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Market Timing and Capital Structure in the Nordic Markets

An Empirical Analysis of the Prevalence of Market Timing in the Nordic Markets

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Abstract

This thesis investigates capital structures and the prevalence of market timing among publicly listed firms in the Nordic markets from 1995 to 2023. Building on Baker and Wurgler's seminal 2002 study, Market Timing and Capital Structure, we explore how market timing behavior affects leverage across three dimensions: short-term shifts, cross-sectional levels, and long-term persistence. Our findings indicate that, while equity financing is a common funding method in the Nordics, evidence of market timing behavior is limited to modest and sporadic short-term impacts. Furthermore, there is no evidence to suggest that historical market timing behavior significantly influences cross-sectional leverage or has a meaningful long-term impact.

Keywords – market timing, nordic markets, NHH, master thesis, corporate finance

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1 Introduction

The stock market is often considered semi-efficient, with stock prices reflecting all publicly available information. However, company management, relying on their insider knowledge, is better positioned to evaluate whether the market has accurately valued their company's shares, uncovering potential overpricing or underpricing. Building on this concept, Baker and Wurgler, in their influential 2002 study, "Market Timing and Capital Structure", found that management in U.S companies appears to time the market by issuing equity when they believe their shares to be overvalued. This behavior highlights a strategic prioritization of existing shareholders' interests, often at the expense of new investors. Not least, they suggest that a firm's capital structure is largely the cumulative outcome of such attempts to time the equity market.

Baker and Wurgler's framework offers a strong foundation for exploring whether company management in the Nordic markets adopts similar opportunistic strategies. It also provides a basis for analyzing how these strategies may impact capital structures. Building on this, this thesis investigates the effect of market timing through three key perspectives: (1) its influence on short-term shifts, (2) it influence on cross-sectional leverage levels, and (3) the long-term, enduring effects of past market timing behavior on capital structures. Together, these perspectives form a nuanced framework for addressing the following research question: *"To what extent does market timing influence cross-sectional leverage in the short and long term in the Nordic markets?"*

Specifically, short-term shifts are analyzed using the market-to-book ratio, exploring its relationship with net equity issues and the subsequent impact on net leverage. Historical effects are assessed through the external finance-weighted market-to-book ratio, which aggregates market-to-book values over time, weighted by the relative amounts of external financing raised in each period. This metric acts as a proxy for the cumulative effect of past market timing behavior. By assessing its magnitude and comparing it with more current firm-specific characteristics, we gain valuable insights into the perceived long-term influence on leverage.

Overall, this topic offers a nuanced perspective on capital decision-making, a critical aspect of corporate finance. For years, capital structure has drawn considerable attention

from both academics and practitioners. However, the introduction of Baker and Wurgler's market-timing perspective brought a notable change to the discussion. This new approach offered a strong alternative, challenging the traditional dominance of well-known theories like the trade-off theory, agency conflict theory, and pecking order theory.

Since then, this perspective has been partially supported by Huang and Ritter (2009), who acknowledge the persistence of market timing. Although they note that its effects are not entirely permanent. Leary and Roberts (2005) attribute this persistence to adjustment costs, which delay rebalancing, rather than to a lasting impact of market-to-book ratios. Similarly, Flannery and Rangan (2006), Kayhan and Titman (2007), Hovakimian (2006), and Alti (2006) argue that market timing exerts only a short-term influence on capital structures. Over time, companies tend to revert to target leverage levels, with long-term decisions shaped by broader firm-specific and economic factors.

In contrast, Hennessy and Whited (2005) challenge even the short-term implications of market timing. Their analysis suggests that these effects are the result of rational, forward-looking financial policies shaped by path dependence. Factors such as historical and current financial policies, liquidity conditions, and investment needs, dynamically influence capital structure decisions, casting doubt on the prevelance of market timing. As a result, the validity of the market timing hypothesis remains inconclusive based on U.S. data. Consequently, building on Baker and Wurgler's framework to gain an initial understanding of market timing in the Nordic markets, appears to be an effective way to address this issue under different conditions.

Several factors make the Nordic region an excellent starting point for such an analysis. First, the market timing in the Nordic markets remains underexplored. In addition, these markets presents unique dynamics compared to the U.S. market, particularly in terms of its smaller size, lower liquidity and lower valuations, yet defined by strict business regulations and robust governance requirements. The Nordic market is also characterized by a substantially higher proportion of long-term investors compared to the U.S., as noted by Baroudy et al. (2023). This investor profile may influence the presence of market timing and the dynamics of capital structures within the region as well.

At the same time, the capital markets in Nordic countries play a crucial role in the region. According to the Nordic Securities Association (Nordic Securities Association (n.d.)),

the region ranks among the highest globally in stock market capitalization per capita in Europe. It also outperforms other European markets in its ability to raise capital through equity and high-yield bonds, relative to market size. Not least, the region has facilitated a significant number of IPOs over the past decade.

In contrast to Baker and Wurgler's analysis, which relies on data from 1968 to 1999, our study utilizes data spanning from 1995 to 2023. This period reflects significant changes in market dynamics, including increased transparency, greater accessibility, and a notable rise in the number of investors, particularly retail investors ("The Rise of Retail Investors" (n.d.)). Furthermore, our dataset encompasses the impacts of major global events, such as the dot-com bubble, the 2008 financial crisis, and the COVID-19 pandemic, offering a more contemporary perspective on market behavior.

Our findings indicate that while equity financing is a prevalent method in the Nordic markets, there is limited evidence to suggest that market timing has a significant influence on leverage decisions. Short-term effects of market timing are modest and sporadic, while historical market timing behavior does not appear to meaningfully impact cross-sectional leverage or persist as a long-term determinant of capital structure. These results contrast with Baker and Wurgler's findings for the U.S. market, suggesting that market timing plays a less prominent role in shaping capital structures in the Nordic region.

The thesis is structured as follows. First, the methodology is presented, closely following the framework established by Baker and Wurgler. This is followed by a detailed description of the dataset and its preparation. The analysis section applies the methodology to address the research question, exploring patterns in financing behavior and capital structure. Next, a robustness analysis is conducted to ensure the reliability and credibility of the findings. Finally, the thesis concludes by summarizing the results and discussing their implications.

2 Methodology

Our analysis consists of two main components: a descriptive section and an explanatory section. The descriptive section provides an overview of the data, highlighting financing patterns and metrics, and establishing a foundation for the subsequent explanatory analysis. The explanatory section then examines the relationships between leverage and its underlying determinants.

Consequently, this methodology section starts by presenting the methodology used in the descriptive analysis. It then offers a detailed overview of the explanatory section, outlining its main structure in alignment with Baker and Wurgler (2002). Additionally, it introduces the functions and variables in the order they are applied throughout the analysis.

2.1 Descriptive analysis

The descriptive section begins by examining trends and summary statistics of leverage metrics and market-to-book ratio, to provide an initial overview of capital structures and valuation in the Nordics. Market leverage is calculated as the ratio of interest bearing book debt to the sum of total assets minus book equity plus market capitalization, and book leverage, defined as the ratio of interest bearing book debt to total assets. We use interest-bearing debt because it appears to offer a more accurate reflection of firms' active capital decision-making. However, total leverage is also included in the robustness analysis to enable a direct comparison to Baker and Wurgler (2002) which uses total book debt.

Additionally, the market-to-book ratio (M/B) reflects either growth potential or potential market mispricing, or a combination of both. Its relevance to the market-timing hypothesis becomes significant only when it captures market mispricing or inefficiencies. This can potentially reveal whether managers exploit misvaluations to time equity issuance or buybacks. It is calculated as book assets minus book equity plus market equity, divided by book assets.

The descriptive analysis then examine key trends in the financing activity, breaking down changes in assets into three components: net debt issuance, net equity issuance, and

newly retained earnings. Net debt issuance (d) is defined based on cash flow impact as the net cash flow change from issuing and retiring long-term and short-term debt. Net equity issuance (e) is similarly defined as net cash flow from issuance and repurchase or retirement of stocks, including inflows from converted warrants and exercised stock options. While this definition of net equity issuance is a simplified definition excluding non-cash transactions such as share-based compensation, it is adequate in this case, where the focus is overall picture rather than minor details. In addition, newly retained earnings (ΔRE) are defined as the change in retained earnings recorded on the balance sheet between the current period and the previous period.

To ensure comparability, these components can be expressed as proportions of total assets by dividing their respective values by book assets. Alternatively, they can be scaled relative to the market value of assets, which is calculated as total assets minus book equity plus market capitalization. This market-adjusted approach provides a perspective that reflects the relative size of these components in the context of market valuation, complementing the accounting-based view.

2.2 Explanatory analysis

The explanatory analysis involves performing regressions on multiple equations using the Ordinary Least Squares (OLS) method. This aims to examine both the short term and cross-sectional impact, as well as the persistent impact of market-timing, while also addressing other variables and theories where applicable.

Additionally, we calculate Fama-MacBeth coefficients by averaging cross-sectional coefficients for each year within the specified time frame. The regression follows the methodology described by Cochrane in Asset Pricing (Cochrane, 2001). As period-specific effects are smoothed out through the averaging process, this approach helps to mitigate confounding factors in time-series data, and facilitates the interpretation of persistent effects without noise. Additionally, Newey-West standard errors with a lag of one are computed to account for potential autocorrelation and heteroscedasticity in the data. These adjusted standard errors form the basis for calculating t-values for the Fama-MacBeth coefficients.

2.2.1 Determinants of annual shifts in leverage

The first part of the explanatory analysis investigates the annual change in book leverage, with particular attention to the market-to-book ratio (M/B). While market-timing theory suggests higher market-to-book ratios encourage equity issuance and reduces leverage (and low ratios lead to potential buybacks), the overall effect remains uncertain. Firms with high market-to-book ratios often experience rapid growth and may issue significant debt alongside equity. This initial analysis offers a starting point for understanding the role of market valuations, and establishes a basis for the deeper investigations that follows. The model is described in Equation 2.1

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t \quad (2.1)$$

The equation examines the relationship between change in the debt-to-asset (D/A) ratio between two consecutive periods, and the various variables described below. Note that a positive value on the left-hand side of the equation, corresponds to an increase in leverage.

In addition to the one-period lagged market-to-book ratio (M/B_{t-1}), the equation includes three one-period lagged control variables, consistent with the methodology in Baker and Wurgler (2002). These control variables were originally proposed by Rajan and Zingales (1995) and are known to correlate with leverage across firms in the G-7 countries. The control variables are incorporated into all subsequent regressions, and are described in detail below.

1. Asset Tangibility (PPE/A): The ratio of net plant, property, and equipment to total assets serves as a proxy for asset tangibility. As Rajan and Zingales (1995) observe, tangible assets are linked to higher leverage because they can be used as collateral, reducing lender risk and potentially lowering bankruptcy costs due to their liquidity. This relationship also aligns with traditional trade-off theory, which suggests that increased tangible assets reduce financial distress costs, allowing firms to maintain higher leverage.

2. Profitability ($EBITDA/A$): Earnings before interest, taxes, depreciation, and

amortization (EBITDA) divided by total assets serves as a measure of profitability. According to the pecking order theory, higher profitability enhances access to internal funds, reducing the need for external leverage. This relationship is also consistent with Titman and Wessels (1988) findings on U.S. firms, which later have been supported by studies such as Fama and French (2002) and Frank and Goyal (2003). Additionally, Frank and Goyal (2003) and DeAngelo et al. (2006) argue that higher profitability often leads to increased retained earnings, which are more tax-advantageous compared to dividends.

Conversely, Jensen (1986), highlights potential free cash flow problems in profitable firms, where excess cash can result in inefficiencies. In such cases, increased leverage may reduce agency costs and encouraging more efficient capital allocation . Therefore, the effect of profitability on leverage is unclear, reflecting a tension between pecking order and agency-based trade-off theories.

3. Firm size ($log(S)$): The logarithm of revenue from business activities serves as a proxy for firm size. Rajan and Zingales (1995) note that larger firms tend to be more financially stable and face lower risk of financial distress. According to traditional trade-off theory, this supports a positive relationship between firm size and leverage. Larger firms having more debt is also noted by Frank and Goyal (2003) who found that larger firms typically have better access to debt markets. In contrast, smaller firms facing limited access to this markets, often deviate from the pecking order theory and issue equity instead.

Additionally, the one-period lagged debt-to-asset ratio (D/A_{t-1}) is included in Equation 2.1 to account for the bounded nature of leverage, constrained between zero and one. Firms near these boundaries are more likely to experience leverage adjustments in subsequent periods. Because firms close to their maximum leverage constraint have limited capacity for further increases, making a decrease more likely, and vice versa. By accounting for this dynamic, the model isolates the effects of other variables on leverage changes.

2.2.2 Decomposition of shifts in leverage

Annual changes in leverage can be decomposed into net equity issues (e), change in retained earnings (ΔRE), and a residual component. This breakdown highlights each

factor's contribution to shifts in capital structure and, among other insights, helps identify market-timing behavior by isolating the impact of equity issues.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left[\left(\frac{E}{A}\right)_t - \left(\frac{E}{A}\right)_{t-1}\right] = -\left(\frac{e}{A}\right)_t - \left(\frac{\Delta RE}{A}\right)_t - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] \tag{2.2}$$

Equation 2.2 shows that the change in the book leverage-to-asset ratio (D/A) between two consecutive years is initially equal to the negative change in the book equity-to-assets ratio. This highlights the inverse relationship between equity and leverage in a firm's capital structure, where an increase in book leverage-to-asset ratio (D/A) corresponds to a decrease in book equity-to-asset ratio (E/A), and vice versa. Building on his, the relationship can be further broken down into the specified components of interest, as described below.

1. Net equity issues-to-assets ($-(e/A)_t$) has a negative sign, because equity issues, in isolation, leads to a reduction in the debt-to-asset ratio from one period to the next. Again, note that in Equation 2.2 a negative shift on the left hand, indicates a lower debt-to-asset ratio compared to the previous period. Conversely, equity buybacks typically increase leverage.

2. Change in retained earnings ($-(\Delta RE/A)_t$) also carries a negative sign, as an increase in retained earnings raises equity and reduces leverage.

3. The residual component $[-E_{t-1}(1/A_t - 1/A_{t-1})]$ reflects the total change in a firm's asset base resulting from the combined effects of equity issuance, retained earnings, and debt issuance. It is important as it captures how these financing activities indirectly affect the leverage ratio by changing the size of the total asset base in relation to the firm's debt and equity. Specifically, in the equation, the change in the inverse of total assets between the current period (t) and the previous period ($t-1$) is calculated as $1/A_t - 1/A_{t-1}$. When total assets (A) grow significantly ($A_t > A_{t-1}$), this difference becomes negative, and vice versa. The negative of the prior period's equity level (-E_{t-1}) acts as a multiplier on this term, meaning that firms with larger equity bases experience greater leverage sensitivity. For instance, an increase in assets will then lead to a more pronounced increase in leverage for firms with higher equity, and vice versa. This occurs because a larger equity base,

which constitutes a greater proportion of total assets, makes the equity-to-asset ratio more sensitive to changes in total assets.

The decomposition from Equation 2.2 is integrated into Equation 2.1, enabling an analysis of the relationship between the one-period lagged market-to-book ratio ($(M/B)_{t-1}$), asset tangibility ($(PPE/A)_{t-1}$), profitability ($(EBITDA/A)_{t-1}$), firm size ($log(S)_{t-1}$) and debt-to-asset ($(D/A)_{t-1}$) ratio, with each of the three components of change in leverage. This approach provides a framework for assessing whether firms adjust leverage through equity issuance during periods of high market-to-book ratio, a key aspect for evaluating the presence of market timing, while also accounting for the role of the other control variables. This is shown in equation 2.3

$$\begin{aligned}\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} &= -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] \\ &= a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t \end{aligned} \tag{2.3}$$

2.2.3 Capturing historical characteristics: The external finance weighted-average approach

After examining the short-term shifts and single-year relationships among the variables, it is important to account for the cumulative effects of choices made over time . To address this, we introduce the "external finance weighted average", as defined in Equation 2.4. Although, the formula is demonstrated using the market-to-book (M/B) ratio, it will also be applied to the other control variables.

$$\left(\frac{M}{B}\right)_{efwa,t-1} = \sum_{s=0}^{t-1} \frac{e_s + d_s}{\sum_{r=0}^{t-1} e_r + d_r} \cdot \left(\frac{M}{B}\right)_s \tag{2.4}$$

Equation 2.4, calculates the external finance weighted average of the historical market-to-book (M/B_{efwa}) ratio, starting from year 0 (typically the IPO year) and moving forward. It captures data up to year $t-1$, providing a cumulative measure over time.

Furthermore, e represents net equity issues and d , net debt issues. The weights for each

year are determined by the proportion of external financing activity (the sum of net equity and debt issuance) in that year, relative to the sum of the firm's total external financing in the period. Years with higher levels of external financing activity are assigned higher weights. Consequently, this approach highlights key moments of capital decision-making and link these decisions to the market-to-book (M/B) ratio observed at that time.

As a result, the M/B_{efwa} variable reflects the cumulative impact of past market conditions and the connected capital decisions. It is implicitly assumed that external financing decisions will favor equity issuance when market timing opportunities arise. This allows the variable to capture market-timing behavior, reflecting managers' efforts to exploit favorable market conditions over time. Based on this, it is designed to evaluate the persistence of the cumulative effect of earlier market-timing in shaping leverage, and serve as an important variable in subsequent analysis. Moreover, to improve the interpretation of the M/B_{efwa} ratio as a proxy on the cumulative effect of past market timing behavior, it is necessary to include the single-year one-period-lagged market-to-book (M/B_{t-1}) ratio as a control variable. This inclusion accounts for the current cross-sectional variation in the market-to-book ratio (M/B), as will be discussed later.

