

Thesis

How firms prioritize the dynamic trade-off theory and funding horizon theory: Investigating the impact of cash needs on adjustment speed toward leverage target

Mahdad Mollazamani

May 2025

A Thesis submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfilment of the requirements of the degree of

MASTER OF SCIENCE

Asper School of Business

University of Manitoba

Winnipeg

Copyright © 2025 by Mahdad Mollazamani

Abstract

This study explores how firms adjust their capital structure in response to short- and long-term cash needs, examining the dynamic trade-off and funding horizon theories. While liquidity constraints may temporarily push firms away from target leverage, they ultimately rebalance, supporting the dynamic trade-off theory. However, adjustment speed varies with cash need severity, as greater liquidity constraints delay rebalancing. The findings highlight financial frictions' role in capital structure decisions, showing that cash shortages create persistent barriers to optimal leverage. This study contributes to the literature by demonstrating how liquidity constraints shape firms' leverage adjustments and financial decision-making.

Keywords: Funding Horizon Theory, Dynamic Trade-Off Theory, Adjustment Speed, Short-term Cash Needs, Long-term Cash Needs, Optimal Capital Structure

Table of contents

1.	Introduction.....	4
2.	Literature Review and Hypothesis Development.....	7
3.	Data	14
4.	Results and Discussion.....	28
4.1	Main Results	28
4.1.1	Hypothesis 1 Results	28
4.1.2	Hypothesis 2 Results	34
4.1.3	Hypothesis 3 Results	37
4.2	Identification Strategies.....	39
4.2.1	Identification strategy for H2: Impact of COVID-19 on Cash Needs in Vulnerable Industries	39
4.2.2	Identification strategy for H3: Underfunded Pensions vs. Funded Pensions	43
4.3	Robustness Tests.....	51
4.3.1	Winsorizing vs. Trimming of average lambda.....	51
4.3.2	Operating Cash Flow (OCF) vs. Internal Cash Flow (ICF)	54
4.3.3	Cash _{ex ante} vs. Cash _{ex post}	58
4.3.4	Debt type Alignment with Cash Need Duration: Evidence Supporting H2 and H3	62
5.	Conclusion	64
6.	References	66
	Appendix A: Variables definitions	70
7.	Internet Appendix	72
7.1	Additional variables description	72
7.2	Sub-Industries Impacted by COVID-19.....	74

1. Introduction

The dynamic trade-off and funding horizon theories are competing theories that describe how firms make capital structure decisions. While the dynamic trade-off theory, by Fischer et al. (1989), suggests that firms will move toward their optimal capital structure over time, the funding-horizon theory, by Huang and Ritter (2020), suggests that firms with immediate or short-term cash needs lean towards debt financing to benefit from lower costs and tax advantages. Those with longer-term needs prefer equity financing to maintain financial flexibility by keeping unused debt capacity and avoiding debt constraints.

There are two key scenarios below that reflect the fundamental argument of this study's hypotheses. The confrontation between these theories is most pronounced in scenarios where firms deviate from their theoretical optimal debt levels in response to immediate cash needs. In the first scenario, there is a firm that is already over-leveraged, which means its debt ratio is above the optimal debt ratio defined by the dynamic trade-off theory. Although the given firm is over-leveraged, it can still choose to issue more debt if faced with short-term cash shortages, as predicted by funding horizon theory, which will drag it further away from the target leverage. Similarly, for the second scenario, consider an under-leveraged firm that may issue equity to secure long-term financial stability, moving further away from its target capital structure as determined by dynamic trade-off theory. In both scenarios, I explore how firms' debt and equity structures react after they make financial decisions that move them away from their ideal debt levels. This study examines whether and how these firms realign with their target leverage over time.

This study proposes a structured approach to understanding how firms navigate the tension between these competing theories by formulating hypotheses that test whether firms actively adjust their capital structures after deviating due to liquidity constraints. Specifically, I hypothesize that despite the immediate financial pressures pushing firms away from their optimal leverage, they will exhibit systematic rebalancing behavior over time, consistent with the dynamic trade-off theory. The first hypothesis (H1) tests whether firms that are already over-leveraged and take on more debt to meet short-term cash needs eventually try to reduce their leverage. It examines whether these firms adjust their capital structure to move closer to their target levels. This would suggest that while firms may temporarily rely on debt to address liquidity constraints, they still prioritize long-term financial stability by deleveraging when conditions permit. If H1 holds and firms indeed move toward their target leverage despite initial cash-driven deviations, the next step is to examine whether the speed of this adjustment varies depending on the nature of cash needs. Now, if H1 stands to be true, the second hypothesis (H2) investigates whether over-leveraged firms with short-term financial needs move more slowly toward their target capital structure. It tests whether these firms, due to their reliance on debt issuance, exhibit a lower adjustment speed. Equivalently, the third hypothesis (H3) explores the effect of long-term financial obligations on capital structure adjustment. It evaluates whether firms with sustained funding needs also exhibit a slower adjustment toward their target leverage due to their reliance on equity issuance. If firms eventually rebalance after initially diverging from their optimal capital structure, it would reinforce the view that financial frictions influence short-term decision-making but do not undermine firms' adherence to the dynamic trade-off framework. Lastly, I propose that the speed of adjustment depends on the nature and severity of cash needs. Firms facing

greater financial constraints may take longer to realign with their target leverage, as rebalancing is contingent on factors such as profitability, market conditions, and access to capital markets.

In short, this research contributes to the literature by examining the interplay between the dynamic trade-off theory and the funding horizon theory, assessing whether the latter fully overrides the former. If the funding horizon theory does not entirely dominate, I analyze its influence in slowing down capital structure adjustments predicted by the dynamic trade-off theory. By bridging the gap between these theories, this study demonstrates that while firms do move toward their optimal capital structure, the presence of significant cash needs alters the speed of this adjustment. The funding horizon theory may temporarily impact financing behavior, yet the persistence of capital structure realignment validates the dominance of the dynamic trade-off theory. Ultimately, firms' leverage decisions remain primarily guided by the dynamic trade-off framework despite temporary deviations.

The findings of this research provide strong empirical support for the dynamic trade-off theory while demonstrating that cash needs, whether short-term or long-term, can significantly slow down the adjustment process toward optimal leverage. Empirical results confirm that firms consistently adjust toward their target leverage, albeit at a slower pace when faced with urgent liquidity constraints. However, firms facing urgent cash needs adjust more slowly, reinforcing the hypothesis that financial pressures act as frictions in the realignment process.

To address potential endogeneity concerns, I employ two key identification strategies. First, I use the COVID-19 pandemic as an exogenous shock to identify firms most affected by short-term liquidity constraints, particularly those in industries such as hospitality, retail, and transportation. The pandemic serves as a natural experiment, allowing me to test whether firms experiencing

acute cash flow shortages exhibit delayed capital structure adjustments. Second, I incorporate pension funding status as an additional identification factor for long-term cash needs. This allows for a comparison between firms with underfunded and fully funded pensions, isolating the impact of financial obligations on capital structure realignment. Both identification strategies corroborate the main regression findings.

2. Literature Review and Hypothesis Development

As stated by Fischer et al. (1989), the Dynamic Trade-Off Theory explains how firms balance the costs and benefits of debt financing, adjusting their capital structures gradually rather than instantly due to market frictions, adjustment costs, and financial constraints. Firms tolerate temporary deviations from their target leverage, only rebalancing when the benefits outweigh the costs, with adjustment speed influenced by external factors like market stability, interest rates, and firm-specific conditions. In contrast, the Funding Horizon Theory, discussed by Huang and Ritter (2020), argues that firms prioritize financing decisions based on the expected duration of their cash needs rather than optimizing leverage. Firms with short-term liquidity needs prefer debt for quick capital access, while those with long-term obligations favor equity to maintain flexibility. This perspective shifts the focus from reaching an optimal capital structure to managing liquidity efficiently, highlighting a situational and pragmatic approach to financial decision-making.

Distinguishing between short-term and long-term cash needs is essential because the timing of liquidity demands fundamentally shapes firms' financing behavior. Firms do not simply raise capital based on the size of their funding gaps; they also consider the horizon over which funds

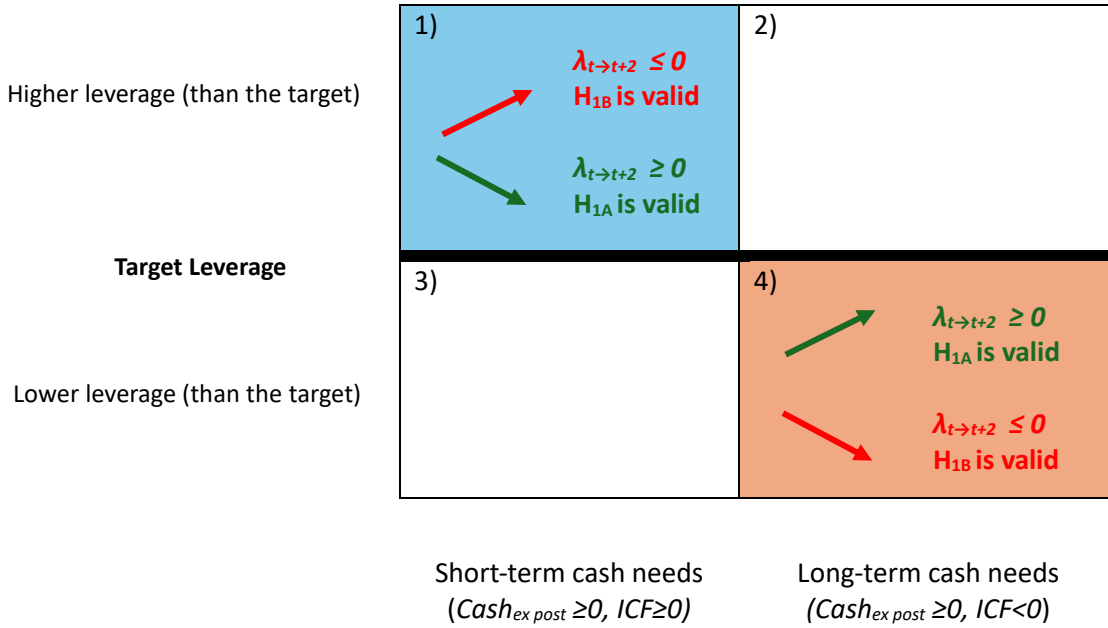
are needed. As shown by Huang and Ritter (2020), short-term cash needs typically lead firms to issue short-term debt, such as commercial paper or credit lines, because it offers flexibility and minimal long-term commitment. In contrast, long-term cash obligations, like pension deficits or multi-year investments, push firms toward long-term debt or equity to secure more permanent funding and avoid future refinancing risk. This behavior is widely recognized by practitioners: CFOs and treasurers deliberately align the maturity of financing instruments with the duration of their funding requirements. Likewise, investors and analysts interpret capital raising events differently depending on whether the firm is addressing a temporary liquidity shortfall or preparing for sustained long-term obligations. Despite this practical importance, most prior research, particularly studies rooted in static trade-off theory, treats financing needs as uniform, often summarizing them with a single deficit measure that ignores timing. This simplification overlooks a key reality: when a firm needs cash can significantly influence how it finances that need, and ultimately, how fast it returns to its optimal capital structure. Therefore, separating short- and long-term cash needs adds both empirical clarity and real-world relevance to the study of capital structure.

Hypothesis 1: Firms will move to their target capital structures regardless of the firm's short-term/long-term cash needs.

This research aims to critically examine the dynamic trade-off theory and the funding horizon theory to determine if the latter completely overrides the former, a comparison not previously explored in the literature. This exploration is crucial as it addresses the foundational assumptions about how firms manage their capital structures in response to immediate financial pressures versus long-term financial strategies.

Figure 1: Firm-Year Observations by Leverage and Cash Needs Urgency

This matrix categorizes firm-year observations into four cells based on their leverage status on the y-axis (above or below target) and the immediacy of their cash needs on the x-axis (short-term or long-term). $Cash_{ex\ post} \geq 0$ signifies that firms are experiencing urgent cash needs. Additionally, ICF (internal cash flow) differentiates between short-term and long-term cash needs, where $ICF \geq 0$ represents the short-term cash needs and $ICF < 0$ indicates the long-term cash needs. Further details on these proxies can be found in section 3.2.1.



In Figure 1, I categorize firm-year observations by the duration of their cash shortfalls and whether they are above or below optimal leverage. I then divide the firm-year observations in the sample into four cells. Vertically, firms are split based on their leverage compared to their target leverage. Horizontally, firms are divided based on their urgency for cash needs, which, according to the funding horizon theory, would translate into firms' preference for issuing debt and equity, respectively, to resolve their cash shortfalls.

Dynamic trade-off theory and Funding horizon theory are in conflict in cells 1 and 4. In cell 1, firms prefer to issue debt to alleviate urgent cash needs despite being over-levered relative to their target capital structure, thus diverging further from it. Similarly, in Cell 4, these firms tend to issue equity in order to mitigate their long-term cash needs; however, this will drag them further away from their target as they are already under-levered compared to their target. Thus, to test hypothesis 1, I examine if firms in cells 1 and 4 move towards their optimal capital structure or away from it over a three-year period after the issuance.

Huang and Ritter (2020) provide the most underlying evidence that supports my first hypothesis (H1). It demonstrates that while firms may deviate from the optimal capital structure by prioritizing cash needs, this does not contradict the dynamic trade-off theory, suggesting that capital structure decisions are path-dependent and influenced by past financing actions. This leaves open the possibility that firms attempt to return to their target capital structure after deviating to address cash needs. My research contributes to the literature by examining whether firms realign with their optimal leverage once their cash constraints are resolved, ultimately testing whether these two theories can coexist in the long-term.

There are a variety of other papers that support the H1 hypothesis as well. First, Myers (1977) supports the dynamic trade-off theory by showing how debt influences firms' investment decisions due to its impact on real options, suggesting firms continuously adjust their capital structures in response to evolving conditions. Second, Stulz (1990) highlights the significance of cash flow distribution across different periods, emphasizing its influence on the choice between debt and equity issuance. So, firms dynamically modify their capital structures to adapt to evolving risk conditions, which is compatible with dynamic trade-off theory over funding-horizon

theory. Third, Hennessy and Whited (2005) support the dynamic trade-off theory by presenting a model where firms' leverage decisions are path-dependent and influenced by liquidity and investment opportunities, supporting the fact that dynamic trade-off theory is not overshadowed by other factors (H1).

