

# Study of Share Repurchases and Cash Holdings: Nordic Evidence

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## Abstract

This Master's Thesis attempts to expand on the existing research regarding the determination of share repurchases using Northern European evidence. The paper examines the popular theory of excess cash on share repurchases by testing the significance of previously applied variables measuring excess cash holdings of companies. In the research three new cash holding models are applied in addition to a model previously applied by Oswald and Young (2007) and the cash-to-total-assets famously applied by Jensen (1986), to define the independent variable excess cash.

In my research I find that while previous definitions of excess cash have resulted in the recognition of the correct, positive, relationship between share repurchases and excess cash, the large volume of research that measure excess cash through a cash-to-total-assets ratio has likely downplayed the significance of the relationship.

# 1. Introduction

## 1.1 Background

The primary objective of the master's thesis is to expand existing research on the determinants of share repurchases<sup>1</sup> through independent variable re-modification with the intention of providing a more robust basis for the study of the *excess cash* hypothesis. The excess cash theory was established by Jensen (1986) who finds that companies in possession of high proportion of cash holdings to total assets are more likely to repurchase shares as means of distributing capital to shareholders. Dittmar (2000) finds support for the excess cash hypothesis in her determinant study; however both Jensen's and Dittmar's studies measure excess cash through the measure cash-to-total-assets, which from a variable definition perspective is problematic.

Opler et al (1999) find in their study on the determinants of cash holding balances that the cash balances of companies exhibit a high degree of mean-reversion over time, consistent with their hypothesis that companies have a tendency to target determined cash-to-assets ratios. Chudson (1945) finds that cash-to-asset ratios tend to vary systematically by industry with a tendency of being higher in more profitable, higher margin industries. On the basis of the findings by Opler et al and Chudson on cash holdings, it can be stated that there exists clear theoretical framework suggesting why cash-to-total assets is an insufficient measure of excess cash, and a more sophisticated framework to evaluate cash holdings should be applied to test the explanatory power of the excess cash theory of repurchases.

A small number of research studies have previously been published with the objective of testing the robustness of the excess cash theory. Most significantly Oswald and Young (2007) applied a surplus cash model in their study of share repurchases; however it lacked a number of considerations including cash flow<sup>2</sup> uncertainty and industry-driven variation, both of which have been recognized to impact cash holding levels. Chudson (1945) showed that the cash holdings of companies vary greatly by industry, while Almeida, Campello and Weisbach (2004) showed that the volatility of firm cash flows has a significant impact on the size of

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<sup>1</sup> The research does not make a distinction between open market repurchases, fixed price tender offers and Dutch auctions due to data limitations

<sup>2</sup> Measured as change in the ratio of earnings before extraordinary items and depreciation (minus dividends) to total assets

cash holdings. Therefore the effectiveness of Oswald and Young's study in measuring the impact of excess cash holdings<sup>3</sup> on share repurchases can be considered limited.

D'Mello, Krishnaswami and Larkin (2007) study corporate cash holdings using data from corporate spin-offs. Studying spin-off's allows for the observation of cash holdings without the aggregation of past decisions, because spin-offed companies can be considered newly established companies. In newly spinned-off companies the management can decide at the point of establishment, what the optimal cash holding level should be. D'Mello et al. find that spin-offs with high sales growth, R&D expenditures and lower access to capital markets tend to be allocated larger portions of cash.

Given the high volume of research on cash holding studies that have resulted in a number of varying cash holding models, as an improvement to Oswald and Young's research I will apply four cash holding models to obtain a more robust understanding of the explanatory power of the excess cash hypothesis. The models applied include (1) a model used by Drobetz, Gruninger and Hirschvogel (2010) that incorporates both the impact of cash flow uncertainty as well as industry variation alongside a range of more traditional determinants<sup>4</sup>. Also applied is (2) the cash holding model used by Oswald and Young (2007) to provide a comparative reference point with previous studies; a cash holding model (3) designed by Almeida, Campello and Weisbach (2004) that approaches the concept of optimal cash holdings from the perspective of firm cash flows. As the (4) fourth model I will use the model designed by Opler et al. (1999) and previously used in their research by D'Mello, Krishnaswami and Larkin (2007). As a further reference to existing research I will also assess the relationship between cash-to-total-assets ratio and share repurchases as was originally tested by Jensen (1986). Given the prevalence and significance of the excess cash theory in explaining repurchases, it is of utmost importance that actual determining force of the theory is put under test.