Replacing the market-to-book ratio (M/B) , in Equation 2.4 with variables such as the profitability ($EBITDA/A$), asset tangibility (PPE/A) or firm size ($log(S)$), connects financial decision to these characteristics at the time of financing. This provides insight into their influence during financing events.

2.2.4 Univariate explanatory power of the variables

Building on the external finance weighted approach, we perform a univariate explanatory power analysis to compare the explanatory power of the lagged single-year and external finance-weighted versions of each variable. This analysis highlights the relative effectiveness of the two approaches, while also providing an initial understanding of how each variable contributes to explaining leverage over time. Consequently, this analysis is important as it provides a preliminary understanding of how cross-sectional leverage reflects both current conditions and the cumulative effects of past financial decisions along with the corresponding variable values at those times. It also sheds light on how these influences evolve as firms age. The model is based on Equation 2.5

$$\left(\frac{D}{A}\right)_{IPO+t} = a + bX_{t-1} + u_t \tag{2.5}$$

More specifically, Equation 2.5 models the relationship between a firm's cross-sectional debt-to-asset ratio at time t after the IPO ($(D/A)_{IPO+t}$), and the one-period lagged value of a variable, X_{t-1}. While the primary focus is on both the lagged single-year and external finance-weighted versions of the market-to-book ratio as the X-value, the analysis also includes both versions of each control variable; Asset tangibility (PPE/A), Profitability ($EBITDA/A$) and Firm Size ($log(S)$).

We then perform regressions on Equation 2.5 for each variable and its versions separately at each time t since the IPO. This approach allows us to evaluate the explanatory power (R^2) for each version of the variable across different time periods.

2.2.5 Multivariate determinants of cross-sectional leverage

The multivariate analysis examines the independent contribution of each variable to cross-sectional leverage, while controlling for the influence of the others. By analyzing cross-sectional leverage, the study provides insight into the variation in capital structure across firms. This helps to explain differences in leverage based on the variables, with a main focus on the external finance weighted market-to-book ratio (M/B_{efwa}). The model is given by Equation 2.6.

$$\left(\frac{D}{A}\right)_t = a + b\left(\frac{M}{B}\right)_{efwa,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t \tag{2.6}$$

Specifically, Equation 2.6 evaluates cross-sectional leverage at a specific time t by incorporating the external finance weighted market-to-book (M/B_{efwa}), alongside the control variables: asset tangibility (PPE/A), profitability ($EBITDA/A$), and firm size ($log(S)$).

To separate the impact of current cross-sectional variation from historical market timing effects, the one-period lagged market-to-book ratio ($(M/B)_{t-1}$) is also included. This controls for current cross-sectional variation in the level of market-to-book, often linked

to growth or investment opportunities. In this way it facilitates the historical within-firm variations reflected by the external finance-weighted market-to-book ratio (M/B_{efwa}), to better capture earlier market timing opportunities. This is also an important aspect of our experimental design, and aligns with the methodology in Baker and Wurgler (2002).

Overall, the multivariate approach extends the univariate analysis by accounting for interrelationships and shared explanatory power. This provides a more robust understanding of the determinants of cross-sectional leverage. Additionally, it reduces bias from potential overstated or confounded effects, which could be present in the single-variable analysis in Equation 2.5.

2.2.6 Determinants of long-term shifts in leverage

The link (or missing link) between market valuations and short-term adjustments, and market valuations and cross-sectional leverage, is shaped by the presence or absence of persistence. Examining shifts in leverage over a longer time horizon, with the external finance-weighted market-to-book ratio (M/B_{efwa}) as a key determinant, is then an important step in identifying a potential persistence. This is further addressed by Equation 2.7.

$$\begin{aligned}\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{pre-IPO} = a + b\left(\frac{M}{B}\right)_{efwa,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} \\ + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + g\left(\frac{D}{A}\right)_{pre-IPO} + u_t \end{aligned} \tag{2.7}$$

More specifically, Equation 2.7 examines the relationship between changes in debt-to-asset ratio from the pre-IPO level to time t, and its determinants. Similar to Equation 2.6, the model includes the external finance-weighted market-to-book ratio ($(M/B)_{efwa,t-1}$) alongside with one-period lagged market-to-book ($(M/B)_{t-1}$). As mentioned, this approach allows for accounting for current cross-sectional variation, and then clarify the interpretation of the external finance-weighted market-to-book ratio ($(M/B)_{efwa,t-1}$) as the proxy on the cumulative effects of historical market timing decisions. Additionally, the control variables: profitability ($EBITDA/A$), asset tangibility (PPE/A) and firm size ($log(s)$) are included.

The initial leverage level ($(D/A)_{pre-IPO}$) is included as well, as a control for a firm's starting capital structure. This distinction is critical for isolating the firm's baseline capital structure, from its subsequent adjustments to market conditions. It also addresses the intrinsic constraint that leverage (D/A) is bounded between 0 and 1. Firms close to these boundaries face mechanical limitations in their ability to adjust leverage. For firms that are fully or nearly fully equity-financed, issuing additional equity during periods of high market valuation does not result in significant changes to their leverage. This is precisely because the potential change in leverage is mechanically constrained. Failing to control for initial leverage could then lead to misleading conclusions, such as underestimating the influence of market valuations on leverage adjustments.

The inclusion of pre-IPO leverage in Equation 2.7 highlights the role of the IPO itself, as a significant shift in a firm's capital structure, often linked to market values. Since IPOs typically involve substantial equity issuance, they significantly influence the external finance-weighted market-to-book ratio ($(M/B)_{efwa}$). In this context, Equation 2.7 examines whether IPO financing decisions contribute to long-term leverage adjustments, as part of its broader focus on the persistence of market timing effects.

2.2.7 Testing persistence

Lastly, we examine the persistence of market-to-book values in determining leverage over subsequent years. This analysis employs a system of two equations, Equations 2.8 and 2.9. Performing a Fama-MacBeth regression on these equations, with a focus on the coefficients of the external finance-weighted market-to-book ratio ($(M/B)_{efwa,t}$), provides insights into the long-term effects of historical fluctuations in the market-to-book ratio. By comparing results across different $t+\tau$ horizons, the analysis also reveals indications of the speed of adjustment. These findings are central for evaluating the relative validity of market-timing theory versus trade-off theories.

$$\left(\frac{D}{A}\right)_{t+\tau} = a_2 + b_2\left(\frac{M}{B}\right)_{efwa,t} + c_2\left(\frac{M}{B}\right)_t + d_2\left(\frac{PPE}{A}\right)_t + e_2\left(\frac{EBITDA}{A}\right)_t + f_2\log(S)_t + u_{2,t+\tau} \tag{2.8}$$

$$\begin{aligned}\left(\frac{D}{A}\right)_{t+\tau} = a_3 &+ b_3\left(\frac{M}{B}\right)_{efwa,t} + c_3\left(\frac{M}{B}\right)_{t+\tau-1} + d_3\left(\frac{PPE}{A}\right)_{t+\tau-1} \\ &+ e_3\left(\frac{EBITDA}{A}\right)_{t+\tau-1} + f_3\log(S)_{t+\tau-1} + u_{3,t+\tau}\end{aligned} \tag{2.9}$$

Equation 2.8 models the debt-to-asset ratio (D/A) at a future time $t+\tau$, determined by variables observed at time t. The single-year market-to-book ratio (M/B_t) at time t captures cross-sectional variations, while the external finance weighted market-to-book ratio $(M/B_{efwa,t})$ is left to capture the long-term impact of historical market timing behaviors. Additionally, the control variables: Profitability $((EBITDA/A)_t)$, Asset Tangibility $(PPE/A)_t)$ and Firm Size $((log(S)_t)$ provide a snapshot of the firms characteristics at time t.

Equation 2.9 analyzes the debt-to-asset ratio (D/A) at a future time $t+\tau$. Like Equation 2.8 , it includes the external finance weighted market-to-book ratio $(\mathrm{M}/B_{efwa,t})$ at time t. However, it differs by including the other control variables are measured at $t+\tau-1$, allowing for a comparison between the significance of the historical path of market-to-book ratio and the influence of more recent firm characteristics.

3 Data

Our dataset, retrieved from the EIKON database, includes data on currently active companies listed in Norway, Sweden, Denmark, and Finland, covering the period from 1995 to 2023. Due to the increasing number of companies going public since 1995, the size of the dataset grows each year. Figure A.1 in the appendix provides a detailed breakdown of the distribution of firms going public. Although the dataset includes some missing values, observations with complete data for the required variables are included in each regression. As a result, the samples used in different regressions may vary slightly. However, we opted not to exclude all observations with missing values to avoid unnecessarily reducing the dataset size. Furthermore, as the missing data appears to occur randomly, we believe these slight variations in sample composition do not compromise the validity of our analysis.

The data is divided into subsamples, each representing a specific number of years since the IPO, denoted as IPO + n, enabling the analysis of post-IPO financial changes. Additionally, we include a PRE-IPO sample, consisting of observations from the fiscal year-end preceding the IPO, referred to as the "Subsample PRE-IPO." Together with the "IPO" dataset, which contains observations from the first fiscal year-end following the IPO, these samples highlight the significant financial transitions firms experience when transitioning from private to public ownership. Finally, the "All Firms" dataset pools all firm-year observations by calendar time, allowing for a broader analysis of financial patterns by capturing both cross-sectional and time-series variations. This dataset provides an aggregate perspective, enabling the study of overall trends and relationships that may not be apparent within individual subsamples.

The exclusion of delisted firms (as we only have data on currently active firms) introduces survivorship bias, potentially leading to an overestimation of firm performance. By omitting weaker firms, the dataset may disproportionately represent stronger performers, which could skew the analysis. For instance, the firms included in our study may report higher newly retained earnings than would be observed if data on delisted firms were available, potentially distorting the results. Furthermore, in analyses based on IPO timing, observations for IPO+10 are only available for firms that have survived at least 10 years post-IPO. Despite this limitation, the regression results across IPO time remain relatively

consistent, suggesting that the impact of survivorship bias on our findings may be minimal.

Table 3.1 provides an overview of all variables retrieved, along with their corresponding names in the EIKON database. Detailed descriptions of these variables are available in Table A.12 in the appendix. All financial figures have been converted to USD from their original reported currencies using fixed exchange rates as of the retrieval date (29.11.24). By applying the same exchange rate across all periods, we ensure that changes in the balance sheet are not distorted by FX fluctuations. The exchange rates applied are listed in Table A.13 in the appendix.

Table 3.1: Data Retrieval Overview

Overview of all variables and variable names retrieved from the EIKON database.

Variable	EIKON Name
$EBITDA$	Earnings before Interest, Taxes, Depreciation & Amortization (EBITDA) [SEBITDA]
IPO	IPO Date
$MCAP$	Market Capitalization
d	Debt - Long-Term & Short-Term - Issuance/(Retirement) - Total
e	Stock - Total - Issuance/(Retirement) - Net
PPE	Property, Plant & Equipment - Net - Total [SPPE]
S	Revenue from Business Activities - Total [STLR]
RE	Retained Earnings - Total [SRED]
$TRBC\ Sector$	The Refinitiv Business Classification (TRBC) Business Sector Description
$\#shares$	Common Shares - Outstanding - Total [STCOC]
A	Total Assets [ATOT]
D	Interest Bearing Liabilities - Total [SINBL]

We applied restrictions to variables in our dataset to exclude economically implausible or extreme values, following discrepancies identified during the data audit, as detailed in Section A.2 in the Appendix. Observations that did not meet these criteria were set to NA and excluded from further analysis. A summary of these exclusions is presented in Table 3.2. The dataset comprises 1,664 active firms, spanning 30 years of data and resulting in 49,920 rows per variable. To focus on firms with a meaningful level of economic activity, we set a minimum market capitalization threshold of m1USD . Additionally, a minimum threshold of m0.5USD for book assets was applied, as many of our variables use book assets as a denominator, and smaller values could lead to disproportionately large ratios. Firms in the financial sector, as classified by the TRBC Business Sector classification, were excluded due to their unique capital structure and the regulatory environment shaping their operations.

Table 3.2: Criteria for Data Exclusions and Resulting Sample Size Reductions

Overview of data exclusion criteria for the different variables. Values that meet the exclusion criteria are set to NA. The table also reports the number of values before and after applying the exclusion criteria, as well as the difference between the two.

Variable	Set to NA criteria	N_{before}	N_{after}	ΔN
Sector	Companies within the following sectors: Banking & Investment Services, Investment Holding Companies, Insurance, Collective Investments, Financial Technology (Fintech) & Infrastructure	48,401	43,084	-5,317
$MCAP$	$MCAP < m1USD$	16,219	15,870	-349
A	$A < m0.5USD$	18,725	18,353	-372
$\Delta RE/A$	$\Delta RE/A < -0.5, \Delta RE/A > 1$	14,882	13,715	-1,167
D/A	$D/A < 0$, $D/A > 1$	16,066	15,949	-117
d/A	$d/A > 1$, $d/A < -1$	15,577	15,534	-43
e/A	$e/A > 1$, $e/A < -1$	12,041	11,582	-459
MB	$MB > 10$	13,925	13,467	-458
PPE/A	$PPE/A < 0$, $PPE/A > 1$	17,328	17,073	-255
$EBITDA/A$	$EBITDA/A > 5$, $EBITDA/A < -5$	18,311	18,301	-10
$Sales$	$S =< 0$	18,393	17,731	-662

We observed that the number of net equity issue-to-assets observations (e/A) was significantly lower compared to net debt issue-to-assets observations (d/A), raising concerns that the data might be skewed, particularly if years with no equity transactions were inadvertently excluded. To address this issue, we adjusted e/A by verifying whether the number of shares outstanding changed during the year for companies where net equity issue (e) data was missing. If no change was detected, we assigned e a value of zero. This adjustment increased the number of observations by 4,127, from 11,582 to 15,709, thereby reducing potential bias and enhancing the completeness of the dataset.

The overall quality of the data is high, with most values being accurate. However, a small number of discrepancies were identified during the auditing process as described in Section A.2 in the Appendix. The variables audited included e/A, d, ΔRE, PPE/A, $D_{interest-bearing}$, and D_{total}. Notably, errors were observed in specific variables, such as e/A, where a dividend was incorrectly recorded as a buyback, and PPE/A, which exhibited the highest error rate due to misaligned values, incorrect signs, or missing entries in EIKON. Given that PPE/A is a control variable in the regression models, such errors may introduce bias or reduce the precision of our estimates, potentially affecting the robustness of our findings.

In total, cross-referencing values retrieved from EIKON with 55 financial statements from the respective companies' annual reports revealed four errors. While these errors are relatively limited, they underscore the importance of exercising caution when interpreting results based on variables with identified discrepancies. A detailed description of the

auditing process and findings can be found in Section A.2 of the appendix.

4 Analysis

Building on the methodology part and data outlined in the data section, we will now present our findings. We start with the results from the descriptive analysis. This is followed by the explanatory analysis, where regressions are performed on the specified equations in the order described in the methodology section.

4.1 Descriptive analysis

In the descriptive analysis, we explore trends and summary statistics of leverage metrics and the market-to-book (M/B) ratio. This provides an overview of capital structures and valuation in the Nordics across IPO time and calendar time. The analysis focuses on how these metrics evolve post-IPO and their alignment with the Market Timing Theory. Additionally, we examine key financing activities, such as equity issuance, debt issuance, and change in retained earnings, to gain insights into firms financing choices over time.

4.1.1 IPO-time

Table 4.1 provides summary statistics of book leverage, market leverage, and the market-to-book (M/B) ratio based on IPO-time. The key findings highlight a sharp decrease in average book leverage immediately following the IPO, followed by a gradual upward trend in subsequent years. Similarly, market leverage increases steadily as firms mature. This pattern suggests that firms use the IPO as an opportunity to delever, and then gradually relever as they grow post-IPO. Additionally, the market-to-book ratio (M/B) declines over time, dropping from 2.46 pre-IPO to 1.96 by IPO+10. This trend may indicate a reduction in the prevalence of mispricing as firms mature, thereby limiting managers ability to exploit overvalued equity through market timing.

Table 4.1: Summary Statistics of Leverage and Market-to-Book (IPO-Time)

Medians, means, and standard deviations of book leverage, market leverage, and the market-to-book (M/B) ratio across IPO time. Book leverage is defined as interest-bearing book debt divided by total assets. Market leverage is calculated as interest-bearing book debt divided by total book assets minus book equity plus market capitalization (MCAP). The market-to-book (M/B) ratio is calculated as total book assets minus book equity plus MCAP, divided by total book assets.

		Book Leverage%			*Market Leverage%*			*M/B*		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
PRE-IPO	718	24.28	27.18	21.45						
IPO	470	19.01	22.07	17.18	9.06	15.35	17.33	1.80	2.46	1.81
IPO+1	561	20.08	23.01	18.43	10.78	17.31	18.97	1.61	2.18	1.69
IPO+3	472	22.01	25.31	19.97	12.09	19.82	21.13	1.54	2.21	1.84
IPO+5	453	21.39	25.09	20.25	11.48	20.11	21.14	1.43	2.13	1.73
IPO+10	266	20.14	24.26	19.65	11.84	19.99	21.47	1.32	1.96	1.63

Breaking these trends down further, we observe that average book leverage decreases from 27% pre-IPO to 22% immediately after the IPO. It then gradually increases, reaching 25% by IPO+10. Similarly, market leverage increases from 15% at the IPO to approximately 20% over time. These findings align closely with those of Baker and Wurgler, who also noted a decline in leverage post-IPO, followed by an increase in the subsequent years.

As for the decline in market-to-book ratio (M/B), it could also reflect reduced growth expectations and fewer investment opportunities as firms age. The higher mean compared to the median market-to-book ratio (M/B) suggests that some firms maintain significantly higher valuations, pointing to potential instances of mispricing that managers could exploit through market timing. Additionally, the larger gap between mean and median market leverage indicates that firms with lower market-to-book ratios (M/B) rely more heavily on leverage. This supports the market timing hypothesis, as equity is less likely to be mispriced at lower market-to-book ratios (M/B) , making debt a more appealing financing option for managers.