Fourth, DeAngelo and Whited (2011) argue that firms adjust their debt levels dynamically based on their internal and external environments, which is compatible with the H1 hypothesis. Finally, Dierker et al.'s (2019) paper focuses on dynamic trade-off theory in relation to risk changes. It supports the H1A hypothesis by reinforcing the argument that firms actively adjust their capital structures in response to changing risk profiles, consistent with the dynamic nature of the trade-off theory. Overall, the literature supports the H1 Hypothesis that even if firms have short-term/long-term cash needs, firms are expected to move toward their optimal capital structure.

Furthermore, Frank and Goyal (2009) in their well-recognized paper reinforce the dynamic trade-off theory by demonstrating that firms' capital structure adjustments are consistent with changes in market conditions and internal company metrics, aiming to balance costs and benefits. Alongside this, Titman and Tsyplakov (2007) that further substantiate the view that firms strategically manage their debt levels to align with long-term financial objectives, aligning with the argument that firms actively seek their target debt ratios over other considerations.

Hypothesis 2: As **short-term** cash needs increase, the speed of capital structure adjustment will correspondingly decelerate.

Hypothesis 3: As **long-term** cash needs increase, the speed of capital structure adjustment will correspondingly decelerate.

Even if the dynamic trade-off theory effect has a more pronounced effect than the funding horizon theory, the funding horizon effects may slow down the transition to the optimal capital structure. Consequently, I hypothesize that firms' immediate cash needs will slow capital structure adjustment speed toward the target debt ratio when the two theories are in conflict.

Although the literature has yet to explore the impact of urgent cash needs on the speed of capital structure adjustment, which makes my research distinct, several studies support H2 and H3, as there are many factors that can slow the speed of capital structure adjustment. Dang et al. (2012) concluded from their dynamic panel threshold model that firms with large financing imbalance (or a deficit) adjust faster toward target leverage than those with the opposite characteristics. Byoun (2008) claimed that most adjustments occur when firms have above-target (below-target) debt with a financial surplus (deficit). This result suggests that firms move toward the target capital structure when they face a financial deficit/surplus. On the contrary to Byoun, Dang, and Garrett (2015) found that firms adjusting fastest have above-target leverage and a financing deficit and state the fact that alternative assumptions about leverage dynamics may lead to different conclusions about target adjustment behavior.

Faulkender and Wang (2006) stated that urgent financial needs could either decelerate or accelerate the adjustment speed, depending on the firm's access to external financing and investment opportunities. Zou and Bai (2022) concluded that firms with lower dividend payouts tend to adjust their capital structure faster, indicating an inverse relationship between excess cash flows and the speed of adjustment. Hegde et al. (2023) highlighted that dynamic economic

conditions, corporate governance, and adjustment costs are crucial factors affecting the speed of adjustment. Finally, Acharya et al. (2005) highlight that for firms with high external financing costs, cash is a strategic asset that slows debt adjustments by meeting immediate needs internally, thereby influencing the speed of capital structure adjustment. These all show how various factors can influence capital structure speed.

On the other hand, there are studies, including Lemmon et al. (2008), that suggest entirely opposing factors, pointing to an unobserved, time-invariant effect that generates surprisingly stable capital structures that is present even prior to the IPO. In another surprising research, Douglas and Tang (2010) claimed that firms leverage toward target faster in good macroeconomic states compared to the bad states, independent of financial constraints.

My contribution to the literature begins by analyzing the interaction between the dynamic trade-off theory and the funding horizon theory, determining which framework firms prioritize when the two are in conflict and whether the dynamic trade-off theory is overridden by immediate cash needs (H1). I then investigate how short-term cash needs influence the speed of capital structure adjustment (H2) and examine whether long-term financial constraints affect firms' ability to realign with their optimal leverage (H3). This study contributes to the literature by differentiating between short-term and long-term cash needs as key factors influencing capital structure adjustment speeds. While existing research acknowledges that firms deviate from their target leverage due to financial constraints, it often does not distinguish whether the urgency and duration of these constraints affect the adjustment process differently. My research addresses this gap by examining how firms prioritize capital structure decisions when faced with temporary liquidity shortages versus persistent financial obligations.

Beyond its theoretical contributions, this distinction holds significant relevance for practitioners. The duration of cash needs materially influences the structure and timing of financing decisions. Short-term needs are met with flexible, low-cost borrowing, while long-term obligations often require permanent capital. By capturing this separation, the study offers actionable insights for CFOs and analysts and enhances the explanatory power of capital structure theory. It shows that when cash is needed plays a key role in both financing choices and adjustment speed. By integrating these two dimensions, this study offers a more comprehensive framework for understanding capital structure adjustments, showing that firms' responses to financial pressures depend not only on past financing decisions but also on the nature of their cash constraints. This perspective enhances the existing theories by demonstrating that the speed and extent of leverage adjustments are shaped by both immediate cash flow pressures and long-term financial commitments, refining our understanding of how firms navigate capital structure rigidity and financial flexibility.

3. Data

I employ the Compustat database to gather all relevant financial and firm-level variables required for the analysis. For this study, I have drawn observations spanning the period from 1960 to 2023, which allows for a thorough analysis of long-term trends and patterns in capital structure adjustments. To ensure the integrity and completeness of the analysis, I performed a thorough data-cleaning process to ensure the integrity of the final dataset. For essential financial variables, I applied logical imputations only when justified by accounting conventions or when the economic meaning of the variable supported it. For example, missing values for equity in net loss (*ESUBC*), noncontrolling interests (*MIBN*), dividends (*DVT*), intangible assets (*INTAN*), preferred stock

(*PSTK*), sale of property and investments (*SPPIV*), and certain tax items (*TXACH*, *TXDC*) were set to zero under the assumption that these items were immaterial or absent for the firm in that year. Some variables, such as changes in inventory (*INVCH*) and assets and liabilities (*AOLOCH*), were recalculated using first differences; missing values that remained after recalculation were left as missing. Depreciation was taken from either *DP* or *DPC* and set to zero only if both were missing. Total liabilities (*LT*) was recalculated as the sum of short-term liabilities (*DLC*) and long-term liabilities (*DLTT*) when missing, but left missing if both components were unavailable. Total equity (*TEQ*) was imputed as the sum of total common/ordinary Equity (*CEQ*), total preferred/preference stock (*PSTK*), and Noncontrolling Interests (*MIBN*) when missing. In contrast, key performance variables like earnings before interest and tax (*EBIT*), earnings before interest, taxes, depreciation, and amortization (*EBITDA*), net cash flow from operating activities (*OANCF*), and Income Before Extraordinary Items (*IBC*) were kept as missing to avoid introducing bias through imputation. Importantly, since the calculation of average adjustment speed ($\lambda_{t \rightarrow t+2}$) spans three consecutive years, all firms with fewer than three consecutive observations were automatically dropped from the sample, ensuring that firms with only one or two years of data did not influence the regression results. This refinement process was crucial for maintaining a balanced panel and ensuring that the regression models could provide reliable and interpretable results.

I excluded financial and utility firms because these firms have very high leverage, unique regulatory environments, industry-specific capital requirements, and distinct financing structures. The Dynamic Trade-Off Theory suggests that firms adjust their leverage based on trade-offs between the costs and benefits of debt, but financial institutions are subject to regulatory capital requirements that override traditional capital structure optimization (Flannery

& Rangan, 2006). Additionally, the Funding Horizon Theory posits that firms select financing methods based on the duration of their funding needs; however, financial firms have access to alternative funding mechanisms, such as deposits and interbank lending, which do not follow the same corporate financing principles as non-financial firms (Diamond, 1991). Similarly, utilities face regulated pricing structures and high fixed asset requirements, making their capital structure decisions more dependent on government policies and infrastructure investments than firm-level trade-offs (Myers, 2001). Given these industry-specific constraints, prior literature commonly excludes financial and utility firms from capital structure studies to ensure comparability

Table 1 shows the step-by-step process used to clean and narrow down the dataset. The full Compustat dataset included 514,239 firm-year observations from 1960 to 2023. First, I kept only firms with positive equity, which reduced the sample to 376,347 observations. Then, I removed firms that were missing key control variables needed for the regression, leaving 253,937. To calculate the key dependent variable (λ , the capital structure adjustment speed), the sample was further restricted to observations with sufficient data to compute lagged and forward-looking capital structure variables, as well as complete industry- and year-level fixed effects, which dropped the sample to 128,412 observations. Next, I kept only those with cash needs, bringing the sample to 57,608. I also removed observations with missing average λ values, which left 9,183. Finally, I excluded financial and utility firms. This gave me a final sample of 8,123 firm-year observations with 3,819 unique firms used for the main analysis.

Table 1: Sample Selection

This table outlines the sequential filtration steps applied to the initial dataset, showing the number of observations retained after each step. It details the criteria used for each filtration, the percentage of observations removed at each stage, and the cumulative percentage of the original dataset remaining. This process reflects the data refinement undertaken to establish a robust and analyzable final sample for the study.

Description of Filtration Criterion	Number of remaining Obs
Full Compustat dataset	514,239
Kept observations with positive equity	376,347
Removed firms missing control variables	253,937
Removed missing values for BDR and λ calculation and year and industry FE ¹	128,412
Kept observations with positive cash needs (Cash _{Ex Post} > 0)	57,608
Removed observations with missing $\lambda_{t \rightarrow t+2}$	9,183
Excluded Financial and Utility industries	8,123

I used $\lambda_{t \rightarrow t+2}$ in all three hypotheses, which is the three-year average adjustment speed (average of $\lambda_t, \lambda_{t+1}, \lambda_{t+2}$). To test the dynamic trade-off theory, instead of λ introduced in models 1- 4, I will use a three-year average adjustment speed following debt or equity issuance, denoted as $\lambda_{t \rightarrow t+2}$. This will help determine if firms in cells 1 and 4, which may have initially moved away from their target leverage, realign with their target over time.

To illustrate the industry distribution of the final dataset, Table 2 provides the composition of observations using both Fama-French 12 and 48 classifications. Part A displays broader sector groupings under FF12, while Part B offers a more detailed breakdown using the FF48 schema. This dual perspective ensures transparency regarding the sample's sectoral coverage.

¹ Referring to the variables in model (4)

Table 2: Industry Composition of Final Sample – Fama-French 12 and 48 Classifications

This table presents the industry composition of the final sample as outlined in the sample selection. Part A shows the distribution of observations using the broader Fama-French 12 classification, and Part B provides a more detailed breakdown using the Fama-French 48 classification in descending order of frequency

A. Fama French 12

Fama-French 12 Industry	Frequency	Percent of Total Frequency
Other	2,277	28%
Energy	1,208	15%
Manufacturing	1,051	13%
Shops	866	11%
Business Equipment	774	10%
Healthcare	604	7%
Consumer Nondurables	551	7%
Telecommunications	361	4%
Consumer Durables	245	3%
Chemicals	186	2%
Utilities	-	0%
Finance	-	0%

B. Fama French 48

Fama-French 48 Industry	Number of Observations	Percent of Total Frequency
Petroleum and Natural Gas	1,187	15%
Non-Metallic Mining	683	8%
Precious Metals	583	7%
Business Services	491	6%
Retail	431	5%
Pharmaceutical Products	362	4%
Communication	361	4%
Wholesale	325	4%
Transportation	280	3%
Construction Materials	262	3%
Electronic Equipment	258	3%
Machinery	240	3%
Food Products	196	2%
Business Supplies	183	2%
Computers	182	2%
Other	174	2%

Table 2 – continued

Fama-French 48 Industry	Number of Observations	Percent of Total Frequency
Chemicals	163	2%
Automobiles and Trucks	146	2%
Medical Equipment	143	2%
Steel Works Etc	143	2%
Restaurants, Hotels, Motels	120	1%
Electrical Equipment	113	1%
Consumer Goods	99	1%
Entertainment	99	1%
Healthcare	99	1%
Printing and Publishing	86	1%
Beer & Liquor	78	1%
Measuring and Control Equipment	75	1%
Construction	69	1%
Personal Services	66	1%
Rubber and Plastic Products	59	1%
Apparel	57	1%
Fabricated Products	56	1%
Aircraft	43	1%
Textiles	43	1%
Agriculture	34	0%
Recreation	31	0%
Tobacco Products	21	0%
Shipping Containers	20	0%
Candy & Soda	19	0%
Shipbuilding, Railroad Equipment	18	0%
Coal	17	0%
Defense	8	0%

Capital Structure Adjustment Speed (λ)

A key focus of this research is the average lambda variable, $\lambda_{t \rightarrow t+2}$, serves as the dependent variable in my regression models. Lambda is calculated as $\lambda = (BDR_{i,t+1} - BDR_{i,t}) / (BDR^*_{i,t+1} - BDR_{i,t})$, where $BDR_{i,t}$ is the book debt ratio of firm i at time t and λ is the adjustment speed toward the target capital structure. The $\lambda_{t \rightarrow t+2}$ variable captures the average adjustment speed towards

the target leverage over a three-year period, by calculating the average of λ , the adjustment speed, from the current year t through $t+2$. Consequently, while the broader dataset spans up to 2023, the calculation of average lambda is feasible only until 2021. This constraint is due to the need for future observations to compute the average adjustment speed, resulting in an effective time range for average lambda from 1960 to 2021.

I use the same method Flannery and Rangan (2006) used to investigate the adjustment speed of capital structure (λ). Lambda, or λ , represents the speed at which a company adjusts its debt level towards a specific target ratio of debt to equity, known as its target capital structure. Based on model 1, it is clear that if λ is high (close to 1), the company is quickly adjusting its capital structure to reach the desired level of debt relative to its equity. Conversely, a low λ (close to 0) indicates that the company is making slower adjustments, taking more time to reach its target debt ratio. Also, values between -1 and 0 suggest that the firm is moving away from its target leverage ratio.

In Appendix A, I include variable definitions for all models.

Standard partial adjustment model is given by model 1:

$$BDR_{i,t+1} - BDR_{i,t} = \lambda(DBR^*_{i,t+1} - BDR_{i,t}) + \gamma DEF_{i,t+1} + \eta MB_{efwa\ i,t+1} + \varepsilon_{i,t+1} \quad (1)$$

Model (1) can be restated as model (2):

$$BDR_{i,t+1} = \lambda BDR^*_{i,t+1} + (1-\lambda) BDR_{i,t} + \gamma DEF_{i,t+1} + \eta MB_{efwa\ i,t+1} + \varepsilon_{i,t+1} \quad (2)$$

We control for the impact of various factors such as profitability (*EBIT*), investment opportunities (*Q*), depreciation and amortization (*DEP*), asset structure (*FA*), R&D investment (*RD*), size (*SIZE*), and the level of the industrial asset-liability ratio (*IND_median_{i,t}*):

$$BDR_{i,t+1}^* = \alpha_0 + \alpha_1 EBIT_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 DEP_{i,t} + \alpha_4 FA_{i,t} + \alpha_5 RD_{i,t} + \alpha_6 SIZE_{i,t} + \alpha_7 IND_median_{i,t} \quad (3)$$

We incorporate the equations from models (2) and (3) into the model (1) to derive our primary regression equation, model (4):

$$BDR_{i,t+1} = \lambda(\alpha_0 + \alpha_1 EBIT_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 DEP_{i,t} + \alpha_4 FA_{i,t} + \alpha_5 RD_{i,t} + \alpha_6 SIZE_{i,t} + \alpha_7 IND_median_{i,t}) + (1-\lambda) BDR_{i,t} + \gamma DEF_{i,t+1} + \eta MB_efwa_{i,t+1} + \varepsilon_{i,t+1} \quad (4)$$

Also, *MB_efwa* is the external finance weighted-average market to book ratio, as defined by Baker and Wurgler (2002). I provided the model for its calculation in the appendix A, variables definitions table.

