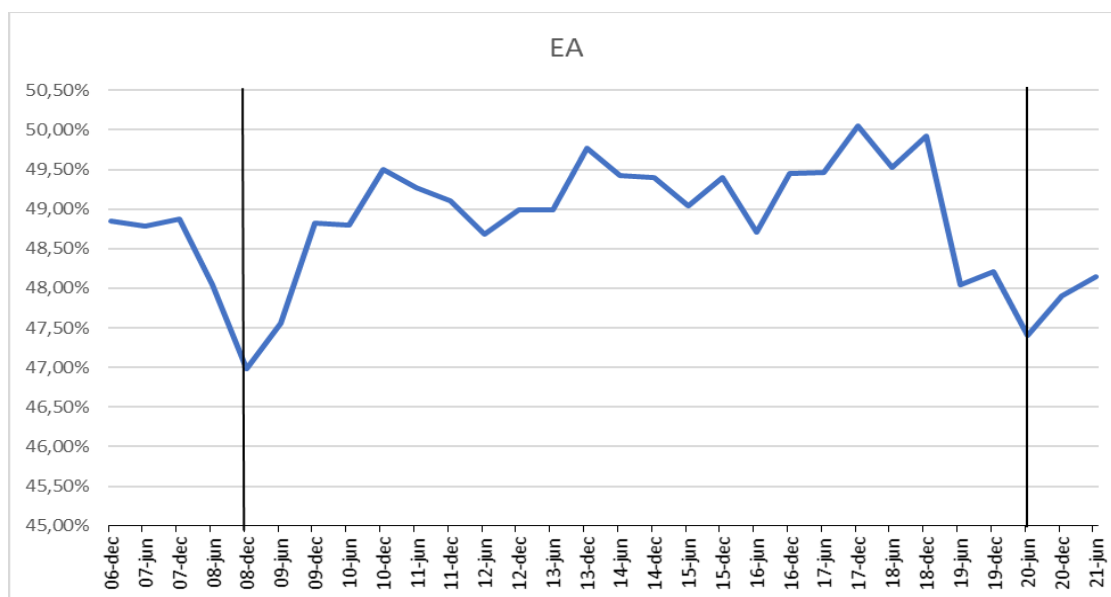
Figure 2 Equity to Asset ratio from December 2006 to June 2021. The two lines mark the crises.
Left: Financial crisis. Right: Covid-19 pandemic

At the start of 2019 the equity to asset ratio dropped about the same amount as in the financial crisis. It occurred before the start of the pandemic and then dropped an additional 0.5 percentage point. June 2020 is the turning point and by the end of the year the ratio is back to about the same value as before the pandemic.
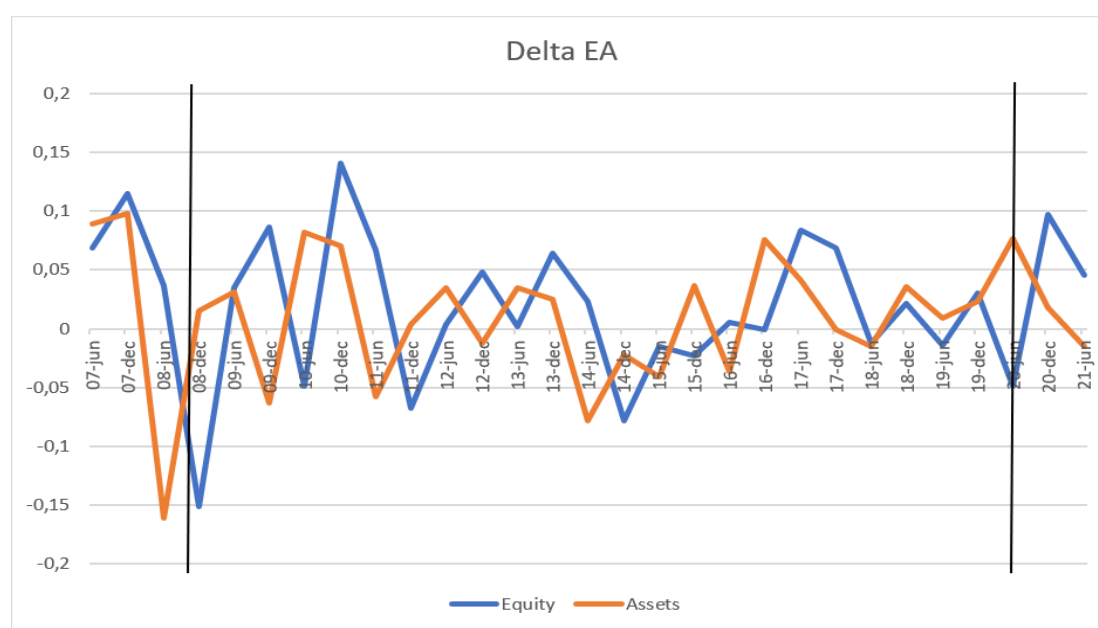