The number of observations increases from 470 at the IPO to 561 by IPO+1, primarily because missing data for some firms in the IPO year becomes available in the subsequent year. As discussed in the Data Section, the missing data appears to occur randomly, suggesting that these slight variations in sample composition are unlikely to compromise the validity of our analysis. Beyond IPO+1, the number of observations gradually decreases. This decline, as illustrated in Figure A.1 in the Appendix and noted in the Data Section, is largely attributable to a significant proportion of currently active firms being listed after 2015. In other words, they do not have data available for IPO+5 or IPO+10 in our

samples.

Table 4.2 reports the financing methods used by firms relative to book assets. Contrary to the Pecking Order Theory, equity issuance emerges as the dominant financing method, with debt and retained earnings playing significantly smaller roles.

Table 4.2: Summary Statistics of Financing Relative to Book Assets (IPO-Time)

Medians, means, and standard deviations of net debt issuance (d), net equity issuance (e), and change in retained earnings (ΔRE) relative to book assets across IPO time. Change in retained earnings (ΔRE) is calculated as the difference in retained earnings on the balance sheet between two consecutive years.

		$d/A\%$			$e/A\%$			$\Delta RE/A\%$		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
IPO	470	-0.73	-0.58	14.26	16.79	26.03	27.67	1.98	2.69	20.71
IPO+1	561	-0.06	2.96	10.64	0.00	9.04	19.84	1.50	-1.77	16.77
IPO+3	472	-0.46	0.62	9.47	0.02	9.66	19.48	0.53	-1.63	19.16
IPO+5	453	-0.64	0.17	11.03	0.00	8.50	19.09	0.77	-1.26	17.46
IPO+10	266	-0.44	0.47	9.74	0.00	4.76	14.60	1.85	0.44	13.24

Following the IPO, the average net equity issuance-to-assets ($e/A\%$) declines, while the median net equity issuance-to-assets remains at 0 across all periods, indicating that most firms does not issue equity in a given year. However, the significant gap between the median and mean suggests that when firms do issue equity, the transactions are typically substantial. This pattern is analyzed in more detail in Figures 4.1, 4.2, and 4.3. In all periods except IPO+1, average net debt issuance-to-assets ($d/A\%$) is minimal, suggesting that firms tend to make one major debt issuance in the year following their IPO. The median debt issuance-to-assets is negative, likely reflecting that most firms repay maturing debt rather than issuing new debt in a given year. On average, retained earnings-to-assets ($\Delta RE/A\%$) are close to zero, and even negative in several periods. This may point to low profitability or high dividend payouts among Nordic firms.

Compared to Baker and Wurgler's findings, Nordic firms rely much less on debt financing and the average equity issuance is higher. Additionally, while retained earnings often are negative in the Nordics, they tend to be positive in the US.

The high average equity issuance stands in sharp contrast to the Pecking Order Theory, underscoring the need for further analysis. Figure 4.1 illustrates equity issuance patterns across IPO-time, with the frequency distribution of net equity-issuance-to-assets (e/A) showing a preference for smaller transactions or no issuances in most periods, except naturally during the IPO year. The most common e/A values, represented by the dark

yellow and green columns in the figure, fall between -0.05 and 0.05, reflecting small buybacks, warrant conversions, or the absence of equity transactions in a given year. However, when firms issue equity (not only converting warrents), the transactions are often substantial, exceeding 15% of book assets. Over time, as firms mature, such large equity issuances become increasingly rare, indicating a reduced reliance on equity financing.

Figure 4.1: Frequency Distribution of e/A by Year Relative to IPO

Overview of the frequency distribution of net equity issuance-to-assets (e/A) across different (e/A) intervals by year relative to the IPO.

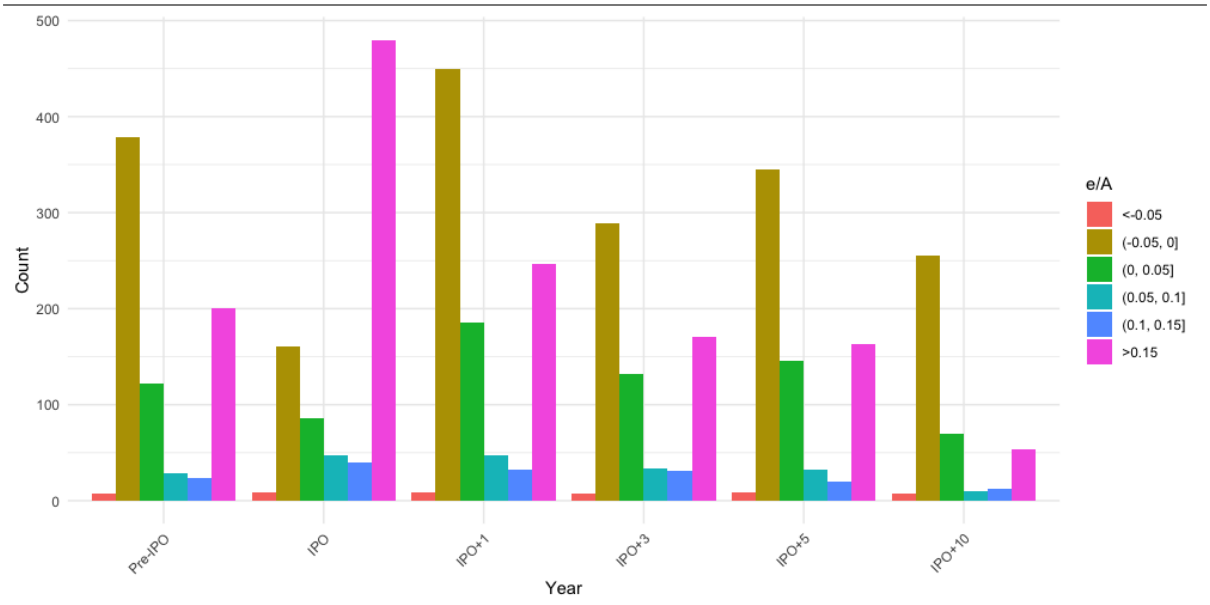
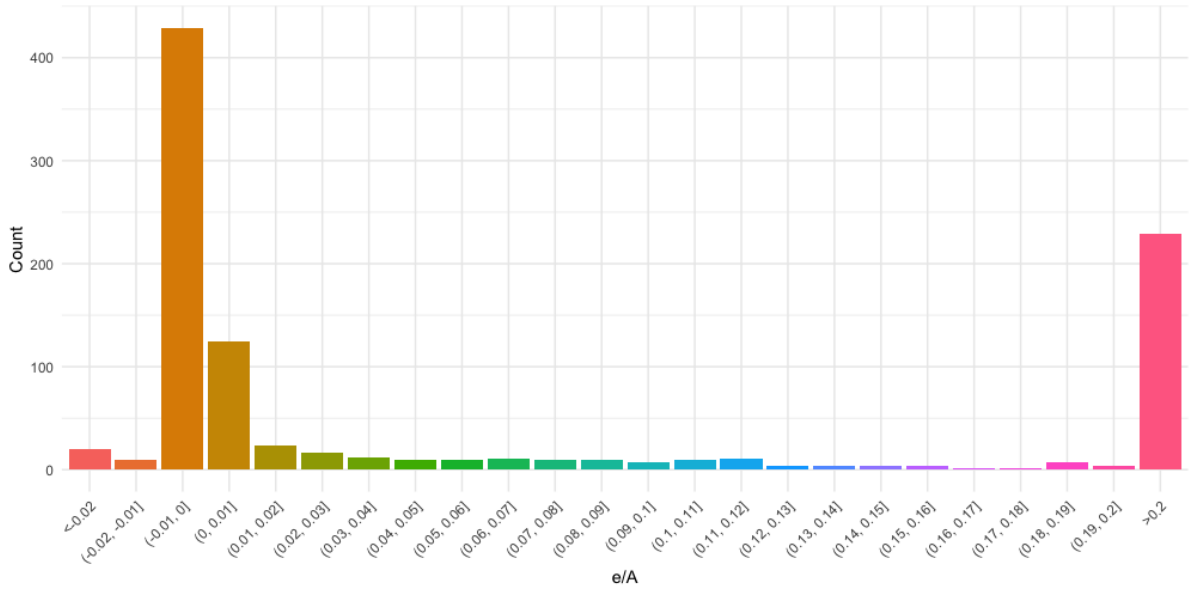


Figure 4.2 displays the frequency distribution of net equity issuance-to-assets (e/A) in IPO+1, highlighting that equity transactions are typically either (near) zero or exceed 20% of the book asset value, with minimal activity in the intermediate range.

Figure 4.2: Frequency Distribution of e/A in IPO+1

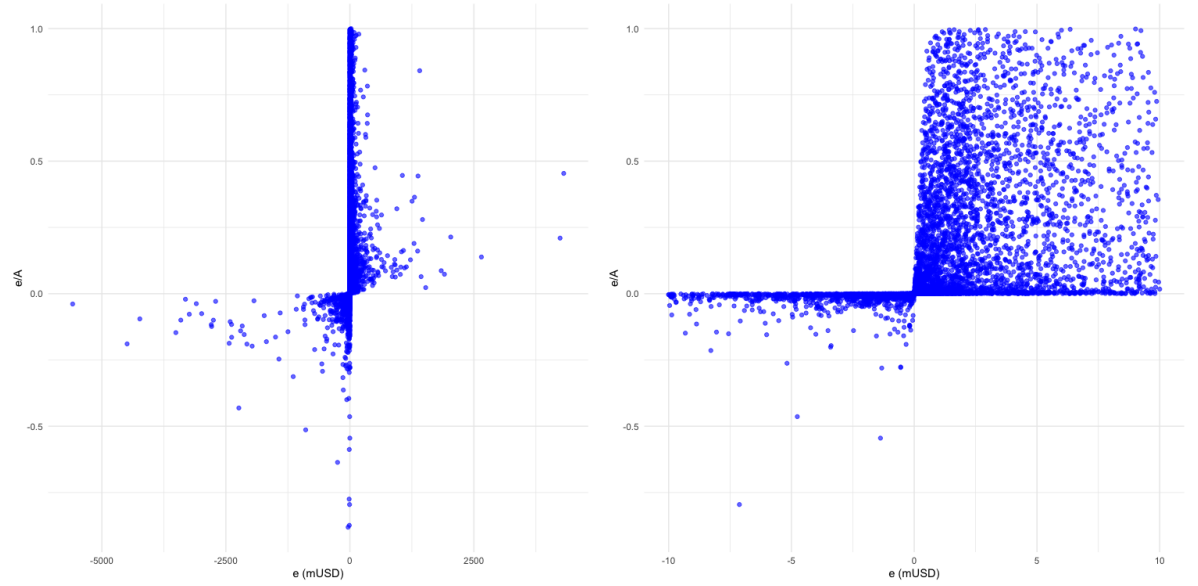
Overview of the frequency distribution of net equity issuance-to-assets (e/A) across different (e/A) intervals in IPO+1.



Expanding further on net equity issuance activity in IPO+1, Figure 4.3 examines the relationship between net equity issuance (e) in mUSD and net equity issuance-to-assets (e/A) for IPO+1. Panel (a) displays the full distribution of e, while Panel (b) zooms in on equity transactions between -10 and 10 mUSD. The plots reveal a clear asymmetry between negative and positive e/A values, with significantly larger transactions observed in the positive domain compared to the negative range. This disparity helps explain the gap between the median and average e/A values reported in Table 4.2.

Figure 4.3: Scatterplots of e/A Distribution and e in IPO+1

Overview of net equity issuance (e) in million USD (x-axis) compared to net equity issuance-to-assets (e/A) (y-axis). Panel (a) on the left includes all observations, while Panel (b) focuses on e values ranging from -10 to 10 million USD.



(a) Full Distribution of e in mUSD and e/A **(b)** e Ranging from -10 to 10 mUSD

Table 4.3 presents summary statistics of financing relative to the market value of assets across IPO time. The trends are consistent with those observed in Table 4.2.

Table 4.3: Summary Statistics of Financing Relative to Market Value of Asset (IPO-Time)

Medians, means, and standard deviations of net debt issuance (d), net equity issuance (e), and change in retained earnings (ΔRE) relative to market value of assets across IPO time. Change in retained earnings (ΔRE) is calculated as the difference in retained earnings on the balance sheet between two consecutive years. Market value of assets is defined as total book assets minus book equity plus market capitalization (MCAP).

		$d/A\%$			$e/A\%$			$\Delta RE/A\%$		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
IPO	470	-0.18	0.06	10.68	8.79	12.23	16.24	0.96	0.99	11.55
IPO+1	561	-0.03	2.15	7.87	0.00	4.65	15.22	0.65	-0.58	11.83
IPO+3	472	-0.12	0.60	7.17	0.01	4.06	8.97	0.23	-1.35	11.36
IPO+5	453	-0.22	0.09	9.28	0.00	3.92	9.81	0.44	-1.13	12.54
IPO+10	266	-0.28	0.05	7.16	0.00	2.18	8.06	1.09	-0.05	9.77

4.1.2 Calendar-time

Moving on from IPO-time to Calendar-Timer, Table 4.4 presents summary statistics of book leverage, market leverage, and the M/B ratio across different calendar periods. Book and market leverage remain relatively stable over time, while the M/B ratio shows more variation across periods.

Table 4.4: Summary Statistics of Leverage and Market-to-Book (Calendar-Time)

Medians, means, and standard deviations of book leverage, market leverage, and the market-to-book (M/B) ratio across calendar year periods. Book leverage is defined as interest-bearing book debt divided by total assets. Market leverage is calculated as interest-bearing book debt divided by total book assets minus book equity plus market capitalization (MCAP). The market-to-book (M/B) ratio is calculated as total book assets minus book equity plus MCAP, divided by total book assets.

		Book Leverage%			*Market Leverage%*			*M/B*		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
1995-1999	45	24.70	27.46	14.81	22.31	20.75	15.62	1.45	2.14	1.50
2000-2004	390	24.98	25.75	15.87	19.89	21.99	16.40	1.15	1.56	1.21
2005-2009	510	24.10	25.34	16.17	15.80	20.45	16.95	1.29	1.69	1.19
2010-2014	795	22.66	25.62	17.61	15.77	22.44	19.90	1.17	1.52	1.06
2015-2019	1,155	24.64	26.89	17.95	14.85	22.03	21.33	1.31	1.83	1.42
2020-2023	1,936	23.21	25.56	17.89	13.66	19.47	18.81	1.45	2.09	1.63

Table 4.5 presents summary statistics of financing relative to book assets across calendar periods. Change in retained earnings-to-assets ($\Delta RE/A$) decline steadily over time, while net equity issuance-to-assets (e/A) is generally low but. Although, we see net equity issuance-to-assets spikes significantly in 2020–2023, reflecting increased reliance on equity financing during the COVID-19 period. In contrast, net debt issuance-to-assets (d/A) remains near zero across all periods, indicating limited use of debt financing throughout all periods.

Table 4.5: Summary Statistics of Financing Relative to Book Assets (Calendar-Time)

Medians, means, and standard deviations of net debt issuance (d), net equity issuance (e), and change in retained earnings (ΔRE) relative to book assets (A) across calendar year periods. Change in retained earnings (ΔRE) is calculated as the difference in retained earnings on the balance sheet between two consecutive years.

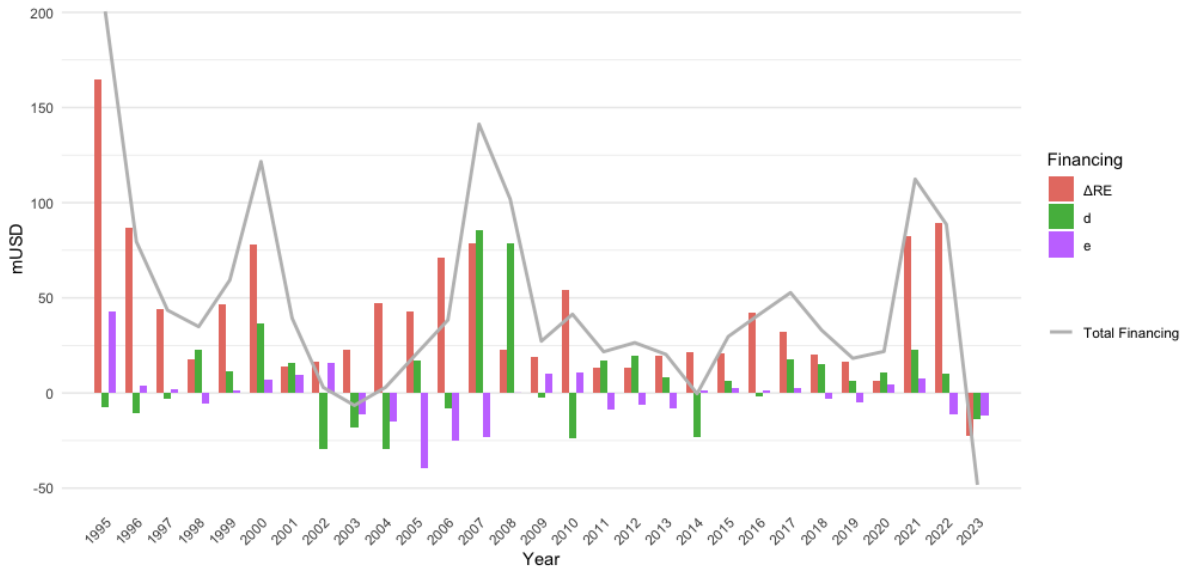
		$d/A\%$			$e/A\%$			$\Delta RE/A\%$		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
1995-1999	45	0.87	-0.05	8.77	0.00	1.02	6.75	3.54	4.65	7.89
2000-2004	390	-0.66	0.11	9.15	0.00	1.15	8.19	1.73	2.40	12.10
2005-2009	510	-0.26	0.91	8.48	0.00	0.43	8.05	2.30	1.43	11.58
2010-2014	795	-0.41	0.10	7.15	0.00	1.93	8.60	1.56	0.82	10.06
2015-2019	1,155	-0.12	0.70	7.68	0.00	2.70	11.61	2.40	0.95	10.66
2020-2023	1,936	-0.96	-0.29	8.33	0.00	4.85	14.07	1.70	0.07	12.84

Looking more closely at financing, Figure 4.4 provides an overview of the average net equity issuance (e), net debt issuance (d) and change in retained earnings (ΔRE) for firms across all calendar years. Unlike Table 4.5, this analysis does not adjust financing by dividing it by assets, which gives larger transactions and firms a greater influence on the results. The differences between Table 4.5 and Figure 4.4 indicate that larger firms have a different financing mix compared to smaller firms. The findings in Figure 4.4 align more closely with the Pecking Order Theory, as retained earnings (ΔRE) consistently

represent the largest financing source. Net debt issues (d) also play an important role, with most periods showing positive net debt issuances, although some years feature debt buybacks. By contrast, net equity financing (e) has a relatively minor impact, with buybacks dominating most periods and only occasional small net equity issuances.