The secondary purpose of the thesis is to test the significance of the excess cash in relation to other dominant theories on share repurchases such as undervaluation<sup>5</sup>, executive compensation, leverage, takeover deterrence and insider holdings. The insider ownership

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<sup>3</sup> The recognition of an optimal cash position is a prerequisite for the recognition of excess or a shortfall of cash holdings

<sup>4</sup> Valuation measured by market-to-book ratio, indebtedness measured by leverage ratio, research intensity measured by R&D expense-percentage of sales, capital intensity measured by capital expenditure-percentage of sales, working capital intensity measured by net working capital-percentage of net assets, cash flow generation measured by free cash flow to net assets, capital distribution measured by a dividend dummy and size measured by logarithm of net assets

<sup>5</sup> Also known as the signaling hypothesis

theory has an increased significance in the present thesis as an independent variable explaining a company's decision to repurchase shares, given its somewhat un-established position as a determinant of share repurchases. The theory has received little attention in the context of repurchases, despite the existence of a clear theoretical framework.

Jensen (1986) recognized that managers of companies characterized with significant agency conflicts<sup>6</sup> are more likely to use company resources in a wasteful manner, which increases the personal utility of managers at the cost of shareholders. Vice versa, with companies characterized by low agency conflicts, the managers have a tendency to distribute capital which is found to be in excess of operational and investing requirements. Li and McNally (1999) find in their working paper evidence to support the agency conflict as a determinant of share repurchases.

The present study applies a multivariate Tobit-regression model to investigate the impact of the aforementioned theories on share repurchase determination. The theories are tested applying data from the Nordic Stock Exchanges for a period of 9 years, from 2000 up to 2009<sup>7</sup>. It is worth mentioning that up until 1997, Finnish companies were not allowed to purchase their own shares from the capital markets, leaving dividends as the sole vehicle for distributing excess capital to shareholders. Similarly in Sweden share repurchases were allowed since 2000, Norway in 1999 and Denmark in 1995.

## 1.2 Motivation of study and definition of research problem

Despite being the subject of many research papers since 1980's, the underlying determinants of open market repurchases continue to receive significant research attention, mainly due to the growing significance of share repurchases in the modern financial markets as a means of distributing capital. The increasing popularity largely stems from the beneficial tax treatment<sup>8</sup> (Allen and Michaely (2003); Gottesman and Jacoby (2004)) of share repurchases compared to dividends that is in place in a number of developed tax jurisdictions such as the United States and majority of countries in the European Union. Globally share repurchases have

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<sup>6</sup> For which insider holdings is a proxy

<sup>7</sup> From the sample countries Sweden limits the observation period, because repurchases were not allowed by law until the year 2000

<sup>8</sup> Gains from share repurchases are taxed as capital gains, whereas dividends are taxed at income tax rates



significantly increased in terms of total value as an alternative means for distributing capital to shareholders, with open market repurchases representing the most popular type of repurchase methodology<sup>9</sup>.

The excess cash theory represent one of the oldest as well as most influential theories of share repurchase determination with a large volume of studies providing systematically conclusive results (Jensen (1986), Dittmar (2000) and Oswald and Young (2008)). Given the significance of the excess cash theory and its centrality as a necessary condition for other theories (companies that do not have “excess cash”, hence all funds are required by the general operations, are not in a position to repurchase shares even in case other hypothesized conditions were met), it is important that the variable measuring *excess cash* is correctly determined. By correct determination it is meant that the independent variable measuring the excess cash is actually able to identify the presence of cash that exceeds the normal operational requirements of the company at a given balance sheet date.

Further, the motivation to study share repurchase activity in the Nordic markets arises from the low degree of literature coverage on repurchasing activities in the region despite their increasing significance as means of distributing capital to shareholders. In the Finnish market share repurchases have previously been covered by Karhunen (2002 and 2001) and Liljeblom and Pasternack (2006), however the prior studies have focused on market reactions and market performance of companies repurchasing their shares rather than determinants of share repurchase activity, whilst the latter has focused on the substitution hypothesis<sup>10</sup> of dividends and share repurchases. In Sweden a few studies have been published on share repurchases focusing on the liquidity impact as well as the price impact of repurchases (De Ridder and Råsbrant (2009) and Råsbrant (2011)). Similar patterns in research can be found in Norway and Denmark.

In the U.S. open market repurchases has been the subject of a large volume of studies by researchers such as Dittmar (2000), Ikenberry et al. (1995), Stephens and Weisbach (1998) and Vermaelen (1981) amongst many others. In comparison, the repurchasing activities of companies outside the U.S. have received much less attention.

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<sup>9</sup> The main repurchasing methodologies include: open market, fixed-price tender offer and Dutch offer. For further information on the mentioned methodologies, please refer to appendix A.

<sup>10</sup> The substitution hypothesis assumes that the increasing distribution of capital in the form of share repurchases has arisen from a decline in dividend payout growth, i.e. substituting the payout.

