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Sensitivity to Target Leverage Deviation and its Effect on Speed of Adjustment

– A Study of Capital Structure Adjustments in a Nordic Context

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ABSTRACT

In this paper, we study whether cost of equity is sensitive to deviations from target leverage and if this sensitivity is an explanatory factor for firms' speed of adjustment (SOA) towards an optimal capital structure. Further, we explore if access to bond markets could influence SOA. The study is made using a balanced panel of quarterly observations for 142 Nordic listed firms from 2007 to 2015. We construct a cost of equity measure based on a set of five valuation methods, and estimate target leverage using well-established leverage determinants. This allows us to test if there is a sensitivity of cost of equity to target leverage deviation. Next, we determine whether this sensitivity can explain the SOA by constructing a sensitivity measure based on a direct approach. The results of our study indicate that the cost of equity is not sensitive to target leverage deviation in a Nordic context. Consequently, we find that sensitivity of cost of equity to target leverage deviation cannot explain a firm's SOA. Finally, we find that the SOA of Nordic listed firms is lower compared to studies made on U.S. data. In spite of different access to bond markets for Nordic and U.S. firms, the usage of bonds as a proxy for a more market-based capital structure cannot be shown to be a driver of SOA in a Nordic setting.

Keywords: Target leverage deviation, speed of adjustment, cost of equity, sensitivity, bank-based economy

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1. Introduction

In corporate finance, the firm's capital structure decision is fundamental. Much research has been conducted in order to find determinants of financial leverage, leading to a rich supply of previous research. Theories such as the trade-off theory, the market timing theory and the pecking order theory are widely accepted, but the results of past research are highly heterogeneous (Baker and Wurgler, 2002; Myers, 1984; Graham and Leary, 2011; and others). In recent research, the trade-off theory has increased in popularity, arguing that firms do have a target capital structure (Graham and Harvey, 2001; and others). However, empirical data shows that firms often deviate from this target leverage ratio. Several theories try to explain the determinants for how a firm adjusts its capital structure towards this target, and at what speed. Firms are found to balance the cost of adjusting and the benefits of being on target (Fischer, Heinkel and Zechner, 1989; Leary and Roberts, 2005; etc.). Most commonly, these costs and benefits are measured in terms of cash flow effects, which in turn will have an impact on firm value.

Zhou, Tan, Faff and Zhu (2016) study U.S. firms, measuring the effect of target leverage deviation on implied cost of equity, and its potential implications for firm equity value. They construct an estimate of target leverage based on a regression using a set of leverage determinants. The target leverage for each firm and period is the fitted value from this target leverage regression. Zhou et al. (2016) find that firms with larger target leverage deviation also experience higher cost of equity. Further, they go on to measure the sensitivity of a firm's cost of equity to the target leverage deviation and observe that firms with high sensitivity have higher speed of adjustment (SOA) towards their target capital structure. This novel theory broadens the scope of explanatory variables when assessing SOA.

In this paper, we expand on this theory by investigating whether the findings of Zhou et al. (2016) are robust in a Nordic[1] context. Past literature has emphasized that findings in capital structure research might not be applicable when changing the geographical setting (Antoniou, Guney and Paudyal, 2008). Institutional differences and varying purposes of financial markets will have an impact on how firms adjust their capital structures (Öztekin and Flannery, 2012). The Nordic countries are fundamentally different compared to the U.S. when comparing the role of the financial market. A major difference between Nordic and U.S. economies is the heavy reliance on corporate bonds among U.S. firms. Antoniou et al. (2008) divide countries into bank- and market-based economies, where the Nordics belong to the former and the U.S. belongs to the latter. Firms acting in the bank-based economic archetype experience slower SOA (Antoniou et al., 2008). The authors hypothesize that this is due to the close ties between the firms and the creditors, which enables the firms to adjust slowly towards their target, without incurring significant agency costs. The need for using debt as a signal of quality to a large investor base is lower for bank-based firms. Thus, the cost of being off target is low compared to the adjustment costs and SOA can be lower.

[1] We define the Nordics as Sweden, Norway, Denmark and Finland.

We test the findings of Zhou et al. (2016) to see if we find cost of equity to be sensitive to target leverage deviation, and check whether this sensitivity can explain the SOA of Nordic listed firms. We define our research question as follows:

Is the cost of equity sensitive to deviations from target leverage, and is this sensitivity an explanatory factor for Nordic firms' speed of adjustment towards an optimal capital structure?

Thus, we answer the question if sensitivity of cost of equity to target leverage deviation has explanatory power in the bank-based economies in the Nordics. Since previous research has found differences in SOA between bank-based and market-based systems, it is reasonable our findings might differ from those of Zhou et al. (2016). The market-based archetype, like the U.S. which Zhou et al. (2016) study, is characterized by a large reliance on bonds for debt financing. Therefore, it is reasonable to believe that differences in our results compared to studies made on U.S. data are driven by the low reliance on corporate bonds among Nordic firms. If it is true that firms in a market-based economy have higher SOA due to a larger reliance on bonds, we should be able to find similar patterns within our data set if bond usage is a valid proxy for being more market-based.

First, by employing five different methods of estimating the cost of equity, and using fitted values from a target leverage regression, we are able to test whether firms' cost of equity is sensitive to target leverage deviation. Second, by constructing a sensitivity measure using a direct method where we calculate the sensitivity per firm period using a formula derived in previous literature, we can assess if more sensitive firms show signs of higher SOA. Finally, we split our data set into quartiles based on the reliance on bonds to assess if this is a driver of SOA within a Nordic context. Our findings point to the conclusion that the market does not seem to evaluate target leverage deviation when setting its required rate of return. We do find support for the well-established relationship that cost of equity increases with actual leverage level (Modigliani and Miller, 1958). However, the cost of equity of firms in our data set show no sign of being sensitive to any sort of target leverage deviation. We also analyze industries separately to see if there are major differences, but still find no indication that target leverage deviation has an effect on cost of equity. Our findings are robust to alternative target leverage measures as well as extended data panels. Consequently, when applying our direct measure of sensitivity in SOA regressions, we do not find the sensitivity to have explanatory power. Lastly, bond usage as an explanatory variable for SOA yields no meaningful results. Although SOA seems to differ in a Nordic context compared to findings from market-based economies, we do not find bond usage to explain differences in SOA within our bank-based data set.

This paper is organized as follows. Section 2 makes a brief summary of related previous literature and hypotheses development, section 3 explains our data collection process and variable definition, section 4 outlines our empirical method, section 5 presents our results discussion, section 6 includes a robustness discussion and section 7 concludes.

2. Theory and Hypotheses

In this section, we review previous literature and go through the most important underlying theory in regard to capital structure adjustments and how these might differ in the Nordic context. We elaborate on our contribution to existing research and develop our hypotheses.

2.1 Previous Literature

2.1.1 Competing Theories

As with most studies of firms' financing decisions, also this one starts with Modigliani and Miller's irrelevance proposition from 1958, describing how capital structure does not matter (Modigliani and Miller, 1958). However, due to market imperfections, firms will strive to make capital structure decisions based on what maximizes firm value. The classical trade-off theory posits that firms will weigh costs and benefits when choosing the optimal capital structure. A survey conducted by Graham and Harvey, dating back to 2001, found that 81% of managers have a target capital ratio in mind when making financing decisions. In contrast to this theory are the pecking order theory and market timing theory. The pecking order theory, further elaborated on by Myers (1984), points to information asymmetries and that managers, who perceive their shares as underpriced, will finance investment decisions using internal funds. Only when internal funds are insufficient, safe debt is used. Equity financing will only be used as a last resort. Thus, the capital structure is merely a result of a firm's past profitability and investment opportunities (Flannery and Rangan, 2006). The market timing theory on the other hand argues that the capital structure of a firm will be based on the ability to sell overpriced equity. Equity will thus be issued in times when the market-to-book ratio is high. Baker and Wurgler (2002) find that resulting effects on capital structure are highly persistent. The leverage ratios of firms are thus the results of past attempts to time the equity market. These two theories reject the notion of convergence to a specific target capital structure. As such, firms will have no propensity to reverse leverage changes. The pecking order theory and the market timing theory contrast the trade-off theory as they imply that firms do not recognize a link between capital structure and firm value (Flannery and Rangan, 2006). According to the trade-off theory, firms will continuously adjust their level of leverage in order to decrease the deviations from optimal leverage levels, and thereby maximize firm value. Flannery and Rangan (2006) use a partial adjustment model and find evidence suggesting that firms do target a long-run capital ratio, and that the speed to bridge the gap between current leverage and target leverage is around 30% of the gap per year. This result strongly supports the trade-off theory and that targeting behavior is important in explaining the capital structure of firms. Therefore, recent research has applied dynamic models and tried to explain targeting behavior and firms' SOA towards this target. However, findings are disparate. Huang and Ritter (2009) find that firms need 3.7 years to bridge the target leverage deviation by half. Lemmon, Roberts and Zender (2008) instead find half-lives ranging from 1.42 to 4.96 years. Others argue that the SOA is not sufficiently rapid to prove that there is in fact a long-run target at all. Welch (2004) finds that stock returns can explain 40% of debt ratio dynamics, and that corporate issuing behavior therefore still remains a mystery. Zhou et al. (2016) claim that explaining the heterogeneity in SOA and capital structures between firms remains the most important question in capital structure research, which is why the conditional nature of the SOA needs special attention.

2.1.2 Studies on Speed of Adjustment

When explaining the SOA, previous research has highlighted a number of explanatory factors. Byoun (2008) finds that there is a difference in SOA depending on whether firms are over- or underleveraged, and whether they have a financial surplus or deficit. For example, if the transaction costs are higher for equity compared to debt, a firm with financial surplus will reduce debt rather than equity, thereby preserving debt capacity for the future. This means that the SOA will be lower for these underleveraged firms. Byoun (2008) also shows that SOA will be high for firms with a financial surplus and leverage above target ratios (close to 100% SOA per year) as well as for firms with a financial deficit and leverage below target ratios (80% SOA per year). The findings are intuitive and show that firms are in general quicker to reduce debt than issuing new debt. This in turn suggests that firms face different adjustment costs, depending on if they lever up or down.

Mukherjee and Wang (2013) find that the SOA is positively related to the distance from target leverage ratio. The author finds that, on average, a one-standard-deviation difference in initial leverage departure leads to a 10.4 percentage point difference in SOA. This is large compared to the full sample where average SOA is 12%. Mukherjee and Wang (2013) use the trade-off argument to explain this finding, and establish a link between the adjustment benefit and the adjustment speed. Firms with larger deviations will enjoy a larger benefit from adjusting and thus have a higher SOA. The authors also find that overleveraged firms are more sensitive to target leverage deviations compared to underleveraged firms. These costs and benefits come in the form of cash flow such as increased interest tax shields and reduced costs of financial distress, effects that in turn have an impact on firm value.

Drobetz and Wanzenried (2006) analyze the SOA based on a set of firm specific characteristics and a number of macroeconomic factors. They find that the SOA is faster for firms that have high growth rates. In line with Mukherjee and Wang (2013), Drobetz and Wanzenried (2006) find that firms who are far away from their target capital structures will have a higher rate of adjustment. Macroeconomic factors such as high term spreads and good economic prospects show a positive relation to SOA as well.

Warr, Elliott, Koëter-Kant and Öztekin (2012) focus on the cost of adjustment as an explanatory variable for SOA. They emphasize that the mispricing of equity will increase or decrease the cost of adjustment. Firms that are overleveraged and need to issue equity are more likely to have a high SOA in times when they are overvalued. Correspondingly, a firm that is underleveraged and needs to buy back equity will have a higher SOA when they are undervalued. The focus in their paper is again on the cost of adjustment, but in the context of mispricing in the market.

Öztekin and Flannery (2012) observe international differences in adjustment behavior, which is explained by different costs and benefits from rebalancing in different local markets. The environment and the traditions in which a firm operates in affect the adjustment behavior and speed. Countries with malfunctioning institutions will suffer from higher adjustment costs and SOA will be lower. Thus, the choice of geography is important for the results when studying SOA. Their results show that findings from one geography might not be generalizable to other parts of the world.

Whereas the studies above find a range of variables explaining the SOA, most of them focus on the costs and benefits that debt has on value through the impact on cash flows. Adjustments are influenced by advantages such as reduced taxes and disadvantages in the form of costs of financial distress and costs of rebalancing. These in turn affect cash flows, which will have an impact on firm value. However, there are fewer studies on the value effect directly from the impact on cost of equity. Huang and Ritter (2009) link financing choices to the equity risk premium for U.S. listed firms. Consistent with the market-timing hypothesis, they find that external equity financing is more likely when relative cost of equity is low, and that risk premiums have long lasting effects on capital structures. The contribution of their research lies in the explicit linking of cost of equity capital to securities issuance by measuring the equity risk premium.