Figure 4.4: Average Net Equity Issuance (e), Net Debt Issuance (d) and Change in Retained Earnings (ΔRE) Averages Across Calendar Years

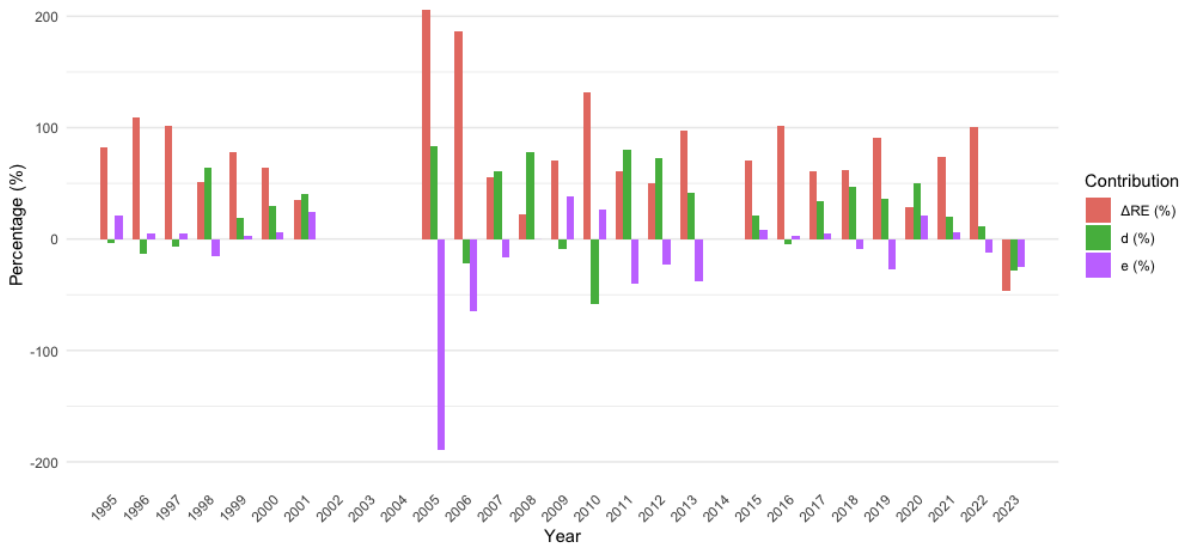
Overview of the average of the different financing components and the sum of these averages across calendar years. The figure illustrates the average change in retained earnings (ΔRE), net debt issuance (d), and net equity issuance (e) for firms in the sample, measured in million USD. The colored bars represent the averages of the individual financing components: change in retained earnings in red, net debt issuance in green, and net equity issuance in purple. The gray line plots the sum of the averages of the different financing components, representing total average financing over time.



Building on this, Figure 4.5 illustrates the proportional contribution of each financing component from Figure 4.4 to total financing. Retained earnings consistently represent the largest share, followed by debt, while equity remains the least utilized component and is frequently negative.

Figure 4.5: Overview of the Contribution of the Different Financing Components Across Calendar Years

Overview of the contribution of the different financing components to total financing across calendar years. The figure shows the contribution of change in retained earnings (ΔRE), net debt issuance (d), and net equity issuance (e) to total financing for firms in the sample, expressed as a percentage. The colored bars represent the contributions of the individual financing components: change in retained earnings in red, net debt issuance in green, and net equity issuance in purple.



Note: Data for 2002, 2003, 2004, and 2014 are not shown due to low net total financing, which caused disproportionately large values

As the final component of the descriptive analysis, Table 4.6 provides summary statistics of financing relative to market-adjusted book assets across calendar periods. The findings closely mirror those in Table 4.5.

Table 4.6: Summary Statistics of Financing Relative to Market Value of Assets (Calendar-Time)

Medians, means, and standard deviations of net debt issuance (d), net equity issuance (e), and change in retained earnings (ΔRE) relative to market value of assets across calendar year periods. Change in retained earnings (ΔRE) is calculated as the difference in retained earnings on the balance sheet between two consecutive years. Market value of assets is defined as total book assets minus book equity plus market capitalization (MCAP).

		$d/A\%$			$e/A\%$			$\Delta RE/A\%$		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
1995-1999	45	0.54	-0.84	8.11	0.00	0.47	2.89	2.04	2.37	4.04
2000-2004	390	-0.42	-0.12	8.53	0.00	0.57	4.98	1.11	1.38	8.65
2005-2009	510	-0.09	0.65	7.04	0.00	0.12	4.06	1.51	1.38	11.78
2010-2014	795	-0.26	-0.10	6.41	0.00	1.21	5.25	1.04	0.50	7.86
2015-2019	1,155	-0.04	0.24	7.45	0.00	1.36	5.65	1.32	0.63	9.72
2020-2023	1,936	-0.36	-0.30	6.26	0.00	2.12	6.89	0.81	-0.11	8.94

4.2 Explanatory analysis

4.2.1 Determinants of annual shifts in leverage

The explanatory analysis begins by examining the determinants of annual shifts in leverage, across different time since the IPO ($IPO + n$). Using OLS regressions, it focuses particularly on the role of the market-to-book ratio (M/B), as specified in Equation 2.1 in the Methodology. The results are presented in Table 4.7 below.

Table 4.7: Determinants of Annual Changes in Book Leverage

OLS regression of changes in book leverage on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t \quad (2.1)$$

a and f are not reported. Book leverage is defined as interest-bearing book debt divided by book assets and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Change in Book Leverage ($\Delta(D/A)_t$)%				
	IPO	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	−2.00***				
	(0.32)				
M/B_{t-1}		−0.25	−0.29	−0.74***	−0.80*
		(0.23)	(0.28)	(0.26)	(0.45)
PPE/A_{t-1}%	9.20***	1.10	7.70***	0.31	−1.10
	(2.80)	(2.00)	(1.90)	(1.90)	(2.40)
$EBITDA/A_{t-1}$%	−0.09	−2.40	−1.70	−1.20	1.40
	(2.00)	(1.80)	(2.60)	(2.30)	(3.50)
$log(S)_{t-1}$	0.69***	0.14	0.10	0.24	0.49*
	(0.23)	(0.18)	(0.21)	(0.20)	(0.26)
Observations	421	494	413	401	242
R^2	0.48	0.04	0.08	0.08	0.08
Adjusted R^2	0.47	0.03	0.07	0.07	0.06
Residual Std. Error	12.00 (df = 415)	9.20 (df = 488)	8.90 (df = 407)	8.70 (df = 395)	8.80 (df = 236)
F Statistic	76.00*** (df = 5; 415)	4.10*** (df = 5; 488)	7.10*** (df = 5; 407)	6.90*** (df = 5; 395)	4.30*** (df = 5; 236)
Note:					*p<0.1; **p<0.05; ***p<0.01

Market-timing theory predicts a negative relationship between market-to-book ratios (M/B) and leverage (D/A). This occurs as firms take advantage of favorable market conditions by issuing equity or conducting buybacks. Our analysis identifies a modest negative relationship between the one-period lagged market-to-book ratio (M/B_{t-1}) and leverage over time. The negative coefficients indicate that higher market valuations in the prior period, may slightly reduce leverage to the subsequent period. However, note that

these coefficients are only statistically significance in the later periods.

Specifically, the coefficients range from -0.25 to -0.80 between IPO + 1 and IPO + 10. However, as noted, only the coefficients at IPO + 5 and IPO + 10 are statistically significant, with the latter being significant only at 10 percentage level. The growing magnitude over time suggests that firms may increasingly adjust their capital structures in response to market valuations as they mature.

Despite these findings, the economic significance remains modest in any case. A one-unit increase in the prior period's market-to-book ratio (M/B_{t-1}) corresponds to a reduction in leverage of between 0.25 and 0.80 percentage points. It is important to note that a reduction in the debt-to-asset (D/A) ratio compared to the previous year, is indicated by a negative number, and vice versa. Although, given that a one-unit change in the market-to-book ratio requires a substantial increase in market capitalization, all else being equal, the overall impact on leverage is limited.

Due to the absence of lagged market-to-book values in the IPO-year, the current market-to-book ratio $(M/B)_t$ is used. This aligns with the methodology in Baker and Wurgler (2002). The coefficient is also negative, but larger in magnitude. Although, it may be biased as it reflects the market-to-book ratio at the end of the IPO year, after the IPO has already occurred. Consequently, this ratio may be influenced by post-IPO dynamics, potentially disconnecting it from the conditions present at the time of the IPO.

Regarding other variables, asset tangibility (PPE/A) and size ($log(S)$) exhibit significant relationships with leverage evolution from pre-IPO levels. As seen from the IPO column, higher asset tangibility and increased size are associated with increasing debt levels. This likely reflects structural factors influencing financing decisions at the IPO. Asset tangibility also stands out with a coefficient of 9.20, in contrast to size, which has a coefficient of 0.69. This suggests that firms with more tangible assets and larger size may have issued more debt alongside equity during the IPO.

In subsequent periods following the IPO, the lack of significance for the control variables offers limited interpretive value. Nevertheless, the signs generally align with expectations. Asset tangibility (PPE/A) and size ($log(S)$) mostly support increased leverage, while increased profitability ($EBITDA/A$) encourages lower leverage.

Baker and Wurgler (2002) observed similar overall trends in their study of the U.S. market. Although they report more statistically significant coefficients with larger magnitudes for the lagged market-to-book ratio (M/B_{t-1}) across all periods. In isolation, this could suggest a stronger link between market valuations and leverage in determining annual changes in leverage in the U.S market. However, their analysis also benefited from a significantly larger sample size, ranging from 2,652 observations at IPO + 1 to 715 at IPO + 10. This likely increased the statistical power of their findings. Conversely, their control variables exhibit limited economic impact, but demonstrates greater statistical significance compared in our results.

4.2.2 Decomposition of shifts in leverage

After analyzing the net effect of annual changes in leverage, the next step involves running separate OLS regressions for each of the three components of annual change in leverage: net equity issues, newly retained earnings and the residual components related to total asset growth. While the net effect results in Table 4.7 show limited significance for some variables, including that a significant relationship with market-to-book ratio only occur in later periods following the IPO, the decomposition offers a complementary analysis that may uncover relationships obscured or offset in the aggregated model. Not least, it allows for examining of whether market valuations are positively correlated with net equity issuance, as the market timing theory proposes.

This approach, illustrated in Equation 2.3 in the methodology section, examines how each component correlates with the market-to-book ratio (M/B) and the control variables. In this way, the analysis offers insights into how these variables, with a particularly emphasis on the market-to-book ratio (M/B), drive net changes in leverage by affecting each of the three components.

The results of the decomposition are presented in Table 4.8 for changes in book leverage due to net equity issues, Table 4.9 for newly retained earnings, and Table 4.10 for the residual components related to total asset growth. To ensure precision, all regressions, including the previous one examining net change in leverage in Table 4.7, are conducted using the same set of observations for each $IPO + n$ time frame.

Table 4.8: Changes in Book Leverage Due to Net Equity Issues

OLS regression of changes in book leverage due to net equity issues on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$-\left(\frac{e_t}{A_t}\right) = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

a and f are not reported. Net equity issue-to-assets is defined as net equity issues divided by total assets and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Change in Book Leverage Due to Net Equity Issues $(-e/A_t)\%$				
	IPO + 0	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	-3.20^{***}				
	(0.60)				
M/B_{t-1}		-1.90^{***}	-1.50^{***}	-1.50^{***}	-0.91^{*}
		(0.40)	(0.40)	(0.40)	(0.50)
$PPE/A_{t-1}\%$	6.70	−3.50	−2.80	−1.00	2.00
	(5.10)	(3.50)	(2.60)	(3.00)	(2.70)
$EBITDA/A_{t-1}\%$	15.00^{***}	11.00^{***}	34.00^{***}	19.00^{***}	29.00^{***}
	(3.80)	(3.00)	(3.70)	(3.60)	(3.80)
$log(S)_{t-1}$	4.10^{***}	2.50^{***}	1.60^{***}	2.10^{***}	1.00^{***}
	(0.42)	(0.31)	(0.29)	(0.32)	(0.29)
Observations	421	494	413	401	242
R^2	0.35	0.29	0.44	0.33	0.38
Adjusted R^2	0.34	0.28	0.43	0.32	0.36
Residual Std. Error	22.00 (df = 415)	16.00 (df = 488)	12.00 (df = 407)	14.00 (df = 395)	9.80 (df = 236)
F Statistic	45.00^{***} (df = 5; 415)	40.00^{***} (df = 5; 488)	64.00^{***} (df = 5; 407)	38.00^{***} (df = 5; 395)	29.00^{***} (df = 5; 236)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4.9: Changes in Book Leverage Due To Newly Retained Earnings

OLS regression of changes in book leverage due to newly retained earnings on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$-\left(\frac{\Delta RE_t}{A_t}\right) = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

a and f are not reported. Newly retained earnings-to-assets is calculated as the difference in retained earnings on the balance sheet between two consecutive years divided by book assets. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Change in Leverage Due to Newly Retained Earnings $(-RE/A_t)\%$				
	IPO + 0	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	−0.66				
	(0.54)				
M/B_{t-1}		−0.05	−1.50***	−0.53	−0.43
		(0.39)	(0.53)	(0.47)	(0.62)
$PPE/A_{t-1}\%$	1.40	2.30	3.20	4.10	−6.50*
	(4.60)	(3.50)	(3.50)	(3.50)	(3.40)
$EBITDA/A_{t-1}\%$	−5.20	−8.70***	−11.00**	−14.00***	−7.90
	(3.40)	(3.00)	(4.90)	(4.20)	(4.80)
$log(S)_{t-1}$	−0.79**	−1.60***	−1.30***	−1.40***	0.37
	(0.38)	(0.30)	(0.39)	(0.37)	(0.36)
Observations	421	494	413	401	242
R^2	0.03	0.12	0.10	0.11	0.04
Adjusted R^2	0.01	0.11	0.09	0.10	0.02
Residual Std. Error	20.00 (df = 415)	16.00 (df = 488)	17.00 (df = 407)	16.00 (df = 395)	12.00 (df = 236)
F Statistic	2.10* (df = 5; 415)	13.00*** (df = 5; 488)	9.40*** (df = 5; 407)	9.70*** (df = 5; 395)	1.80 (df = 5; 236)
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 4.10: Changes in Book Leverage Due to Growth in Assets

OLS regression of changes in book leverage due to growth in assets on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

a and f are not reported. Asset growth is calculated as the change in the inverse of book assets between the current period (t) and the previous period ($t-1$) multiplied by the previous period ($t-1$) book equity. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Change in Book Leverage Due to Growth in Assets $(-E_{t-1}(1/A_t - 1/A_{t-1}))\%$				
	IPO + 0	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	1.10***				
	(0.42)				
M/B_{t-1}		1.50***	1.50***	1.00**	0.62
		(0.40)	(0.40)	(0.41)	(0.54)
$PPE/A_{t-1}\%$	−0.82	3.80	2.20	−0.81	4.10
	(3.60)	(3.50)	(2.70)	(3.00)	(2.90)
$EBITDA/A_{t-1}\%$	2.30	3.50	5.10	2.10	9.90**
	(2.60)	(3.00)	(3.80)	(3.60)	(4.20)
$log(S)_{t-1}$	−1.50***	−0.21	−0.01	0.32	−1.20***
	(0.29)	(0.31)	(0.30)	(0.32)	(0.31)
Observations	421	494	413	401	242
R^2	0.16	0.04	0.04	0.03	0.08
Adjusted R^2	0.15	0.03	0.03	0.02	0.06
Residual Std. Error	15.00 (df = 415)	16.00 (df = 488)	13.00 (df = 407)	14.00 (df = 395)	11.00 (df = 236)
F Statistic	16.00*** (df = 5; 415)	3.80*** (df = 5; 488)	3.20*** (df = 5; 407)	2.60** (df = 5; 395)	4.30*** (df = 5; 236)

Note: *p<0.1; **p<0.05; ***p<0.01

Given the market-timing hypothesis, the negative relationship between the market-to-book ratio (M/B) and leverage arises because firms issue equity when market valuations are high. Consequently, we expect a positive relationship between market-to-book ratio and net equity issues, indicating market timing behavior.

Our findings confirms that reductions in leverage in connection with higher market valuation, primarily are driven by equity issuance (Note that the dependent variable in Table 4.8 has a negative sign, so a negative coefficient on the market-to-book ratio indicates a positive relationship) . Conversely, higher market valuations also drive total asset growth, which increases leverage (again, note the negative sign of the dependent variable in Table 4.10). However, this increase is typically insufficient to fully offset the leverage reduction caused by equity issuance. Lastly, the negative and small coefficients for retained earnings suggest only modest increases with higher market valuations, and vice versa, though their lack of statistical significance limits meaningful interpretation.