Figure 3 Changes in equity and assets from December 2006 to June 2021. The two lines mark the crises.
Left: Financial crisis. Right: Covid-19 pandemic

By looking at the differences between the two variables there is a clear pattern, until mid to late 2010s. Equity follows the movement in assets and the relationship between the two can be measured using correlation. (see Figure 3)

$$Corr(Equity, Assets) = 0,07$$

The correlation between the derivatives of equity and assets in the same period is 0.07, showing that in the same period there is no correlation between how the two moves.

$$Corr(Equity_t, Assets_{t-1}) = 0,82$$

Calculating the correlation between equity in time t and assets time t-1, the result is 0.82. There is a strong positive relationship between assets the period before and equity.

The equity level during the financial crisis did not recover to pre-crisis level until December 2010, four periods after its earlier peak. During the pandemic a decrease in equity was observed in the crisis period, the next coming periods observed a rise in equity. The peak in asset level, pre-financial crisis, is not reached again until the pandemic begins. After the start of the financial crisis, the level of assets did not increase until June 2010. It then hovered around the same level until the pandemic started.

4.3.   Return on equity
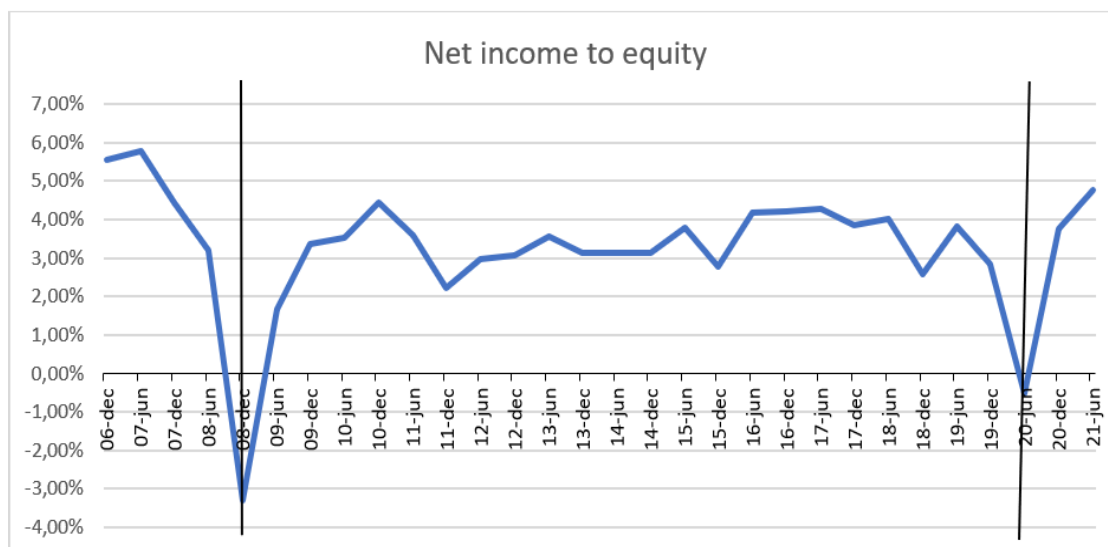
Figure 4 Return on equity ratio from December 2006 to June 2021. The two lines marks the two crises. Left: Financial Crisis Right: Covid-19 pandemic