Zhou et al. (2016) identify a gap in previous research as well, and try to measure the effect of target leverage deviations on cost of equity, and the potential implications for firm equity value. They find that deviations are positively related to cost of equity. Firms that are overleveraged will have higher cost of equity the further they deviate from their target. In reverse, firms that are underleveraged will have a lower cost of equity the further they fall below their target. Modigliani and Miller established the theoretical relationship between equity returns and leverage in their 1958 paper. However, empirical results are disparate. Zhou et al. (2016) claim that the mixed results found in research can be explained by the heterogeneous leverage targets among firms. Firms with similar debt levels but separate leverage targets can still differ in risk profiles. The authors therefore emphasize the importance of studying the deviation from target leverage, rather than the actual level of leverage itself. In contrast to previous literature, Zhou et al. (2016) use ex ante cost of equity rather than ex post stock returns. This enables the analysis of the effect of target leverage deviation on the market's perceived ex ante risks. Their second contribution lies in their study of the heterogeneity in value relevance of leverage between firms. Depending on unique firm characteristics, some firms' equity value will be more sensitive to target leverage deviations than others. SOA will thus be different for different firms, depending on how relevant their leverage is for firm equity value. This also implies that a sample of firms with value relevant leverage will also show more clear signs of capital structure adjustments and finding proof of the trade-off theory is more likely within this particular sample. Studying U.S. data, Zhou et al. (2016) indeed find that in the subsample of overleveraged firms, target leverage deviation is positively related to the cost of equity, and that the more sensitive a firm's cost of equity is to the leverage deviation, the higher is the SOA. Acknowledging this heterogeneity in speeds of adjustment is important as it otherwise might lead to the rejection of capital structure theories such as the trade-off theory when looking at a full sample of firms. Zhou et al. (2016) claim that analyzing subsamples such as those of firms with value highly sensitive to target leverage deviation is more meaningful when testing capital structure theories.

The study by Zhou et al. (2016) is made on U.S. listed firms. As emphasized by previous research, there are geographical differences that change the expected adjustment behavior of firms (Lööf, 2003; Öztekin and Flannery, 2012). As Öztekin and Flannery (2012) point out, differences in local institutions might change the costs of adjustment, which in turn will affect the SOA of firms acting in that market. Lööf (2003) points out that there are fundamental differences in adjustment behavior depending on if a country is market-based or relationship-based. In the relationship-based market, bank lending is more dominant and the relationship to the lender is emphasized. According to Lööf (2003), an example of a relationship-based market is the Nordic region, where firms have a tradition of relying on banks for the larger part of their financing needs. This is echoed by Antoniou et al. (2008) who study determinants of capital structures and SOA, across market-oriented and bank-oriented economies. The authors claim that lessons learned from one environment cannot be generalized to other countries with dissimilar legal and institutional traditions. This calls for an analysis of adjustment behavior and SOA in a Nordic context where the results might differ from a U.S. and market-based context.

2.1.3 Contributions to Existing Research

In previous literature the major explanatory variables used to study SOA have been connected to costs and benefits of debt that lead to cash flow improvements, which in turn affect value either in the form of increased tax shields or in the form of reduced costs of financial distress. Following Zhou et al. (2016), we are interested in the implied cost of equity as an explanatory factor for the heterogeneous SOA among firms. By using a dynamic model for target leverage, we study the changes in target leverage deviation, as opposed to actual leverage levels. The importance of understanding if differences in leverage are due to differences in actual leverage ratios or differences in target leverage ratios was emphasized by Myers already in 1984. Target leverage deviation better reflects the true risk profile of the firm, which influences the market's ex ante expectation of equity returns. Target leverage is creating much of the heterogeneity in leverage levels among firms and must not be ignored (Zhou et al., 2016). Looking at actual leverage levels might obscure the true patterns being studied, leading to the mixed results of prior studies.

When using cost of equity in explaining the SOA, we can highlight for which firms the choice of leverage level is more important for equity value maximization. In other words, the capital structure decision is more crucial for some firms than others, which in turn can explain the different adjustment behaviors and heterogeneity in SOA (Korteweg, 2010; Zhou et al., 2016).

Our unique contribution comes from applying this analysis to Nordic data (Sweden, Norway, Denmark and Finland). As emphasized by Lööf (2003), dynamics of capital structure adjustment are different across the two archetypes of financial systems. The first one is the market-based system which includes the U.S. where Zhou et al. (2016) conduct their study. The other is the bank-based system, which includes the Nordic countries. Observing data from sources such as Sweden's Central Bank (2014), Statistics Finland (2016) and Denmark's Central Bank (2016) confirms the image of the Nordics as a bank based system. Whereas corporate bonds make up 60% of total corporate debt in the U.S., corresponding levels in the

Nordics range from 6% to 20%.[2] Although the market for bonds has been growing quickly in the Nordics during the last decade[3], the difference between the Nordic countries and the U.S. is still substantial. Lööf (2003) finds that the SOA is faster for firms in the market-based system compared to firms in the bank-based system.

Antoniou et al. (2008) make a comparison of capital structure determinants and SOA between firms in market-based and bank-based systems. German and Japanese firms, both active in bank-based systems, have slower SOA compared to firms in the market-oriented systems (U.S. and U.K.). The authors hypothesize that firms in a bank-based system will have closer ties to their creditors and can thus adjust slowly towards their target leverage ratios without suffering from significant agency costs. Firms in Germany and Japan are less reliant on using debt as a signal of quality to a large group of investors, compared to firms in the U.S. or U.K. For Germany and Japan, the cost of being off target is therefore low relative to the adjustment costs. Consequently, the SOA for firms in these countries is lower.

A study on the Nordic countries is justified and can tell us whether target leverage deviation in Nordic firms is as relevant for the cost of equity as it is for firms in the U.S. This study will investigate SOA in a bank-based context and test if sensitivity of cost of equity to target leverage deviation can explain SOA also in the Nordic countries.

2.2 Underlying Theory

This section describes the underlying theory behind the variables used in our tests. When defining our variables, we follow the methodology adopted by Zhou et al. (2016), who base their derivations on Modigliani and Miller (1958 and 1963) as well as Dhaliwal, Heitzman and Li (2006).

2.2.1 Cost of Equity and Sensitivity to Target Leverage Deviation

Based on the theories developed by Modigliani and Miller, we expect a positive relationship between leverage and cost of equity[4]. However, this relationship needs to be expanded to take target leverage deviations into account. In a world without taxes, Modigliani and Miller suggest that the expected return on a share is equal to the appropriate capitalization rate for an unlevered equity stream invested in the firm's own risk class plus a premium for financial risk (Zhou et al. 2016). This financial premium is derived by taking the product of the leverage ratio and the spread between the unlevered cost of equity and the cost of debt (Dhaliwal et al. 2006). This gives us the following expression:

$$r_E^L = r_E^U + (r_E^U - r_D)L \tag{1}$$

[2] Sources include a 2014 report on the "Development of the Swedish Bond Market" by Sweden's Central Bank, 2016 data for Finland from "Financial Accounts: Financial liabilities of Non-financial corporations" by Statistics Finland, a 2014 report on "Corporate Capital Structure and Profitability, Productivity and Access to Finance" Denmark's Central Bank and The Federal Reserve's 2016 presentation of "Financial Accounts of the United States". See subsection Government Documents under References.

[3] Ibid.

[4] Cost of equity is also referred to as the required rate of return.

where r_E^L is the cost of levered equity, r_U^L is the unlevered cost of equity, r_D is the cost of debt and L is the leverage ratio. When taxes T_c are introduced in the model, the expression becomes (Modigliani and Miller, 1963):

$$r_E^L = r_E^U + (r_E^U - r_D)(1 - T_c)L \tag{2}$$

A firm that is holding the optimal leverage ratio, L^*, will have an optimal levered cost of equity r_E^O which maximizes equity value. This can be substituted into the model, which becomes:

$$r_E^O = r_E^U + (r_E^U - r_D)(1 - T_c)L^* \tag{3}$$

In accordance with Zhou et al. (2016), we subtract Equation (2) by Equation (3) to obtain Equation (4) below.

$$r_E^L - r_E^O = (r_E^U - r_D)(1 - T_c)(L - L^*) \tag{4}$$

Thus, the expression $(L - L^*)$, or L^{dev}, measures the difference between firm leverage and target leverage. When L^{dev} is negative a firm is underleveraged, and when L^{dev} is positive a firm is overleveraged. The expression $(r_E^U - r_D)(1 - T_c)$ measures the sensitivity of cost of equity to target leverage deviation. We denote this sensitivity as the parameter θ.

$$\theta = (r_E^U - r_D)(1 - T_c) \tag{5}$$

Simplifying expression (4) using (5) yields Equation (6) below:

$$r_E^L = r_E^O + \theta * L^{dev} \tag{6}$$

Equation (6) forms the theoretical basis for testing the sensitivity, θ, on the equity cost of capital. θ captures the effect of L^{dev} on the cost of equity.

2.2.2 Speed of Adjustment

In a frictionless world, the actual level of leverage, L_{it} is equal to the optimal level of leverage L_{it}^*. The change in actual leverage in each period would reflect the change in optimal leverage level, and the firm capital structure would always be on target. However, in reality, transaction costs such as equity mispricing, fees and commissions inhibit adjustments and firms will not adjust fully in each period (Warr et al., 2012; Öztekin and Flannery, 2012). In a partial adjustment framework, we allow for target leverage deviations, and firms adjust towards their target leverage ratio over time. The speed of which a firm adjusts towards its target leverage ratio will be referred to as the speed of adjustment (SOA). Following previous research, we express the SOA in the following way (Mukherjee and Wang, 2013; Zhou et al., 2016; and others):

$$SOA = \frac{L_{it} - L_{it-1}}{L_{it}^* - L_{it-1}} \tag{7}$$

The expression gives us the difference between the leverage ratio in period t and period $t-1$, divided by the difference between the *target* leverage ratio in period t and the leverage ratio in period $t-1$. The SOA will be equal to 1 only when the firm adjusts fully in a period. The SOA will be <1 when the firm is adjusting partially and >1 when the firm is over-adjusting. Equation (7) forms the theoretical basis in our SOA regressions, when testing if a firm's sensitivity of cost of equity to target leverage deviation can explain the SOA.

2.3 Development of Hypotheses

Based on the underlying theory in the preceding section, we state three hypotheses that we will test in order to answer our research question.

First, we test the sensitivity of cost of equity to target leverage deviation. With Equation (6) as our starting point, Zhou et al. (2016) take the partial derivative of r_E^L with respect to L^{dev}.

$$\frac{\partial r_E^L}{\partial L^{dev}} = \frac{\partial r_E^O}{\partial L^{dev}} + \theta \tag{8}$$

As r_E^O is a function of L^* we can take the partial derivative of r_E^O from Equation (3) with respect to L^{dev} which yields

$$\frac{\partial r_E^O}{\partial L^{dev}} = \theta * \frac{\partial L^*}{\partial L^{dev}} = \theta * \frac{1}{\frac{\partial L}{\partial L^*} - 1} \tag{9}$$

As we focus on the effect on cost of equity by target leverage deviation, we substitute in Equation (9) into Equation (8) and get

$$\frac{\partial r_E^L}{\partial L^{dev}} = \theta * \frac{1}{\frac{\partial L}{\partial L^*} - 1} + \theta = \theta * \left(\frac{1}{1 - \frac{\partial L^*}{\partial L}}\right) \tag{10}$$

We expect θ to be >0, as we defined the sensitivity θ as $(r_E^U - r_D)(1 - T_c)$, which will be positive as long as the after tax return on equity is larger than the after tax return on debt. This assumption seems reasonable and is generally accepted in previous literature (Zhou et al., 2016; Dhaliwal et al., 2006). We also expect $\frac{\partial L^*}{\partial L}$ to be <1. This is reasonable as the change in actual leverage ratio is expected to be more rapid than the change in target leverage ratio. This assumption is in line with previous research that finds a narrowing gap between leverage ratios and target leverage ratios (Flannery and Rangan, 2006; Hovakimian, Hovakimian and Tehranian, 2004; Byoun, 2008). If these two assumptions hold, Equation (10) will be positive. That is, there will be a positive relationship between cost of equity and target leverage deviation. This takes us to our first hypothesis:

H1: There is a positive relationship between the cost of equity and target leverage deviation, L^{dev}

Leverage deviation L^{dev} is defined as $(L - L^{*})$. Thus, when a firm increases its target leverage deviation, L^{dev}, we expect cost of equity to go up. In contrast, when a firm decreases its target leverage deviation, L^{dev}, we expect cost of equity to go down. We do not analyze the absolute value of L^{dev}, but look at the actual value, negative or positive.