More specifically, Table 4.8 shows that the coefficients for the relationship between net equity issues and one-lagged market-to-book ratio range between -1.9 and -0.91 from IPO + 1 to IPO + 10. In the IPO year, the coefficient of current market-to-book ratio is -3.2. Given the negative sign of the dependent variable, a higher market-to-book ratio is associated with higher net equity issuance. This effect aligns with the findings of Marsh (1984), who examined UK firms from 1959 to 1974 , and Baker and Wurgler (2002), though the coefficients in their studies are somewhat larger and consequently carry larger economical significance. Conversely, market-to-book ratios appear to have little impact on retained earnings in both studies, a result consistent with our findings in Table 4.9.

Table 4.10 shows strongly significant one-period-lagged market-to-book ((M/B_{t-1}) coefficients ranging from 1.50 to 1.00 from IPO + 1 to IPO + 5. We also see a non-significant coefficient of 0.62 for IPO + 10. In addition, a coefficient of 1.10 is observed for the IPO year. However, the result for the IPO year is subject to a potential bias related to the current market-to-book ratio. Generally, given the dependent variable, $-E_{t-1}(1/A_t - 1/A_{t-1})\%$, we see an increase in market-to-book ratio aligns with asset growth. This asset growth is not fully financed through equity issuance or retained earnings alone, necessitating additional debt and thereby increasing leverage. As a result, changes in equity or retained earnings, do not translate into a one-to-one effect on leverage. This trend is also present in the findings of Baker and Wurgler (2002).

In conclusion, the market-to-book ratio shows a somewhat mixed and occasionally conflicting effect on leverage. On the one hand, it leads to increased equity issuance, indicating market-timing behavior. This appears to be the primary factor contributing to reduced leverage on an annual basis. This is especially true in later periods following the IPOs when the market-to-book ratio's impact on net leverage change is statistically significant in Table 4.7. On the other hand, rising market-to-book values stimulate total asset growth, which, in isolation, generates a need for increased leverage. However, the net effect on leverage change remains negative, as the absolute value of the coefficient for net equity issuance outweighs the opposing effect of growth in total assets

As seen in Table 4.7 the other control variables generally show limited significance in explaining net leverage changes. However, their influence becomes more pronounced when examining the decomposition of financing decisions. Specifically, both profitability

($EBITDA/A$) and firm size ($log(S)$) significantly influence net equity issues and retained earnings.

A key finding is that an increase in profitability is related to significantly lower equity issues (again, note the negative sign of the dependent variable). Table 4.9 further emphasize this, showing that higher profitability is related to increased newly retained earnings. The preference for retained earnings over equity issues when available (for instance when profitability increase) aligns with the pecking order theory. However, the rise in retained earnings is not sufficient to fully counteract the leverage-increasing effect of reduced equity issuance. This contrasts with the findings of Baker and Wurgler (2002) , where profitability was found to primarily influence retained earnings.

Larger firm size is linked to lower equity issuance, which in isolation, leads to higher leverage ratio. This aligns with trade-off theories, suggesting that larger firms are better equipped to manage higher level of debt, because they face lower financial distress costs. Moreover, the effect of firm size is most pronounced during the IPO year, before its influence diminishes over time. Furthermore, greater firm size leads to an increase in retained earnings, likely reflecting the increased financial stability of larger firms. Baker and Wurgler (2002) found the same general trends related to firm size, though with coefficients of smaller magnitude.

In addition to the standard OLS regressions, we performed Fama-MacBeth regressions. However, the limited number of observations per calendar year resulted in highly variable coefficients, making the results largely unreliable and difficult to interpret. The detailed results and the number of observations for each calendar year are provided in Section A.3 and A.4 of the Appendix, respectively. A similar issue occurred in most of the other regressions. As a result, we chose to omit the Fama-MacBeth regression tables to save space.

4.2.3 Univariate explanatory power of the variables

In the next step, we conduct univariate regressions following Equation 2.5 in the Methodology part. Based on this, we evaluate the explanatory power of the market-to-book ratio (M/B) and the control variables in determining cross-sectional leverage over time, separately. Additionally, the external finance-weighted approach variables,

introduced in 2.4 in the methodology, are included. This allows for a comparison between the explanatory power related to one-year lagged values and the external finance-weighted versions of the variables. It also provides an overall understanding of how each of the determinants contributes to explaining leverage. The results of the explanatory power of the different variables over time, are given in the figure below.

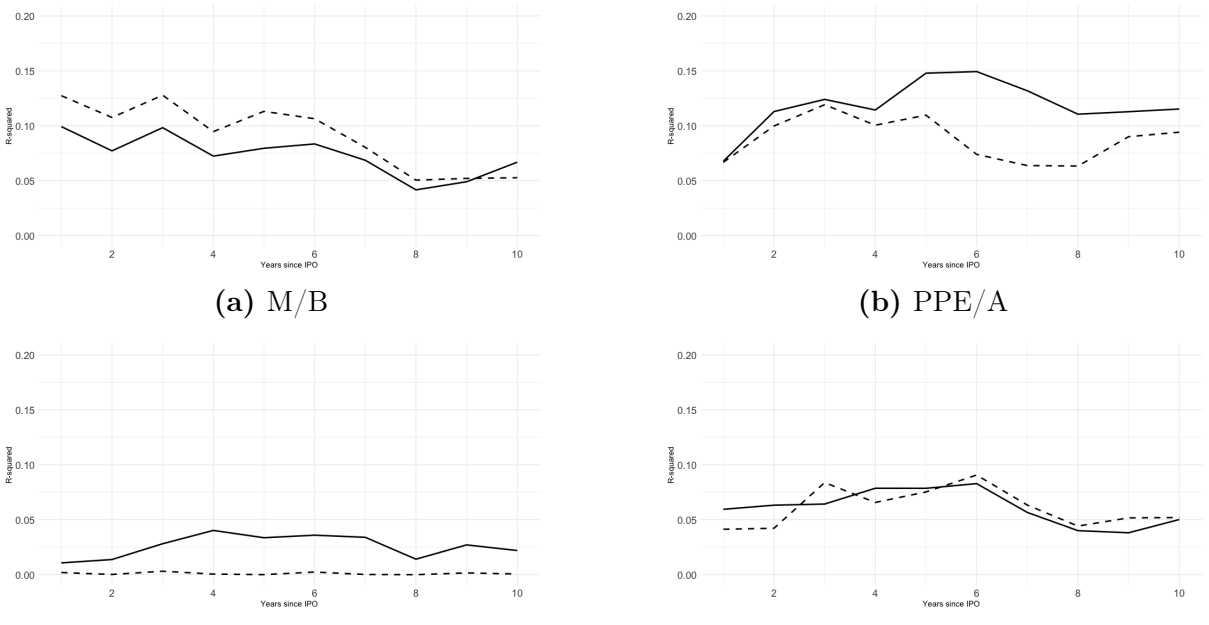
Figure 4.6: Univariate explanatory power of determinants of capital structure since IPO

Explanatory power (R^2) for univariate OLS regressions of book leverage on determinants of capital structure

$$\left(\frac{D}{A}\right)_{IPO+t} = a + bX_{t-1} + u_t \tag{2.5}$$

Book leverage is defined as book interest bearing debt to book assets. We consider four independent variables, which we replace with X in Equation 2.5, and each variable is defined in two ways. The solid line represent the simple one period lagged version of the variable and the dotted line is the external finance weighted version of the variable, where 2.4 shows the calculation of M/B_{efwa}. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defines as the log of sales.

$$\left(\frac{M}{B}\right)_{efwa,t-1} = \sum_{s=0}^{t-1} \frac{e_s + d_s}{\sum_{r=0}^{t-1} e_r + d_r} \cdot \left(\frac{M}{B}\right)_s \tag{2.4}$$



(a) M/B **(b)** PPE/A

(c) EBITDA/A **(d)** log(S)

In Figure 4.6, the dashed lines show cross-sectional R-squared (R^2) for the external finance weighted-average versions ($X_{efwa,t-1}$) of the variables cross different times since the IPO. On the other hand, the solid lines represent the R-squared (R^2) values for variables using simple one-year lagged values (X_{t-1}). The time frame is indicated on the x-axis.

Given Baker and Wurgler (2002) findings, capital structures are thought to reflect the cumulative outcome of past attempts to time the equity market. For this pattern to hold in the Nordic market as well, the external finance-weighted market-to-book ratio is expected to play a significant (and ideally increasingly important role) in determining cross-sectional leverage over time.

However, our results show the opposite. The external finance-weighted market-to-book ratio ($M/B_{efwa,t-1}$) shows greater explanatory power in the early years following the IPO, peaking at around 13 percentage, during the IPO and three years after. Its influence then diminishes, stabilizing at approximately 5 percentage. It even falls below the single one-period lagged (M/B_{t-1}) version in later years. This suggests that historical market valuations become less relevant for firms beyond the initial years after their IPO.

Patterns observed in the descriptive analysis, such as a decline in net equity issuance as firms mature may help explain this trend. This could probably naturally lead to a reduced impact of the simple one-lagged version (M/B_{t-1}) over time as well. When the external finance-weighted version ($M/B_{efwa,t-1}$) also declines, it could suggest that firms gradually converge toward an optimal leverage ratio, adjusting away the impact of earlier market valuations. This also aligns with predictions of trade-off theories.

The ratio $EBITDA/A$, used as a proxy for profitability, has a modest effect in the Nordic market. While the simple one-year lagged version yield an R^2 of around 2,5 percentage, the external finance-weighted profitability ratio shows effectively no explanatory power. One possible explanation lies in the relationship between profitability and retained earnings. The descriptive analysis indicates that Nordic firms tend to have relatively low retained earnings compared to U.S firms. This lack of accumulated earnings may weaken the connection between past profitability and current leverage. Additionally, this could partially explain why the results differ from those of studies Baker and Wurgler (2002) and Titman and Wessels (1988). These studies found that the negative relationship and impact of past profitability on current cross-sectional leverage strengthens, as retained earnings accumulate over time. However, in the Nordic market, where the potential for such accumulation is much lower, this impact appears significantly weaker.

The explanatory power of PPE/A, a proxy for asset tangibility, and $log(s)$, a proxy for firm size, follows similar dynamics, increasing in the periods immediately after the IPO.

While the two versions of firm size ($log(s)$) remain close during the following period, the versions of asset tangibility (PPE/A) begin to diverge. However, both versions of both asset tangibility (PPE/A) converges to an explanatory level of around 10 percent, which is somewhat higher than its initial value. Both versions of firm size ($log(s)$) stabilizes at approximately 5 percent, close to its initial level at the IPO. In contrast, Baker and Wurgler (2002) observe the opposite trend for these variables. Both PPE/A and $log(s)$ significantly influence capital structure at the time of the IPO, before their explanatory power declines as firms mature. Our findings, however, likely indicate effects driven more by the post-IPO period. The increased importance of asset tangibility may result from firms investing in fixed assets shortly after the IPO, temporarily increasing its importance for leverage. As firms mature, this effect declines. Similarly, the influence of firm size likely reflects growth dynamics in the immediate post-IPO phase, before stabilizing.

4.2.4 Multivariate determinants of cross-sectional leverage

After conducting individual regressions for each variable, we perform a multivariate OLS regression on cross-sectional leverage to account for potential interrelationships among the variables. The primary focus is on the external finance-weighted market-to-book ratio ($M/B_{efwa,t-1}$), and its comparison to the single-year one-lagged version. As outlined in the methodology, the one-period lagged market-to-book ratio (M/B_{t-1}) is included to capture current cross-sectional variation in the level of market-to-book. We also include the other control variables, using the approach described in Equation 2.6 in the Methodology. The results are presented in Table 4.11 using book leverage as dependent variable, and in Table 4.12 using market leverage.

Table 4.11: Determinants of Book Leverage

OLS regression of book leverage on the market-to-book ratios, asset tangibility, profitability and firm size.

$$\left(\frac{D}{A}\right)_t = a + b\left(\frac{M}{B}\right)_{efwa,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t \tag{2.6}$$

a is not reported. Book leverage is defined as interest-bearing book debt divided by book assets and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B measured at time $t-1$. The second one is the simple one period lagged M/B which is also measured at time $t-1$. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. For IPO + 1 we excluded the weighted M/B ratio to avoid perfect collinearity. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Book Leverage D/A%				
	IPO + 1	IPO + 3	IPO + 5	IPO + 10	All firms
$M/B_{efwa,t-1}$		-2.40^{***}	-1.80^{**}	-1.70	-0.86^{***}
		(0.81)	(0.76)	(1.00)	(0.18)
M/B_{t-1}	-2.00^{***}	-0.99	-0.77	-1.70^{*}	-1.30^{***}
	(0.35)	(0.78)	(0.66)	(0.95)	(0.16)
$PPE/A_{t-1}\%$	0.18^{***}	0.21^{***}	0.24^{***}	0.21^{***}	0.21^{***}
	(0.03)	(0.03)	(0.03)	(0.04)	(0.01)
$EBITDA/A_{t-1}\%$	-0.06^{**}	-0.09^{**}	-0.06^{*}	0.01	-0.03^{***}
	(0.03)	(0.04)	(0.03)	(0.05)	(0.01)
$log(S)_{t-1}$	1.20^{***}	1.40^{***}	1.20^{***}	0.55	0.28^{***}
	(0.26)	(0.38)	(0.36)	(0.45)	(0.08)
Observations	672	507	497	320	10,095
R^2	0.17	0.22	0.23	0.18	0.13
Adjusted R^2	0.16	0.21	0.22	0.16	0.13
Residual Std. Error	17.00 (df = 667)	18.00 (df = 501)	18.00 (df = 491)	18.00 (df = 314)	17.00 (df = 10089)
F Statistic	33.00^{***} (df = 4; 667)	29.00^{***} (df = 5; 501)	29.00^{***} (df = 5; 491)	13.00^{***} (df = 5; 314)	302.00^{***} (df = 5; 10089)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4.12: Determinants of Market Leverage

OLS regression of market leverage on the market-to-book ratios, asset tangibility, profitability and firm size.

$$\left(\frac{D}{A}\right)_t = a + b\left(\frac{M}{B}\right)_{efwa,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t \quad (2.6)$$

a is not reported. Market leverage is calculated as interest-bearing book debt divided by total book assets minus book equity plus market capitalization (MCAP) and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B measured at time $t-1$. The second one is the simple one period lagged M/B which is also measured at time $t-1$. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. For IPO + 1 we excluded the weighted M/B ratio to avoid perfect collinearity. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Market Leverage D/A%				
	IPO + 1	IPO + 3	IPO + 5	IPO + 10	All firms
$M/B_{efwa,t-1}$		−3.10***	−2.30***	−2.50**	−1.60***
		(0.77)	(0.75)	(1.00)	(0.17)
M/B_{t-1}	−3.30***	−2.20***	−2.60***	−4.30***	−3.50***
	(0.31)	(0.74)	(0.65)	(0.94)	(0.15)
$PPE/A_{t-1}\%$	0.19***	0.23***	0.28***	0.22***	0.22***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.01)
$EBITDA/A_{t-1}\%$	−0.02	−0.09**	−0.07**	−0.01	−0.03***
	(0.02)	(0.04)	(0.03)	(0.05)	(0.01)
$log(S)_{t-1}$	0.77***	1.00***	0.90**	0.19	−0.16**
	(0.23)	(0.37)	(0.36)	(0.45)	(0.07)
Observations	667	501	493	321	10,101
R^2	0.29	0.34	0.35	0.28	0.26
Adjusted R^2	0.29	0.34	0.35	0.27	0.26
Residual Std. Error	15.00 (df = 662)	17.00 (df = 495)	18.00 (df = 487)	17.00 (df = 315)	17.00 (df = 10095)
F Statistic	67.00*** (df = 4; 662)	52.00*** (df = 5; 495)	53.00*** (df = 5; 487)	25.00*** (df = 5; 315)	701.00*** (df = 5; 10095)

Note: *p<0.1; **p<0.05; ***p<0.01

Overall, market valuations seem to be the most important variable in determining cross-sectional leverage over all time frames. Hereunder, the external finance weighted market-to-book ratio ($M/B_{efwa,t-1}$) yields significant and negative coefficients. This illustrates that higher historical market valuations are linked to lower leverage ratio in the cross-section. On its own, such a significant coefficient for the external finance-weighted market-to-book ratio would support the market timing theory, suggesting that historical market timing behavior can have long-lasting effects

On the other hand, using market-leverage, the one-period lagged market-to-book ratio also yields significant and negative coefficients using market leverage. Although, the importance compared to the weighted market-to-book ratio varies heavily. The relationship between simple one-period lagged market-to-book ratio and the market leverage may also be driven heavily be a mechanical relationship between the variables.

More specifically, using book leverage as shown in Table 4.11, the weighted market-to-

book ratio is the most economically important of the variables at IPO + 3 and IPO + 5. Although, the economic effect is still quite modest, with a one unit increase in historical market valuations leading to 2.40 or 1.80 percentage point reduction in book leverage. At the same time, the one-period lagged market-to-book ratio appears to lack significance in the model. This suggest that historical market valuations play a more significant role in determining leverage than current cross-sectional variations in market value. These findings support the persistence of historical valuations. Additionally, it stands in contrast to the normative trade-off theory, which proposes that managers adjust leverage to maintain a target based on current firm characteristics.

Examining market leverage, Table 4.12 shows that the one-lagged market-to-book ratio (M/B_{t-1}) is generally more significant than the weighted market-to-book ratio ($M/B_{efwa,t-1}$). This suggests that current cross-sectional differences play a greater role in determining leverage, contrasting with the findings for book leverage. These results lend stronger support to trade-off theories compared to market-timing theories. Although some historical effect remains, as reflected in the weighted market-to-book coefficients, which range from -2.3 to -3.1. Similarly, in the pooled "All Firms" dataset, the one-period lagged market-to-book ratios are also significant and larger in magnitude than the weighted versions, for both market and book leverage.