In table 3 below, the coefficients and their alpha values are provided:

Table 3. Coefficients and Corresponding Alpha Values from Regression Model 4

This table provides the results of model (4) regression. These coefficients are put in model (3) to calculate each firm's target leverage. All variables definitions are available in Appendix 1.

Variable	Coefficients Estimate	Alpha (α)
<i>Intercept</i>	0.023	$\alpha_0 = 0.101$
<i>EBIT</i>	0.012	$\alpha_1 = 0.009$
<i>Q</i>	0.002	$\alpha_2 = 0.008$
<i>Dep</i>	0.003	$\alpha_3 = 0.014$
<i>FA</i>	0.025	$\alpha_4 = 0.108$
<i>RD</i>	0.038	$\alpha_5 = 0.165$
<i>SIZE</i>	0.003	$\alpha_6 = 0.014$
<i>IND_median i,t</i>	0.086	$\alpha_7 = 0.378$
λ		$\lambda = 0.228$

So, after obtaining coefficients from model 4 results, I apply the coefficients to model 3 to arrive at $BDR^*_{i,t+1}$.

To evaluate whether firms move back toward their target capital structure after deviating due to debt or equity issuance, I rely on average lambda from t to t+2 ($\lambda_{t \rightarrow t+2}$), calculated by averaging λ_t , λ_{t+1} , λ_{t+2} , as a forward-looking measure of adjustment speed. Specifically, average lambda captures the rate at which a firm reduces the gap between its actual and target leverage over the three years following a capital structure event. After issuing debt or equity, a firm may significantly deviate from its theoretical target leverage. A positive average lambda indicates that the firm is getting closer to the target capital structure during the adjustment window, suggesting that rebalancing behavior has occurred. In contrast, a negative average lambda implies that the firm has moved further away from the target. Thus, average lambda serves as a meaningful indicator of whether firms actively correct deviations from their optimal leverage in the periods following capital structure decisions.

Table 4. Sample Description

This table provides summary statistics for the final sample. All variables are defined in Appendix A. The sample period is from 1960-2023 using Compustat data.

Variable	N	Mean	Std. Dev	P25	Median	P75
$\lambda_{t \rightarrow t+2}$	8,123	0.25	1.01	-0.11	0.1	0.35
λ_t	8,123	0.19	74.04	-0.13	0	0.44
λ_{t+1}	8,123	0.21	34.27	-0.16	0	0.4
λ_{t+2}	8,123	0.34	32.77	-0.2	0	0.36
<i>Cash_{expost}</i>	8,123	80.63	324.83	2.5	9.97	43.87
<i>Short_term_Cash_needs</i>	8,123	0.22	0.41	0	0	0
<i>Short_Term_Debt_Ratio</i>	8,123	0.05	0.08	0.00	0.02	0.06
<i>Long_term_Cash_needs</i>	8,123	0.78	0.41	1	1	1
<i>Long_Term_Debt_Ratio</i>	8,123	0.17	0.16	0.01	0.15	0.28
<i>EBIT</i>	8,123	0.03	0.36	0	0.11	0.16
<i>MB</i>	8,123	3.03	11.36	0.98	1.63	2.79
<i>Size</i>	8,123	5	2.13	3.48	4.88	6.4
<i>FA</i>	8,123	0.44	0.29	0.19	0.41	0.69
<i>Q</i>	8,123	1.93	2.75	0.99	1.31	1.95
<i>DEP</i>	8,123	0.04	0.04	0.02	0.04	0.06
<i>RD</i>	8,123	0.08	0.16	0.00	0.00	0.08
<i>IND_median_{i,t}</i>	8,123	0.2	0.06	0.19	0.21	0.24
<i>FINDEF</i>	8,123	0.05	0.69	-0.01	0.05	0.15
<i>MB_efwa_{t+1}</i>	8,123	2.36	6.59	0.89	1.43	2.37
<i>BDR</i>	8,123	0.22	0.18	0.05	0.21	0.35
<i>BDR*_{t+1}</i>	8,123	0.31	0.06	0.27	0.31	0.35
<i>OCF</i>	8,123	147.26	1598.9	-0.31	9.16	59.75
<i>mv</i>	8,123	1157.4	6431.1	31.75	117.58	500.1
<i>DEF_{t+1}</i>	8,123	0.06	0.69	-0.06	0.02	0.11
<i>BDR_{t+1}</i>	8,123	0.31	0.06	0.27	0.31	0.35
<i>ICF</i>	8,123	43.75	818.08	0	0	0
<i>matrix_area_1</i>	8,123	0.1	0.3	0	0	0
<i>matrix_area_4</i>	8,123	0.6	0.49	0	1	1
<i>Underfunded</i>	1,182	0.39	0.49	0	0	1
<i>funding_gap</i>	1,182	8.13	69.48	-0.32	0	4.33
<i>covid_dummy</i>	8,123	0.02	0.12	0	0	0
<i>Cash_{exante}</i>	8,217	73.94	312.91	2.56	7.47	34.3

Proxies for cash needs urgency

I use two variables to measure if a firm has short-term and long-term cash needs. These proxies are used to segment the observations in the matrix horizontally. First, to determine if a firm needs cash, I use $Cash_{ex\ post}$ as the proxy (Huang and Ritter 2020). This variable represents the amount of cash shortage if there was no external financing, and it is defined as $Cash_{t-1} + NCF$. Plus, NCF_t represents the net cash flow (the difference between the internal cash flow [ICF] and the sum of investment, change in noncash net working capital, and dividends) at year t . ICF is significant in determining firm profitability, with unprofitable firms, often with ongoing R&D expenses, facing more consistent cash needs and thus more frequently resorting to equity financing in alignment with the funding-horizon theory (Huang and Ritter, 2021). Therefore, as the matrix in Figure 1 indicates, I identify short-term cash needs under conditions where $Cash_{ex\ post} \geq 0$, $ICF \geq 0$, and long-term cash needs when $Cash_{ex\ post} \geq 0$, $ICF < 0$. The definition for $Cash_{ex\ post}$ ² and ICF ³ in the footnote below.

I incorporate the Fama-French 12 industry classification to account for industry fixed effects in my regressions. This classification provides a widely accepted standard in empirical finance research, ensuring consistency with prior literature while effectively capturing industry-specific variations in capital structure decisions.

² $Cash_{ex\ post}$: - [Equals $Cash_{t-1} + NCF_t$] (represents the amount of cash shortage if there was no external financing)

³ ICF : Internal cash flow. $ICF = \text{Income Before Extraordinary Items (IBC)} + \text{Extraordinary Items and Discontinued Operations (XIDOC)} + \text{Depreciation and Amortization (DPC)} + \text{Deferred Taxes (Changes) (TXDC)} + \text{Equity in Net Loss (Earnings) (ESUBC)} + \text{Sale of Property Plant and Equipment and Investments Gain (Loss) (SPPIV)} + \text{Funds from Operations Other (FOPO)} + \text{Sources of Funds Other (FSRCO)}$.

Distinguishing Equity and Debt Issuance

Based on Huang and Ritter (2020), I considered a firm to have issued net debt or equity in a given fiscal year if the net proceeds from debt or equity, as reported in the cash flow statement, amount to at least 5% of the book value of assets or 3% of the market value of equity at the beginning of the year.

Winsorizing

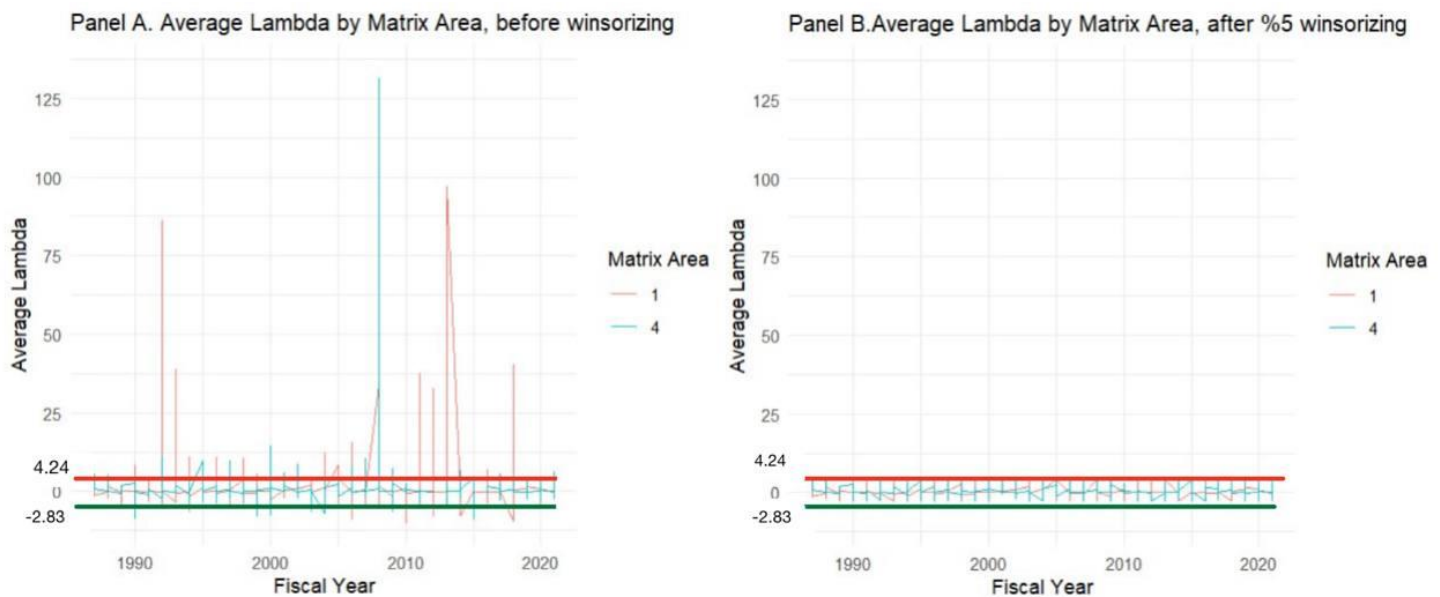
The $\lambda_{t \rightarrow t+2}$ values in the sample are winsorized at the 5/95% level. As you can see from the distribution of Average Lambda in Figure 2 panel A, there are outliers that can impact the results significantly.

There are several reasons for these outliers. Many studies, including Cook & Tang (2010) and Flannery and Rangan (2006), assume a single average adjustment speed (lambda) for all firms. Following this approach, I use the mean lambda from Model 4 and apply each firm's characteristics in Equation 3 to estimate its individual adjustment speed. This method is reasonable because the average adjustment speed and firm-specific characteristics are closely aligned. Secondly, any unusual values for lambda, such as -100 or +100 are unlikely, since lambda is calculated as $\lambda = (BDR_{i,t+1} - BDR_{i,t}) / (DBR^*_{i,t+1} - BDR_{i,t})$, these extremes may result from significant fluctuations in the debt ratio (numerator) due to measurement errors or extraordinary corporate events, or a very small denominator when the optimal debt ratio is already close to the current debt ratio, leading to exaggerated lambda values.

Consequently, I winsorized the results at the 5/95% level to avoid the impact of such outliers on the results. Figure 2 panel B shows the distribution of Average Lambda without outliers, revealing a much more consistent pattern.

Figure 2. Average Lambda by Matrix Area Before and After Winsorization

This figure presents the average capital structure adjustment speed (lambda) for firms in Matrix Areas 1 and 4 over time. Panel A (left) displays the data, where extreme fluctuations in lambda values are visible. Panel B (right) shows the results after 5% winsorization, reducing the impact of outliers and providing a more stable trend. The comparison highlights how winsorization improves the interpretability of leverage adjustment patterns while preserving meaningful variation in the data.



Justification for 5/95 Winsorization

Using a 5% winsorization is both methodologically sound and consistent with common practice in corporate finance panel studies. Outlier observations can severely bias OLS estimates in long firm-year panels, especially for sensitive financial ratios like leverage or cash flows. In fact, several high-quality studies in capital structure and corporate liquidity explicitly choose 5/95 winsorization to limit the influence of outliers while preserving data. For example, Campbell et al. (2008), which works on default risk using Compustat data, winsorize all variables at the 5th and 95th percentiles. Likewise, the Atanasova (2025) paper on corporate liquidity management (lines of credit vs. cash) winsorizes the top/bottom 5% of each variable's distribution to "avoid potential problems with extreme values". This approach is particularly important in our 1960–2023 panel: it spans many decades and firm types, so occasional outliers (due to data errors, crises, or unusual transactions) could otherwise disproportionately affect the estimated speed of adjustment toward target leverage. Prior research, such as Lim et al. (2022) shows that using 5/95 winsorization instead of 1/99 does not alter core results, but it more effectively caps extreme values while preserving more data. In my study, variables like $\lambda_{t \rightarrow t+2}$, $Cash_{ex_post}$ and MB are skewed and sensitive to spikes, making a broader 5% threshold a more robust choice for avoiding distortion from outliers in leverage regressions.

4. Results and Discussion

4.1 Main Results

4.1.1 Hypothesis 1 Results

The univariate analysis will include testing for statistical significance, calculating confidence intervals, and comparing the mean against zero to ensure robustness. Table 5 shows the univariate results for the first hypothesis. As presented in the table, the mean of average lambda is positive across all four matrix areas, indicating that firms tend to move closer to their target leverage, even when they deviate from it due to cash needs.