The study made by Zhou et al. (2016) finds that firms with a higher sensitivity of cost of equity to leverage deviation, θ, will adjust their capital structures more quickly. That is, those firms will have a higher SOA since target leverage deviation will affect the firm equity value to a greater extent. This takes us to our second hypothesis:

H2: There is a positive relationship between the sensitivity of cost of equity to target leverage deviation, θ, and the SOA

We base our study on Nordic companies where financial markets have different characteristics compared to the U.S. As outlined in section 2.1.3, previous research finds that firms in countries with bank-based financial systems, such as the Nordics, will exhibit slower SOA. We are therefore interested in testing if the adjustment behavior is in fact different when looking at Nordic companies, and if employing a Nordic sample would yield different results. In line with previous findings, we expect to see a positive relationship between θ and the SOA. However, it is plausible the SOA will be lower in our tests compared to when looking at U.S. firms, independent of sensitivity (Lööf, 2003). The division of bank-focused and market-focused financial systems is generally made by looking at the role of banks and the financial market. In bank-based financial systems, banks have a central role in mobilizing savings and allocating capital. In a market-based financial system, this task is shared by the market together with the banks (Demirguc-Künt and Levine, 1999). We use reliance on bonds as a proxy for being more market-based. We want to test whether a quicker adjustment behavior can be attributed to the fact that a firm issues a significant amount of bonds, as those firms are able to more actively participate in the market. This would mean that these firm are more market-based, even though they operate in the bank-based Nordic system. If so, we should see a difference between firms in our data set, depending on their reliance on bonds. We find it interesting to see if the ability to issue bonds matters in the Nordic context. This leads us to our third and final hypothesis:

H3: There is a positive relationship between the reliance on corporate bonds for financing and the SOA

3. Data Collection and Variable Definitions

In section 3.1, we begin by presenting our data collection process. In section 3.2 we discuss and choose our definition of firm leverage. Section 3.3 describes how we determine target leverage, and subsequently the target leverage deviation. Section 3.4 concerns our five estimation methods for a measure of levered cost of equity. Finally, in section 3.5 we explain how the sensitivity of cost of equity to target leverage deviation can be calculated using a direct approach.

3.1 Data Collection Process

Our data set is comprised of Nordic data from Sweden, Norway, Denmark and Finland. Initially, we started by reviewing the list of firms on the OMX Nordic Large Cap, Mid Cap and Small Cap lists (for Sweden, Denmark and Finland), as well as the companies listed on Oslo Børs (Norway). As our analysis is dependent on large amounts of reliable and complete data, ranging from share prices and company financials to analyst consensus forecasts, the decision came naturally to focus on the firms on the main lists. These firms have more extensive analyst coverage and have been listed with publically available information for a longer period, compared to firms on e.g. Nasdaq First North. Firms not listed on a stock exchange are disregarded, as they lack analyst coverage as well as share prices, thus inhibiting our method of calculating the cost of equity. In a first stage, data for these firms is downloaded using the database S&P Capital IQ as per each quarter for these 714 firms from the first quarter 2007 to the fourth quarter in 2015. We choose year 2007 as our first year due to the availability of data in S&P Capital IQ. To limit the risk of erroneous data from our data source, we performed random checks that confirmed its validity. The data is collected as of the fiscal filing date at the end of each quarter. For instance, if a firm's fourth quarter 2015 ends the 31th of July 2015, this will also be the date that the market capitalizations and analyst forecasts are retrieved as of.

Further, following previous research, we exclude financial firms, as these have leverage controlled by regulation rather than by corporate decisions (Faulkender, Flannery, Hankins and Smith, 2012; Drobetz and Wanzenried., 2006). We exclude observations lacking any data, e.g. due to not being listed for the full timeframe or lacking analyst coverage. We also exclude firms with fewer than two cost of equity estimates, to make sure the uncertainty in the resulting average measure is limited (see a description of the calculation of cost of equity in section 3.4). Finally, we exclude firms with negative book value of equity as this inhibits the valuation models for backing out the cost of equity. This makes us exclude roughly 60% of the data set and reach 450 firms with 10,567 firm quarter observations.

As a next step, for statistical accuracy, firms that lack observations for any variable are excluded, to achieve a balanced panel of data. Firms that are present only a small number of years could otherwise cause large biases (Huang and Ritter, 2009). By doing this, we reach a complete panel of 142 firms, with 5,112 firm quarters. For our subsequent analysis, we introduce lagged variables by one quarter and are forced to exclude one period of data, where theses lagged variables are missing, reaching our final data set of 4,970 firm quarters (35 periods of 142 firms). For a summarized list of our data sample selection, see Table 1. Due to only including firms with full data availability over the period, our final data set is naturally biased towards larger, more established firms with similar firm characteristics (see Table 2). We see that median market capitalization for our sample is 14,420 SEK million, whereas median for the full data set is 2,092 SEK million. Leverage levels are similar in the full data set and our sample, while profitability is higher in the latter. We therefore acknowledge that our sample is skewed towards larger firms with somewhat higher profitability, which makes any results less generalizable.

Table 1. Data sample selection

#	Criteria	Firm quarters	Firms
1	Initial data set for firms listed as of end of 2015 (Q1 2007 – Q4 2015)	25,704	714
2	Excluding observations without all data, and financial firms	10,567	450
3	Excluding firms without all data for every quarter in period	5,112	142
4	Excluding firms' first quarter of data (introducing lagged variables)	4,970	142
	Final data set	**4,970**	**142**

The data sample selection process is summarized above. The table describes in brief the steps taken from the initial population of listed Nordic firms to our sample, which is a balanced panel of listed firms active since 2007 until the end of 2015.

However, the exclusion of firms without all required data is necessary for our analysis. The firms in our final panel have extensive analyst coverage and thus create more valid estimates, such as when backing out the cost of equity. All data is collected on a quarterly basis, a decision influenced by the availability of balance sheet and income statement data, published quarterly for all Nordic listed firms. In the era of quarterly capitalism, all firms will have to adapt each quarter and meet the market's expectations. Thus, we see fit to use quarterly observations for our analysis of SOA. It could be argued that the market needs more time to take leverage adjustments into account when setting the required rate of return. This is specifically true if firms only adjust their capital structures once a year (Leary and Roberts, 2005). Therefore, one might argue that the use of quarterly numbers might inhibit some of the conclusion to be drawn. However, as a test for validity we run our tests for yearly observations as well (see section 6.1 for a robustness check in this regard, where we reach similar results). Regarding statistical accuracy, the reduction of our panel to a few yearly observations per firm potentially introduces a short panel bias when regressing with fixed effects (Flannery and Hankins, 2013). This is another reason for employing quarterly observations, which extends the sample and limits the bias.

Table 2. Sample selection bias

Variables	Data set	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	# of Obs.
Market cap	Sample	45,236	116,292	437	4,776	14,420	44,115	1,245,576	142
(MSEK)	Population	20,162	73,359	9	532	2,092	10,407	1,245,576	687
Leverage	Sample	26.0%	22.4%	0.1%	9.2%	18.1%	36.4%	98.0%	142
(L_{TDM})	Population	29.4%	28.9%	0.0%	4.9%	18.9%	47.2%	100.0%	714
Profitability	Sample	7.8%	7.0%	-17.5%	4.6%	6.9%	10.6%	51.0%	142
	Population	3.4%	21.2%	-263.4%	1.9%	5.8%	10.3%	51.0%	660

Data for full year 2015

The sample selection bias is illustrated above. The table describes the size (market cap), leverage (L_{TDM} = short and long-term debt divided by short and long-term debt and market value of equity) and profitability (EBIT divided by assets) of our final sample compared to the initial population.

3.2 Firm Leverage

When looking at firm capital structures, there are many potential ways to measure leverage. Previous literature adopts a range of definitions of the leverage ratio (Frank and Goyal, 2009). The measures can broadly be divided into market value-based and book value-based measures, depending on the choice of asset base in the denominator. A market value measure is future oriented as it reflects expectations on future cash flows while a book value based measure emphasizes the historic performance of the firm (Lööf, 2003). From this perspective, it is difficult to claim that one measure captures the true leverage better than the other. The first measure commonly used is L_{TDM}, which is defined as total debt to the market value of assets. The second market-based measure is L_{LDM} which is defined as long-term debt to market value of assets. The two remaining measures, commonly adopted by research, are L_{TDA} and L_{LDA} which both are book value based. These are defined in the same way as the two preceding measures, but instead use book value of assets as the denominator (Frank and Goyal, 2009). For our tests, previous research has shown that the choice of leverage measure is not determinant for the results (Zhou et al, 2016). However, a market-based measure of leverage is sensitive to fluctuations in market value of equity and thus provides a more realistic picture of the actual financial risk in a company. Therefore, we choose L_{TDM} (defined as short and long term debt divided by short and long term debt plus market value of equity) as our main proxy for leverage in line with recent studies on this topic (Frank and Goyal, 2009; Uysal, 2011; Zhou et al., 2016).[5]

3.3 Estimation of Target Leverage Deviation

To find the target leverage deviation for each firm and period, we must first estimate the target leverage. Previous literature has again adopted a variety of variables in estimating target leverage. For instance, growth

[5] It should be noted that this definition of leverage differs from the definition used in Modigliani and Miller Proposition II (1963), where leverage is defined as debt-to-equity as opposed to debt-to-value. The proposition is used to highlight the relationship between levered cost of equity and leverage (debt-to-equity) in section 2.2.1. However, when analyzing the SOA of firms, previous literature has consistently adopted debt-to-value measures (Öztekin and Flannery, 2012; Mukherjee and Wang, 2013; Drobetz and Wanzenried, 2006; and others). As in Zhou et al. (2016), we want to use a leverage measure that is consistent with previous studies, and consistent throughout the paper. MM Proposition II is merely used in developing our Hypothesis 1, and not as part of our main test.

has been shown to increase the risk of financial distress, which in turn reduces the possibility to take on leverage (Frank and Goyal, 2009). The most common and reliable proxy for growth is the market-to-book asset ratio (Adam and Goyal, 2008; Frank and Goyal, 2009). Thus, the market-to-book ratio is an important determinant for firm leverage. Hovakimian, Opler and Titman (2001), show that firms are influenced by the industry average when adjusting their capital structure. Further, the ratio of tangible assets to total assets has been shown to have a strong relationship with leverage, as creditors will have an improved guarantee of repayment (Drobetz and Wanzenried., 2006; Titman and Wessels, 1988; Rajan and Zingales, 1995; Fama and French, 2002). The effect of profitability on leverage has also been well established. Firms with higher profits are prone to lower levels of leverage in line with the pecking order theory, where firms prefer internally generated funds for financing over externally generated funds. Size has also shown a clear relationship with leverage, as large firms are more diversified and tend to fail less often (Titman and Wessels, 1988).

In our target leverage estimation, we follow the findings of Frank and Goyal (2009) and Marchica and Mura (2010) who show that the most reliably important factors for explaining leverage are:

1. median industry leverage
2. market-to-book asset ratio
3. tangibility (net property, plant and equipment divided by total assets)
4. profitability (EBIT divided by total assets)
5. log of assets
6. expected inflation

The choice of factors is backed by several studies. We conduct a quarterly cross-sectional regression on the full data panel and assign a fitted value for target leverage each firm period. Following Zhou et al (2016), we specify the model in the following way:

$$L_{i,t}^{*} = \beta X_{i,t-1} + \varepsilon_{i,t} \tag{11}$$

where $X_{i,t-1}$ contains our six chosen variables, lagged by one quarter. The target leverage determinants are regressed on our chosen measure of leverage ratio, as defined in the section above.

For each firm period we now construct our measure of target leverage deviation, L^{dev}, defined as:

$$L^{dev} = \left(L_{i,t} - L_{i,t}^{*}\right) \tag{12}$$

where $L_{i,t}$ is our chosen measure of leverage ratio L_{TDM} and $L_{i,t}^{*}$ is the fitted value from running a regression following Equation (11). Firms with a positive (negative) L^{dev} are above (below) their optimal leverage ratio and thus overleveraged (underleveraged).