It is meaningful to test the excess cash hypothesis and other determinant theories of share repurchases in financial markets outside the United States as significant regional differences exist when observing capital return profiles of various market indices. It is very difficult to obtain reliable statistics on share repurchases across regional financial markets, however when comparing the dividend yields between European Stock Exchanges to the S&P 500 a clear distinction becomes evident. The market capitalization weighted dividend yield of the S&P 500 in 2011 was 2.15%, compared to the 4.35% in OMX Stockholm 30, 3.74% in DAX and 4.17% in Euronext Paris<sup>11</sup>.

Due to the presence of multiple distinctive objectives that the thesis attempts to accomplish, the research problems of the paper are divided into three separate parts. The research problems are as following:

*Problem 1: Does a relationship exist between share repurchases and excess cash holdings?*

*Problem 2: Is the relationship between excess cash holdings and share repurchases as strong as suggested by previously applied variable designs?*

*Problem 3: Does the existing evidence on repurchases hold in the Nordic region?*

### 1.3 Limitations of study

The current study is subject to certain limitations that are described in detail below. The limitations arise mainly from data limitations as well as the uniqueness of the Nordic financial markets when considering the topic of capital distribution.

The study limits the observations to the public companies of four Nordic countries (Finland, Sweden, Norway, and Denmark<sup>12</sup>) for a period spanning nine years, from 2000 to 2009. Whilst sufficient for the present study, the limitation results in significantly smaller sample when compared to previous studies that are largely based on data from the New York Stock

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<sup>11</sup> Source: Bloomberg

<sup>12</sup> Iceland is excluded from the country specific analysis given the small number of listing companies on the local stock exchange, however it does contribute to the annual regressions, done using country consolidated data

Exchange. The deflated sample size has an impact on the validity of the annual regressions where the number of observed companies ranges between 300 and 500<sup>13</sup>.

A second key limitation to the present study arises from data availability and the consistency of data from the Thomson Financial-database, which was the main source of data for the research. Due to inconsistent financial reporting of the observed companies, data for some variables had incomplete information (expressed as N/A in the database), with the problem proving more severe with *small-cap* companies. The variables with most frequent inconsistencies were the data on share repurchases and insider holdings<sup>14</sup>. In order to avoid a *size bias* in the regressions, a large volume of the missing data was manually completed from the annual reports and corporate releases of companies.

The study is also limited to a broad definition of share repurchases, not distinguishing between open market repurchases, fixed price tender offers and Dutch auctions. All of the aforementioned share repurchase methodologies have their own characteristics that may result in different results of the determinant variables. However, the risk obtaining diluted research results on the basis of not distinguishing between share repurchase methodologies is low as a significant majority of share repurchases globally are conducted through open market repurchases. Fried (2000) finds that approximately 90 to 95% of share repurchases in the US are conducted via open market repurchases.

Data limitation issues also lead to the omission of the variable “*stock market liquidity*” in the regressions for share repurchase determination. Stock market liquidity would be used as a control variable measuring the historical liquidity of a given stock, the theory behind the variable being that companies with low liquidity are less likely to repurchase shares as they wish to avoid further illiquidity discount on the stock. Discussion on stock market liquidity will be covered in sections 2.2<sup>15</sup> and 3.7<sup>16</sup>.

The econometric nature of the Tobit regression which is applied in the research prevents one from making comparisons regarding the explanatory power of the cash holding models in explaining share repurchases. This is due to the fact that the data analysis tools used for the thesis only allow for the calculation of the pseudo  $R^2$  value for Tobit regressions, which can

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<sup>13</sup> The large range arises from new listings that did not exist in the early years, as well as lower data quality regarding stock repurchases in the initial years

<sup>14</sup> Variable definition covered in greater length in section 4.4

<sup>15</sup> Literature review on share repurchases

<sup>16</sup> Control variables

take values above 1 and below 0. The nature of the pseudo R2 measure is covered in more depth in section 5 where the results of the study are analysed.

#### 1.4 Structure of study

The rest of the research paper is organized as following. Section 2 contains a review of the relevant scientific literature related to the determinants of share repurchases, general capital distribution policy and research on corporate cash holdings. Section 3 states the hypotheses of the cash holding models as well as the share repurchase determinants. Section 4 contains a description of the applied data, the applied research methodologies as well as the variable design. The variable design section includes the introduction of the cash holding models as well as the cash holding model regression results. Section 5 covers the results and findings of the statistical analysis. The results are presented for two data samples: one sample where the Nordic data is combined into a single sample and one where the results for each Nordic stock exchange are presented separately. Finally, section 6 contains the conclusions of the research and suggestions for further research.

## 2. Literature Review

This section offers an overview of the scientific literature on share repurchases that is fundamentally relevant to the study. The present study touches upon many popular topics of corporate finance research and therefore the scope of the literature review is limited to research on general payout policy, share repurchase determination as well as research on corporate cash holdings.