The ROE, started in 2007 at a highest point close to 6%, it did not return to this level. From June 2007 it dropped about 3 percentage points until June 2008 where it took a 6 percentage points nosedive ending up at -3% at the lowest measured point. It can be related to the bankruptcy of Lehman Brothers in September 2008. A year after, in December 2009 ROE was back at the point before the financial crisis and it was relatively stable during the 2010s. With the start in late 2019 the ratio fell and going into 2020, when the pandemic reached Europe, 3.5 percentage point drop got ROE back into a negative value. Much like the financial crisis period, the negative ROE did not last long and by the end of 2020 it was back at pre pandemic levels and rising. (see Figure 4)
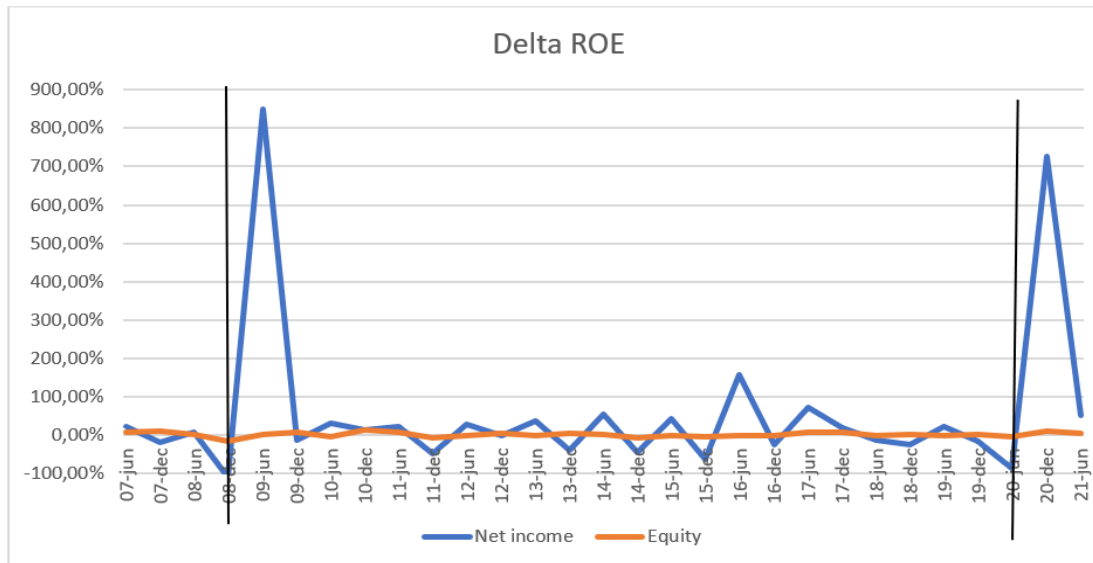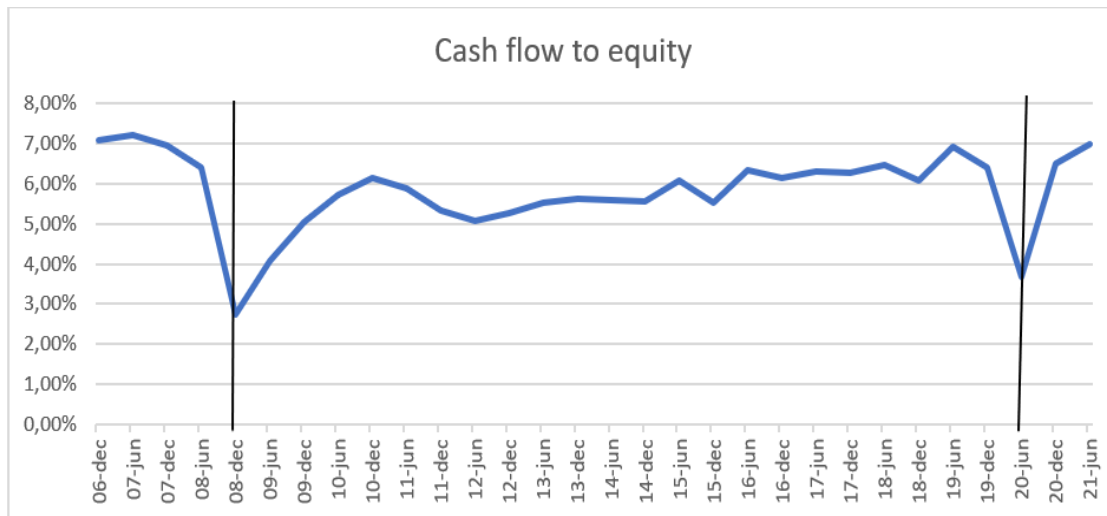
Figure 5 Changes in Net income and Equity from December 2006 to June 2021. The two lines mark the crises.
Left: Financial crisis. Right: Covid-19 pandemic