3.4 Estimation of Cost of Equity

The cost of equity is estimated using a direct approach through various valuation models, ranging from the simpler models based on the price-to-earnings ratio to more sophisticated methods based on the residual income valuation model. The inputs are ex-ante derived from the combination of current stock price, analyst forecasts of earnings and dividends as well as assumptions on future growth rates and profitability (Dhaliwal et al. 2006; Attig, Guedhami and Mishra, 2008; Hou, van Dijk and Zhang, 2012; Zhou et al., 2016). Using ex-post realized returns as a proxy for expected returns has been shown previously to be imprecise (e.g., Blume and Friend, 1973; Sharpe, 1978; Elton, 1999). This includes asset based pricing models such as the CAPM and the more exhaustive Fama and French (1993) multi-factor model. Not surprisingly, the trend in current research has been in favor of the direct ex-ante approach. The different models used are debated on their accuracy, e.g. the intricate model defined by Gebhardt, Lee and Swaminathan (2001) is argued by Guay, Kothari and Shu (2011) to be the most precise model, while Botosan and Plumlee (2005) find the model less related to estimates of the expected return. Following previous research, we use the arithmetic average of five estimates of the levered cost of equity, r_E^L, to reduce the uncertainty in which model that is most appropriate and to limit the effect of invalid results. (Dhaliwal et al., 2006; Attig et al., 2008; Jäckel, 2014). The estimates used are labeled the following way:

1. r_{OJ} (Ohlson and Juettner-Naeroth, 2005)
2. r_{PE} (Gordon and Gordon, 1997)
3. r_{PEG} (Easton, 2004)
4. r_{MPEG} (Easton, 2004)
5. r_{GLS} (Gebhardt et al., 2001)

For a full description and definitions of the various methods, refer to Appendix Table 1.

3.5 Estimation of Sensitivity of Cost of Equity to Target Leverage Deviation

The measure of sensitivity of cost of equity to target leverage deviation, according to section 2.2.1, is estimated using a direct method. Alternative methods of estimating the sensitivity measure would include using an indirect method by running a regression mimicking Equation (6) for each firm separately. However, the number of periods per firm is only 35 in our final panel, meaning that the number of observations for each regression would be low. We therefore choose to follow the method employed by Zhou et al. (2016) who use a direct method for calculating the sensitivity of cost of equity to target leverage deviation, defined as:

$$\theta = (r_E^U - r_D) \times (1 - \mathrm{T}_c) \tag{5}$$

where θ is our measure of sensitivity of cost of equity to target leverage deviation, r_D is the estimated cost of debt[6], T_c is the corporate tax rate[7], and r_E^U as our measure of the unlevered cost of equity capital, defined as:

$$r_E^U = \frac{(r_E^L + r_D \times (1 - \mathrm{T}_c) \times L_{TDM})}{(1 + (1 - \mathrm{T}_c) \times L_{TDM})} \tag{13}$$

where L_{TDM} is our measurement of firm leverage according to section 3.2, and r_E^L is our measure of the backed out cost of equity from section 3.4.

[6] The cost of debt, r_D, is approximated using the interest cost for the period divided by interest-bearing debt. More sophisticated methods to estimate the cost of debt include using specific yields spreads for each firm, and applying a risk free rate, approximated using government bills with appropriate maturities. However, since a majority of the firms in our sample have no corporate bonds outstanding, our simplified method of backing out r_D gives better coverage and allows us to apply the same estimation method for all firms in our data set.

[7] We assume that the statutory tax rate for the country of domicile is the corporate tax rate due.

4. Methodology

In section 4.1 we describe how to test if cost of equity is sensitive to target leverage deviation (H1). Section 4.2 concerns how we test if firms with higher sensitivity of cost of equity to target leverage deviation show signs of higher SOA (H2). In section 4.3 we explain how we test if higher bond usage can explain a higher SOA (H3). Lastly, in section 4.4 we address the biases in testing that our methods potentially introduce.

4.1 Testing Hypothesis 1

We conduct one main test for each of our three hypotheses. Starting with H1, we want to measure the effect of leverage deviation on implied cost of equity, r_E^L. We predict a positive relationship between L^{dev} and implied cost of equity. An increase in L^{dev} is interpreted differently depending on if a firm is over- or underleveraged. When L^{dev} increases, it implies an increase in deviation from target leverage for the overleveraged firms, while it implies a decrease in deviation from target leverage for the underleveraged firms. It is reasonable the predicted relationship will be more apparent in the overleveraged subset, since these firms already have taken on more debt than optimal. The market might therefore react more strongly when this subset increases their leverage, deviating even further away from optimal levels. Following Zhou et al. (2016), we therefore split our data set into two subsets based on if L^{dev} is positive or negative. We use the following regression specification to test the relationship:

$$r_{E_{i,t}}^L = \alpha + \gamma L_{i,t-1}^{dev} + \omega X_{i,t-1} + \varepsilon_{i,t} \tag{14}$$

The theoretical base of Equation (14) is the relationship between cost of equity and target leverage deviation shown in Equation (6). The coefficient of interest in Equation (14) is γ, which estimates the impact L^{dev} has on the implied cost of equity, r_E^L. Thus, γ indicates whether Equation (6) holds in our data set or not. By studying γ we can answer if Hypothesis 1 holds and if θ as a direct measure of sensitivity makes sense (observe that γ is only used to answer H1 and not used to construct θ). Our hypothesis predicts a positive sign, which would indicate that an increase in deviation from target leverage has a positive effect on the cost of equity. In order to reduce the risk of reversed causality, we lag both the explanatory variable and the control variables by one quarter. This way we limit the effect of leverage adjustments made as a response to high cost of equity, which would distort our analysis, since we are interested in the opposite causation. To reduce bias in γ we include control variables known to affect cost of equity and which might also be correlated with target leverage deviation. Previous literature gives a range of factors that could be included in our specification. We choose to include stock price volatility, stock price momentum, bias in analyst forecasts, book-to-market ratio and the market value of equity. Further examples of potential control variables are plenty (Fama and French, 1992; Chen, Chen and Wei, 2009; Boubakri, Guedhami, Mishra and Saffar, 2012; Attig et al., 2008; Davis, Fama and French, 2000; Wang, 2015). Zhou et al (2016) try several sets of control variables for testing the same relationship on U.S. data, all with similar results. In their baseline regression they include, in addition to our control variables, a liquidity measure as well as a proxy for analyst forecast dispersion. However, these variables prove to be statistically insignificant in their regression. Therefore, we deem the potential bias due to their omission to be small (see a detailed definition of control variables in Appendix Table 2).

Before testing H1, we also make sure our data follows the well-established pattern where leverage ratio is positively correlated with cost of equity. We test this using the following model specification:

$$r^L_{E_{i,t}} = \alpha + \rho L^{TDM}_{i,t-1} + \omega X_{i,t-1} + \varepsilon_{i,t} \tag{15}$$

We use L^{TDM} as our measure of leverage and the chosen control variables for this regression are the same as for the model specification in (14). In line with previous research (Modigliani and Miller, 1963), we predict a positive sign for ρ.

4.2 Testing Hypothesis 2

Our second hypothesis states that firms with a higher sensitivity, θ, will have a higher SOA. To test this, we use a two stage procedure to measure the effect of $(L^*_{it} - L_{it-1})$ on $(L_{it} - L_{it-1})$. That is, we regress the adjustment made between period $t = -1$ and $t = 0$ on the gap between actual leverage in period $t = -1$ and the target leverage in period $t = 0$. For target leverage, L^*_{it}, we use the fitted value from our target leverage regression. See Equation (11). In recent research, many papers choose to estimate the target leverage and the SOA simultaneously, in a one-step procedure. However, following several studies (Fama and French, 2002; Kayhan and Titman, 2007; Faulkender et al., 2012; Mukherjee and Wang, 2013), we choose to estimate target leverage separately and use this result in the estimation of SOA. We use the following model specification for testing Hypothesis 2:

$$(L_{it} - L_{it-1}) = \psi(L^*_{it} - L_{it-1}) + \varepsilon_{i,t} \tag{16}$$

The coefficient ψ measures the adjustment speed between two periods. That is, if the adjustment of leverage between period $t = -1$ and $t = 0$ is equal to the gap between the leverage ratio in period $t = -1$ and target leverage ratio in period $t = 0$, the adjustment is full and $\psi = 1$. If the adjustment is less than full, ψ will be lower than 1. To test if our hypothesis holds, we run the regression on quartiles of our data set, based on the firms' sensitivity of cost of equity to target leverage deviation, θ. This sensitivity is estimated directly for each observation according to Equation (5) (See section 3.5). To prove our hypothesis, we should find that the quartile with the most sensitive firms experience a higher SOA. We therefore predict ψ to be the highest for quartile 4, second highest for quartile 3 and so on. To increase the robustness of our test we also run a regression on the full data panel, following a modified model where we add a dummy and an interaction term "SensDummy". This dummy is equal to 1 if an observation is included in the quartile of the most sensitive firms. This gives us the following:

$$(L_{it} - L_{it-1}) = \psi(L^*_{it} - L_{it-1}) + v_0 SensDummy + v_1 SensDummy * (L^*_{it} - L_{it-1}) + \varepsilon_{i,t} \tag{17}$$

In this regression, the coefficient υ_1 is of interest. We expect a positive sign, which would give us the additional SOA implied by being included in the most sensitive quartile of our data panel.

4.3 Testing Hypothesis 3

Our third and final hypothesis states that firms with a higher reliance on bond financing will experience a higher SOA, in line with findings in previous research that indicate a higher SOA in countries with a market-based system, where bond financing makes up a larger share of firms' debt financing. Hypothesis 3 is based on the idea that high bond usage is a proxy for firms being more market-based, even though they operate in the bank-based Nordic system. Thus, we divide our data panel into quartiles in the same manner as when testing Hypothesis 2, but instead based on the reliance on bonds. We use the model specification in Equation (16) to test whether the firms in the quartile with the most bond financing experience a higher SOA. We predict a positive relationship between the reliance on bonds and the SOA. Again, we also add a dummy variable "BondDummy" to analyze the impact of being in the quartile with the highest bond reliance. Adding this to Equation (16) yields:

$$(L_{it} - L_{it-1}) = \psi(L_{it}^{*} - L_{it-1}) + \upsilon_0 BondDummy + \upsilon_1 BondDummy * (L_{it}^{*} - L_{it-1}) + \varepsilon_{i,t} \quad (18)$$

As in the section above, ψ measures the SOA and we expect it to be positive. The coefficient υ_1 will be positive and significant if reliance on bonds has a positive effect on SOA. When we run a regression following Equation (18), we use the full data panel to find the impact of belonging to the quartile with largest bond reliance.

4.4 Potential Biases in Testing

For the models specified in Equation (16) through (18), there are risks of econometric biases. Flannery and Hankins (2013) conclude that when estimating SOA, an appropriate model specification must include a lagged dependent variable that controls for the past period's leverage level. However, when including both fixed effects and a lagged dependent variable we introduce a potential bias that can be substantial. This is particularly true for short panels. Flannery and Hankins show that estimates of SOA increases drastically when the number of observations fall below 30, as the correlation between the lagged dependent variable and the regression error term increases with fewer observations. There are several ways to adjust for these biases to retrieve more reliable SOA estimates (Arellano and Bond, 1991, Blundell and Bond, 1998, and others). However, Flannery and Hankins claim that in the presence of endogenous regressors and second-order serial correlation, the alternative techniques are compromised. If these problems are substantial, the fixed effects estimator is often the most reliable technique. The authors also conclude that the fixed effects estimator is superior for dependent variable clustering. The great disadvantage of the fixed effects estimator is its sensitivity to panel length and imbalance in the panel. However, as we employ a balanced panel with 35 periods, we deem the fixed effects estimator to yield trustworthy results for our tests. Keeping the potential disadvantages in mind, we still choose to rely on a fixed effects model for our study.

5. Discussion of Results

In section 5.1, we first present a description of our data and constructed variables. Section 5.2 includes the results of our target leverage regression. Section 5.3 includes the results from running a regression of cost of equity on target leverage deviation as well as on actual leverage levels, for the full data sample as well as on industries separately (H1). Section 5.4 and section 5.5 present the results from our SOA regressions, where we test H2 and H3 in each section respectively.

5.1 Data Description

In this section, we outline summary statistics of our main variables used for testing. In Table 3 we present descriptive statistics for all our variables used. The variables have distributions similar to previous research, where especially the control variables show a large dispersion. Interesting to note is the existence of observations with negative sensitivity of cost of equity to target leverage deviation. This is in contrast to the assumption of $\theta > 0$ which was shown imperative for Hypothesis 1 to hold, which predicts a positive relationship between changes in target leverage deviation and cost of equity (see section 2.3). As expected in the bank-based economies of the Nordics, bonds as a share of total liabilities is low (median of 2.2%).