Table 5. Univariate T-Test Results for Average Lambda Across Matrix Areas

This table presents the summary statistics and t-test results for the average lambda in each matrix area after 5% winsorization, including the sample size (N), mean, standard deviation, standard error, minimum, and maximum values. The 95% confidence intervals for the mean and standard deviation are also provided, along with the degrees of freedom (DF), t-value, and p-value for significance testing. These results illustrate the variation in average lambda across different matrix areas, highlighting significant differences in adjustment speed towards target leverage. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Matrix Area	N	Mean	t Value	P value
1	832	0.152	3.75	(<0.01)
4	4,825	0.221	18.48	(<0.01)
2	1,505	0.193	5.94	(<0.01)
3	934	0.342	8.78	(<0.01)

The findings confirm Hypothesis 1, indicating that firms, regardless of short-term or long-term cash needs, consistently move closer to their target leverage, supporting the validity of the dynamic trade-off theory. Despite situations where funding horizon theory suggests firms might temporarily deviate due to immediate cash requirements, the underlying drive toward an optimal capital structure remains strong. This implies that while cash needs influence short-term and long-term financing decisions, they do not overshadow the broader strategy of aligning leverage with long-term targets, underscoring the dynamic trade-off theory's resilience in guiding firms' capital structure adjustments.

I also ran a multivariate regression to strengthen the findings related to Hypothesis 1 (H1). The univariate analysis provides initial support for H1, suggesting that firms adjust their capital structure towards their target leverage. However, it does not account for control variables that could affect the interpretation of the results, such as profitability, size, and market conditions. The multivariate regression results, provided in table 6, addresses this limitation by incorporating control variables into the analysis. By including these variables, the regression ensures that the observed movement towards target leverage is not driven by other firm characteristics.

The regressions in Models 5 and 6, and any other regression results in this thesis that include controls, use EBIT (Earnings Before Interest and Taxes / Total Assets) to measure profitability relative to firm size. More profitable firms may have different leverage dynamics due to more accessible access to internal financing. *MB* (Market-to-Book Ratio) indicates how the market values the firm relative to its book value. Firms with higher *MB* ratios may have more growth opportunities and might adjust their capital structure differently compared to firms with lower

MB ratios. *Size* (Logarithm of Total Assets) is of great importance since larger firms may experience different adjustment speeds due to these factors. *FA* (Fixed Assets / Total Assets) provides insight into the firm's asset structure. Firms with a higher proportion of fixed assets may have more stable cash flows and collateral, affecting their capital structure adjustments. *DP* (Depreciation Expense / Total Assets) can impact cash flow and tax liabilities, affecting the capital structure. *IND_median_{i,t}* (Median Industry Leverage) accounts for industry-specific leverage norms and effects, which could influence a firm's target capital structure and its adjustments. *FINDEF* (Financial Deficit) represents the shortfall in internal funds relative to investment needs. Firms facing financial deficits may adjust their capital structures differently from those with surpluses. *FINDEF* is defined as [(dividend payments + investments + change in working capital + Internal cashflow) / (total assets)].

Focusing on matrix areas 1 and 4 in Figure 1 is particularly important because these areas represent the scenarios where the dynamic trade-off theory and the funding horizon theory are most at odds. Matrix area 1 comprises over-levered firms with short-term cash needs, while area 4 includes under-levered firms with long-term cash needs. These areas test the crux of the hypothesis: whether firms in these conflicting scenarios still exhibit behavior consistent with the dynamic trade-off theory by moving towards their target leverage.

To evaluate whether firms in specific matrix areas actively adjust their capital structures toward a target leverage ratio, two multivariate regression models are specified. These models test whether firms in Matrix Area 1 (over-leveraged with short-term cash needs) and Matrix Area 4 (under-leveraged with long-term cash needs) exhibit a positive and significant average adjustment speed, supporting the dynamic trade-off theory. Both models use a dummy variable structure where one matrix area is omitted, allowing the intercept to capture the average adjustment speed for that reference category. Model (5) omits Matrix Area 1, making it the reference group, and estimates how the other areas differ in their adjustment behavior. Conversely, Model (6) omits Matrix Area 4 as the baseline, enabling a direct interpretation of the adjustment speed for firms in this area via the intercept. Model (5) is designed to investigate the behavior of firms in matrix area 1 toward the target:

$$\lambda_{t \rightarrow t+2} = \beta_0 + \beta_1 \text{matrix_area_2} + \beta_2 \text{matrix_area_3} + \beta_3 \text{matrix_area_4} + \beta_4 EBIT + \beta_5 MB_{i,t} + \beta_6 Size_{i,t} + \beta_7 FA + \beta_8 Dep + \beta_9 IND_median_{i,t} + \beta_{10} FINDEF_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (5)$$

Model (6) is used to assess the behavior of firms in matrix area 4 toward the target:

$$\lambda_{t \rightarrow t+2} = \beta_0 + \beta_1 \text{matrix_area_1} + \beta_2 \text{matrix_area_2} + \beta_3 \text{matrix_area_3} + \beta_4 EBIT + \beta_5 MB_{i,t} + \beta_6 Size_{i,t} + \beta_7 FA + \beta_8 Dep + \beta_9 IND_median_{i,t} + \beta_{10} FINDEF_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (6)$$

Table 6. Multivariate Regression Results Across Matrix Areas with Controls

This table reports multivariate regression results examining the speed of adjustment toward target leverage for firms in Matrix Area 1 (over-leveraged with short-term cash needs) and Matrix Area 4 (under-leveraged with long-term cash needs). The primary coefficients of interest are the intercepts, which capture the average adjustment speed (λ) for firms in these two matrix areas. Control variables include EBIT, market-to-book ratio (MB), firm size, fixed assets (FA), depreciation (DP), industry median leverage (IND_median_{it}), and financial deficit (FINDEF). Robust standard errors are used, and R-squared values reflect the explanatory power of the models. The dataset has been 5% winsorized to mitigate the influence of outliers. Statistical significance is denoted at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

	(1)		(2)		(3)	
Areas	Matrix Area 1	Matrix Area 4	Matrix Area 1	Matrix Area 4	Matrix Area 1	Matrix Area 4
Intercept	0.273 (<0.01)***	0.341 (<0.01)***	0.241 (0.02)**	0.304 (0.02)**	0.226 (0.03)***	0.298 (0.04)**
matrix_area_1	N/A	0.624	N/A	0.752	N/A	0.722
	N/A	(<0.01)***	N/A	(0.03)**	N/A	(0.03)**
matrix_area_2	0.345	0.347	0.294	0.297	0.263	0.226
	(<0.01)***	(<0.01)***	(0.03)**	(0.02)**	(0.04)**	(0.02)**
matrix_area_3	0.337	0.284	0.302	0.293	0.274	0.222
	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***
matrix_area_4	0.236	N/A	0.185	N/A	0.162	N/A
	(<0.01)***	N/A	(0.02)**	N/A	(0.02)**	N/A
Controls	No	No	Yes	Yes	Yes	Yes
Industry and Year						
FE	No	No	No	No	Yes	Yes
N	12,373	12,373	8,123	8,123	8,123	8,123
R ²	9%	11%	12%	13%	14%	16%

The regression results for matrix areas 1 and 4 indicate significant positive coefficients, implying that firms within these areas exhibit a positive average adjustment speed, $\lambda_{t \rightarrow t+2}$, towards their target leverage. This finding supports H1, confirming that even under varying financial constraints, firms actively strive to align with their optimal capital structures.

In addition, in a subsequent test, I conducted t-tests comparing matrix areas 1 and 3, and 2 and 4, demonstrating significant differences between these areas. I conducted a t-test, in table 7 below, to examine the significance of differences in *average_lambda* across matrix areas 1 and 3, as well as areas 2 and 4. The selection of these specific areas is intentional: areas 1 and 3 both involve short-term cash needs, but differ in leverage status, with area 1 underleveraged and area 3 overleveraged. Similarly, areas 2 and 4 represent long-term cash needs under differing leverage conditions. By using these comparisons, I aim to validate the consistency of my results across scenarios with similar cash needs but varying leverage statuses, ensuring that my conclusions are not driven by biases in specific leverage or cash need categories. This robustness check confirms that my original analysis holds under differing conditions without investigating any new relationships.

Table 7 presents the t-test results comparing matrix areas 1 and 3, as well as areas 2 and 4. The results of the t-tests reveal significant differences in *average_lambda* between the selected matrix areas. For the comparison between areas 1 and 3, which both have short-term cash needs but differ in leverage status, the p-values indicate statistically significant differences at the 5% level. Similarly, for the comparison between areas 2 and 4, which represent long-term cash needs under different leverage conditions, the p-values also demonstrate significance at the 5% level.

Table 7: T-Test Results Comparing Average Lambda Between Matrix Areas

This table presents the results of t-tests comparing the means of *average_lambda* between selected matrix areas to assess robustness. The comparisons are made between areas 1 and 3, which have short-term cash needs but differing leverage statuses, and areas 2 and 4, which have long-term cash needs under different leverage conditions. The methods used include pooled and Satterthwaite approaches, with equal and unequal variance assumptions, respectively. The results provide p-values and confidence intervals to validate the consistency of findings across these differing conditions. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Matrix Area Comparison	N1	Mean 1	N2	Mean 2	Mean Difference	t Value	P value
1 vs 3	832	0.152	934	0.342	0.171	2.99	(<0.01)***
2 vs 4	1505	0.193	4825	0.221	0.229	3.72	(<0.01)***

These findings confirm that the differences in *average_lambda* are not due to random variation, thus reinforcing the robustness of my initial conclusions. The significant p-values support the validity of my analysis, showing that leverage adjustments are consistently influenced by cash needs and leverage positions across these varying matrix conditions.

4.1.2 Hypothesis 2 Results

Based on hypothesis 2, I anticipate that cash needs will decelerate the adjustment speed for firms with short-term cash needs (H2). Before designing the regression models to capture these impacts, I introduce *Short_term_cash_need_{i,t}*, which differentiates short-term cash needs (for H2), Regression 7 analyzes the relationship between short-term cash needs and average adjustment speed to test the validity of Hypothesis 2:

$$\lambda_{t \rightarrow t+2} = \beta_1 \text{Cash}_{ex\ post\ i,t} + \beta_2 \text{Short_term_cash_need}_{i,t} + \beta_3 \text{Cash}_{ex\ post\ i,t} * \text{Short_term_cash_need}_{i,t} + \beta_4 \text{EBIT} + \beta_5 \text{MB}_{i,t} + \beta_6 \text{Size}_{i,t} + \beta_7 \text{FA} + \beta_8 \text{DEP} + \beta_9 \text{IND_Median}_t + \beta_{10} \text{FINDEF}_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (7)$$

The results for the regression 7 are shown in table 8 below. There is a negative and significant relationship between $\text{Cash}_{ex\ post\ i,t}$, and $\lambda_{t \rightarrow t+2}$, indicating that as cash needs become more urgent, the adjustment speed towards the target decelerates, as expected in H2. Also, the negative and significant coefficient for the interaction term highlights the fact that as the short-term cash needs increase, the adjustment speed slows down correspondingly, supporting Hypothesis 2.

Consequently, while the positive mean of average lambda across all firms with cash needs (H1) indicates a return toward the target capital structure, the negative and significant coefficients for $\text{Cash}_{ex\ post}$, and $\text{Short_term_Cash_needs}$, in both regressions reveal that as short-term cash needs increase, the adjustment speed decelerates accordingly.

Table 8: Impact of Short-Term Cash Needs on Capital Structure Adjustment Speed

This table presents the regression results examining Hypothesis 2, which posits that as short-term cash needs increase, the speed of capital structure adjustment decelerates. The independent variable, *Cash_{expost}*, represents the amount of cash needs relative to total assets, and *Short_term_Cash_needs* is a dummy variable indicating short-term cash needs. The interaction term between *Cash_{expost}* and *Short_term_Cash_needs* tests the combined effect on adjustment speed. All variables are defined in Appendix A. The dataset has been 5% winsorized to mitigate the influence of outliers. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
<i>Cash_{expost}</i>	-2.239 (<0.01)***	-1.640 (<0.01)***	-1.824 (<0.01)***	-1.713 (<0.01)***	-1.699 (0.02)**
<i>Short_Cash_needs</i>	-0.012 (0.03)**	0.101 (0.04)**	0.202 (0.05)**	0.264 (0.07)*	0.257 (-0.09)*
<i>Cash_{expost} * Short_Cash_needs</i>	-3.975 (<0.01)***	-3.914 (<0.01)***	-3.875 (<0.01)***	-3.983 (<0.01)***	-3.685 (<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	12,373	12,373	8,123	8,123	8,123
R ²	12%	12%	13%	15%	17%

4.1.3 Hypothesis 3 Results

According to hypotheses 3, I anticipate that cash needs will decelerate the adjustment speed for firms with long-term cash needs (H3). Before designing the regression models to capture these impacts, I introduce *Long_term_cash_need_{i,t}*, which differentiates short-term cash needs (for H2) and long-term cash needs (for H3), respectively. Regression 8 analyzes the relationship between long-term cash needs and average adjustment speed to test the validity of Hypothesis 3:

$$\lambda_{t \rightarrow t+2} = \beta_1 \text{Cash}_{ex\ post\ i,t} + \beta_2 \text{Long_term_cash_need}_{i,t} + \beta_3 \text{Cash}_{ex\ post\ i,t} + \beta_4 \text{EBIT} + \beta_5 \text{MB}_{i,t} + \beta_6 \text{Size}_{i,t} + \beta_7 \text{FA} \\ + \beta_8 \text{DEP} + \beta_9 \text{IND_median}_{i,t} + \beta_{10} \text{FINDEF}_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (8)$$

Controls are similar to regression 7 above.

As the results for the regression 8 are shown in table 9 below, there is a negative and significant relationship between *Cash_{ex post i,t}*, and $\lambda_{t \rightarrow t+2}$, indicating that as cash needs become more urgent, the adjustment speed towards the target decelerates, as expected in H3 and the same as the results in regression 7.

The negative and significant coefficient for the interaction term, *Cash_{ex post i,t} * Long_term_cash_need_{i,t}*, highlights the fact that as the long-term cash needs increase, the adjustment speed slows down correspondingly, supporting Hypothesis 3. Consequently, while the positive mean of average lambda across all firms with cash needs (H1) indicates a return toward the target capital structure, the negative and significant coefficients for *Cash_{ex post i,t}*, and *Long_term_Cash_needs*, in both regressions reveal that as cash needs both short-term and long-term (H2 and H3) increase, the adjustment speed decelerates accordingly.