By looking at the differences between the two variables there is a clear difference. While equity holds stable throughout the time period, net income fluctuates, at certain points quite violently. The fluctuations in net income match the fluctuations in ROE, in terms of direction and not magnitude. It can be assumed that the fluctuations in ROE largely depend on net income and not on equity. (see Figure 5)

$$Corr(Net\ income, Equity) = 0,28$$

The calculation of the correlation between net income and equity gives a value of 0.28. Indicating a weak positive relationship. Since net income after the financial crisis and the pandemic have such violent fluctuations and equity barely moves it can be assumed to weaken the overall correlation quite a bit.

4.4. Cash flow to equity

Figure 6 Cash flow to equity from December 2006 to June 2021. The two lines mark the crises.
Left: Financial crisis. Right: Covid-19 pandemic

Cash flow to equity reaches its highest point in mid 2007 before a downward trend from the start of 2008 and around the time the investment bank Lehman Brothers went into bankruptcy. The financial crisis struck globally, and the ratio fell 3.5 percentage points. The recovery period does not quite reach pre-crisis levels and after a 1 percentage point decrease, over a two-year period, there is an upward trend. Apart from a slight drop 2015 it is quite stable. Late 2019 is when the next downward trend starts and early 2020 it drops 3.5 percentage points. The recovery is faster in the pandemic than in the financial crisis and by the end of 2020 it has reached pre-pandemic levels again. (see Figure 6)
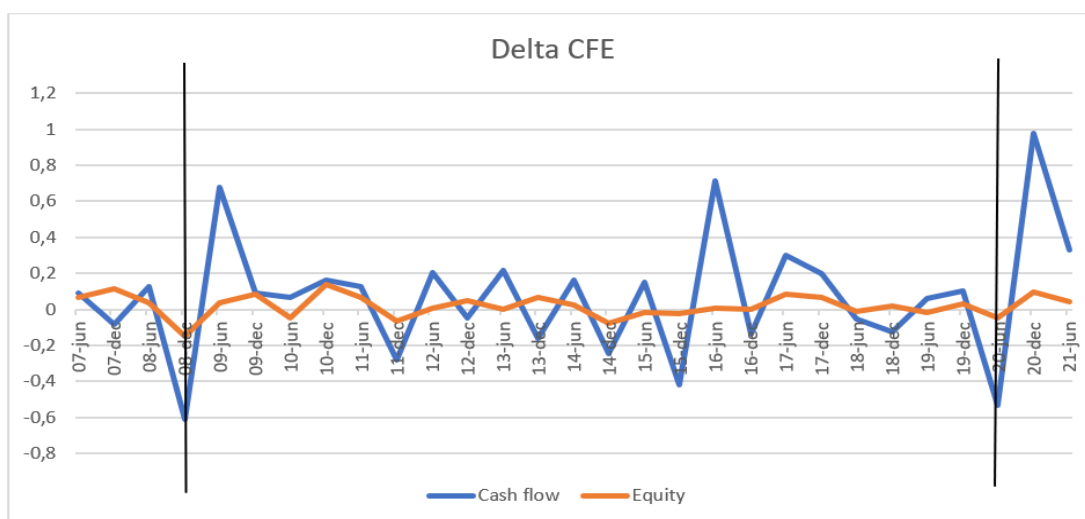

Figure 7 Changes in Cash flow and Equity from December 2006 to June 2021. The two lines mark the crises.
Left: Financial crisis. Right: Covid-19 pandemic