Table 3. Data sample descriptive statistics

Variables	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	# of Obs.
Main variables								
Leverage (L_{TDM})	28.2%	21.0%	0.1%	11.4%	23.5%	40.7%	83.8%	4,970
Target leverage (L^*)	28.3%	19.1%	0.0%	13.5%	25.1%	39.1%	77.5%	4,970
Leverage deviation (L^{dev})	-0.1%	7.4%	-66.8%	-4.3%	-0.3%	3.7%	40.3%	4,970
Levered cost of equity (r_E^L)	10.8%	4.0%	1.9%	8.3%	10.1%	12.4%	33.9%	4,970
Sensitivity (θ)	3.8%	3.9%	-103.7%	2.6%	3.9%	5.2%	22.3%	4,970
Other variables & control variables								
Industry leverage (L_{ind})	23.8%	15.7%	0.2%	14.4%	22.9%	31.5%	67.9%	4,970
Market-to-book ratio	126.3%	76.1%	42.4%	78.6%	102.2%	149.2%	480.1%	4,970
Tangibility of assets	30.4%	26.1%	0.4%	9.6%	22.7%	43.5%	98.4%	4,970
Profitability	8.5%	6.3%	-6.5%	4.8%	7.5%	11.4%	31.7%	4,970
Size (log of total assets)	9.4	1.4	6.3	8.4	9.5	10.2	12.6	4,970
Expected inflation	1.2%	1.2%	-0.5%	-0.1%	1.2%	2.2%	3.4%	4,970
Stock price volatility	3.5%	1.5%	1.5%	2.4%	3.1%	4.0%	9.8%	4,970
Stock price momentum	2.5%	19.0%	-47.9%	-8.4%	2.2%	13.2%	61.1%	4,970
Analyst forecast bias	38.1%	77.3%	-362.6%	21.0%	32.5%	50.5%	444.2%	4,970
Log of B-to-M ratio	-61.5%	70.9%	-235.2%	-110.5%	-62.9%	-12.3%	105.2%	4,970
Log of MV of equity	9.3	1.5	6.2	8.3	9.2	10.3	13.0	4,970
Bonds' % of total liab.	9.6%	13.2%	0.0%	0.0%	2.2%	15.8%	76.8%	4,970

Descriptive statistics for the data sample is presented above. The table describes the range of values for our main variables, control variables and other variables.

In Table 4, we show the correlation coefficients for the target leverage input variables. The correlation coefficients are low across the board, mirroring previous research, with a low risk for multicollinearity. In similarity to the results of Zhou et al. (2016), the profitability variable has a high correlation with the market-to-book ratio (66.3%). This is expected since profitability is closely related to return on equity, which is one of the drivers of the market-to-book ratio[8]. Further, tangibility is highly correlated to industry median leverage. This can be explained by the fact that the two industries with lowest leverage in our sample are Healthcare and Information Technology (characterized by large human capital or intangible assets on the balance sheet) while the two industries with the highest leverage are Real Estate and Energy (which are industries with large tangible assets). For statistics on target leverage by industry, see Appendix Table 4.

Table 4. Correlation coefficients for the inputs to the target leverage regression

	Inflation	Market-to-book	Tangibility	Profitability	Size
Market-to-book ratio	-5.0%				
Tangibility of assets	0.2%	-14.9%			
Profitability	12.7%	66.3%	-15.6%		
Size (log of total assets)	-1.8%	-21.0%	17.1%	-10.8%	
Industry leverage (L_{ind})	4.9%	-35.4%	62.5%	-21.9%	27.7%

Correlation coefficients for the inputs to the target leverage regression are presented above.

As mentioned in section 3.4, we use the arithmetic average of five estimates of r_E^L to limit the effect of invalid results. In Table 5 below, the descriptive statistics for these estimates are shown. Our final measure of r_E^L has a median of 10.1% and a standard deviation of only 4.0%, which is in line with previous research (Easton and Monahan, 2005; Botosan, Plumlee and Wen, 2011; Zhou et al. 2016).

Table 5. Cost of equity descriptive statistics

Cost of equity method	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	# of Obs.
r_{OJ}	10.6%	3.5%	3.3%	8.2%	10.0%	12.3%	24.9%	4,344
r_{PE}	8.5%	4.9%	0.0%	6.0%	7.7%	9.8%	36.3%	4,970
r_{PEG}	13.3%	5.1%	4.1%	9.9%	12.4%	15.7%	34.8%	4,278
r_{MPEG}	12.0%	6.5%	2.6%	8.0%	10.5%	14.0%	41.3%	4,650
r_{GLS}	9.5%	3.3%	3.8%	7.4%	8.9%	11.1%	23.9%	4,948
r_E levered	**10.8%**	**4.0%**	**1.9%**	**8.3%**	**10.1%**	**12.4%**	**33.9%**	**4,970**

Descriptive statistics for the cost of equity measure is presented above. The table describes the range of values for our five cost of equity estimates as well as for our final average measure used in the analysis.

In Table 6 the correlation coefficients for the different cost of equity estimates are presented. The OJ and PEG, and MPEG measures are the most interdependent, and also highly correlated with the final measure of cost of equity. Thus, these three estimates are the most influential for our final cost of equity estimate.

[8] The market-to-book ratio for a stable growth firm can be expressed as: $\frac{ROE-g}{r_E-g}$ (Varaiya, Kerin and Weeks, 1987; and others).

Table 6. Cost of equity correlation coefficients

	r_{OJ}	r_{PE}	r_{PEG}	r_{MPEG}	r_{GLS}
r_{PE}	44.5%				
r_{PEG}	97.3%	34.5%			
r_{MPEG}	89.4%	22.2%	96.3%		
r_{GLS}	56.8%	65.4%	55.0%	53.8%	
r_E levered	**94.4%**	**65.4%**	**94.8%**	**86.4%**	**79.2%**

Correlation coefficients for the cost of equity estimates are presented above, including how the final measure correlates with the five estimates.

5.2 Target Leverage

Table 7 summarizes the results from our target leverage regression, using Equation (11). As our dependent variable we use the leverage measure L_{TDM}. We lag all explanatory variables to reduce the risk of reversed causality. In this regression, we include both firm and time fixed effects. Standard errors are clustered to correct for autocorrelation. We find that median industry leverage, tangibility, size and expected inflation have a positive effect on leverage, whereas market-to-book ratio and profitability have a negative effect. All variables used are statistically significant with p-values well below 5%. Both R^2 and adjusted R^2 are close to 0.87, which confirms that our model specification does a good job in predicting leverage level. These results echo the findings of previous literature (Frank and Goyal, 2009; Marchica and Mura, 2010; Zhou et al., 2016).

Table 7. Target leverage regression

	Dependent variable: L_{TDM}	*Consistent sign w/ literature?*	*Source*
Industry leverage (L_{ind})	0.388***	Yes	Frank and Goyal (2009),
	(0.068)		Marchica and Mura (2010)
Market-to-book ratio	-0.046***	Yes	Frank and Goyal (2009),
	(0.010)		Marchica and Mura (2010)
Tangibility of assets	0.173***	Yes	Frank and Goyal (2009),
	(0.062)		Marchica and Mura (2010)
Profitability	-0.567***	Yes	Frank and Goyal (2009),
	(0.079)		Marchica and Mura (2010)
Size (log of total assets)	0.062***	Yes	Frank and Goyal (2009),
	(0.017)		Marchica and Mura (2010)
Inflation	1.717**	Yes	Frank and Goyal (2009),
	(0.783)		Marchica and Mura (2010)
Constant	-0.406**		
	(0.168)		
Observations	4,970		
R^2	0.873		
Adjusted R^2	0.869		
F Statistic	183.604***		
	(df = 180; 4789)		
	(p = 0.000)		
Note:	*p<0.1; **p<0.05; ***p<0.01		

The results for the target leverage regression are presented above (Eq. 11). Both period and firm fixed effects are included. The dependent variable is the firms' leverage level (L_{TDM}). The independent variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis. The third column indicates if the signs of the coefficients are in line with previous literature, and column 4 displays examples of sources for previous studies.

Our estimate of target leverage for each firm period is the fitted value using this regression. We find that the target leverage for the median firm is above actual leverage levels for the median firm, indicating that firms in our data set are on average somewhat underleveraged. We take the difference between actual leverage level, L_{TDM} and the estimated target leverage to find L^{dev}. Thus, a positive (negative) target leverage deviation implies overleverage (underleverage). Our data seems to be in line with previous studies that find that many firms hold leverage levels below their optimum level (Miller, 1977; Graham, 2000; Korteweg, 2010). Table 8 summarizes the target leverage over time for the full data set. In this table we can see a clear increase in leverage around the time of the financial crisis. As our measure of leverage is market based, leverage levels are driven by both actual debt levels and market value of equity. During a time such as the financial crisis, market values tend to fall and market measures of leverage increase. Thus the observed pattern in our target leverage measures is justified.

Table 8. Target leverage by period

Period	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	# of Obs.
FQ2 2007	20.4%	18.0%	0.0%	4.7%	16.2%	31.7%	72.7%	142
FQ3 2007	21.6%	18.4%	0.0%	6.5%	17.4%	32.8%	74.9%	142
FQ4 2007	23.5%	18.7%	0.0%	8.2%	19.1%	34.6%	71.1%	142
FQ1 2008	25.2%	19.0%	0.0%	9.9%	20.1%	37.6%	72.7%	142
FQ2 2008	28.4%	18.7%	0.0%	12.8%	23.8%	40.9%	73.5%	142
FQ3 2008	33.0%	19.2%	0.0%	17.7%	28.6%	45.5%	77.5%	142
FQ4 2008	40.6%	18.9%	5.5%	25.5%	36.5%	53.3%	77.5%	142
FQ1 2009	41.2%	18.4%	10.7%	26.6%	38.0%	53.8%	77.5%	142
FQ2 2009	36.1%	18.6%	4.7%	21.8%	33.5%	46.8%	77.5%	142
FQ3 2009	30.6%	18.6%	0.0%	16.7%	28.1%	40.6%	77.5%	142
FQ4 2009	27.8%	18.4%	0.0%	13.4%	24.4%	37.1%	77.5%	142
FQ1 2010	26.0%	18.2%	0.0%	11.9%	22.2%	35.2%	77.5%	142
FQ2 2010	28.0%	18.5%	0.0%	13.9%	24.9%	37.1%	77.5%	142
FQ3 2010	25.3%	18.8%	0.0%	10.5%	22.1%	35.8%	77.5%	142
FQ4 2010	23.5%	18.2%	0.0%	9.0%	20.1%	33.0%	77.5%	142
FQ1 2011	23.9%	18.7%	0.0%	8.4%	20.7%	33.5%	76.5%	142
FQ2 2011	26.2%	18.7%	0.0%	11.8%	23.7%	35.9%	77.5%	142
FQ3 2011	31.5%	19.3%	0.1%	16.7%	28.4%	41.1%	77.5%	142
FQ4 2011	30.6%	19.3%	0.3%	16.2%	27.5%	41.1%	77.5%	142
FQ1 2012	28.7%	19.0%	0.0%	13.3%	26.5%	38.8%	77.5%	142
FQ2 2012	31.4%	19.1%	0.0%	16.4%	29.7%	41.7%	77.5%	142
FQ3 2012	30.6%	18.9%	0.0%	15.5%	28.3%	40.8%	77.5%	142
FQ4 2012	30.1%	18.7%	0.0%	15.7%	27.8%	40.2%	77.5%	142
FQ1 2013	28.8%	18.6%	0.0%	13.8%	25.4%	38.6%	77.5%	142
FQ2 2013	30.0%	18.5%	0.0%	14.8%	27.0%	39.8%	77.5%	142
FQ3 2013	28.1%	18.2%	0.0%	13.0%	25.5%	37.8%	77.5%	142
FQ4 2013	26.5%	18.7%	0.0%	12.7%	22.8%	37.0%	77.5%	142
FQ1 2014	26.0%	18.3%	0.0%	12.1%	22.8%	35.5%	76.6%	142
FQ2 2014	25.8%	18.5%	0.0%	11.5%	22.8%	35.6%	77.5%	142
FQ3 2014	27.4%	18.6%	0.0%	13.7%	24.4%	37.6%	77.5%	142
FQ4 2014	27.4%	18.5%	0.0%	13.6%	25.1%	38.0%	77.5%	142
FQ1 2015	26.0%	18.6%	0.0%	11.4%	23.5%	37.4%	77.5%	142
FQ2 2015	27.2%	19.0%	0.0%	13.2%	24.6%	39.2%	77.5%	142
FQ3 2015	28.1%	19.0%	0.0%	14.4%	25.3%	38.7%	77.5%	142
FQ4 2015	26.2%	19.4%	0.0%	11.8%	22.2%	38.2%	77.5%	142
Total	**28.3%**	**19.1%**	**0.0%**	**13.5%**	**25.1%**	**39.1%**	**77.5%**	**4,970**

Descriptive statistics for target leverage by period are presented above. The table describes the range of values for target leverage for each period of our sample data.

5.3 Sensitivity of Cost of Equity to Target Leverage Deviation (H1)

To be able to answer H1 truthfully, section 5.3 includes the results from running a regression of cost of equity on target leverage deviation as well as on actual leverage levels. In section 5.3.1 this is performed for the full data sample, and in section 5.3.2 for the industries separately.