Table 9: Impact of long-Term Cash Needs on Capital Structure Adjustment Speed

This table presents the regression results examining Hypothesis 3, which posits that as long-term cash needs increase, the speed of capital structure adjustment decelerates. The independent variable, $Cash_{ex\ post\ i,t}$, represents the amount of cash needs relative to total assets, and $Long_term_Cash_needs$ is a dummy variable for long-term cash needs. The interaction term between $Cash_{ex\ post\ i,t}$ and $Long_term_Cash_needs$ tests the combined effect on adjustment speed. All variables are defined in Appendix A. The dataset has been 5% winsorized to mitigate the influence of outliers. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
$Cash_{ex\ post}$	-2.347 (<0.01)***	-2.227 (<0.01)***	-2.432 (<0.01)***	-3.317 (<0.01)***	-3.004 (<0.01)***
$Long_Cash_needs$	-0.095 (0.02)**	0.079 (0.02)**	0.063 (0.09)***	0.041 (0.37)	0.023 (0.68)
$Cash_{ex\ post} * Long_Cash_needs$	-3.134 (<0.01)***	-2.861 (<0.01)***	-2.572 (<0.01)***	-2.617 (<0.01)***	-2.321 (<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	12,373	12,373	8,123	8,123	8,123
R ²	9%	10%	12%	13%	15%

4.2 Identification Strategies

4.2.1 Identification strategy for H2: Impact of COVID-19 on Cash Needs in Vulnerable Industries

There are several papers in the literature such as Thai et al. (2023) and Almeida (2020) that used COVID-19 period as cash shock in their studies. So, to establish a relevant identification factor, this study examines the differential impact of COVID-19 on industries with heightened cash management challenges during the pandemic. This factor is inspired by the observed disruptions in cash flow and liquidity needs among industries that experienced operational limitations, supply chain issues, and demand shifts due to the pandemic. COVID-19 acts as an exogenous shock, largely due to its impact being independent of individual firm characteristics and more related to broader economic effects, which assists in isolating external shocks from firms' internal dynamics. Moreover, the treatment group, defined by the significant impact of COVID-19 on firms, functions similarly to an instrumental variable, helping to separate the effects of COVID-19 from other confounding factors that may influence adjustment speed, thereby offering a clearer understanding of the pandemic's direct impact.

By focusing on sectors vulnerable to the pandemic, including hospitality, transportation, healthcare, and retail, the identification factor aims to capture the pandemic's role as an exogenous shock impacting firms' capital structure adjustments. This identification enables a comparative analysis of capital structure behavior during versus outside the COVID period, specifically targeting changes in firms' leverage adjustments and cash flow management practices. Since the financial disruptions caused by COVID-19 were concentrated in 2020 and 2021, particularly in vulnerable industries, the pandemic is treated as a short-term exogenous

cash shock. This allows us to capture its effect on firms' short-term liquidity needs and corresponding capital structure adjustments. This focus provides insights into how economic disruptions can influence firms' financial strategies and response mechanisms, supporting a robust framework for evaluating the hypotheses related to capital structure adjustment speed and cash needs. Prior studies have considered various list of industries as impacted by COVID-19. Here is the full list of industries considered impacted by COVID-19 that in common by most studies in this area including Szczygielski et al. (2022) and Rio-Chanona et al. (2020):

- Hospitality and Leisure
- Airlines and Transportation
- Retail Trade
- Food and Beverage Services
- Oil and Gas
- Automotive and Transportation Equipment
- Entertainment and Motion Pictures
- Real Estate

I included only the segments within these industries that were most likely affected by COVID-19.

A detailed list of the selected sub-industries is provided in Appendix Table 7.2.

Table 10 presents the results of a regression analysis examining the impact of COVID-19 on the speed of capital structure adjustment, using the treatment group to identify firms in industries most affected by the pandemic. The model evaluates how firms' adjustment behavior changed during the COVID period compared to pre-pandemic years. The *covid_dummy* variable captures

the overall effect of the pandemic by identifying industries that are considered vulnerable to COVID-19 in the years 2020 and 2021, while the interaction term between *covid_dummy* and *Cash_{ex post}* assesses whether firms in the treatment group during the years of 2020 and 2021 experienced a differential slowdown in adjustment speed. The analysis includes control variables to account for firm-specific factors.

The regression models used for this analysis are specified as follows:

$$\lambda_{t \rightarrow t+2} = \beta_1 covid_dummy_{i,t} + \beta_2 Cash_{ex\ post\ i,t} + \beta_3 covid_dummy_{i,t} * Cash_{ex\ post\ i,t} + \beta_4 EBIT + \beta_5 MB_{i,t} + \beta_6 Size_{i,t} + \beta_7 FA + \beta_8 Dep + \beta_9 IND_median_{i,t} + \beta_{10} FINDEF_{i,t} + Industry\ fixed\ effects_i + Year\ fixed\ effects_t + \varepsilon_{i,t} \quad (9)$$

The controls are similar to regression (7) above. The results are shown in table 10 below.

We have already demonstrated the negative and significant coefficient for *Cash_{ex post}* in Tables 8 and 9, illustrating the decelerating impact of firms' cash urgency on their leverage adjustment speed towards the target. In Table 10, we introduce the *covid_dummy* variable to underscore the impact of COVID-19 on firms' adjustment speed. This is pertinent as COVID-19 likely had a short-term and immediate effect on firms' cash flow, serving as a key identification factor for Hypothesis 2.

Table 10. Impact of COVID-19 on Cash Needs in Vulnerable Industries

Table 10 presents the regression results testing the impact of COVID-19 as an exogenous shock on the speed of capital structure adjustment. The key variables include *covid_dummy*, indicating the firms in industries most impacted by the pandemic during 2020 and 2021, and its interaction term with *Cash_{ex post}*. Controls are included, the dataset has been 5% winsorized to mitigate the influence of outliers. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)
<i>Covid_dummy</i>	-1.867 (0.03)**	-1.661 (0.05)**	-1.099 (0.05)**
<i>Cash_{ex post}</i>	0.637 (0.44)	0.391 (0.32)	0.368 (0.29)
<i>covid_dummy * Cash_{ex post}</i>	-1.429 (<0.01)***	-1.406 (0.02)**	-1.267 (0.03)**
Controls	No	Yes	Yes
Year FE	Yes	No	Yes
Industry FE	Yes	No	Yes
N	12,373	8,123	8,123
R ²	12%	14%	15%

The regression results suggest that COVID-19 significantly slowed down firms' capital structure adjustment speed, with the effect being more pronounced for firms in industries most impacted by the pandemic during 2020 and 2021. During COVID, firms generally adjusted capital structures more slowly. This delay was even greater for businesses in affected industries that also faced cash shortfalls. The findings indicate that short-term cash constraints, exacerbated by the pandemic, created financial frictions that hindered firms' ability to return to their target leverage.

4.2.2 Identification strategy for H3: Underfunded Pensions vs. Funded Pensions

I used pension funding status as an identification strategy to explore how firms' long-term cash needs, driven by their pension obligations, impact their capital structure adjustment speed. The reason for considering the comparison between funded and underfunded pensions as an identification strategy for H3 and a long-term cash needs shock is that the academic research and regulations indicate that underfunded pension liabilities are typically addressed over extended periods, rather than requiring immediate cash infusions.

Long-Term Nature of Pension Underfunding Obligations

The Employee Retirement Income Security Act (ERISA) and the Internal Revenue Code (IRC) mandate that employers sponsoring underfunded pension plans must make contributions to eliminate funding deficiencies. The Pension Protection Act of 2006 (PPA) initially required that any funding shortfall be amortized over a 7-year period⁴. However, the American Rescue Plan Act of 2021 extended this amortization period to 15 years, providing plan sponsors with a longer timeframe to address underfunding. This change applies to plan years beginning in 2022, with options for earlier application⁵. Similarly, the Governmental Accounting Standards Board (GASB) allows for amortization periods of up to 30 years for public pension plans, enabling entities to spread the recognition of unfunded liabilities over a substantial timeframe.⁶ These structured amortization schedules suggest that underfunded pension liabilities are not immediate cash expenses but obligations that companies can address over several years, thereby influencing long-

⁴ <https://www.dol.gov/sites/dolgov/files/EBSA/laws-and-regulations/laws/pension-protection-act/pension-protection-act-technical-explanation.pdf>

⁵ <https://www.irs.gov/pub/irs-drop/n-21-48.pdf>

⁶ <https://www.nasra.org//Files/Papers/NASRA%20Amortization%20Overview.pdf>

term financial planning and capital structure decisions. Also, Liu and Tonks (2013) finds that companies facing large required pension contributions tend to cut dividends and investment in order to meet those obligations. This trade-off highlights how underfunded pensions can constrain financial flexibility: resources that might have gone toward growth opportunities or shareholder returns are instead allocated to closing the pension gap. Consistent with this, a corporate finance review by Shivdasani (2013) observes that firms with large pension deficits show weaker equity valuations and reduced financial flexibility compared to peers, in part because pension deficits “impair the company’s ability to grow” by tying up cash in the plan. Overall, these studies support the view that pension underfunding creates a long-term drag on discretionary spending, pressuring firms to scale back investments and payouts over time. Bartram (2016) finds that increases in pension liabilities are associated with lower levels of traditional debt financing – roughly, a 1% increase in a company’s pension benefit obligation corresponds to about a 0.23% decrease in its outstanding debt, holding other factors constant. This crowding-out effect suggests that firms with underfunded pensions restrain their issuance of new debt (or accelerate debt reduction) to compensate for the implicit debt of the pension shortfall. In other words, pension underfunding can create a form of “pension debt overhang” that slows the firm’s adjustment toward its optimal capital structure. A company that might otherwise increase leverage (to reach a target debt ratio) will move more cautiously if it already carries a large pension deficit on its shoulders, since the pension must eventually be funded from future cash flows.

Pension Underfunding as an Exogenous Shock to Long-Term Financial Constraints

Researchers have noted that mandatory pension contributions can be treated as plausibly exogenous shocks to firms' finances, since they are driven by funding rules and actuarial conditions (e.g. discount rates, asset returns) rather than by current investment opportunities. Rauh (2006), for instance, uses required pension contributions as a natural experiment, arguing they are largely outside management's immediate control (due to regulation) and thus exogenous to the firm's growth prospects. Consistent with this, Franzoni (2009) finds that the stock price drop when firms make pension contributions is larger at cash-constrained firms – indicative of under-investment due to forced cash outflows, whereas in poorly governed firms with surplus cash, contributions are greeted positively (they preempt wasteful spending). Finally, the literature stresses why these pension-induced shocks can be viewed as exogenous for identification. Major drivers of funding status, like asset returns and discount rates, are largely external to management's actions. Shen et al. (2020) explicitly describe mandatory pension contributions as an "exogenous shock to firm internal funds" and examine their impact on innovation activity.

Firms with underfunded pensions face ongoing financial obligations, which can create a higher demand for liquidity and limit their flexibility in maintaining or adjusting capital structures. Conversely, firms with fully funded pensions may have fewer constraints on their cash flow, potentially allowing for more consistent or faster adjustments toward target capital structures. By categorizing firms into "Funded Pensions" and "Underfunded Pensions," this analysis aims to distinguish the capital structure dynamics based on the availability of internal financial resources.

Following Wang and Zhang (2013), I calculated the funding status of pension plans by comparing the projected benefit obligations (*PBO*) to the fair value of plan assets, both of which are available in the Compustat database. A pension plan is considered underfunded when its PBO exceeds the fair value of its assets. To investigate this further, I introduced a new variable called the *funding_gap*, calculated as the difference between the pension benefit obligations (*PBO*) and the fair value of pension plan assets (*FVPA*). This variable was developed to capture the degree of underfunding or overfunding in pension plans and serves as the basis for categorizing observations into funded and underfunded pensions.

This regression model 10, below, examines how pension underfunding affects the speed of capital structure adjustment, incorporating both a binary indicator for underfunding and a continuous measure of the funding gap. By including an interaction term between these two variables, the model tests whether the impact of underfunded pensions on adjustment speed varies depending on the severity of the funding shortfall.

$$\lambda_{t \rightarrow t+2} = \beta_1 \text{Underfunded}_i + \beta_2 \text{funding_gap}_{i,t} + \beta_3 \text{Underfunded}_i * \text{Funding gap}_{i,t} + \beta_4 \text{EBIT} + \beta_5 \text{MB}_{i,t} + \beta_6 \text{Size}_{i,t} + \beta_7 \text{FA} + \beta_8 \text{Dep} + \beta_9 \text{IND_median}_{i,t} + \beta_{10} \text{FINDEF}_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (10)$$

Table 11 presents the multivariate results of Pension Underfunding and Capital Structure Adjustment Speed.

Table 11. Multivariate Regression Analysis of Pension Underfunding and Capital Structure Adjustment Speeds

This table presents the results of a multivariate regression model analyzing the impact of pension underfunding on the speed of capital structure adjustment. The key explanatory variables include *Underfunded*, a dummy variable indicating whether a firm's pension plan is underfunded, and *funding_gap*, which measures the severity of the pension deficit. The interaction term (between *Underfunded* and *funding_gap*) examines whether the effect of pension underfunding on adjustment speed is amplified as the funding gap increases. Controls are included. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively. Also, since all of this dataset consists of pensions, I replaced industry fixed effect with firm fixed effect.

	(1)	(2)
<i>Underfunded</i>	-0.032 (0.149)	-0.573 (0.07)*
<i>funding_gap</i>	-1.114 (<0.01)***	-0.670 (<0.01)***
<i>Underfunded*funding_gap</i>	-0.93 (<0.04)**	-1.074 (<0.01)***
Controls	No	Yes
Year FE	Yes	Yes
Firm FE	Yes	Yes
N	2,786	1,182
R2	11%	14%

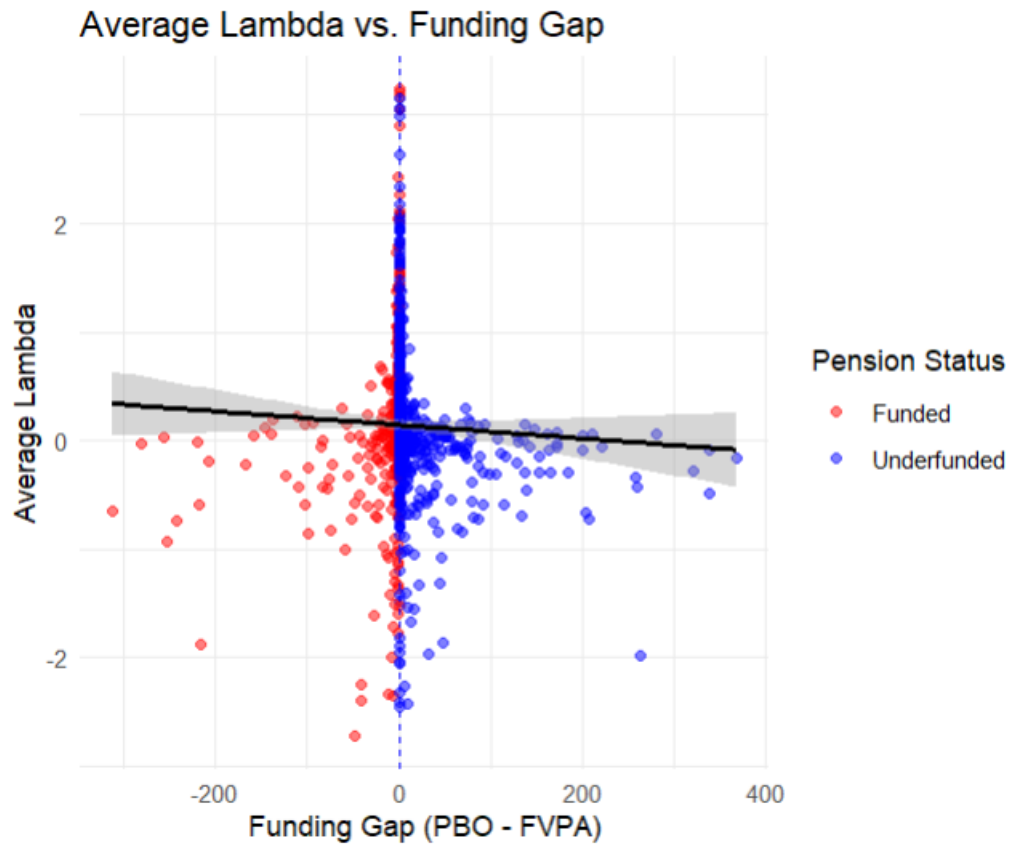
The results indicate that firms with underfunded pensions adjust their capital structures more slowly than those with fully funded pensions. This suggests that long-term financial obligations associated with pension underfunding act as a structural constraint, limiting firms' flexibility in reaching their target leverage. Additionally, the negative coefficient on the funding gap variable confirms that greater pension deficits are associated with an even slower adjustment speed, reinforcing the idea that firms experiencing more severe underfunding face higher financial constraints.