On the other hand, the mechanical relationship between market leverage and the market-to-book ratio, arising from the inclusion of market equity in both metrics, likely overstates the coefficients for the one-period lagged market-to-book ratio. This bias is more pronounced for the single year one-lagged ratio, compared to the weighted version, as the latter incorporates historical values. However, the extent of this effect is challenging to quantify.

The control variables generally produce significant coefficients, though their magnitudes are modest. An exception is the one-period lagged size ($log(S)_{t-1}$), which appears to be associated with increased leverage during the initial years after the IPO.

Baker and Wurgler (2002) find a stronger negative relationship between the weighted market-to-book ratio and leverage compared to our results. They also observe that the coefficients for the weighted market-to-book ratio are consistently larger than those for the one-period lagged version. This, they argue, supports the market-timing theory, and stands in contrasts to the normative trade-off theory. Our findings does not align with

Baker and Wurgler's conclusions. Specifically, we observe inconsistencies between market leverage and the "All Firms" dataset (including analyses of book leverage) on one hand, and book leverage in $IPO + n$ periods on the other . These inconsistencies makes it difficult to draw clear conclusions, but point toward a weaker role for historical market valuations in explaining leverage.

4.2.5 Determinants of long-term shifts in leverage

In the next step, we analyze the relationship between the cumulative change in leverage from pre-IPO levels, and market-to-book ratios, along with the other control variables. This is specified in Equation 2.7 in the Methodology.

Particular focus is given to the weighted market-to-book ratio (M/B_{efwa}), and its comparison to the simple one-period lagged market-to-book ratio (M/B_{t-1}). This analysis aims to provide deeper insights into the persistence of market valuations in influencing leverage. However, any persistent effects are expected to be modest. This is due to that a significant relationship between market valuations and annual changes in leverage only is detectable in the later years following the IPO. Additionally, inconsistencies in the cross-sectional results for market and book leverage, combined with a generally lack of significance, hinder our ability to confirm the role of historical market valuations to be important in determining leverage. Moreover, the regression results, presented below in Table 4.13 for book leverage, and Table 4.14 for market leverage, further undermine the interpretation of persistent market valuations as important for determining capital structures.

Table 4.13: Determinants of Cumulative Changes in Book Leverage from the PRE-IPO Value

OLS regression of cumulative change in book leverage since the pre-IPO value on the market-to-book ratios, asset tangibility, profitability and firm size.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{pre-IPO} = a + b\left(\frac{M}{B}\right)_{efwa,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + g\left(\frac{D}{A}\right)_{pre-IPO} + u_t \tag{2.7}$$

a and g are not reported. Book leverage is defined as interest-bearing book debt divided by book assets and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B measured at time $t-1$. The second one is the simple one period lagged M/B which is also measured at time $t-1$. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. For IPO + 1 we excluded the weighted M/B ratio to avoid perfect collinearity. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Book Leverage D/A%				
	IPO + 1	IPO + 3	IPO + 5	IPO + 10	All Firms
$M/B_{efwa,t-1}$		-2.10^{***}	-2.00^{**}	0.09	-0.83^{***}
		(0.79)	(0.81)	(1.10)	(0.21)
M/B_{t-1}	-1.80^{***}	-0.90	-0.89	-0.90	-1.10^{***}
	(0.35)	(0.78)	(0.72)	(1.10)	(0.20)
$PPE/A_{t-1}\%$	0.14^{***}	0.18^{***}	0.22^{***}	0.23^{***}	0.16^{***}
	(0.03)	(0.04)	(0.04)	(0.05)	(0.01)
$EBITDA/A_{t-1}\%$	-0.04^{*}	-0.05	-0.06	-0.37^{***}	-0.03^{***}
	(0.02)	(0.05)	(0.05)	(0.12)	(0.01)
$log(S)_{t-1}$	0.77^{***}	0.73^{*}	0.75^{*}	0.71	0.49^{***}
	(0.26)	(0.39)	(0.43)	(0.56)	(0.10)
Observations	560	378	332	172	4,742
R^2	0.44	0.46	0.47	0.47	0.43
Adjusted R^2	0.43	0.45	0.46	0.45	0.43
Residual Std. Error	15.00 (df = 554)	15.00 (df = 371)	16.00 (df = 325)	15.00 (df = 165)	16.00 (df = 4735)
F Statistic	86.00^{***} (df = 5; 554)	53.00^{***} (df = 6; 371)	47.00^{***} (df = 6; 325)	24.00^{***} (df = 6; 165)	591.00^{***} (df = 6; 4735)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4.14: Determinants of Cumulative Changes in Market Leverage from the PRE-IPO Value

OLS regression of cumulative change in market leverage since the pre-IPO value on the market-to-book ratios, asset tangibility, profitability and firm size.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{pre-IPO} = a + b\left(\frac{M}{B}\right)_{efwa,t-1} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + g\left(\frac{D}{A}\right)_{pre-IPO} + u_t \quad (2.7)$$

a and g are not reported. Market leverage is calculated as interest-bearing book debt divided by total book assets minus book equity plus market capitalization (MCAP) and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B measured at time $t-1$. The second one is the simple one period lagged M/B which is also measured at time $t-1$. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. For IPO + 1 we excluded the weighted M/B ratio to avoid perfect collinearity. Standard deviations are reported in the parentheses.

	Dependent variable:				
	Market Leverage D/A%				
	IPO + 1	IPO + 3	IPO + 5	IPO + 10	All Firms
$M/B_{efwa,t-1}$		−0.64	−0.59	−0.40	−0.22
		(0.74)	(0.81)	(1.00)	(0.20)
M/B_{t-1}	−1.40***	−2.50***	−2.80***	−4.40***	−3.20***
	(0.31)	(0.70)	(0.69)	(0.97)	(0.18)
$PPE/A_{t-1}\%$	0.12***	0.19***	0.28***	0.27***	0.17***
	(0.03)	(0.03)	(0.04)	(0.05)	(0.01)
$EBITDA/A_{t-1}\%$	0.03	−0.09**	−0.13***	−0.16*	−0.03***
	(0.02)	(0.04)	(0.04)	(0.08)	(0.01)
$log(S)_{t-1}$	−0.03	0.51	0.56	0.001	−0.12
	(0.21)	(0.37)	(0.43)	(0.53)	(0.10)
Observations	563	367	318	164	4,572
R^2	0.16	0.27	0.35	0.45	0.32
Adjusted R^2	0.16	0.26	0.33	0.43	0.32
Residual Std. Error	12.00 (df = 557)	14.00 (df = 360)	15.00 (df = 311)	14.00 (df = 157)	14.00 (df = 4565)
F Statistic	22.00*** (df = 5; 557)	22.00*** (df = 6; 360)	27.00*** (df = 6; 311)	22.00*** (df = 6; 157)	362.00*** (df = 6; 4565)
Note:					*p<0.1; **p<0.05; ***p<0.01

In Table 4.13, using book leverage, the one-lagged weighted market-to-book ratio ($M/B_{efwa,t-1}$) yields significant and negative coefficients equal to -2.10 and -2.00, three and five years following the IPO, respectively. In contrast, the simple one-period lagged market-to-book ratio (M/B_{t-1}) lacks significance for the entire IPO + n time frame. Although, the simple version has consistently lower magnitude compared to the weighted version three and five years following the IPO. These findings may suggest that historical valuation may hold greater importance than current cross-sectional variation.

On the other hand, in Table 4.14, which examines market value, the results show the opposite trend. Significant coefficients for the simple one-period lagged market-to-book ratio(M/B_{t-1}) range from -2.50 at IPO + 3 to -4.40 at IPO + 10. In contrast, the coefficients for the external finance-weighted market-to-book ratio ($M/B_{efwa,t-1}$) are

smaller in magnitude and lack significance. However, this may be partially explained by the simple one-period lagged market-to-book ratio having a mechanical relationship with market leverage. Nonetheless, when analyzing the "All Firms" dataset using book leverage, the simple one-period lagged market-to-book ratio still shows larger and significant coefficients with magnitude of -1.1, compared to -0.83 for the weighted version. These findings may suggest that current cross-sectional variation may be the most influential factor in determining leverage changes.

Similar to the cross-sectional regressions, the effects of other variables remain quite modest in this context. However, firm size occasionally shows a significant impact on book leverage, with larger firms tending to exhibit higher leverage.

As a conclusion the differences observed between market and book leverage highlight similarities between the long-term shifts regression and the cross-sectional regression. Both regressions yield similar overall trends, which is consistent with the findings of Baker and Wurgler (2002). Although, their results provided stronger evidence that market valuations, through market timing behavior, influence capital structures in a way that persists and accumulates over time. This was supported by the consistently higher magnitudes observed for the weighted market-to-book ratio compared to the simple one, in both regression. In contrast, our findings reveal inconsistencies that call into question the robustness of the observed relationships, making it difficult to conclusively confirm any significant and lasting impact of market valuations on capital structures in the Nordic markets.

4.2.6 Testing persistence

In the final section of our main analysis, we test the persistence of historical market-to-book values in determining leverage over subsequent years. While our findings so far have not shown a significant impact of historical market valuations, this analysis still provides value by using a dynamic time frame examining the leverage ratio at $t + \tau$ ($D/A_{t+\tau}$). In addition, by including the external finance-weighted market-to-book ratio at time t ($M/B_{efwa,t}$), it provides insight into the speed of adjustments.

The analysis is conducted through Fama-Macbeth regressions on the two Equations 2.8 and 2.9 as described in the Methodology section. Where the first equation uses control variables, including the single-year, market-to-book ratio (M/B_t) at time t, while latter

equation uses them at $t + \tau - 1$.

As noted, the data spans from 1995 to 2023. However, for intervals such as $t + 3$, debt-to-asset values (D/A) can only be used starting from 1998, with the corresponding with the corresponding M/B_{efwa} values taken three years earlier, in 1995. This approach applies to the other intervals as well. As a result, each firm may appear multiple times in the dataset but for different calendar years. Over time, as more firms go public, the cross-sectional regressions for each year, which form the basis of the Fama-MacBeth regression, are constructed with an increasing number of observations. Although, to ensure comparability, both the market and book leverage in both regression formulas use the same set of firms within each time interval $t + \tau$. The number of observations for each calendar year seems to be consistently adequate, and is listed in Table A.11 in the Appendix. In addition, the regression results are presented below. Note that the $t - values$ are shown in parentheses.

Table 4.15: Persistence of Market-to-Book Effects on Book Leverage

Fama-MacBeth regression of future book leverage on the market-to-book ratios, asset tangibility, profitability and firm size.

$$\left(\frac{D}{A}\right)_{t+\tau} = a_2 + b_2 \left(\frac{M}{B}\right)_{efwa,t} + c_2 \left(\frac{M}{B}\right)_t + d_2 \left(\frac{PPE}{A}\right)_t + e_2 \left(\frac{EBITDA}{A}\right)_t + f_2 \log(S)_t + u_{2,t+\tau} \tag{2.8}$$

a_2 is not reported. Book leverage is defined as interest-bearing book debt divided by book assets measured at time $t + \tau$ and is expressed in percentage terms . The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B. The second one is the simple M/B. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. All independent variables are measured at time t. t-values are reported in the parentheses

	Dependent variable:			
	Book Leverage D/A%			
	$t+1$	$t+3$	$t+5$	$t+10$
$M/B_{efwa,t}$	-1.37	-1.2	-1.06	-1.52
	(-3.25)	(-2.9)	(-2.3)	(-2.86)
M/B_t	-1.12	-1.11	-1.07	-0.6
	(-4.34)	(-4.03)	(-3.35)	(-1.62)
PPE/A_t	19.84	19.92	20.01	19.79
	(6.87)	(6.91)	(6.56)	(5.09)
$EBITDA/A_t$	-2.97	-2.5	-3.05	-4.38
	(-1.92)	(-1.63)	(-1.84)	(-2.29)
$log(S)_t$	0.06	-0.09	-0.1	-0.13
	(0.43)	(-0.62)	(-0.73)	(-0.66)

Table 4.16: Persistence of Market-to-Book Effects on Market Leverage

Fama-MacBeth regression of future market leverage on the market-to-book ratios, asset tangibility, profitability and firm size.

$$\left(\frac{D}{A}\right)_{t+\tau} = a_2 + b_2\left(\frac{M}{B}\right)_{efwa,t} + c_2\left(\frac{M}{B}\right)_t + d_2\left(\frac{PPE}{A}\right)_t + e_2\left(\frac{EBITDA}{A}\right)_t + f_2\log(S)_t + u_{2,t+\tau} \tag{2.8}$$

a_2 is not reported. Market leverage is calculated as interest-bearing book debt divided by total book assets minus book equity plus market capitalization (MCAP) measured at time $t+\tau$ and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B. The second one is the simple M/B. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. All independent variables are measured at time t. t-values are reported in the parentheses

	Dependent variable:			
	Market Leverage D/A%			
	$t+1$	$t+3$	$t+5$	$t+10$
$M/B_{efwa,t}$	-2.65	-2.78	-2.9	-3.11
	(-4.97)	(-4.92)	(-4.77)	(-4.12)
M/B_t	-4.46	-4.55	-4.56	-4.64
	(-15.99)	(-15.29)	(-14.07)	(-10.89)
PPE/A_t	20.69	20.68	21.1	20.26
	(7.7)	(7.09)	(6.75)	(5.16)
$EBITDA/A_t$	-3.38	-3.16	-3.22	-3.99
	(-2.36)	(-2.11)	(-2.03)	(-2.02)
$log(S)_t$	-0.41	-0.51	-0.5	-0.45
	(-3.81)	(-4.85)	(-4.88)	(-3.33)

Table 4.15 and Table 4.16, which examines book leverage and market leverage, respectively, are both based on Equation 2.8. Both tables reveal a significant influence of the historical weighted market-to-book ratio over all time frames $t+\tau$. For book leverage, we see significant coefficients range between –1.06 and -1.52, while for market leverage they range from -2.78 to -3.11. Notably, the magnitude of the coefficients using market leverage increases over time, indicating a stronger impact in later periods.

On the other hand, the single-year market-to-book ratio, capturing cross-sectional variation at time t, yields more significant results and coefficients of greater magnitude when using market-leverage, and generally at the same level coefficients when considering book leverage. Additionally, asset tangibility ($(PPE/A)_t$) demonstrates the the strongest relationship with leverage, consistently contributing to increased leverage. In contrast, profitability ($(EBITDA/A)_t$) occasionally exhibits a significant negative association with leverage.

Although, while the coefficients of the historical weighted market-to-book ratio ($(M/B)_{efwa,t}$) generally are modest compared to other variables, their magnitude and

significance suggests a deviation from the behavior predicted by traditional trade-off theories. According to these theories, market value fluctuations should be temporary, with coefficients nearing zero within at least 10 years as firms return to their optimal capital structure. This finding may indicate at least some degree of persistence of historical market valuations.

Tables 4.17 & 4.18, use Equation2.9 to analyze book and market leverage. They include control variables, such as the single-year market-to-book ratio at time $t + \tau - 1$.

Table 4.17: Persistence of Market-to-Book Effects on Book Leverage, Controlled for One-Period Lagged Firm Characteristics

Fama-MacBeth regression of future book leverage on the market-to-book ratios, asset tangibility, profitability and firm size controlled for one-period lagged firm characteristics.

$$\left(\frac{D}{A}\right)_{t+\tau} = a_3 + b_3\left(\frac{M}{B}\right)_{efwa,t} + c_3\left(\frac{M}{B}\right)_{t+\tau-1} + d_3\left(\frac{PPE}{A}\right)_{t+\tau-1} + e_3\left(\frac{EBITDA}{A}\right)_{t+\tau-1} + f_3\log(S)_{t+\tau-1} + u_{3,t+\tau} \tag{2.9}$$

a_3 is not reported. Book leverage is defined as interest-bearing book debt divided by book assets measured at time $t + \tau$ and is expressed in percentage terms . The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B. The second one is the simple M/B. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. All independent variables except (MB_{efwa}) are measured at time $t + \tau - 1$. t-values are reported in the parentheses

	Dependent variable:			
	Book Leverage D/A%			
	$t+1$	$t+3$	$t+5$	$t+10$
$M/B_{efwa,t}$	-3.82	-4.18	-1.98	-2.24
	(-1.38)	(-1.19)	(-1.45)	(-1.99)
$M/B_{t+\tau-1}$	1.86	2.73	0.99	1.47
	(0.7)	(0.77)	(0.61)	(1.0)
$PPE/A_{t+\tau-1}$	20.98	20.43	17.75	14.74
	(7.66)	(8.97)	(7.72)	(2.84)
$EBITDA/A_{t+\tau-1}$	-5.85	-3.14	2.56	5.76
	(-2.04)	(-0.91)	(1.49)	(1.59)
$log(S)_{t+\tau-1}$	-0.19	-0.39	-0.58	-1.24
	(-1.06)	(-2.21)	(-2.38)	(-2.86)

Table 4.18: Persistence of Market-to-Book Effects on Market Leverage, Controlled for One-Period Lagged Firm Characteristics

Fama-MacBeth regression of future market leverage on the market-to-book ratios, asset tangibility, profitability and firm size controlled for one-period lagged firm characteristics.

$$\left(\frac{D}{A}\right)_{t+\tau} = a_3 + b_3\left(\frac{M}{B}\right)_{efwa,t} + c_3\left(\frac{M}{B}\right)_{t+\tau-1} + d_3\left(\frac{PPE}{A}\right)_{t+\tau-1} + e_3\left(\frac{EBITDA}{A}\right)_{t+\tau-1} + f_3\log(S)_{t+\tau-1} + u_{3,t+\tau} \tag{2.9}$$

a_3 is not reported. Market leverage is calculated as interest-bearing book debt divided by total book assets minus book equity plus market capitalization (MCAP) measured at time $t+\tau$ and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. There are two versions of M/B. The first one is the external finance weighted M/B. The second one is the simple M/B. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. All independent variables except MB_{efwa} are measured at time $t+\tau-1$. t-values are reported in the parentheses

	Dependent variable:			
	Market Leverage D/A%			
	$t+1$	$t+3$	$t+5$	$t+10$
$M/B_{efwa,t}$	-5.03	-5.0	-5.3	-4.52
	(-1.99)	(-1.79)	(-1.67)	(-1.6)
$M/B_{t+\tau-1}$	-0.86	-0.42	0.3	0.84
	(-0.38)	(-0.15)	(0.09)	(0.28)
$PPE/A_{t+\tau-1}$	21.44	21.84	19.93	16.71
	(7.91)	(10.21)	(10.75)	(3.53)
$EBITDA/A_{t+\tau-1}$	-6.43	-4.83	-3.1	0.04
	(-2.62)	(-1.96)	(-1.01)	(0.04)
$log(S)_{t+\tau-1}$	-0.49	-0.74	-0.88	-1.38
	(-4.43)	(-4.53)	(-5.04)	(-4.46)

Including control variables closer to the timing of the dependent variable results in the historical weighted market-to-book values at time t showing much larger coefficients relative to the single-year market-to-book ratios at time $t+\tau-1$. This effect is particularly pronounced when analyzing market leverage, which is surprising given the stronger mechanical relationship typically expected for the single-year version. These findings suggest that historical market-to-book ratios may play a greater role than recent ones, supporting the idea of a persistent effect from earlier market valuations. However, while this may hold for certain time frames, the general lack of statistical significance across most periods makes it difficult to draw definitive conclusions about a persistent effect. Additionally, asset tangibility remains a strong and positive correlation with leverage.