5.3.1 Sensitivity of Cost of Equity to Target Leverage Deviation for the Full Sample

Before testing Hypothesis 1, we run a regression following Equation (15) to make sure our data follows the well-established pattern where cost of equity increases with leverage levels. Results from the regression are presented in Table 9. We find that L_{TDM} indeed has a positive effect on cost of equity, which is consistent with

Table 9. Regressing cost of equity on leverage

	Dependent variable:
	r_E^L
Leverage (L_{TDM})	0.034**
	(0.014)
Stock price volatility	0.00002
	(0.000)
Stock price momentum	-0.021***
	(0.003)
Analyst forecast bias	0.007***
	(0.001)
Log of book-to-market ratio	0.007
	(0.007)
Log of market value of equity	-0.007
	(0.007)
Constant	0.129**
	(0.060)
Observations	4,970
R2	0.648
Adjusted R2	0.635
F Statistic	48.706***
	(df = 181; 4788)
	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01

The results from regressing the cost of equity on leverage are presented above (Eq. 15). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable (L_{TDM}) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

previous literature (Modigliani and Miller, 1963). The coefficient on L_{TDM} is significant below the 5% level and indicates that a one percentage point increase in leverage implies a 0.034 percentage unit increase in cost of equity. This confirms that our data follows predicted patterns. This makes us more confident that our measures of leverage and cost of equity are well designed and that the potential error in measurement is low.

Next, we run a regression following the model specified in Equation in (14) to test Hypothesis 1. Table 10 summarizes our results. We split the data set into two groups based on if the firms are over- or underleveraged. This is to facilitate the analysis of target leverage deviation and its effect on cost of equity, since an increase in target leverage deviation for an overleveraged firm means a step away from target leverage, whereas the opposite relation is true for underleveraged firms.

Table 10. Regressing cost of equity on target leverage deviation

	Dependent variable:	
	r_E^L	
	Underleveraged firms	*Overleveraged firms*
Leverage deviation (L^{dev})	-0.002	0.044
	(0.025)	(0.028)
Stock price volatility	-0.00004	0.00000
	(0.000)	(0.0001)
Stock price momentum	-0.018***	-0.022***
	(0.005)	(0.004)
Analyst forecast bias	0.010***	0.005***
	(0.002)	(0.001)
Log of book-to-market ratio	0.014*	0.003
	(0.008)	(0.007)
Log of market value of equity	-0.004	-0.009
	(0.010)	(0.007)
Constant	0.117	0.157**
	(0.089)	(0.064)
Observations	2,554	2,416
R2	0.659	0.699
Adjusted R2	0.634	0.675
F Statistic	25.382***	28.694***
	(df = 181; 2372)	(df = 181; 2234)
	(p = 0.000)	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01	

The results from regressing the cost of equity on target leverage deviation are presented above (Eq. 14). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable (L^{dev}) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

The left hand side of Table 10 shows our results from regressing the underleveraged subsample while the right hand side of the table shows the results for the overleveraged subsample. For both the subsets, target leverage deviation, L^{dev}, seems to have no effect on cost of equity. In this regression we adjust our standard errors for autocorrelation, and retrieve p-values far above acceptable levels. The overleveraged subsample has the expected sign, and p-values are lower compared to the underleveraged subsample (13% vs 93%). This means, our overleveraged subset is close to show significance. The positive sign is in line with our expectations, and indicates that increases in target leverage deviation has a positive effect on cost of equity for overleveraged firms. However, the test result is still weak. In order to avoid making a type 1 error, we are inclined to reject Hypothesis 1, which states that target leverage deviation, L^{dev}, is positively related to cost of equity. Since p-values are rather low for the overleveraged subsample, we perform robustness tests in section 6 to ensure we do not make a type 2 error.

5.3.2 Sensitivity of Cost of Equity to Target Leverage Deviation for Industries Separately

Before making a definite rejection of H1, due to p-values being close to significant (13% for overleveraged firms), we continue to make the same regression on subsets for each industry in our panel to make sure there are no differences between industries. We start by regressing actual leverage level L_{TDM} on cost of equity to find if leverage affects cost of equity more in some industries than others. For brevity we only report the regression results from the industry with lowest (Healthcare) and highest (Real Estate) median leverage in our timeframe. These results are presented in Table 11.

Table 11. ***Healthcare & Real Estate:*** *Regressing cost of equity on leverage*

	Dependent variable:	
	r_E^L	
	Healthcare	*Real Estate*
Leverage (L_{TDM})	0.058**	-0.01
	(0.025)	(0.014)
Stock price volatility	-0.00001	0.0001
	(0.000)	(0.000)
Stock price momentum	-0.010***	-0.0002
	(0.004)	(0.007)
Analyst forecast bias	0.0003	0.007**
	(0.002)	(0.003)
Log of book-to-market ratio	0.016*	0.019**
	(0.010)	(0.008)
Log of market value of equity	0.018	0.004
	(0.013)	(0.006)
Constant	-0.073	0.028
	(0.107)	(0.060)
Observations	455	315
R2	0.596	0.542
Adjusted R2	0.543	0.459
F Statistic	11.389***	6.556***
	(df = 52; 402)	(df = 48; 266)
	(p = 0.000)	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01	

The results from regressing the cost of equity on leverage in the healthcare and real estate industry are presented above (Eq. 15). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable (L_{TDM}) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

We find that firms in the low leverage industry has a clear relationship between leverage levels and cost of equity. The coefficient is significant below the 5% level and shows that a one percentage point increase in leverage implies a 0.058 percentage point increase in cost of equity. This effect is larger compared to the full sample where the coefficient was 0.034. Looking at the high leverage industry instead, we find no statistically significant effect of leverage level on cost of equity. When considering the features of these industries the result makes sense. The Real Estate industry is characterized by large tangible assets and low risk operations. An increase in leverage will therefore be less worrying for the investors who might not adjust their required rate of return considerably. The Healthcare industry is characterized by high risk assets such as patents and immaterial assets. Operations are thus riskier and an increase in leverage might very well be met by increased required rate of return from investors. Therefore, analyzing the effect of target leverage deviation on cost of equity on separate industries makes sense, as investors might react differently to target leverage deviation, depending on in which industry the company operates. However, when we continue and analyze the effect of L^{dev} on cost of equity we still find no meaningful results that are in line with our Hypothesis 1, and this does not differ depending on which industry we observe.

Table 12. ***Healthcare & Real Estate:*** *Regressing cost of equity on target leverage deviation*

	Dependent variable:			
	r_E^L			
	Healthcare		*Real Estate*	
	Underleveraged firms	*Overleveraged firms*	*Underleveraged firms*	*Overleveraged firms*
Leverage deviation (L^{dev})	0.041	0.01	0.027*	-0.141**
	(0.031)	(0.097)	(0.016)	(0.061)
Stock price volatility	-0.00003	-0.00010	-0.0003	0.00020
	(0.000)	(0.0002)	(0.000)	(0.0003)
Stock price momentum	-0.003	-0.001	-0.005	0.003
	(0.005)	(0.006)	(0.015)	(0.011)
Analyst forecast bias	0.002	-0.003	0.005*	0.008*
	(0.001)	(0.005)	(0.003)	(0.005)
Log of book-to-market ratio	0.015*	0.019**	0.025***	0.015
	(0.007)	(0.009)	(0.007)	(0.016)
Log of market value of equity	0.013	0.015	0.016**	-0.012
	(0.008)	(0.012)	(0.008)	(0.009)
Constant	-0.037	-0.023	-0.087	0.175*
	(0.073)	(0.102)	(0.073)	(0.089)
Observations	220	235	149	166
R2	0.776	0.526	0.678	0.643
Adjusted R2	0.706	0.39	0.533	0.496
F Statistic	11.132***	3.881***	4.679***	4.389***
	(df = 52; 167)	(df = 52; 182)	(df = 46; 102)	(df = 48; 117)
	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01			

The results from regressing the cost of equity on target leverage deviation in the healthcare and real estate industry are presented above (Eq. 14). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable (L^{dev}) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

Table 12 summarizes our results from regressing the cost of equity on L^{dev}. Again, we only include the same two industries for brevity. We see that the regression gives no statistically significant results for the healthcare industry. However, for the highly leveraged real estate firms, we find that L^{dev} has a positive and statistically significant effect on cost of equity for the underleveraged subset. For the subset of overleveraged real estate firms, we find the opposite relationship. This would imply that overleveraged real estate firms would see a decrease in cost of equity, the further they deviate from their target. This is in stark contrast to our hypothesis and findings of previous research. The inconclusiveness of the tests presented in Table 12 in combination with the low p-values in Table 10 force us to reject our Hypothesis 1. In section

6.3 we employ an alternative and simplified measure of target leverage deviation for robustness testing. This is in order to see if the market is less sophisticated in setting their target leverage and if this measure can better capture investors' adjustments of required rate of return. Unfortunately, the results are in line with our main tests.

The rejection of Hypothesis 1 is in contrast to both results of previous literature as well as our own expectations. While it is difficult to determine the true reason for why this finding differs in a Nordic context, we can confirm that geographical setting indeed seems to matter. One explanation might lie in the way investors set their required rate of return and how they define over- and underleverage. If U.S. and Nordic investors differ in this regard, it is reasonable that we find no meaningful results in our tests. Our proxies have their origin from studies on U.S. data and might be unfit for the Nordic market. How investors analyze leverage and set the required rate of return falls outside of our scope, but would be valuable knowledge and a potential topic for future research.

5.4 Speed of Adjustment and Sensitivity of Cost of Equity (H2)

We estimate the SOA by setting the leverage change from one period to the next as our dependent variable and potential full adjustment to the theoretical target leverage level as our independent variable (See Eq. 16). Looking at the full sample, we observe an SOA of 21.5%. Thus, for every period, each firm in our data set adjusts their leverage level by 21.5% on average. Graham and Leary (2011) present a table of various SOA estimates, where our result is in the lower end, compared to other fixed effects estimations, but overall in the span of reasonable adjustment speeds (see Table 13).

Table 13. Comparison of SOA estimates (Graham and Leary, 2011)

	OLS	GMM/IV	Fixed effects	Alternatives
Fama and French (2002)	9 - 18%			
Flannery and Rangan (2006)	13%	34%	38%	
Kayhan and Titman (2007)	10%			
Lemmon, Roberts and Zender (2008)	17%	25%	39%	
Huang and Ritter (2009)		17%		
Elsas and Florysiak (2010)				26%
Iliev and Welch (2010)				<0%
Zhou et al. (2016)			25%	
Hedman and Lüning (2016)			**22%**	

The table above has its origin in Graham and Leary's 2011 article. It presents a comparison of speed of adjustment (SOA) estimates from recent publications. SOA is presented as a share of the actual leverage adjustment from t-1 to t compared to what a full adjustment to the target leverage would entail. Further, the estimates in the article by Zhou et al. (2016), as well as our results, are added by us.

To analyze if firms with cost of equity more sensitive to target leverage deviation have a higher SOA, we divide the panel into four quartiles, ranging from the most sensitive to the least sensitive, using the sensitivity measure derived in Equation (5) in section 2.2.1. The results are shown in Table 14.

Table 14. Regressing speed of adjustment on quartiles divided by the sensitivity measure θ

	Dependent variable:					
	Actual leverage adjustment $(L_{it} - L_{it-1})$					
	Full sample	*Q1 sensitivity*	*Q2 sensitivity*	*Q3 sensitivity*	*Q4 sensitivity*	*Full sample w/ dummy*
Full adjustment $(L^*_{it} - L_{it-1})$	0.215***	0.320***	0.289***	0.187***	0.226***	0.218***
	(0.030)	(0.083)	(0.043)	(0.045)	(0.038)	(0.038)
Sens dummy	n.a.	n.a.	n.a.	n.a.	n.a.	0.015***
	n.a.	n.a.	n.a.	n.a.	n.a.	(0.003)
Sens dummy x Full adjustment	n.a.	n.a.	n.a.	n.a.	n.a.	0.007
	n.a.	n.a.	n.a.	n.a.	n.a.	(0.047)
Constant	-0.003	0.095***	-0.031***	-0.014	-0.013	-0.002
	(0.003)	(0.008)	(0.007)	(0.013)	(0.014)	(0.003)
Observations	4,970	1,243	1,242	1,242	1,243	4,970
R2	0.304	0.43	0.443	0.343	0.418	0.311
Adjusted R2	0.279	0.344	0.354	0.240	0.341	0.286
F Statistic	11.902***	5.029***	4.970***	3.352***	5.399***	12.177***
	(df = 176; 4793)	(df = 162; 1080)	(df = 171; 1070)	(df = 167; 1074)	(df = 146; 1096)	(df = 178; 4791)
	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

The results from regressing the speed of adjustment (SOA) on quartiles based on sensitivity are presented above (Eq. 16 and eq. 17 when regressing with a dummy). Both period and firm fixed effects are included. The dependent variable is the firms' actual leverage adjustment $(L_{it} - L_{it-1})$. The independent variable is the full leverage adjustment $(L^*_{it} - L_{it-1})$. The quartiles (Q1-Q4) are divided by our sensitivity measure (θ). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis

The first panel of Table 14 shows the SOA regression for the full sample, followed by quartiles 1 through 4. The 6th and final panel in Table 14 shows the results from regressing the model specified in Equation (17) on the full sample. The variable of interest in this panel is "Sens dummy x Full adjustment" which gives us the additional SOA if a firm belongs to the quartile of most sensitive firms. Hypothesis 2 predicted that we should see a clear pattern where SOA is highest in quartile 4 and the lowest in quartile 1. Our SOA estimates are all statistically significant below the 1% level. However, in contrast to previous literature and our Hypothesis 2, we find that the SOA is lowest in quartile 3 and highest in quartile 1. The trend we were anticipating cannot be found. This is echoed by the coefficient on our interaction dummy that turns out to have p-values far above acceptable levels. Any additional SOA due to belonging to quartile 4 cannot be detected.