By looking at the differences between the two variables there is a clear difference. Equity holds steady apart from the time period 2008-2011. Net cash flow fluctuates violently over the entire measured time period, with three points showing extreme fluctuations. The first extreme fluctuation happens during the financial crisis, the second around 2016 and the third around the pandemic. The three extreme fluctuating delta value of net cash flow correlates to the fluctuations seen in the ratio. (see Figure 7)

$$Corr(Cash\ flow, Equity) = 0,52$$

The correlation between net cash flow and equity has a value of 0.52 indicating a moderately strong positive correlation. When net cash flow changes, equity tends to follow in the same direction. There is a noticeable difference in how much they individually fluctuate between periods. Due to the positive correlation between the variables the ratio is more stable than the variables individually.

$$Corr(ROE, CFE) = 0,896$$

The correlation between return on equity and cash flow to equity have a value of 0.896 indicating a strong positive correlation. Return on equity is a part of the net cash flow for the corporation meaning it is reasonable for the ratios to have a strong correlation. It shows the importance of the return on equity since a fall leads to a fall in cash flow to equity as well.

$$Corr(ROE, CFE - ROE) = -0,870$$

The correlation between return on equity and cash flow to equity subtracting the return on equity have a value of -0.870 indicating a strong negative correlation. When the return on equity ratio falls, cash flow to equity from other sources rises.

5. Analysis

5.1 How do the variables influence changes in the capital structure?

The equity to assets hypothesis:

$$H_0 : The\ equity\ to\ assets\ in\ the\ previous\ period\ have\ no\ ,$$
$$or\ a\ negative, impact\ on\ the\ capital\ structure$$
$$H_A : The\ equity\ to\ assets\ in\ the\ previous\ period\ have$$
$$a\ positive\ impact\ on\ the\ capital\ structure$$

The regression output for the variable equity to assets, in the previous period, show a p-value of 0.045, which is less than the chosen significance value of 0.05 and the null hypothesis can therefore be rejected. The positive impact of the equity to asset ratio is reasonable. Corporations tend to keep the capital structure consistent, a corporation that over time has relied more on debt keep relying on it in the future. It implies a positive relationship where a high equity to asset ratio now tends to lead to a high equity to asset ratio in the future.

The size hypothesis, where size is represented by assets:

$$H_0 : Assets\ have\ no, or\ a\ positive, impact\ on\ the\ capital\ structure$$
$$H_A : Assets\ have\ a\ negative\ impact\ on\ the\ capital\ structure$$

The regression output for the variable asset shows a p-value of 0.033 which is less than the chosen significance value of 0.05 and the null hypothesis can therefore be rejected. Size has a negative relationship with the equity to asset ratio. Corporations of greater size usually have easier access to financial markets; they are less likely to default which is in accordance with earlier research.

The return on equity hypothesis:

$$H_0: Return\ on\ equity\ have\ no, or\ a\ negative, impact\ on\ the\ capital\ structure$$
$$H_A: Return\ on\ equity\ have\ a\ positive\ impact\ on\ the\ capital\ structure$$

The regression output for return on equity shows a p-value of 0.01, which is less than the chosen significance value of 0.05 and the null hypothesis can therefore be rejected. A positive relationship between return on equity and equity to assets is reasonable, since a more profitable firm has more retained earnings and thus a higher level of equity.

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The interest rate hypothesis:

$$H_0: Interest\ rate\ have\ no, or\ a\ negative, impact\ on\ the\ capital\ structure$$
$$H_A: Interest\ rate\ have\ a\ positive\ impact\ on\ the\ capital\ structure$$

The regression output shows a p-value of 0.007, which is less than the chosen significance level of 0.05 and the null hypothesis can first be assumed to be rejected. However, the coefficient for the interest rate variable have a value of -0.25 which is in line with the null hypothesis and should therefore not be rejected.

The theory assumes a positive relationship between interest rate and equity to assets. A higher interest rate should mean that corporations prefer less debt and thus more equity. Since the coefficient of the variable show a negative value there is a contradiction to earlier research. A possible explanation is that equity to assets has increased over time while interest rates have decreased and therefore just a coincidence. Lower interest rates mean a lower cost of debt and a lower cost of equity, if cost of equity reacts stronger to changes in interest rate it implies a lower interest rate increases the equity to assets ratio.