The interaction term further strengthens this conclusion, revealing that the negative effect of pension underfunding is amplified for firms with larger funding gaps. This means that not only does pension underfunding slow adjustment speeds, but its impact becomes more pronounced as the severity of the funding shortfall increases. Firms with extreme pension deficits may struggle to prioritize leverage adjustments due to ongoing financial pressures, further delaying their ability to return to an optimal capital structure. These results provide strong evidence that pension obligations function as a long-term financial constraint, significantly influencing firms' strategic financial decisions beyond immediate liquidity concerns, therefore, support the slowing impact of long-term cash needs on leverage adjustment speed (H3).

To visualize the relationship between the funding gap and firms' adjustment behavior, the figure 3 scatterplot, below, was constructed, displaying average lambda values across varying levels of the funding gap.

Figure 3. Scatterplot of Average Lambda by Funding Gap with Pension Status

This scatterplot illustrates the relationship between the funding gap (PBO - FVPA) and the average lambda for funded and underfunded pensions. The vertical dashed line represents the threshold at which pensions transition from funded (blue) to underfunded (orange) status. The regression lines highlight distinct trends in average lambda on either side of the threshold, suggesting potential discontinuity in behavior around the funding gap of zero.



The plot reveals a general trend where average λ decreases as the funding gap becomes more positive, particularly for underfunded pensions. This aligns with the third hypothesis that as the severity of a firm's long-term cash shortfall increases, its adjustment speed slows down. Underfunded pensions face greater financial strain, which forces firms to prioritize liquidity and financial stability over adjustment efforts, reducing average λ .

Using pension funding status as an identification strategy provides a robust method to address endogeneity in assessing how firms' cash needs due to pension obligations influence their capital structure adjustment speed. This strategy categorizes firms into "Funded" and "Underfunded" pensions, leveraging an external criterion largely independent of a firm's immediate financial decisions. By comparing these groups, the analysis directly observes the impact of liquidity constraints on capital structure adjustments without the confounding effects of other variables, effectively mitigating issues like reverse causality and omitted variable bias. This approach not only enhances the credibility of the findings but also empirically supports the hypothesis that immediate financial needs, such as those arising from underfunded pensions, decelerate adjustment speeds toward target capital structures.

The identification strategies employed confirm that liquidity constraints causally slow down capital structure adjustment. By leveraging the COVID-19 pandemic as an exogenous shock and pension funding status as an alternative measure of financial pressure, the analysis strengthens the robustness of the results and mitigates endogeneity concerns.

4.3 Robustness Tests

To ensure the reliability of the findings, I conduct a series of robustness tests to verify that the observed relationships between cash needs and capital structure adjustment are not driven by data processing choices or alternative variable definitions.

4.3.1 Winsorizing vs. Trimming of average lambda

To validate the consistency of my findings, I conduct a robustness test by applying 5% trimming to the dataset, replacing the winsorizing approach used in Section 4.2.1. While trimming removes extreme observations, winsorization retains all data points by capping extreme values, ensuring that no data is lost while mitigating the influence of outliers. After applying this adjustment, I re-run the analyses for all three hypotheses to determine whether the results remain stable.

The robustness results of trimming for H1 are shown in table 12 below:

Table 12: Univariate Test for H1 Robustness: Trimmed Average Lambda by Matrix Area

This table presents the univariate test results for Hypothesis 1 robustness test, focusing on the mean of average lambda across different matrix areas. The results are derived after applying 5% trimming to the dataset as part of the robustness test. The table provides the mean, standard deviation, standard error, minimum, maximum, 5% confidence intervals, degrees of freedom (DF), t-values, and significance levels ($Pr > |t|$) for each matrix area, illustrating the adjustment speed differences across the matrix areas under the trimmed data. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Matrix Area	N	Mean	t Value	P value
1	843	0.371	11.52	(<0.01)***
4	4,242	0.416	10.44	(<0.01)***
2	1,317	0.541	2.01	(0.02)**
3	884	0.463	5.82	(<0.01)***

Table 12 presents the results of the univariate test for Hypothesis 1 after applying trimming. The mean lambda values remain positive and highly significant across all matrix areas, confirming that firms across different groups continue to adjust their capital structures toward target leverage levels. The significance of the t-values ($p < 0.01$ in most cases) indicates that the variation in adjustment speeds is robust to different data treatments, ensuring that the results are not dependent on extreme observations.

Table 13: Impact of Short-Term Cash Needs on Capital Structure Adjustment Speed: Trimmed Results (Robustness for H2)

This table presents the regression results for Hypothesis 2, assessing the impact of short-term cash needs on the speed of capital structure adjustment, using a 5% trimmed dataset for robustness. The results illustrate the relationship between cash exposure and adjustment speed in areas characterized by short-term cash needs. Trimming is utilized to reduce the influence of outliers, enhancing the reliability of the findings. Key variables include the interaction between short-term cash needs and cash exposure, along with control variables outlined in Appendix A. Significance at the 10%, 5%, and 1% levels is marked by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
<i>Cash_{expost}</i>	-2.177 (<0.01)***	-2.572 (<0.01)***	-2.174 (<0.01)***	-2.398 (0.02)**	-1.683 (0.03)**
<i>Short_Cash_needs</i>	-0.439 (0.03)**	0.374 (0.03)**	0.285 (0.04)**	0.342 (0.06)*	0.337 (0.09)*
<i>Cash_{expost} * Short_Cash_needs</i>	-2.647 (<0.01)***	-2.447 (<0.01)***	-2.334 (<0.01)***	-2.007 (<0.01)***	-3.067 (0.03)**
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	11,135	11,135	7,286	7,286	7,286
R ²	7%	8%	11%	12%	14%

Table 13 (H2 Robustness Test - Short-Term Cash Needs and Adjustment Speed) replicates the analysis of Table 8 using 5% trimming instead of winsorization, to further validate the impact of short-term cash needs on capital structure adjustment. The coefficients for cash exposure ($Cash_{ex\ post}$) remain negative and significant, confirming that higher cash constraints slow down adjustment speed. Also, the interaction term between short-term cash needs and $Cash_{ex\ post\ i,t}$ is negative and significant, suggesting that firms with liquidity pressures experience a slower adjustment pace. The robustness check ensures that this relationship persists even when extreme observations are removed.

Table 14: Impact of Long-Term Cash Needs on Capital Structure Adjustment Speed: Trimmed Results (Robustness for H3)

This table displays the regression results for Hypothesis 3, examining the effect of long-term cash needs on capital structure adjustment speed, utilizing a 5% trimmed dataset for robustness. The results emphasize the influence of cash exposure and long-term cash needs. Significance at the 10%, 5%, and 1% levels is marked by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
$Cash_{expost}$	-1.630 (<0.01)***	-1.171 (<0.01)***	-1.680 (<0.01)***	-2.114 (<0.01)***	-2.397 (<0.01)***
$Long_Cash_needs$	-0.382 (<0.10)*	-0.127 (<0.23)	-0.104 (0.67)	-0.092 (0.61)	-0.040 (0.63)
$Cash_{expost} * Long_Cash_needs$	-1.410 (<0.01)***	-1.204 (<0.01)***	-1.462 (<0.01)***	-1.430 (<0.01)***	-1.311 (<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	11,135	11,135	7,286	7,286	7,286
R ²	8%	10%	11%	11%	14%

Table 14 (H3 Robustness Test - Long-Term Cash Needs and Adjustment Speed) is equivalent to the analysis of Table 9 with the exception of using 5% trimming instead of winsorization. The results for Hypothesis 3 show that long-term cash needs also influence adjustment speed, with the coefficient for cash exposure ($Cash_{expost_AT}$) remaining negative and highly significant. This indicates that firms with greater long-term cash constraints experience slower capital structure adjustments. The interaction term between long-term cash needs and cash exposure is negative and significant across all specifications, implying that the consistent cash need has the same slowing impact on adjustment speed.

As shown above, the results for all hypotheses in the trimmed dataset remain consistent with those in the winsorized dataset, demonstrating the robustness of the findings.

4.3.2 Operating Cash Flow (OCF) vs. Internal Cash Flow (ICF)

As discussed earlier, I used *ICF* as a proxy to distinguish between short-term and long-term cash needs. For the second robustness test, I replace *ICF* with Operating Cash Flow (*OCF*) to determine whether the results remain consistent with this alternative measure. This substitution provides an additional perspective, as *OCF* directly reflects a firm's core cash-generating operations, while *ICF* includes broader internal sources. By using *OCF*, I aim to verify that the findings are robust to different definitions of cash flows and to see if operational performance alone drives the observed cash needs effect on adjustment speeds. The formulas used for both *ICF* and *OCF* are provided in Appendix A. As table 15 shows the univariate results, the means of average lambda are once again positive in all four matrix areas, indicating the fact that firms will get back to their target leverage despite their short-term and long-term cash needs.

Table 15: Univariate Test Results for H1: Average Lambda calculated using operating cash flow

This table provides univariate results for Operating Cash Flow (*OCF*) as part of a robustness test to assess the consistency of findings when using an alternative cash flow measure in place of Internal Cash Flow (*ICF*). Summary statistics, including mean, standard deviation, and confidence intervals, are reported for *OCF* across different matrix areas. This analysis helps determine if the observed effects on adjustment speed hold under various definitions of cash flows, focusing on core cash-generating operations rather than broader internal cash sources. all variables detailed in Appendix A. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Matrix Area	N	Mean	t Value	P value
1	834	0.186	6.59	(<0.01)***
4	4,857	0.260	3.47	(<0.01)***
2	1,439	0.166	6.21	(<0.01)***
3	993	0.196	4.57	(<0.01)***

Equivalent to table 5, in table 16, when using *OCF* instead of *ICF* as the cash needs measure, the relationship between short-term cash needs and capital structure adjustment speed remains consistent with the *ICF*-based findings. The coefficient for cash exposure is negative and significant, meaning firms with higher short-term operational cash constraints still experience a slower adjustment speed. Moreover, the interaction effect indicates that as short-term cash needs increase, the adjustment speed correspondingly decreases, supporting Hypothesis 2.

Table 16: Impact of Short-Term Cash Needs on Capital Structure Adjustment Speed using operating cash flow

This table presents the regression results examining Hypothesis 2 under the robustness test, where Operating Cash Flow (*OCF*) is used in place of Internal Cash Flow (*ICF*) to evaluate short-term cash needs. The analysis includes the independent variable $Cash_{ex\ post\ i,t}$, which indicates the cash needs relative to total assets, and the interaction term between $Cash_{ex\ post\ i,t}$ and *Short_term_Cash_needs*, examining their combined effect on the speed of capital structure adjustment. This robustness test aims to confirm if the observed decelerating impact of short-term cash needs on adjustment speed holds when utilizing *OCF*. Definitions for all variables are provided in Appendix A. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
$Cash_{ex\ post\ i,t}$	-2.552 (<0.01)***	-2.437 (<0.01)***	-2.131 (<0.01)***	-1.970 (<0.01)***	-1.894 (0.02)**
<i>Short_Cash_needs</i>	0.047 (0.10)*	0.042 (0.13)	0.039 (0.15)	0.037 (0.17)	0.032 (0.24)
$Cash_{ex\ post\ i,t} * Short_Cash_needs$	-3.657 (<0.01)***	-3.137 (<0.01)***	-3.711 (<0.01)***	-3.237 (<0.01)***	-3.011 (<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	,Yes
N	12,373	12,373	8,123	8,123	8,123
R ²	8%	10%	12%	16%	16%

Equivalent to Table 8, the regression results in Table 17 present the outcome of testing H3 by using *OCF* instead of *ICF*. The coefficients for $Cash_{expost_AT}$ and its interaction with *Long_term_Cash_needs* are significant, with p-values below 5%. Equivalently, these results reinforce the main findings, demonstrating the critical role of short-term cash needs in decelerating leverage adjustments.

**Table 17: Impact of Long-Term Cash Needs on Capital Structure Adjustment Speed
using operating cash flow**

This table presents the regression results examining Hypothesis 3 under the robustness test, where Operating Cash Flow (*OCF*) replaces Internal Cash Flow (*ICF*) to assess the impact of long-term cash needs. The independent variable $Cash_{ex\ post\ i,t}$ represents cash needs relative to total assets, and *Long_term_Cash_needs* serves as an indicator for long-term cash requirements. The interaction term between $Cash_{ex\ post\ i,t}$ and *Long_term_Cash_needs* examines their combined effect on adjustment speed. This robustness check aims to verify if the observed decelerating influence of long-term cash needs on capital structure adjustment speed remains consistent with *OCF* as the measure of cash flow. Variable definitions are provided in Appendix A. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
$Cash_{ex\ post\ i,t}$	-2.234 (<0.01)***	-2.114 (<0.01)***	-2.094 (<0.01)***	-2.179 (<0.01)***	-1.976 (<0.01)***
<i>Long_Cash_needs</i>	-0.025 (0.19)	-0.143 (0.23)	0.047 (0.33)	0.074 (0.37)	0.036 (0.43)
$Cash_{ex\ post\ i,t} * Long_Cash_needs$	-2.673 (<0.01)***	-2.558 (<0.01)***	-2.437 (<0.01)***	-2.341 (<0.01)***	-1.647 (<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	12,373	12,373	8,123	8,123	8,123
R ²	7%	8%	9%	12%	16%

The original findings, demonstrating the stability of the results across different cash flow metrics. The alignment of *OCF*-based results with those of *ICF* reinforces the conclusion that cash needs significantly influence capital structure adjustment speed, independent of the specific cash flow measure used. This consistency underscores the robustness and reliability of the observed effects on firms' adjustment towards target leverage levels.