In section 5.3, Hypothesis 1 was rejected as we could not find evidence of firm cost of equity being sensitive to target leverage deviation. In other words, γ from Equation (14) which is our regression estimate of θ from Equation (6), was not significant. Thus, our data did not support that any such sensitivity exists, and Equation (6) does not seem to hold for our data set. Consequently, when splitting our panel into quartiles based on θ, a measure we discard as meaningless, it is reasonable that we do not find this very measure to explain SOA. Accordingly, the rejection of Hypothesis 2 is consistent with previous findings of this paper.

5.5 Speed of Adjustment and Reliance on Bond Financing (H3)

In testing Hypothesis 3, we employ the same method as in the preceding section. Leverage change from one period to the next is regressed on potential full adjustment towards the theoretical target leverage, in order to find the SOA (see Eq. 16). However, instead of dividing the data set into four quartiles based on our sensitivity measure, we now divide the panel based on bond usage, with the firms least reliant on bonds in quartile 1, and the firms most reliant on bonds in quartile 4. Bond usage is defined as the book value of total bonds outstanding divided by total liabilities. We use the average bond usage for each firm over the full timeframe when assigning the firms into quartiles. Hypothesis 3 states that SOA will be lowest for firms in the 1st quartile and highest for firms in the 4th quartile. Results are presented in Table 15, with one panel for each quartile. Again, we add a 6th and final panel were we use a dummy variable to measure the additional SOA from belonging to the quartile of firms with the most bond usage (see Eq. 18). For our Hypothesis 3 to hold, we anticipated a positive and statistically significant coefficient on our interaction dummy "Bond dummy x Full adjustment".

Table 15. Regressing speed of adjustment on quartiles divided by the reliance on corporate bonds

	Dependent variable:					
	Actual leverage adjustment $(L_{it} - L_{it-1})$					
	Full sample	*Q1 bond usage*	*Q2 bond usage*	*Q3 bond usage*	*Q4 bond usage*	*Full sample w/ dummy*
Full adjustment $(L^*_{it} - L_{it-1})$	0.215***	0.160***	0.323***	0.191***	0.147***	0.226***
	(0.030)	(0.025)	(0.077)	(0.047)	(0.015)	(0.037)
Bond dummy	n.a.	n.a.	n.a.	n.a.	n.a.	-0.005***
	n.a.	n.a.	n.a.	n.a.	n.a.	(0.000)
Bond dummy x Full adjustment	n.a.	n.a.	n.a.	n.a.	n.a.	-0.053
	n.a.	n.a.	n.a.	n.a.	n.a.	(0.039)
Constant	-0.003	0.004	0.002	-0.002	-0.005	0.002
	(0.003)	(0.005)	(0.009)	(0.007)	(0.005)	(0.003)
Observations	4,970	1,260	1,225	1,260	1,225	4,970
R2	0.304	0.263	0.314	0.338	0.399	0.305
Adjusted R2	0.279	0.22	0.273	0.299	0.363	0.279
F Statistic	11.902***	6.059***	7.668***	8.668***	11.101***	11.883***
	(df = 176; 4793)	(df = 70; 1189)	(df = 69; 1155)	(df = 70; 1189)	(df = 69; 1155)	(df = 177; 4792)
	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)	(p = 0.000)

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

The results for the speed of adjustment (SOA) regression linked to bond financing are presented above (Eq. 16 and eq. 18 when regressing with a dummy). Both period and firm fixed effects are included. The dependent variable is the firms' actual leverage adjustment $(L_{it} - L_{it-1})$. The independent variable is full leverage adjustment $(L^*_{it} - L_{it-1})$. The quartiles (Q1-Q4) are divided by bond usage on a firm average level over the full timeframe. All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

The coefficients of interest in Table 15 are all significant below the 1% level. However, we do not find the predicted pattern. In contrast to our hypothesis, we find that quartile 2 exhibits the highest SOA and quartile 4 the lowest. In line with this finding, we find no statistical significance for our interaction dummy, which indicates that there is no additional SOA coupled with belonging to quartile 4. Thus, we are forced to reject Hypothesis 3 as we find no evidence that firms who rely more on bonds are faster to adjust their capital structures towards a target.

The SOA for our full sample (21.5%) is lower compared to the full sample used in the study by Zhou et al. (2016) of 24.6%, which is made on U.S. firms. This supports the expectation that firms in the Nordics adjust more slowly compared to firms in market-based economies as pointed out in previous studies (Lööf, 2003; Antoniou et al., 2008), but it seems as if it is not the usage of bonds that explains the difference. Besides bond usage, there are several differences between market-based and bank-based systems that could influence the SOA. Our findings indicate that bond usage is not the main factor explaining differences in SOA, at least not within our bank-based sample. It might still hold true that bond usage can explain the difference in SOA between a U.S. sample and a Nordic sample in general. However, we must acknowledge that our test simply checks whether bond usage has explanatory power in a Nordic sample, where we hypothesized that usage of bond markets is a proxy for being more market-based. Thus, our test answers the question if bond usage can explain differences in SOA within a bank-based sample, and not between a bank-based and a market-based sample. To pinpoint how bond usage explains the difference between bank- and market-based systems, a wider cross-country comparison would be needed, which falls outside the scope of this thesis.

6. Robustness Testing

In this section we will briefly present the results from our robustness test. These include tests conducted on alternative and extended data sets or using different variable definitions in order to confirm that our findings are not swayed by the chosen methodology.

6.1 Yearly Data

One potential concern in our methodology is the use of quarterly data, since previous studies made on capital structures and SOA are mainly using yearly observations. Leary and Roberts (2005) analyze capital structure adjustments by using quarterly data. They find that firms in their data set make capital structure adjustments on average once a year. One could therefore make the argument that one quarter is not enough time for the market to react to changes in firm leverage. Thus, by looking at quarterly data there is a risk of being unable to detect changes in cost of equity that follow a change in deviation from target leverage when testing our Hypothesis 1. To confirm our choice of using quarterly data, and to minimize the risk of making a type 2 error, we test our Hypothesis 1 on an alternative data set with yearly observations. Our variables are constructed in the same manner as before and we employ a balanced panel. The total number of observations is 994, with the same 142 firms as in our original panel, but now with 7 yearly observations.

We recalculate our target leverage estimate and run a regression of cost of equity on target leverage deviation according to the model specified in Equation (14). Again, we split the sample into over- and underleveraged firms and make the analysis on each subset separately. The results from the regression is presented in Table 16.

Table 16. Regressing cost of equity on target leverage deviation using yearly data

	Dependent variable:	
	r_E^L	
	Underleveraged firms	*Overleveraged firms*
Leverage deviation (L^{dev})	-0.137	0.016
	(0.094)	(0.034)
Stock price volatility	-0.0001	-0.00040
	(0.000)	(0.0003)
Stock price momentum	-0.021	-0.037
	(0.022)	(0.023)
Analyst forecast bias	0.009	0.003
	(0.006)	(0.003)
Log of book-to-market ratio	0.027	0.008
	(0.018)	(0.011)
Log of market value of equity	0.011	0.01
	(0.023)	(0.011)
Constant	-0.027	0.009
	(0.197)	(0.103)
Observations	506	488
R2	0.740	0.702
Adjusted R2	0.627	0.566
F Statistic	6.554***	5.143***
	(df = 153; 352)	(df = 153; 334)
	(p = 0.000)	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01	

The results from regressing the cost of equity on target leverage deviation using yearly data are presented above (Eq. 14). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable (L^{dev}) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

Consistent with our main test, the results are inconclusive. Standard errors are high and we find no statistical significance for the coefficients of interest. That is, target leverage deviation still does not seem to affect cost of equity when employing a data set of yearly observations. Our main tests using quarterly data do yield the same results as when using yearly observations.

6.2 Extended Panel

In this robustness test, we extend our data set to limit the selection bias in our final panel (see Table 17 for a comparison of data sets). In order to include a larger number of firms, we are less strict on which observations to exclude from the final data panel. We relax the requirement that each observation must have a value for a minimum of two cost of equity measures. Further, we allow the panel to be unbalanced in order to include firms that might only have data for a small number of periods. This way we are able to expand the data set to 16,120 firm quarter observations. As we see in Table 17, the extended panel is more similar to the full population. Most noticeable is how the mean market cap is significantly closer to that of the full population.

Table 17. Sample selection bias in extended panel

Variables	Data set	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	# of Obs.
Market cap (MSEK)	Sample	45,236	116,292	437	4,776	14,420	44,115	1,245,576	142
	Population	20,162	73,359	9	532	2,092	10,407	1,245,576	687
	Extended set	24,788	85,606	23	1,098	4,304	16,191	1,245,576	413
Leverage (L_{TDM})	Sample	26.0%	22.4%	0.1%	9.2%	18.1%	36.4%	98.0%	142
	Population	29.4%	28.9%	0.0%	4.9%	18.9%	47.2%	100.0%	714
	Extended set	25.7%	25.1%	0.0%	6.8%	17.4%	40.5%	99.1%	413
Profitability	Sample	7.8%	7.0%	-17.5%	4.6%	6.9%	10.6%	51.0%	142
	Population	3.4%	21.2%	-263.4%	1.9%	5.8%	10.3%	51.0%	660
	Extended set	5.2%	19.6%	-175.6%	3.4%	6.8%	11.0%	51.0%	413

Data for full year 2015

The sample selection bias is illustrated above. The table describes the size (market cap), leverage (L_{TDM}) and profitability (EBIT divided by assets) of our final sample compared to the initial population, as well as for our newly introduced extended set of data used for robustness testing.

To test our Hypothesis 1 we run a regression following the model specified in Equation (14) and present the results in Table 18.

Table 18. Regressing cost of equity on target leverage deviation using extended sample

	Dependent variable:	
	r_E^L	
	Underleveraged firms	*Overleveraged firms*
Leverage deviation (L^{dev})	0.003	0.02
	(0.016)	(0.017)
Stock price volatility	-0.00004	-0.00001
	(0.000)	(0.0001)
Stock price momentum	-0.010***	-0.008*
	(0.004)	(0.004)
Analyst forecast bias	0.003***	0.003***
	(0.001)	(0.001)
Log of book-to-market ratio	0.010***	0.005
	(0.003)	(0.004)
Log of market value of equity	-0.001	-0.010***
	(0.003)	(0.004)
Constant	0.061**	0.153***
	(0.027)	(0.031)
Observations	8,262	7,858
R2	0.614	0.606
Adjusted R2	0.587	0.576
F Statistic	22.472***	20.292***
	(df = 546; 7715)	(df = 554; 7303)
	(p = 0.000)	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01	

The results from regressing the cost of equity on target leverage deviation using an extended panel are presented above (Eq. 14). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable (L^{dev}) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

Again, we retrieve statistically insignificant results for the coefficient on L^{dev}, indicating that deviation from target leverage does not affect the cost of equity. Thus, our rejection of Hypothesis 1 remains robust to an extended data set.

6.3 Simplified Target Leverage Measure

There are many factors that could explain the absence of meaningful results in our target leverage deviation regressions. When analyzing if a firm is over- or underleveraged, it makes sense to compare it to a theoretical optimal level, rather than staring blindly at the absolute leverage levels. However, for L^{dev} to have an effect on cost of equity, the market must also make the same analysis. There is a possibility that our measure of target leverage is too sophisticated and that the market merely looks at deviation from comparable firms when setting their required rate of return. If this is true, it might explain why we find no connection between L^{dev} and cost of equity. Table 19 presents an alternative regression analysis where L^{dev} is the difference between actual leverage level and the industry median leverage in the same period, defined as $(L - L_{ind})$. Again, we run the regression using the model specified in Equation (14).