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The crisis dummy hypothesis:

$$H_0: A\ crisis\ have\ no\ impact\ on\ the\ capital\ structure$$
$$H_A: A\ crisis\ have\ a\ impact\ on\ the\ capital\ structure$$

The regression output shows a p-value of 0.006, which is less than the chosen significance level of 0.05 and the null hypothesis can therefore be rejected. The variables: equity to assets, return on equity, interest rate and size alone cannot fully explain changes in capital structure. A negative coefficient indicates that crisis period has a negative effect on the capital structure.

The recovery dummy hypothesis:

$$H_0: Recovery\ from\ crisis\ have\ no\ impact\ on\ the\ capital\ structure$$
$$H_A: Recovery\ from\ crisis\ have\ a\ impact\ on\ the\ capital\ structure$$

The regression output shows a p-value of 0.13, which is higher than the chosen significance level of 0.05, the null hypothesis can therefore not be rejected. Meaning that the hypothesis test cannot determine whether the recovery period after a crisis has an impact on the capital structure.

5.2   Can changes in corporation's capital structure during crises be fully explained by the pecking order theory and how can it be adapted to better explain observed behavior?

According to the pecking order theory, the firm should initially use internal financing when cash is needed to compensate for the negative return on equity experienced through a crisis. As current assets, built upon retained earnings, are used the equity to asset ratio will shrink. The effect on the net cash flow will be negative since cash reserves are used.

As the internal capital is used there are two ways to proceed according to the pecking order theory. The first is the use of debt and the second is issuance of equity. Using debt to cover losses or investments will make assets increase and therefore shrink the equity to assets ratio. More liquidity in the corporation implies a positive effect on the net cash flow. Issuing equity will increase both equity and assets and the equity to asset ratio will increase. Like debt, it brings more liquidity to the corporation and will show a positive effect on the net cash flow. There are three ways in how a corporation can receive cash flow: first, through profits from operating activities, second through financing activities and third through investment activities.

5.2.1. Financial Crisis 2008

During the financial crisis a negative net cash flow from operating activities was observed. Combined with a shrinking equity to asset ratio it insinuates that the company uses internal financing.

The four periods following the start of the financial crisis show an increasing equity to asset ratio. Combined with a lower asset level it insinuates that the level of debt has decreased because of the credit crunch experienced through the financial crisis. Debt financing was not a viable option during the crisis period, diverging from the behavior the pecking order theory proposes. The divergence can be explained by the trade off theory, the cost of debt grew to be larger than the cost of equity. Another possible explanation, for what is seen in the study, is downsizing, where non-current assets are used to receive a positive cash flow from investments, and it should show a lower asset level and increase in net cash flow. As the net cash flow contribute more than what the profits do there needs to be another factor to explain this difference. After the crisis, the level of debt and equity are stable and cannot explain the higher level of net cash flow. Downsizing is therefore a possible option.

In the data all corporations are analyzed on an aggregated level, implying that non-current assets traded between European corporations will not be shown in the data. Because of this the extent, at which downsizing is used, cannot be analyzed in this study.

A rise in equity to assets is observed, as well as net cash flow, following the crisis. The rise is in line with the prediction for when equity is issued but it could be more adequately explained

through a rise in profitability. It could be made up from retained earnings from the profits building in the recovery.
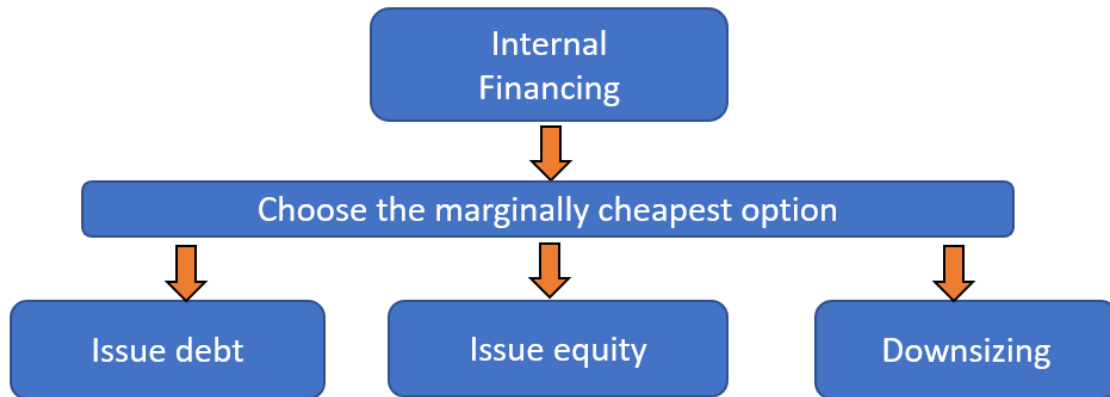