Baker and Wurgler (2002) show that historically weighted market-to-book ratios consistently produce significant and larger coefficients compared to the single-year version. Their coefficients are also much higher than those in our findings. This suggest that

historical fluctuations in market-to-book ratios have strong and lasting effects on capital structures in the U.S. While our results occasionally show persistent effects, these are much smaller than in Baker and Wurgler (2002). Moreover, the lack of consistent trends and the relatively modest coefficients, especially compared to asset tangibility, suggest that historical market valuations, in general, do not have a strong or lasting impact in the Nordic markets.

5 Robustness Analysis

In this section we will conduct a robustness analysis by testing five modifications to our methodology to ensure the validity and consistency of our results. Across all tests, the findings were consistent with our main analysis. Although the statistical significance of some coefficients decreased, their signs and magnitudes were generally preserved, reinforcing the robustness of our conclusions. Noteworthy findings are highlighted and discussed, while regressions that did not provide additional insights are not reported. The outline of the five robustness tests is described below:

1. Alternative Definition of Leverage: All regressions were re-run using total liabilities instead of interest-bearing debt as the measure of leverage. This adjustment ensures consistency with the leverage definition used in Baker and Wurgler's study, enabling a direct comparison between the findings of the two studies.

2. Exclusion of Oil & Gas Firms: We removed Oil & Gas firms from the dataset to account for their potentially unique financial behavior. These firms are particularly sensitive to external shocks, such as the oil price crash of 2014 and the invasion of Ukraine in 2022, which could influence their leverage decisions differently compared to firms in other sectors.

3. Exclusion of Firms Listed During the COVID-19 Period: A significant portion of the firms in our sample went public during the COVID-19 period (2020–2023), a time characterized by an unusually high number of IPOs and firms with distinct characteristics compared to earlier periods. To evaluate whether these firms introduce biases into our results, we re-ran the regressions after excluding them.

4. Alternative Valuation Proxy: To further test the robustness of our findings, we replaced the market-to-book (M/B) ratio with enterprise value-to-EBITDA (EV/EBITDA) as a proxy for valuation and potential mispricing. This substitution allows us to examine whether using a different metric for valuation and potential mispricing yields consistent results.

5. Sector-Adjusted Leverage and Valuation: To account for sector-specific variations, we calculated the sector-average leverage ratio and market-to-book (M/B) ratio for

each year. We then computed the deviations of individual firms from these averages and re-ran the regressions using these sector-adjusted values.

5.1 Alternative definition of leverage

To allow for a direct comparison with the findings of Baker and Wurgler (2002) and to evaluate the impact of including non-interest-bearing debt in our leverage calculations, we re-ran all regressions using total book debt instead of just interest bearing book debt, while keeping the same sample as in the main analysis. The results, presented in Table 5.1, show that both book leverage and market leverage in the Nordic sample are simmilar to the levels observed in Baker and Wurgler's study. Overall, the coefficients remained consistent in both sign and magnitude, though some displayed slightly lower statistical significance.

Table 5.1: Summary Statistics of Leverage Using Total Liabilities and Market-to-Book (Calendar-Time)

Medians, means, and standard deviations of book leverage, market leverage, and the market-to-book (M/B) ratio across calendar year periods. Book leverage is defined as total book liabilities divided by total assets. Market leverage is now calculated as total book debt divided by total book assets minus book equity plus market capitalization (MCAP). The market-to-book (M/B) ratio is calculated as total book assets minus book equity plus MCAP, divided by total book assets.

		Book Leverage%			*Market Leverage%*			*M/B*		
Year	N	Median	Mean	S.D.	Median	Mean	S.D.	Median	Mean	S.D.
1995-1999	45	57.10	56.65	14.01	43.12	41.16	25.72	1.45	2.14	1.50
2000-2004	395	56.25	55.20	14.98	47.45	46.86	23.39	1.14	1.55	1.20
2005-2009	515	56.26	53.93	16.32	40.37	41.46	22.43	1.29	1.68	1.18
2010-2014	785	56.56	53.72	15.60	44.53	44.93	22.54	1.16	1.50	1.03
2015-2019	1,140	55.26	53.47	15.60	39.43	40.16	23.49	1.31	1.84	1.42
2020-2023	1,908	53.54	51.11	19.39	34.35	35.79	23.01	1.45	2.09	1.62

5.2 Exclusion of oil & gas firms

The Nordic region, particularly Norway, has a significant presence of Oil & Gas firms. These firms exhibit unique behaviors as they are heavily influenced by fluctuations in oil prices, such as the sharp decline in 2014 and the subsequent surge following the 2022 invasion of Ukraine. To determine whether excluding these firms would yield more significant results in our regressions—potentially due to the remaining sample being more homogeneous—we removed companies categorized under the TRBC Business Sector "Energy - Fossil Fuels" and re-ran the regressions. This adjustment had minimal impact,

as the coefficients remained largely unchanged in magnitude and retained their statistical significance.

5.3 Exclusion of firms listed during the COVID-19 period

During the COVID-19 pandemic, the Nordic region, like the rest of the world, experienced a surge in IPO activity. Many of these newly listed companies exhibited lower profitability and characteristics that might have precluded them from being listed in normal circumstances. To examine the potential impact of these listings on our results, we excluded all companies that went public between 2020 and 2023 and re-ran the regressions. Since firms listed during this period have not yet reached the IPO+5 stage, the effects of this exclusion are primarily evident from the PRE-IPO stage to IPO+3. Our results remained robust, with coefficients showing similar magnitudes and retaining their statistical significance.

5.4 Alternative valuation proxy

Market-to-book (M/B) is used in our main analysis as a proxy for firm valuation and potential mispricing. To test the robustness of our findings, we replaced this metric with an alternative proxy, enterprise value-to-EBITDA (EV/EBITDA). To address potential multicollinearity, we excluded the profitability variable (EBITDA/A) from regressions where applicable. Table 5.2 presents summary statistics for EV/EBITDA, which averages between 16 and 21, compared to M/B, which ranges from 1.9 to 2.5 in Table 4.1 in our main analysis. In the regressions, the coefficients generally maintained the same signs but showed lower statistical significance, indicating a weaker relationship between leverage and the alternative valuation proxy.

Table 5.2: Summary Statistics of EV-to-EBITDA (IPO Time)

Medians, means, and standard deviations of EV-to-EBITDA across IPO time. EV-to-EBITDA is calculated as total book assets minus book equity plus MCAP minus cash, divided by EBITDA.

		$EV/EBITDA$		
Year	N	Median	Mean	S.D.
IPO	319	14.96	20.78	17.79
IPO+1	367	14.19	19.29	16.60
IPO+3	305	13.20	19.04	16.71
IPO+5	310	13.75	19.47	16.85
IPO+10	210	11.53	16.19	14.58

5.5 Sector-adjusted leverage and valuation

To account for sector-specific differences in leverage and valuation, we calculated the average leverage ratio and market-to-book (M/B) ratio for each sector and year, then computed the deviations of individual firms from these averages. Our hypothesis was that this adjustment might reveal a more pronounced market timing effect, where firms with high M/B ratios relative to their sector average exploit perceived mispricing by issuing equity to reduce leverage compared to the sector average.

However, the results of the regression were largely consistent with our main analysis, showing coefficients of similar magnitude, sign, and statistical significance. This suggests that sector-specific differences have minimal impact on the overall findings.

6 Conclusion

By analyzing data from public companies in the Nordic countries between 1995 and 2023, this thesis addresses the following question: "To what extent does market timing influence cross-sectional leverage in the short and long term in the Nordic markets?"

Our results, based on an $IPO + n$ time frame, indicate that while equity financing is a common funding method in the region, the influence of market timing on cross-sectional leverage is minimal, in both the short and long term. Although occasional short-term impacts of market timing are observed, we find no evidence of significant historical or persistent impacts.

Specifically, we observe a positive relationship between equity issuance and market valuations, suggesting possible market timing behavior. However, the effect is not widespread, and its impact on leverage is limited. Notably, a significant negative net effect on leverage emerges only in later periods following the IPO. Yet, this effect is economically small, as market timing's role in reducing leverage is partially offset by factors such as total asset growth. The general growth in total assets is also driven by increased market valuations, and exerts opposing effects on leverage levels. Consequently, this leads the overall short-term effects on leverage to be sporadic and modest.

For cross-sectional leverage, we occasionally identify traces of historical market timing behavior. However, the lack of statistical significance and inconsistencies between market and book leverage suggest that these effects are neither robust nor impactful. Furthermore, the mechanical relationship between market leverage and one-lagged market-to-book ratios reduces the relative importance of historical market timing behavior. Removing this effect could consequently led to a reduction in the coefficients of the one-lagged market-to-book ratio, thereby highlighting a relatively greater impact of historical market timing behavior. However, due to the challenges in quantifying this effect, we rely on the coefficients as they are.

Lastly, while our persistence tests uncover some occasional lasting effects of earlier market timing, these effects do not appear to play a meaningful role in determining leverage compared to other current firm characteristics. This is further supported by univariate regressions, which show a declining explanatory power of the weighted market-to-book

ratio over time.

Consequently, our analysis stands in contrast to the findings of Baker and Wurgler (2002) for the U.S. market. Unlike their results, we find no evidence that market timing significantly affects cross-sectional leverage in the Nordic markets in the long term. Although we do observe occasional, but really modest effects in the short term. Additionally, our robustness tests consistently reinforce these findings, offering no further insights or deviations from the observed trends.

In our analysis, we rely on the external-finance-weighted market-to-book ratio to capture past market timing attempts, when controlling for current cross-sectional variations (investment opportunities) through the use of the current market-to-book ratio. However, both Kayhan and Titman (2007) and Hovakimian (2006) have shown that the external-finance-weighted market-to-book ratio still reflects investment and growth opportunities, which are not fully captured by the one-period lagged market-to-book ratio. Based on this, we would still expect a negative relationship between weighted market-to-book values and leverage, aligning with Myers (1977) and traditional trade-off theory. This is because high-growth companies are likely to maintain lower leverage to preserve financial flexibility and avoid underinvestment problems. Consequently, if investment opportunities are also reflected in the weighted market-to-book ratio in our regressions, it could significantly challenge the foundation of the analysis.

An alternative approach could involve decomposing the external-finance-weighted market-to-book ratio into distinct components, as demonstrated by Rhodes - Kropf et al. (2005). They separated the market-to-book ratio into three components. This method enables the isolation of growth opportunities from perceived misvaluation, providing a more nuanced understanding of the dynamics at play. Exploring such decomposition in the context of the Nordic markets may present an interesting avenue for future research.

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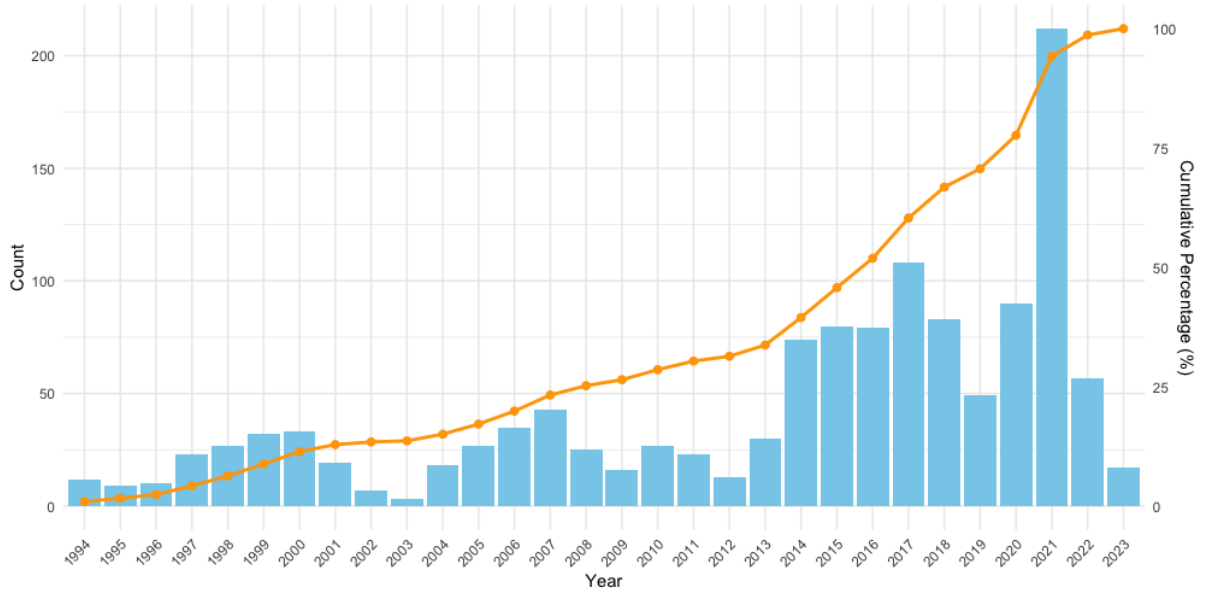
A Appendices

A.1 Distribution of IPO frequencies

Figure A.1: Distribution of IPO frequencies

Distribution of IPO frequencies for active Nordic firms across calendar years. The blue columns represent the annual number of IPOs, measured on the left y-axis as the count of IPOs each year. The orange line represents the cumulative percentage of IPOs, measured on the right y-axis, showing the cumulative share of firms that went public in the period.



A.2 Data audit

As part of our data auditing process, we cross-referenced values from EIKON with 55 different financial statements to evaluate the accuracy and reliability of the dataset. The variables reviewed included e/A, d, $\Delta RE/A$, PPE/A, $D_{interest-bearing}$, and D_{total}. Overall, the data quality is high, with most values accurately reported. However, a few discrepancies were identified during the review.

In the e/A dataset, one error was identified among 20 observations, where a dividend was incorrectly recorded as a buyback in EIKON. The PPE/A dataset exhibited the highest number of errors, with 3 out of 10 observations being inaccurate. One case involved a discrepancy between the value in EIKON and the corresponding financial statement, another case had PPE reported with a negative sign instead of a positive one, and a third case involved PPE not being recorded at all in EIKON.

Despite these issues, the remaining 25 observations across all datasets were consistent with the corresponding financial statements, highlighting the overall reliability of the data.

In Table A.1, we present the results of auditing 20 observations from the dataset. The sample includes the 10 observations with the highest e/A values, as well as 10 randomly selected observations. For two cases, we were unable to locate the financial statements; however, alternative sources confirmed that these companies either issued stock or had a need to issue stock. Additionally, one observation revealed an error where a dividend was incorrectly recorded as a buyback in the database.

Table A.1: Summary of e/A Auditing Results

Summary of the auditing results for net equity issuance-to-assets (e/A), net equity issuance (e), and book assets (A) for the companies tested. The column Y/N/U indicates whether the tested value was correct: Y for yes, N for no, and U for unsure. The table includes specific notes where relevant.

Company	**Year**	e/A	e	A	**Y/N/U**	**Note**
Sensys Gatso Group AB	2002	1.00	2.62	2.63	U	Company faced a liquidity crisis in October 2001, leading to postponed plans for a share issue and cost-cutting measures. The press release indicates financial difficulties but lacks specific details on the value of capital to be raised.
Invent Medic Sweden AB	2017	0.97	0.84	0.87	Y	
Stayble Therapeutics AB	2021	0.95	3.81	4.00	Y	
ProstaLund AB	2014	0.95	1.38	1.45	Y	
Genovis AB	2006	0.94	2.79	2.96	Y	
Arcario AB	2009	0.94	1.52	1.61	U	A stock issue was identified, but the exact value could not be verified.
Horisont Energi AS	2022	0.94	38.00	40.33	Y	
Addnode Group AB (publ)	2000	0.94	41.71	44.54	Y	
Chordate Medical Holding AB (publ)	2018	0.93	1.81	1.94	Y	
Acconeer AB	2018	0.93	16.59	17.83	Y	
Impero A/S	2022	0.28	1.23	4.34	Y	
Nordic Iron Ore AB	2019	0.09	1.36	15.25	Y	
5Th Planet Games A/S	2016	0.73	3.10	4.22	Y	
NetJobs Group AB	2007	-0.54	-1.37	2.52	N	Dividend incorrectly recorded as share buybacks in the database.
Hav Group ASA	2022	-0.07	-2.98	43.51	Y	
ISS A/S	2015	-0.00	-28.87	6982.96	Y	
Brinova Fastigheter AB (publ)	2017	0.00	0.00	300.38	Y	
Western Bulk Chartering AS	2018	0.00	0.00	116.42	Y	
Alligo AB	2018	-0.01	-2.29	250.61	Y	
Terveystalo Oyj	2018	-0.01	-15.20	1227.86	Y	

In Table A.2, we present the results of auditing observations with the highest and lowest net debt issuance (d) for the year 2022. The sample consists of companies with the four largest negative d values (representing significant debt repayments) and the four largest positive d values (representing significant net debt issuances). The auditing process confirmed that all values were consistent with the financial statements of the respective companies.