Table 19. Regressing cost of equity on simple target leverage deviation

	Dependent variable:	
	r_E^L	
	Underleveraged firms	*Overleveraged firms*
Leverage deviation (L^{dev})	-0.024	0.012
	(0.047)	(0.018)
Stock price volatility	-0.0001	0.00010
	(0.000)	(0.0001)
Stock price momentum	-0.023***	-0.023***
	(0.005)	(0.004)
Analyst forecast bias	0.013***	0.005***
	(0.002)	(0.001)
Log of book-to-market ratio	0.019**	-0.001
	(0.009)	(0.009)
Log of market value of equity	0.012*	-0.020**
	(0.007)	(0.008)
Constant	-0.013	0.248***
	(0.056)	(0.073)
Observations	2,201	2,769
R2	0.640	0.687
Adjusted R2	0.614	0.668
F Statistic	24.644***	34.900***
	(df = 148; 2052)	(df = 164; 2604)
	(p = 0.000)	(p = 0.000)
Note:	*p<0.1; **p<0.05; ***p<0.01	

The results from regressing the cost of equity on simple target leverage deviation are presented above (Eq. 14). Both period and firm fixed effects are included. The dependent variable is the firms' levered cost of equity (r_E^L). The independent variable ($L^{dev} = L - L_{ind}$) as well as the control variables are presented in the first column, and are all lagged one period to limit risk for reversed causality (see Appendix Table 2 for detailed definitions of variables). All variables are winsorized at the 1st and 99th percentile. To save space, solely the coefficients are presented next to their significance level indicated by an asterisk. Standard errors are clustered to adjust for autocorrelation and presented in parenthesis.

This analysis uses the deviation from the industry median as the main explanatory variable, which we use as a simplified proxy for target leverage deviation. This way, we check whether the market uses a simpler measure for target leverage when determining if a firm is over- or underleveraged. However, our tests return high p-values for the main explanatory variable, which indicates that the market does not seem to assess deviation from any target leverage when setting their required rate of return. We therefore find no evidence that target leverage deviation affects cost of equity and still reject our Hypothesis 1.

The three robustness tests in the preceding sections makes sure that we are not making a type 2 error by rejecting a true Hypothesis 1. We are confident that our main results from testing Hypothesis 1 are not dependent on the choice of quarterly data as opposed to yearly data. We also confirm that the effect from a potential selection bias is low as our robustness test using an extended data set with a larger number of small firms yields results in line with the main tests. Finally, by testing an alternative definition of target leverage deviation, we feel convinced that the rejection of Hypothesis 1 is wise. Our data does not support that the cost of equity of firms in the Nordics is sensitive to target leverage deviations.

7. Summary and Conclusions

In this paper, we examine whether the cost of equity for Nordic listed firms is sensitive to target leverage deviations, and if this sensitivity can explain the heterogeneous speed of adjustment (SOA) among firms. We construct a measure of cost of equity based on a set of five different valuation methods and estimate target leverage using a regression model based on well-established leverage determinants. This allows us to test whether target leverage deviation in Nordic firms is relevant for the cost of equity as it has been shown to be for U.S. firms. In contrast to previous research and our hypotheses, our results indicate that there is no link between cost of equity and target leverage deviation. This is the case also when looking at individual industries separately. These results are robust to extended data sets and alternative ways of defining target leverage. However, we do find support for the well-documented pattern where cost of equity increases with actual leverage levels.

In our second test, we investigate how SOA differs in the bank-based context of the Nordics and answer the question if the sensitivity of cost of equity to target leverage deviation can explain the SOA in the Nordic countries. We use a direct approach to construct a sensitivity measure for each firm in order to investigate if this sensitivity can explain the SOA. Since we concluded that the cost of equity does not seem to be sensitive to target leverage deviation, it comes as no surprise that our constructed sensitivity measure cannot explain the SOA of firms in our data set. In other words, the SOA cannot be explained by a relationship that does not seem to exist.

For our Nordic companies, we find a SOA of 21.5% for the full sample, which is somewhat lower compared to studies made on firms in market-based economies. In previous research, this difference is in part explained by the greater access to bond markets in market-based economies. However, the reliance on corporate bonds as a proxy for a more market-based capital structure does not seem to drive SOA among the firms within our sample. Thus, we find levels of SOA that are lower compared to studies made on U.S. data, but the limited access to bond markets does not seem to influence the SOA of Nordic firms.

Our study contributes to the stream of capital structure research, where most findings are made on U.S. data. The findings of this paper makes us question the sensitivity measure as an explanatory variable when analyzing SOA. However, even though we find no link between cost of equity and target leverage deviation, it still might be true that the market makes an assessment on if a firm is over- or underleveraged. There is a possibility our analysis is too intricate. Thus, future research should focus on finding an alternative proxy for target leverage that is more in line with the reasoning of investors on the Nordic market. With an appropriate measure of what the market deems to be target leverage deviation, it is likely the link to cost of equity will appear, also in a Nordic context.

We can also conclude that lessons learned from studies made in a certain environment should not be generalized to new contexts where legal and institutional traditions differ. A theory on SOA that seems reasonable might not hold when the geographical setting is changed.

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Appendix

Appendix Table 1. Estimation of levered cost of equity (r_E^L)

r_E	Formulas, assumptions and description	Source
r_{OJ}	$r_E = A + \sqrt{A^2 + \frac{E_t[NI_{t+1}]}{MCAP_t} \times (g - (\gamma - 1))}$ where $g = 0.5\left(\frac{E_t[NI_{t+2}]-E_t[NI_{t+1}]}{E_t[NI_{t+1}]} + 0.02\right)$ and $A = 0.5\left((\gamma - 1) + \frac{E_t[DIV_{t+1}]}{MCAP_t}\right)$ r_E is the implied cost of equity, $E_t[]$ is a notation used for analyst consensus forecasts at time *t*, $MCAP_t$ is the market value of equity, $NI_{t+\tau}$ is the net income in the period $t + \tau$, $DIV_{t+\tau}$ is the dividend in the period $t + \tau$ (analyst forecasts if available, otherwise assuming a payout share of 2% of equity). *g* is the short-term growth rate, using the growth rate from year t+1 to t+2 as in Gode and Mohanram (2003), but as Hou et al (2012) smoothens this rate between different future estimates, we do the same but with a growth rate simulating Nordic countries' inflation targets. Following Gode and Mohanram (2003), as the short term growth only is of importance if net income in both year t+1 and t+2 are positive, we limit our sample to that condition. γ is the long term growth rate (or actually 1 + the growth rate). We assumed a long-term growth in abnormal earnings of 0, thus a value of 1 for γ. This follows the logic of Skogsvik and Juettner-Naeroth (2013), who argue that the value of γ (with a potential span of $0 \leq \gamma < (1 + r_e)$) should be close to 1 when performing parsimonious valuations.	Ohlson and Juettner-Naeroth (2005)
r_{PE}	$MCAP_t = \frac{E_t[NI_{t+1}]}{r_E}$ r_E is the implied cost of equity, $E_t[]$ is a notation used for analyst consensus forecasts as time t, $MCAP_t$ is the market value of equity, NI_{t+1} is the net income in the period $t + \tau$.	Gordon and Gordon (1997)
r_{PEG}	$MCAP_t = \frac{E_t[NI_{t+2}] - E_t[NI_{t+1}]}{{r_E}^2}$ r_E is the implied cost of equity, $E_t[]$ is a notation used for analyst consensus forecasts at time t, $MCAP_t$ is the market value of equity, NI_{t+1} is the net	Easton (2004)

income in the period $t + \tau$. As described in Easton (2004) this formula is a special case of the PEG ratio assuming no growth in abnormal earnings and that dividends
are assumed to be zero.

r_{MPEG}	$MCAP_t = \frac{E_t[NI_{t+2}] + r_e \times E_t[DIV_{t+1}] - E_t[NI_{t+1}]}{r_E{}^2}$ r_E is the implied cost of equity, $E_t[]$ is a notation used for analyst consensus forecasts as time t, $MCAP_t$ is the market value of equity, NI_{t+1} is the net income in the period $t + \tau$. $DIV_{t+\tau}$ is the dividend in the period $t + \tau$ (analyst forecasts if available, otherwise assuming a payout share of 2% of equity). As described in Easton (2004) this formula is derived from the PEG ratio, assuming no growth in abnormal earnings.	Easton (2004)
r_{GLS}	$MCAP_t = BV_t + \sum_{\tau=1}^{11} \frac{E_t[(ROE_{t+\tau} - r_E) \times BV_{t+\tau-1}]}{(1+r_E)^{\tau}} + \frac{E_t[(ROE_{t+12} - r_E) \times BV_{t+11}]}{r_E(1+r_E)^{11}}$ r_E is the implied cost of equity, $E_t[]$ is a notation used for analyst consensus forecasts at time *t*, $MCAP_t$ is the market value of equity, $ROE_{t+\tau}$ is the return on equity in the period $t + \tau$, $BV_{t+\tau}$ is the book value of equity in the period $t + \tau$. ROE for t+1 and t+2 are derived from analyst forecasts, while ROE for the following periods are estimated by linearly interpolating between ROE at t+2 and a mean industry ROE assumed to be in effect at period t+11 (following the procedure of Gebhardt et al (2001) the industry mean ROE is determined per industry and period, excluding unprofitable firms as profit-making firms make a better reflection of long-term returns). The terminal value of the residual income model is assumed to be a perpetuity, resting on the assumption that no economic profits are realized as ROE is equal to the expected industry median.	Gebhardt, Lee and Swaminathan (2001)

The methods for backing out cost of equity are presented above. This table describes in detail how the cost of equity estimations and their assumptions are made.

Appendix Table 2. Variable definitions

Variables	Definitions
Main variables	
Leverage (L_{TDM})	$L_{TDM} = \frac{(Short\text{–}\ term\ debt + Long\text{–}\ term\ debt)}{(Short\text{–}\ term\ debt + Long\text{–}\ term\ debt + Market\ value\ of\ equity)}$
Other variables & control variables	
Cost of debt (r_D)	$= \frac{Interest\ expense}{Opening\ balance\ of\ debt\ outstanding}$
Market-to-book ratio	$= \frac{(Short\text{–}\ term\ debt + Long\text{–}\ term\ debt + Market\ value\ of\ equity)}{Total\ assets}$
Tangibility of assets	$= \frac{Property, plant\ and\ equipment, net}{Total\ assets}$
Profitability	$= \frac{Earnings\ before\ interest\ and\ taxes}{Total\ assets}$
Size (log of total assets)	$= ln\left(\frac{Total\ assets\ in\ MSEK}{GDP\ deflator}\right)$
Expected inflation	Expected inflation is the yearly expected growth rate of the consumer price index (CPI), from the OECD Economic Outlook.
Stock price volatility	Stock price volatility over the past 12 months.
Stock price momentum	Buy and hold return (adjusted to include dividends) for the past 3 months.
Analyst forecast bias	$= \frac{(E_t[NI_{t+1}] - NI_t)}{E_t[NI_{t+1}]}$
Log of book-to-market ratio	$= ln\left(\frac{Book\ value\ of\ equity}{Market\ value\ of\ equity}\right)$
Log of market value of equity	$= ln(Market\ value\ of\ equity\ in\ MSEK)$
Bonds as share of total liabilities	$= \frac{Book\ value\ of\ total\ bonds\ outstanding}{Total\ liabilities}$

This table presents our variable definitions. All variables come from S&P Capital IQ, unless otherwise specified.

Appendix Table 3. Correlation coefficients for the control variables in cost of equity regressions

	Stock price volatility	Stock price momentum	Analyst forecast bias	Log of book-to-market ratio
Stock price momentum	5.1%			
Analyst forecast bias	6.5%	-2.5%		
Log of book-to-market ratio	30.3%	-18.2%	12.4%	
Log of market value of equity	-16.1%	7.5%	-9.8%	-35.4%

Correlation coefficients for the control variables in cost of equity regressions are presented above.

Appendix Table 4. Target leverage by industry

Period	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	# of Obs.
Healthcare	12.1%	11.7%	0.0%	3.5%	8.8%	16.9%	52.4%	455
IT	15.8%	10.6%	0.0%	7.3%	14.8%	23.4%	47.0%	490
Telecom	23.2%	5.9%	7.4%	20.1%	23.1%	25.9%	40.7%	140
Industrials	25.2%	14.9%	0.0%	14.3%	23.6%	33.2%	77.5%	1,575
Consumer Discretionary	26.8%	17.5%	0.0%	12.5%	24.5%	39.3%	77.5%	595
Materials	30.6%	15.9%	0.0%	19.7%	31.8%	41.8%	70.0%	420
Utilities	31.8%	5.7%	19.7%	25.7%	34.1%	36.6%	39.6%	35
Consumer Staples	32.7%	17.5%	0.0%	19.2%	31.2%	46.9%	77.5%	525
Energy	42.1%	21.8%	0.0%	26.1%	37.0%	63.3%	77.5%	420
Real Estate	63.1%	5.9%	46.7%	59.3%	62.8%	66.6%	77.5%	315

Descriptive statistics for target leverage by industry are presented above. The table describes the range of values for target leverage in the different industries.