Figure 8 Visualization of how to adapt the pecking order theory or trade off

5.2.2. Covid-19 pandemic

During the pandemic the cash flow to equity was negative but that from debt was positive indicating changes in net cash flow was due to financing activities, corporations took on more debt.

The first period of the pandemic saw a rise in debt and fall in equity. In the following period a rise in both debt and equity is observed, considering that return on equity increases in the same period the rise in equity can be contributed to retained earnings increasing and not issuance of new equity. The rise in debt lines up with the second stage of the pecking order theory. In accordance with the theory, after internal capital is used, a corporation should use debt. The effect should be a lower equity to assets ratio while net cash flow increases.

Equity continues to increase in the final period of the pandemic. The equity to asset ratio changes in the same direction, implying that debt is either decreasing or stagnant. Changes in equity during the pandemic can therefore not certainly be explained through issuance of equity but rather through retained earnings.

Due to the pandemic not being over in present time, and only three periods after the start of the pandemic are observed, the full recovery cannot be analyzed in this paper. There is a

recovery observed in the data, but no analysis can be made for the full extent of its effect on capital structure.

5.2.3. Comparison

The capital structure has changed in different ways when comparing the two crises which can be explained by the nature of each crisis. Debt was harder to acquire in the financial crisis, but the banks in the pandemic showed more willing to approve loans. During the financial crisis corporations seemed to use internal financing to a greater extent instead of issuing either equity or debt to finance its operations, seen through the decrease in assets. Compared to the pandemic which saw a rise in assets due to acquiring more debt.

When the marginal cost of debt is greater than that of equity a corporation should issue equity. It leads to an increase in the equity to asset ratio. As equity is issued the net cash flow will rise since there is a positive inflow of capital from investment activities. During both crises this series of events is realized but it cannot be surely related to issuance of equity. The rise in return on equity, in the time periods these events happen, can explain both variables through retained earnings.

6. Conclusions

6.1. Thesis

The analysis tested six hypotheses. Two of the hypotheses were for the dummies and the other four for the explanatory variables. Four of the null hypotheses could be rejected. The two null hypotheses that could not be rejected was, for the variables dummy recovery and interest rate, due to insignificance and the coefficient being in line with the null hypothesis respectively. Both return on equity and equity to assets has shown a significant positive impact on the capital structure while the size and dummy crisis showed a negative impact.

It can be concluded that the pecking order theory is insufficient in explaining changes in capital structure during the financial crisis. The reason is the difficulty in raising capital, through either debt or equity, at times when lending was restricted. As the cost of raising capital increase the acquisition of capital through downsizing becomes a more viable option. Downsizing means that a firm receive a positive cash flow from divestment activities which becomes a necessary option when the raising of capital becomes too expensive.

The four variables explain a considerable part of the fluctuations seen in the capital structure. It can be concluded that the variables alone cannot explain the changes seen in a crisis but may explain the change seen in the recovery period. The variables will affect the cost of capital for receiving cash flow from debt, equity, or investment activities. When a corporation needs free capital and decides how to finance that need, the cost of different options is important. Through the adapted pecking order theory, the corporation should choose the option with the lowest marginal cost, adding the additional option of downsizing.

6.2. Further research

An area to research further is the addition of downsizing in the pecking order theory, it was only presented as a possible explanation for the observed behavior in this study and could be the focus of a future study. Considering that the Covid-19 pandemic to this day is not over the full effect could not be analyzed and in time, when the pandemic is considered to be over, a study could be crafted that captures the entire pandemic.

7. References

7.1. Literature

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7.2. Table of figures

7.3. Table of charts