4.3.3 $Cash_{ex\ ante}$ vs. $Cash_{ex\ post}$

In my thesis, I have been using $Cash_{expost}$ to represent the amount of cash needed. Now, as a robustness test, I am replacing $Cash_{expost}$ with $Cash_{exante}$, calculated as $Cash_t - \Delta D_{t-1} - \Delta E_{t-1}$. Using $Cash_{exante}$ instead of $Cash_{expost}$ as a proxy for cash needs is relevant since it measures anticipated cash needs rather than realized shortfalls, which reduces endogeneity concerns. While $Cash_{expost}$, which captures realized shortfalls relative to available cash ($Cash_{t-1} + NCF_t$) is appropriate for testing the main hypothesis due to its direct reflection of financing pressure, the robustness test uses $Cash_{exante}$ to measures anticipated cash needs based on projected cash flow shortfalls ($Cash_{t-1} + NCF_{t-1}$), allowing for an assessment of financing expectations before capital structure decisions are made. As discussed in Huang and Ritter (2021), ex ante measures are less likely to be affected by reverse causality, since they are not influenced by contemporaneous financing decisions that could distort realized outcomes. This distinction strengthens the robustness of the findings by showing that the effect of cash needs on adjustment speed persists even when future-oriented, forward-looking proxies are used. In table 18 below, equivalent to Table 8, I provided the univariate result of H1 using $Cash_{exante}$ instead of $Cash_{expost}$. The means of average lambda are once again positive in all four matrix areas, indicating the fact that firms will get back to their target leverage despite their short-term and long-term cash needs.

Table 18: Univariate Test Results for H1: Average Lambda calculated using $Cash_{exante}$

This table presents the univariate test results for H1, with the average lambda calculated using $Cash_{exante}$ instead of $Cash_{expost}$. The mean values of average lambda across all four matrix areas are positive, indicating that firms are likely to adjust back towards their target leverage despite experiencing both short-term and long-term cash needs. All Variable definitions are provided in Appendix A. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Matrix Area	N	Mean	t Value	P value
1	927	0.190	4.471	(<0.01)***
4	4,551	0.275	3.319	(<0.01)***
2	1,592	0.161	3.474	(0.07)*
3	1,147	0.200	4.687	(<0.01)***

Similar to table 8, which proved the negative correlation between short-term cash needs and the adjustment speed (H2), table 19 below, indicates that the coefficients for $Cash_{exante_AT}$ and its interaction with $Short_term_Cash_needs$ are both highly significant, with p-values well below 5%. These results strongly support the main findings of H2, emphasizing the significant impact of short-term cash needs and leverage adjustments

**Table 19: Impact of Short-Term Cash Needs on Capital Structure Adjustment Speed
using $Cash_{exante}$**

This table displays the regression results examining the effect of short-term cash needs on capital structure adjustment speed, utilizing $Cash_{exante}$ as a robustness measure. The table includes the estimated coefficients, standard errors, t-values, p-values, and confidence intervals for each variable, providing insights into how short-term cash constraints influence the adjustment towards target leverage under the H2 hypothesis. All Variable definitions are provided in Appendix A. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
$Cash_{exante}$	-2.021 (<0.01)***	-1.374 (<0.01)***	-1.571 (<0.01)***	-1.79 (<0.01)***	-1.671 (<0.01)***
$Short_Cash_needs$	0.047 (0.10)	0.037 (0.17)	0.39 (0.19)	0.041 (0.27)	0.029 (0.34)
$Cash_{exante} * Short_Cash_needs$	-4.101 (<0.01)***	-4.379 (<0.01)***	-3.97 (<0.01)***	-3.124 (<0.01)***	-2.973 (<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	13,102	13,102	8,217	8,217	8,217
R ²	6%	9%	10%	11%	11%

As shown in Table 20, the coefficients for $Cash_{exante}$ and its interaction with $Long_term_Cash_needs$ are both significant, with p-values well below 5%. This significance confirms that these variables are crucial in verifying the results of H3, highlighting the negative impact of long-term cash needs on leverage adjustments.

**Table 20: Impact of Long-Term Cash Needs on Capital Structure Adjustment Speed
using $Cash_{exante}$**

This table presents the regression results for H3, assessing the effect of long-term cash needs on capital structure adjustment speed with $Cash_{exante}$ as a robustness measure. The results include estimated coefficients, standard errors, t-values, p-values, and confidence intervals for each variable, illustrating how long-term cash constraints impact the rate at which firms adjust toward their target leverage. All Variable definitions are provided in Appendix A. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
$Cash_{exante}$	-2.794	-2.314	-2.670	-2.147	-1.997
	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***
$Long_Cash_needs$	-0.101	-0.050	0.042	0.076	0.063
	(0.14)	(0.17)	(0.24)	(0.37)	(0.41)
$Cash_{exante} * Long_Cash_needs$	-2.286	-2.373	-2.117	-2.019	-1.934
	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	13,102	13,102	8,217	8,217	8,217
R ²	6%	7%	11%	11%	13%

The robustness test using $Cash_{exante}$ in place of $Cash_{expost}$ confirmed the validity of the initial findings, showing consistent effects on capital structure adjustment speed. This alignment suggests that the influence of cash needs on adjustment speed holds steady regardless of whether we measure cash needs prospectively ($Cash_{exante}$) or retrospectively ($Cash_{expost}$). The consistency across these measures further underscores the robustness of the results, reinforcing the conclusion that cash needs are a reliable predictor of capital structure adjustment behavior.

4.3.4 Debt type Alignment with Cash Need Duration: Evidence Supporting H2 and H3

To reinforce the theoretical mechanism underlying Hypotheses 2 and 3, this section presents a cross-sectional test examining whether firms facing short-term versus long-term cash needs adjust their capital structure in a manner consistent with their cash needs. So as a robustness test, I run a cross-sectional test comparing how short-term debt levels and long-term debt levels vary across firms with short-term vs. long-term cash needs.

These are the key questions addressed here:

- Do firms with short-term cash needs have significantly higher short-term debt levels?
- Do firms with long-term cash needs have significantly higher long-term debt levels?

I construct two dependent variables to capture the composition of firms' capital structures:

Short-term debt ratio = Short-term debt (DLC) / Total Assets

Long-term debt ratio = Long-term debt (DLTT) / Total Assets

I then run two cross-sectional regressions with standard control variables (EBIT, Market-to-Book, firm size, fixed assets, depreciation, financial deficit, and industry fixed effects):

$$\text{Short_Term_Debt_Ratio}_{i,t} = \beta_0 + \beta_1 \text{Short_term_cash_need}_{i,t} + \beta_2 \text{Long_term_cash_need}_{i,t} + \beta_3 \text{EBIT} + \beta_4 \text{MB}_{i,t} + \beta_5 \text{Size}_{i,t} + \beta_6 \text{FA} + \beta_7 \text{Dep} + \beta_8 \text{IND_median}_{i,t} + \beta_9 \text{FINDEF}_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (11)$$

$$\text{Long_Term_Debt_Ratio}_{i,t} = \beta_0 + \beta_1 \text{Short_term_cash_need}_{i,t} + \beta_2 \text{Long_term_cash_need}_{i,t} + \beta_3 \text{EBIT} + \beta_4 \text{MB}_{i,t} + \beta_5 \text{Size}_{i,t} + \beta_6 \text{FA} + \beta_7 \text{Dep} + \beta_8 \text{IND_median}_{i,t} + \beta_9 \text{FINDEF}_{i,t} + \text{Industry fixed effects}_i + \text{Year fixed effects}_t + \varepsilon_{i,t} \quad (12)$$

The analysis tests whether firms align their debt maturity choices with the expected duration of liquidity needs. The results of these regressions are presented in Table 21. As predicted:

Table 21: Cross-Sectional Regressions of Debt Maturity on Short- and Long-Term Cash Needs

This table reports the results of cross-sectional regressions examining how firms adjust the composition of their debt maturity structure in response to different types of cash needs. Part A presents the results for Model (11), where the dependent variable is the short-term debt ratio. Part B shows the results for Model (12), where the dependent variable is the long-term debt ratio. The key independent variables are indicators of short-term and long-term cash needs, and the regressions controls for firm characteristics such as profitability, market-to-book ratio, size, fixed assets, and depreciation. Statistical significance is denoted by *, **, and *** for the 10%, 5%, and 1% levels, respectively.

A. Short_Term_Debt_Ratio

	(1)	(2)	(3)	(4)	(5)
<i>Short_term_cash_need</i>	1.103 (<0.01)***	1.024 (<0.01)***	0.967 (<0.01)***	0.933 (<0.01)***	0.917 (<0.01)***
<i>Long_term_cash_need</i>	-1.012 (0.62)	1.593 (0.64)	0.702 (0.68)	0.641 (0.70)	0.791 (0.76)
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	12,373	12,373	8,123	8,123	8,123
R ²	7%	11%	12%	12%	14%

B. Long_Term_Debt_Ratio

	(1)	(2)	(3)	(4)	(5)
<i>Short_term_cash_need</i>	-1.794 (0.37)	-1.003 (0.43)	0.412 (0.44)	0.448 (0.51)	0.637 (0.58)
<i>Long_term_cash_need</i>	1.348 (<0.01)***	1.307 (<0.01)***	1.167 (0.02)**	1.207 (0.02)**	1.108 (0.02)**
Controls	No	No	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes
N	12,373	12,373	8,123	8,123	8,123
R ²	6%	7%	8%	8%	11%

- In part A, the coefficient on *Short_Term_Debt_Ratio* is positive and statistically significant, indicating that firms facing short-term cash shortage tend to rely more on short-term debt relative to their total assets.
- In part B, the coefficient on *Long_Term_Debt_Ratio* is positive and statistically significant, suggesting that firms with persistent long-term obligations rely more on long-term debt.

Both findings are consistent with the funding horizon theory and confirm that firms' debt maturity structures are aligned with the duration of their cash needs.

These results serve as a mechanism test by showing that firms act in a manner predicted by theory, choosing short- or long-term debt based on the urgency and horizon of their cash needs. Together, these results reinforce the broader conclusion of this study: that the nature and duration of cash needs shape both the financing choices and the subsequent speed at which firms adjust toward their optimal capital structure.

5. Conclusion

This thesis investigates how firms' cash needs influence their capital structure adjustment speed, contributing to the literature on financial constraints and corporate financing decisions. Using a comprehensive dataset from Compustat (1960 – 2023), the study differentiates between short-term and long-term cash needs and examines their effects on firms' ability to move toward target leverage. The findings support the dynamic trade-off theory, showing that firms with cash needs still adjust toward their optimal capital structure (H1). However, greater cash constraints

significantly slow down this adjustment process, with both short-term liquidity pressures (H2) and long-term financial obligations (H3) leading to a deceleration in adjustment speed.

This suggests that limited internal resources restrict firms' ability to swiftly realign their leverage. Robustness tests confirm the persistence of these effects across different measures of cash constraints and data processing techniques. Additionally, two identification strategies—exploiting the COVID-19 pandemic as an exogenous shock and distinguishing firms by pension funding status—further validate the main results.

This research contributes to the capital structure literature by highlighting liquidity constraints as a key determinant of adjustment speed. The findings emphasize that financial frictions play a crucial role in capital structure decisions, particularly during periods of economic uncertainty. Future research could explore how firms' financing policies evolve under different external shocks, further expanding our understanding of capital structure dynamics.

6. References

Acharya, V. V., Almeida, Heitor., & Campello, Murillo. (2005). Is Cash Negative Debt? A Hedging Perspective on Corporate Financial Policies. National Bureau of Economic Research.

Almeida, H. (2021). Liquidity management during the COVID-19 pandemic. *Asia-Pacific Journal of Financial Studies*, 50(1), 7–24.

Atanasova, C., & Willeboordse, F. H. (2025). The impact of corporate diversification on liquidity management: Evidence from lines of credit. *Journal of International Financial Markets, Institutions & Money*, 101, 102139.

Ayerbe, C., & Gómez-Ansón, S. (2010). "Financial flexibility and capital structure adjustment: Evidence from the Spanish market." *International Journal of Managerial Finance*, 6(4), 302-331.

Bartram, S. M. (2016). Corporate post-retirement benefit plans and leverage. *Review of Finance*, 20(2), 575–629.

Byoun, S. (2008). "How and when do firms adjust their capital structures toward targets?" *Journal of Finance*, 63(6), 3069-3096.

Campbell, J. Y., Hilscher, J., & Szilagyi, J. (2008). In search of distress risk. *The Journal of Finance*, 63(6), 2899–2939.

Cook, D. O., & Tang, T. (2010). "Macroeconomic conditions and capital structure adjustment speed." *Journal of Corporate Finance*, 16(1), 73-87.

- Dang, V. A., Kim, M., & Shin, Y. (2012). "Asymmetric capital structure adjustments: New evidence from dynamic panel threshold models." *Journal of Empirical Finance*, 19(4), 465-482
- DeAngelo, H., & Roll, R. (2015). How stable are corporate capital structures? *The Journal of Finance*, 70(1), 373–418.
- DeAngelo, H., DeAngelo, L., & Whited, T. M. (2011). Capital structure dynamics and transitory debt. *Journal of Financial Economics*, 99(2), 235–261.
- Del Rio-Chanona, R. M., Mealy, P., Pichler, A., Lafond, F., & Farmer, J. D. (2020). Supply and demand shocks in the COVID-19 pandemic: An industry and occupation perspective. *Oxford Review of Economic Policy*, 36(S1), S94–S137.
- Faulkender, M., & Wang, R. (2006). "Corporate Financial Policy and the Value of Cash." *Journal of Finance*, 61(4), 1957-1990.
- Fischer, Edwin O., Robert Heinkel, and Josef Zechner. "Dynamic Capital Structure Choice: Theory and Tests." *Journal of Finance*, vol. 44, no. 1, 1989, pp. 19-40.
- Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics*, 79(3), 469–506.
- Frank, M. Z., & Goyal, V. K. (2009). Capital Structure Decisions: Which Factors Are Reliably Important? *Financial Management*, 38(1), 1-37.
- Franzoni, F. (2008). Underinvestment vs. overinvestment: Evidence from price reactions to pension contributions. Swiss Finance Institute Research Paper No. 08-22.