Table A.2: Summary of d Auditing Results

Summary of the auditing results for net debt issuance (d) for the companies tested. The column Y/N/U indicates whether the tested value was correct: Y for yes, N for no, and U for unsure. The table includes firms audited for inconsistencies in reported net debt issuance values. Notes are provided where specific details or observations are relevant.

Company	**Year**	d	**Y/N/U**	**Notes**
Equinor ASA	2022	-6,718.0	Y	
AP Moeller – Maersk A/S	2022	-3,797.0	Y	
H & M Hennes & Mauritz AB	2022	-1,049.8	Y	
Telia Company AB	2022	-785.0	Y	
Volvo AB	2022	3,113.0	Y	
UPM-Kymmene Oyj	2022	2,321.7	Y	
Securitas AB	2022	2,046.0	Y	
Electrolux AB	2022	1,876.3	Y	

In Table A.3, we present the results of auditing observations with the largest positive and negative changes in retained earnings (ΔRE) for the year 2022. The sample includes companies with the five largest increases in retained earnings and the five largest decreases. The auditing process verified that all values for ΔRE, RE_t, and RE_{t-1} were consistent with the financial statements of the respective companies.

Table A.3: Summary of ΔRE Auditing Results

Summary of the auditing results for the change in retained earnings (ΔRE), retained earnings in the current period (RE_t), and retained earnings in the previous period (RE_{t-1}), all of which are based on retained earnings reported on the balance sheet. The column Y/N/U indicates w whether the tested value was correct: Y for yes, N for no, and U for unsure. Notes are provided where relevant.

Company	**Year**	ΔRE	RE_t	RE_{t-1}	**Y/N/U**	**Notes**
Equinor ASA	2022	21,553	58,236.00	36,683.00	Y	
AP Moeller – Maersk A/S	2022	19,859	61,646.00	41,787.00	Y	
Nokia Oyj	2022	3,880	17,813.03	13,932.82	Y	
Telenor ASA	2022	2,889	6,877.33	3,988.45	Y	
Yara International ASA	2022	1,862	10,745.00	8,883.00	Y	
Vestas Wind Systems A/S	2022	-1,725.1	3,171.28	4,896.42	Y	
Samhällsbyggnadsbolaget i Norden AB	2022	-1,654.2	1,610.20	3,264.40	Y	
SSAB AB	2022	-1,480.1	1,755.31	3,235.43	Y	
Telia Company AB	2022	-1,286.7	3,002.42	4,271.17	Y	

In Table A.4, we present the results of auditing observations from the PPE/A dataset. The sample includes two observations with the largest PPE/A values and a selection of random observations for comparison. The auditing process identified discrepancies in three cases. One instance involved a PPE value that did not align with the corresponding financial statement, another case had PPE incorrectly reported with a negative sign instead of a positive one, and a third case involved PPE being recorded as zero in the dataset despite being reported as m6.7 DKK in the financial statement. The remaining observations were consistent with their respective financial statements.

Table A.4: Summary of PPE/A Auditing Results

Summary of the auditing results for property, plant, and equipment-to-assets (PPE/A), property, plant, and equipment (PPE), and book assets (A), all of which are based on values reported on the balance sheet. The Y/N/U column indicates whether the tested value was correct: Y for yes, N for no, and U for unsure. Notes are provided where relevant, explaining discrepancies or issues identified during the auditing process.

Company	**Year**	PPE/A	PPE	A	**Y/N/U**	**Notes**
Rockwool A/S	2010	1.09	1,896.7	1,734.8	N	PPE value does not align with the corresponding financial statement
Northern Ocean Ltd	2021	0.98	953.75	977.55	Y	
Husqvarna AB	2010	-0.15	-400.97	2,603.49	N	PPE value is incorrectly reported with a negative sign instead of positive
Fable Media Group AB	2019	0.00	0.00	15.93	Y	
NTR Holding A/S	2021	0.00	0.00	21.72	Y	
Peptonic Medical AB	2018	0.00	0.00	6.34	N	The financial statement reports PPE as m6.7 DKK, but it is recorded as 0 in the dataset
iZafe Group AB	2020	0.00	0.00	3.22	Y	
Fom Technologies A/S	2022	0.0014	0.01052	7.55	Y	
Aker Solutions ASA	2023	0.13	488.58	3,741.06	Y	
Jeudan A/S	2018	0.0015	5.08	3,437.72	Y	

In Table A.5, we present the results of auditing a random selection of observations from the $D_{interest-bearing}$ and D_{total} datasets. The auditing process verified that all values were consistent with the financial statements of the respective companies.

Table A.5: Summary of $D_{interest-bearing}$ and D_{total} Auditing Results

Summary of the auditing results for interest-bearing debt ($D_{\text{interest-bearing}}$) and total debt ($D_{\text{total}}$), both based on book values reported on the balance sheet. The Y/N/U column indicates whether the tested value was correct: Y for yes, N for no, and U for unsure. Notes are provided where relevant to clarify discrepancies or issues identified during the auditing process.

Company	**Year**	$D_{interest-bearing}$	D_{total}	**Y/N/U**	**Notes**
Aker BP ASA	2022	5,414	25,134	Y	
Dios Fastigheter AB	2021	1,360	1,615	Y	
AAK AB (publ)	2021	421	1,406	Y	
Viaplay Group AB (publ)	2021	351	1,027	Y	
Bilia AB	2017	323	764	Y	
Reach Subsea ASA	2016	7.7	12,301	Y	
Clas Ohlson AB	2017	0	177.4466	Y	
Doxa AB	2020	0	0.5317	Y	

A.3 Fama-MacBeth regressions of tables: 4.7, 4.8, 4.9 & 4.10

The limited number of observations per calendar year led to highly variable coefficients in the following Fama-MacBeth regressions, rendering the results largely unreliable and difficult to interpret. Consequently, these regressions have been excluded from the main analysis.

Table A.6: Determinants of Annual Changes in Book Leverage

Fama-MacBeth regression of changes in book leverage on the market-to-book ratio, fixed assets, profitability, asset tangibility and lagged leverage.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t \quad (2.1)$$

a and f are not reported. Book leverage is defined as interest-bearing book debt divided by book assets and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. t-values are reported in the parentheses.

	Dependent variable:				
	Change in Book Leverage $(\Delta(D/A)_t)\%$				
	IPO	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	3.58	1.8	1.08	1.3	-5.25
	(0.83)	(0.52)	(0.46)	(0.52)	(-1.41)
$PPE/A_{t-1}\%$	37.93	115.45	18.27	-13.28	2.8
	(1.68)	(1.09)	(1.97)	(-0.84)	(0.63)
$EBITDA/A_{t-1}\%$	32.08	-140.85	-22.47	-18.89	-12.7
	(1.32)	(-1.39)	(-1.33)	(-1.31)	(-1.41)
$log(S)_{t-1}$	0.29	13.61	1.31	-0.17	0.54
	(0.4)	(1.94)	(1.81)	(-0.38)	(1.75)

Note: This is the Fama-MacBeth version of Table 4.7

Table A.7: Changes in Book Leverage Due to Net Equity Issues

Fama-MacBeth regression of changes in book leverage due to net equity issues on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$-\left(\frac{e_t}{A_t}\right) = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

a and f are not reported. Net equity issue-to-assets is defined as net equity issues divided by total assets and is expressed in percentage terms. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. t-values are reported in the parentheses.

	Dependent variable:				
	Change in Book Leverage Due to Net Equity Issues $(-e/A_t)\%$				
	IPO	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	-11.62	-4.73	-6.85	-4.24	-3.79
	(-0.74)	(-0.83)	(-1.55)	(-1.23)	(-1.54)
$PPE/A_{t-1}\%$	-3.56	-47.02	-6.84	-35.01	5.15
	(-0.24)	(-1.04)	(-0.64)	(-1.58)	(1.79)
$EBITDA/A_{t-1}\%$	-100.13	27.05	35.17	-1.89	22.19
	(-0.68)	(0.79)	(4.38)	(-0.1)	(2.49)
$log(S)_{t-1}$	5.01	4.09	1.35	0.6	0.73
	(0.64)	(2.54)	(1.98)	(0.85)	(3.01)

Note: This is the Fama-MacBeth version of Table 4.8

Table A.8: Changes in Book Leverage Due To Newly Retained Earnings

Fama-MacBeth regression of changes in book leverage due to newly retained earnings on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$-\left(\frac{\Delta RE_t}{A_t}\right) = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

a and f are not reported. Newly retained earnings-to-assets is calculated as the difference in retained earnings on the balance sheet between two consecutive years divided by book assets. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. t-values are reported in the parentheses.

	Dependent variable:				
	Change in Leverage Due to Newly Retained Earnings $(-RE/A_t)\%$				
	IPO + 0	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	-235.36	-7.5	7.64	-5.96	-5.01
	(-1.08)	(-0.76)	(0.76)	(-1.13)	(-1.19)
$PPE/A_{t-1}\%$	131.37	-9.28	26.38	-80.51	-7.31
	(1.07)	(-0.7)	(0.95)	(-1.41)	(-1.02)
$EBITDA/A_{t-1}\%$	642.84	-58.78	-10.02	8.15	-9.01
	(1.01)	(-1.79)	(-0.82)	(0.38)	(-0.55)
$log(S)_{t-1}$	-100.44	-1.14	-1.78	-0.42	0.26
	(-1.42)	(-0.87)	(-2.33)	(-0.3)	(0.57)

Note: This is the Fama-MacBeth version of Table 4.9

Table A.9: Changes in Book Leverage Due to Growth in Assets

Fama-MacBeth regression of changes in book leverage due to growth in assets on the market-to-book ratio, asset tangibility, profitability, firm size and lagged leverage.

$$-\left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

a and f are not reported. Asset growth is calculated as the change in the inverse of book assets between the current period (t) and the previous period $(t-1)$ multiplied by the previous period $(t-1)$ book equity. The market-to-book (M/B) ratio is calculated as book assets minus book equity plus market capitalization (MCAP), divided by book assets. M/B is measured at time $t-1$ except for the IPO year. Asset tangibility is defined as net PPE divided by book assets. Profitability is calculated as EBITDA divided by book assets. Firm size is defined as the log of sales. $t-values$ are reported in the parentheses.

	Dependent variable:				
	Change in Book Leverage Due to Growth in Assets $(-E_{t-1}(1/A_t - 1/A_{t-1}))\%$				
	IPO	IPO + 1	IPO + 3	IPO + 5	IPO + 10
M/B	-58.4	-1.24	-1.78	1.16	-2.12
	(-0.98)	(-0.88)	(-0.58)	(0.3)	(-0.32)
$PPE/A_{t-1}\%$	41.09	-26.36	41.87	-5.62	17.72
	(1.22)	(-1.88)	(1.32)	(-0.09)	(1.56)
$EBITDA/A_{t-1}\%$	181.69	18.03	-25.43	-44.51	-48.06
	(1.05)	(0.92)	(-1.21)	(-3.07)	(-1.79)
$log(S)_{t-1}$	-22.11	1.2	16.11	-0.21	0.23
	(-1.13)	(0.33)	(1.01)	(-0.33)	(0.22)

Note: This is the Fama-MacBeth version of Table 4.10

A.4 Fama-MacBeth Observations

Table A.10: Number of Observations by IPO Horizons

Overview of the number of observations for each calendar year across different IPO horizons (IPO, IPO+1, IPO+3, IPO+5, and IPO+10). NA indicates years where no observations are available for a given horizon.

Year	IPO	IPO + 1	IPO + 3	IPO + 5	IPO + 10
1995	2	NA	NA	NA	3
1996	4	5	NA	3	NA
1997	4	3	6	2	3
1998	10	5	6	4	5
1999	20	15	6	8	11
2000	7	22	18	8	4
2001	9	6	18	7	5
2002	4	12	18	18	2
2003	NA	4	11	19	5
2004	5	2	13	17	9
2005	6	7	5	12	5
2006	14	8	NA	12	5
2007	15	22	10	6	12
2008	7	22	16	3	18
2009	6	10	23	10	23
2010	11	7	21	15	20
2011	7	13	10	25	14
2012	5	10	5	24	6
2013	16	5	14	13	3
2014	31	18	13	6	13
2015	40	36	7	16	22
2016	28	46	17	14	26
2017	44	35	38	6	26
2018	37	58	50	18	15
2019	21	41	48	45	9
2020	48	26	60	57	20
2021	110	53	43	46	19
2022	30	123	31	70	8
2023	8	36	65	54	24

Table A.11: Number of Observations by Time Horizons

Overview of the number of observations for each calendar year across different time horizons (t, $t+1$, $t+3$, $t+5$, and $t+10$). The table shows the availability of data for each horizon by year, with NA indicating years where no observations are available for a specific horizon.

t	t + 1	t + 3	t + 5	t + 10
1994	7	8	8	8
1995	21	21	21	21
1996	43	43	41	43
1997	62	61	57	61
1998	93	85	90	87
1999	133	125	131	127
2000	148	155	151	159
2001	179	174	174	179
2002	185	177	176	178
2003	197	196	190	192
2004	188	186	186	184
2005	211	210	212	207
2006	239	236	240	231
2007	274	272	264	264
2008	285	289	284	277
2009	290	284	278	286
2010	319	312	304	315
2011	365	358	352	364
2012	370	360	353	366
2013	395	383	375	389
2014	429	414	421	NA
2015	455	447	452	NA
2016	500	501	501	NA
2017	582	574	573	NA
2018	632	626	623	NA
2019	689	683	NA	NA
2020	749	737	NA	NA
2021	889	NA	NA	NA
2022	968	NA	NA	NA

A.5 EIKON variables with description

Table A.12: Data Retrieval Overview with Description

Overview of all variables, variable names and description retrieved from the EIKON database.

Variable	EIKON Name	EIKON Descritption
$EBITDA$	Earnings before Interest, Taxes, Depreciation & Amortization (EBITDA) [SEBITDA]	Represents a sum of Earnings before Interest and Taxes [SEBIT] and the total depreciation and amortization value for the period [STDAE]. Applicable to all Industries.
IPO	IPO Date	N/A
$MCAP$	Market Capitalization	The sum of market value for all relevant instrument level share types. The instrument level market value is calculated by multiplying the requested shares type by latest price. Unlisted Shares are included as applicable. This item supports Default shares type. The default shares type is the most widely reported outstanding shares for a market and it is most commonly Outstanding, Issued or Listed shares. The values are sourced from the strategic Mcap DB where it is calculated as Price Close [TR.PriceClose] * Company Shares [TR.CompanyShares] and if not available in Mcap DB it will be calculated as Price Close [TR.PriceClose] * Common Shares - Outstanding - Total [TR.F.ComShrOutsTot]. This is calculated at a Company level. For depository receipt related instruments the Market Capitalization [TR.F.MktCap] value will be adjusted using the depository receipt ratio. The data item is calculated for all periodicities. It is applicable to all industries.
d	Debt - Long-Term & Short-Term - Issuance/(Retirement) - Total	Cash Flow [SPRD] represents net changes in cash flow due to the changes in the level of debt of a company. Applicable to all Industries.
e	Stock - Total - Issuance/(Retirement) - Net	Cash Flow [SPSS] represents the sum of cash inflows and outflows from issuance and repurchase or retirement of preferred stock and common stock. It includes cash inflow on behalf of warrants converted and stock options exercised. Applicable to all Industries.
PPE	Property, Plant & Equipment - Net - Total [SPPE]	Represents the net book value of all property,plant and equipment. Applicable to all Industries.
S	Revenue from Business Activities - Total [STLR]	Applicable to all Industries.
RE	Retained Earnings - Total [SRED]	Represents combined reported value for retained earnings/reserves and comprehensive income. Applicable to all Industries.
$TRBCSector$	The Refinitiv Business Classification (TRBC) Business Sector Description	TRBC Classifies companies with increasing granularity by Economic Sector, Business Sector, Industry Group, Industry and Activity.
#shares	Common Shares - Outstanding - Total [STCOC]	Represents the number of common shares outstanding (company level, excludes treasury shares). Applicable to all industries.
A	Total Assets [ATOT]	Represents the total assets reported by a company
TL	Interest Bearing Liabilities - Total [SINBL]	Represents the sum of the total value of all borrowings reported by the company. Applicable to all Industries.

A.6 FX rates used in the analysis

Table A.13: FX Rates

Overview of the FX rates used in the analysis, based on data retrival from the EIKON database on the 29.11.24. The FX rates were implicitly calculated by dividing the financial statement values reported in local currencies by their corresponding USD values in our dataset.

FX Rates	USD
NOK	11.03
SEK	10.91
DKK	7.05
EUR	0.95

A.7 Declaration on the use of AI tools in the work on this master's thesis

Name (and version) of the AI tool: ChatGPT 4o

Purpose of using the tool: Used for assistance with writing code in R and improving the flow and clarity of our text.

We are aware that we are responsible for all content of this master's thesis, including the parts where AI tools are used. We are responsible for ensuring that the thesis complies with ethical rules for privacy and publication.