- Hegde, A. A., Masuna, V., Panda, A. K., & Kumar, S. (2023). What we know and what we should know about speed of capital structure adjustment: A retrospective using bibliometric and system thinking approach. *Qualitative Research in Financial Markets*, 15(2), 224-253
- Hennessy, C. A., & Whited, T. M. (2005). Debt Dynamics. *The Journal of Finance*, 60(3), 1129–1165.
- Huang, R., & Ritter, J. R. (2021). Corporate Cash Shortfalls and Financing Decisions. *The Review of Financial Studies*, 34(4), 1789–1833.
- Lemmon, M. L., Roberts, M. R., & Zender, J. F. (2008). "Back to the beginning: Persistence and the cross-section of corporate capital structure." *The Journal of Finance*, 63(4), 1575-1608.
- Lim, C. Y., Lobo, G. J., Rao, P., & Yue, H. (2022). Financial capacity and demand for audit quality. *Accounting and Business Research*, 52(2), 199–236.
- Liu, W., & Tonks, I. (2013). Pension funding constraints and corporate expenditures. *Oxford Bulletin of Economics and Statistics*, 75(2), 235–258.
- Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), 147–175.
- Myers, S. C. (1984). The capital structure puzzle. *Journal of Finance*, 39(3), 575–592.
- Rauh, J. D. (2006). Investment and financing constraints: Evidence from the funding of corporate pension plans. *The Journal of Finance*, 61(1), 33–71.
- Shen, H., Wang, H., Wang, Z., & Yin, D. (2020). Do mandatory pension contributions hinder innovation? *International Journal of Innovation Studies*, 4(1), 27–39.

Shivdasani, A., & Stefanescu, I. (2010). How do pensions affect corporate capital structure decisions? *The Review of Financial Studies*, 23(3), 1287–1323.

Stulz, R. M. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics*, 26(1), 3–27.

Szczygielski, J. J., Charteris, A., Bwanya, P. R., & Brzeszczyński, J. (2022). The impact and role of COVID-19 uncertainty: A global industry analysis. *International Review of Financial Analysis*, 80, 101837.

Thai, T. H. A., Vo, T. T. A., & Mazur, M. (2023). COVID-19 and investment–cash flow sensitivity: A cross-country analysis. *Research in International Business and Finance*, 66, 102014.

Titman, S., & Tsyplakov, S. (2007). A Dynamic Model of Optimal Capital Structure. *Review of Finance*, 11(3), 401-451.

Wang, F. A., & Zhang, T. 2014. "The Effect of Unfunded Pension Liabilities on Corporate Bond Ratings, Default Risk, and Recovery Rate." *Review of Quantitative Finance and Accounting*, 43(4): 781–802.

Zou, Y., & Bai, Q. (2022). The impact of dividend policies and financing strategies on the speed of firms' capital structure adjustment. *Discrete Dynamics in Nature and Society*, 12.

Appendix A: Variables definitions

This table defines the variables discussed in this thesis.

Variable	Definition
<i>BDR</i>	Book Debt Ratio: (short-term debt + long-term debt)/total assets
<i>BDR*</i>	Target capital structure. See equations 1-4 on how to calculate.
<i>Cash_{ex ante}</i>	Cash _{ex ante} is defined as $Cash_{t-1} + NCF_{t-1}$, using the realized NCF_{t-1} as the projected NCF_t to alleviate endogeneity concerns
<i>Cash_{ex post}</i>	- [$Equals\ Cash_{t-1} + NCF_t$] (represents the amount of cash shortage if there was no external financing)
<i>covid_dummy</i>	A dummy variable set to 1 for observations within industries considered vulnerable to COVID-19 (The full list is on page 64) and within the years 2020 and 2021; and set to 0 otherwise.
<i>DEF</i>	(dividend payments + investments + change in working capital-operating cash flow)/total assets
<i>DEP</i>	Depreciation as a proportion of total assets
<i>EBIT</i>	Earnings before interest and taxes/total assets
<i>FA</i>	Fixed asset proportion: property, plant, and equipment/total assets
<i>FINDEF</i>	Financial Deficit, representing the shortfall in internal funds relative to investment needs, Calculated as (dividend payments + investments + change in working capital + Internal cashflow) / (total assets).
<i>Funding_gap</i>	Funding Gap is the difference between a firm's Projected Benefit Obligation (PBO) and the Fair Value of Plan Assets (FVPA), indicating the extent of pension underfunding or overfunding.
<i>FVPA</i>	Pension's fair value of plan assets
<i>HighLevDummy</i>	Dummy variable set to 1 if a firm's capital structure is above target <i>BDR*</i> and zero otherwise
<i>i</i>	A subscript used to denote firm
<i>ICF</i>	Internal cash flow. $ICF = \text{Income Before Extraordinary Items (IBC)} + \text{Extraordinary Items and Discontinued Operations (XIDOC)} + \text{Depreciation and Amortization (DPC)} + \text{Deferred Taxes (Changes) (TXDC)} + \text{Equity in Net Loss (Earnings) (ESUBC)} + \text{Sale of Property Plant and Equipment and Investments Gain (Loss) (SPPIV)} + \text{Funds from Operations Other (FOPO)} + \text{Sources of Funds Other (FSRCO)}$.
<i>IND_median_{i,t}</i>	Median industry leverage, calculated for each year based on the industry level.
<i>Long_term_cash_need</i>	Dummy variable set to 1 if a firm has a long term cash need (in area 2 or 4); zero otherwise
<i>Long_Term_Debt_Ratio</i>	Ratio of long-term debt (DLTT) to total assets.
<i>LowLevDummy</i>	Dummy variable set to 1 if a firm's capital structure is below target <i>BDR*</i> and zero otherwise
<i>LT_Cash</i>	A dummy set to 1 if a firm has $Cash_{ex\ post} < 0$ and $ICF < 0$
<i>matrix_area_1</i>	A dummy set to 1 if observations are in matrix area 1 ($[Cash_{ex\ post} \geq 0, ICF \geq 0]$, and over-leveraged)

Variable	Definition
<i>matrix_area_2</i>	A dummy set to 1 if observations are in matrix area 1 ([Cashex post ≥0, ICF<0], and over-leveraged)
<i>matrix_area_3</i>	A dummy set to 1 if observations are in matrix area 1 ([Cashex post ≥0, ICF≥0], and under-leveraged)
<i>matrix_area_4</i>	A dummy set to 1 if observations are in matrix area 1 ([Cashex post ≥0, ICF<0], and under-leveraged)
<i>MB</i>	The ratio of market value to book value of the total asset
<i>MB_efwa</i>	the external finance weighted-average market to book ratio, as defined by Baker and Wurgler, 2002, and calculated by using the formula below: $MB_{efwa,t} = \sum_{n=1}^t \frac{\Delta e_n + \Delta d_n}{\sum_{m=1}^t \Delta e_m + \Delta d_m} \times MB_{i,n}.$ With Δe and Δd being the difference of common stocks accumulated retained earnings at time t+1 to time t, respectively.
<i>OCF</i>	OCF = Net income/ net loss (NI) + Depreciation (DP) + change in accounts receivable (RECCH) + change in inventory (INVCH) + change in accounts payable (APALCH) + deferred tax (TXDC) + change in other assets and liabilities (AOLOCH)
<i>PBO</i>	Pension's projected benefit obligations
<i>Q</i>	(book liabilities plus market value of equity)/(book liabilities plus book value of equity)
<i>RD</i>	Research and Development expenses
<i>Short_term_cash_need</i>	Dummy variable set to 1 if a firm has a short term cash need (in area 1 or 3); zero otherwise
<i>Short_Term_Debt_Ratio</i>	Ratio of short-term debt (DLC) to total assets.
<i>Size</i>	Logarithm of total assets, used as a proxy for the size of the firm.
<i>ST_Cash</i>	A dummy set to 1 if a firm has Cashex post <0 and ICF ≥ 0
<i>t</i>	A subscript used to denote time periods
<i>Underfunded</i>	A dummy set to 1 if a pension is underfunded (PBO > FVPA)
λ	Speed of capital structure adjustment
$\lambda_{t \rightarrow t+2}$	Five-year average of the capital structure adjustment speed post-issuance

Table appendix A - continued

7. Internet Appendix

7.1 Additional variables description

Variable	N	Mean	Std.Dev	P25	Median	P75
<i>AOLOCH</i>	8,123	-3.15	111.63	-0.21	0	0.01
<i>APALCH</i>	8,123	0.08	610.95	-0.28	0.49	5.23
<i>AT</i>	8,123	1673.06	11256.06	32.41	131.37	603.79
<i>CEQ</i>	8,123	656.71	4472.77	17.88	68.45	285.29
<i>CH</i>	2,357	44.55	478.36	0.58	2.81	12.08
<i>chwcap</i>	8,123	6.99	268.27	-3.32	1.08	11.13
<i>chwcap_{t+1}</i>	8,123	8.68	315.09	-5.23	0.69	10.88
<i>CSHO</i>	8,123	68.4	168.95	6.68	22.36	67
<i>DLC</i>	8,123	102.79	1596.12	0.03	2.02	14.91
<i>DLC_{t+1}</i>	8,123	109.91	1530.06	0.1	2.94	19.56
<i>DLTT</i>	8,123	430.9	2741.3	0.24	13.71	139.23
<i>DLTT_{t+1}</i>	8,123	496.72	3083.75	0.68	19.39	174.32
<i>DPC</i>	8,123	78.27	501.56	0.32	3.8	24.18
<i>DVT</i>	8,123	31.49	217.98	0	0	5.99
<i>DVT_{t+1}</i>	8,123	32.43	219.21	0	0	6.43
<i>EBITDA</i>	8,123	199.35	1208.96	-0.03	12.03	68.33
<i>ESUBC</i>	8,123	-1.55	66.66	0	0	0
<i>FF_48</i>	8,123	27.22	11.07	19	30	35
<i>FOPO</i>	8,123	21.15	256.78	0	0.18	3.17
<i>GVKEY</i>	8,123	48892.65	62421.7	7069	15088	65808
<i>IBC</i>	8,123	53.68	517.19	-1.54	1.54	17.17
<i>INTAN</i>	8,123	216.55	1565.01	0	0.27	18.96
<i>INVCH</i>	8,123	-5.05	94.84	0	0	0
<i>investments</i>	8,123	32.12	532.53	10.47	8.42	87.44
<i>lag_mv</i>	6,370	1219.61	7051.73	29.11	112.24	513.99
<i>LT</i>	8,123	975.61	6809.37	8.73	52.37	302.83
<i>MIBN</i>	8,123	15.49	234.2	0	0	0
<i>OANCF</i>	8,123	111.42	891.39	0	0	12.71
<i>OANCF_{t+1}</i>	8,123	120.47	892.43	-0.02	0	16.41
<i>PPENT</i>	8,123	823.85	5233.78	8.41	43.45	259.88
<i>PRCC_F</i>	8,123	15.69	23.42	2.5	9.25	20.75
<i>PSTK</i>	8,123	11.66	110.44	0	0	0
<i>RE</i>	8,123	336.5	3876.39	-11.92	8.53	90.56
<i>RECCH</i>	8,123	1.58	709.26	-0.14	0.79	7.08
<i>SIC</i>	8,123	3427.02	2129.5	1311	3241	4813

Table 7.1 - continued

Variable	N	Mean	Std.Dev	P25	Median	P75
<i>SICH</i>	3,017	3433.69	2066.87	1311	3140	4813
<i>SPPIV</i>	8,123	-1.6	67.07	0	0	0
<i>TEQ</i>	3,341	1178.49	7043.5	23.85	106.78	501.37
<i>totaleq</i>	8,123	683.86	4651.78	18.53	69.87	295.98
<i>TXACH</i>	8,123	0.02	15.68	0	0	0
<i>TXDC</i>	8,123	3.4	85.93	0	0	0.92
<i>WCAP</i>	8,123	96.66	769.24	1.67	14.48	66.61
<i>XIDOC</i>	8,123	0.44	11.79	0	0	0

7.2 Sub-Industries Impacted by COVID-19

Table 7.2. Sub-Industries Most Severely Affected by COVID-19 Within Key Sectors

This table identifies the specific SIC-classified sub-industries within broader economic sectors that experienced significant operational and financial disruptions due to the COVID-19. Selection is based on government mandates, demand collapses, and industry-specific vulnerabilities during 2020.

Broader Industry	Sub-Industry (SIC)	COVID-19 Impact Description
Oil and Gas	1311 – Crude Petroleum and Natural Gas	Impacted by reduced global energy demand and price volatility.
Oil and Gas	1389 – Oil and Gas Field Services, NEC	Experienced sharp cutbacks in drilling and exploration activity.
Automotive & Transportation	3711 – Motor Vehicles and Passenger Car Bodies	Disrupted by supply chain interruptions and temporary plant shutdowns.
Automotive & Transportation	3721 – Aircraft Manufacturing	Production slowed significantly as airline customers deferred or canceled orders.
Airlines and Transportation	4489 – Water Transportation of Passengers, NEC	Suspended operations amid health concerns and international port restrictions.
Airlines and Transportation	4512 – Air Transportation, Scheduled	Faced widespread route suspensions and operational losses due to global travel bans and reduced passenger demand.
Retail Trade	5311 – Department Stores	Affected by mandatory closures and declining in-person shopping trends.
Retail Trade	5651 – Family Clothing Stores	Temporarily closed during lockdowns, with consumer demand shifting online.
Food and Beverage Services	5812 – Eating Places (Full-Service Restaurants)	Forced to suspend dine-in services, with operations limited to takeout and delivery.
Food and Beverage Services	5813 – Drinking Places (Bars)	Closed under health directives due to their high-contact environments.
Real Estate	6512 – Nonresidential Building Operators (Offices)	Affected by widespread transitions to remote work and declining office space demand.
Real Estate	6517 – Lessors of Shopping Centers	Struggled with tenant closures and growing vacancy rates due to decreased foot traffic.
Hospitality and Leisure	7011 – Hotels and Motels	Experienced drastic declines in occupancy and revenue due to travel restrictions and reduced tourism activity.
Entertainment & Motion Pictures	7832 – Motion Picture Theaters	Closed for extended periods as public gatherings were restricted.
Entertainment & Motion Pictures	7922 – Theatrical Producers (Live Events)	Events canceled or postponed due to prohibitions on large gatherings.
Hospitality and Leisure	7996 – Amusement Parks	Subject to full closures and limited reopening schedules as part of public health mandates.