In part 2.1 I will briefly present the relevant studies on payout policy determination, and section 2.2 will cover actual repurchase determination. In order to fully grasp the determination of share repurchases, one has to cover general payout policy concepts to understand the initial position of why companies choose to distribute capital. Also given that repurchases compete with dividends as the favored payout method, the dynamics of the alternate means requires coverage. Section 2.3 is dedicated to the relevant studies on cash holdings.

### 2.1 Literature on payout policy

In order to understand why a company repurchases stock, one needs to understand why companies choose to distribute capital to shareholders. Companies have been paying significant fractions of their earnings as dividends to shareholders since the formation of the concept of Limited Liability Company in the 15<sup>th</sup> century. Interestingly enough, it has not always been fully clear to economists and researchers why companies distribute capital, or even why shareholders would choose to demand dividends despite the universality of the capital distribution phenomena. Below I will cover the central theories and research conducted on payout policy.

Modigliani and Miller (1958) laid the foundations for the modern thoughts on capital structure by proposing that in the absence of taxes, bankruptcy costs and asymmetric information, in an efficient market the value of a firm is unaffected by the choice of firm financing. Hence, if the financial markets are efficient then, *ceteris paribus*, an investor should not exhibit preference between a levered and an unlevered company, and consequently the value of such companies should be the same. Following their previous research Modigliani and Miller (1961) stated that under the perfect market conditions, a company's

dividend policy is an irrelevant factor when determining the value of a company. Given that there is no preference or distinction between investors obtaining a dividend payment or alternatively obtaining a capital gain, *ceteris paribus*, the value of a company paying dividends should equal the value of a company that doesn't pay dividends.

In his study on the uses of corporate income Lintner (1956) states that a firm's dividend decisions depend primarily on the company's earnings, suggesting that companies with high or increasing earnings are more likely to pay dividends. The findings of the study also indicate that dividends are not a reaction to a short-term movement in earnings, but rather a longer-term development, as explained by the concept of sticky dividends. Companies that cut their dividend face a negative stock price reaction following the announcement, because market participants tend to view dividend cut backs as a sign of financial distress or declining cash flow generation in the future. Company management is therefore reluctant to cut dividends, but also to increase them too much (above a sustainable level) in the fear of being forced into cuts in the near future, hence the term "sticky dividend". Lintner's (1956) findings are supported by Fama and Babiak (1968) who show that well-established firms tend to adjust dividends only marginally up in response to earnings increases.

Jensen and Meckling (1976) find that if managers have the ability to freely allocate the resources of the company to activities that result in their private benefit, as opposed to the benefit of shareholders, they will do so. Followed by this view, Easterbrook (1984) indicates that dividends can be used as a potential solution to the problem of agency conflict. When managers are forced by annual general meetings to commit to annual dividend payments, they will subsequently have less capital to allocate between operations and investments that increase their personal utility at the expense of the utility of shareholders. This translates to a higher scrutiny of investment decisions (as post dividend payment they will be made from a lower capital base) and lower ability to wastefully spend corporate resources. In cases where the dividend payments result in investments requiring external financing, the decisions tend to be subject to more even extensive scrutiny by external capital providers.

Fama and French (2001) recognized that young firms are less likely to pay out dividends than mature firms, giving rise to the life-cycle theory of dividends. Mature companies have fewer requirements for internally generated capital due to their established market positions, predictable cash flows, and low growth opportunities. A significant portion of the corporate earnings remains available for distribution after the required investments are made to maintain

asset base and market position. Consequently such companies are more likely to distribute capital to shareholders.

Investment opportunities have been recognized to play a role in payout policy by a wide range of well-known studies including Fama and French 2001, Grullon and Michaely (2002) as well as DeAngelo, DeAngelo and Stulz (2006). Firms that have positive net present value investment opportunities, serve the best interest of the shareholders by retaining the capital (that could be used to capital distribution purposes) for investment purposes. Alternatively, companies that face very few, or no investment opportunities should payout excess capital back to the shareholders who can then decide on the re-allocation of their funds in order to mitigate the potential over-investment problems by the company's management<sup>17</sup>.

Chay and Suh (2009) document evidence on cash flow uncertainty, measured by stock return volatility, affecting the payout policies of companies. Given that managers value flexibility and place significant utility on that flexibility, they are likely to be reluctant to distribute large cash holdings as dividends or share repurchases. This is due to the difficulty related to predicting of cash flows and the fact that a company might face difficulties in maintaining the dividend level in the long-term given a substantial payout took place. Companies with stable cash flows are better able to distribute larger portions of earnings to shareholders, because they can better forecast future capital requirements and how well the requirements will be covered by the internally generated cash flow. Chay and Suh (2009) also find that cash flow uncertainty in explaining payout policy is independent of the firm's life-cycle, which is important, because the fact that mature companies tend to have more stable cash flows and vice versa could cause the impact of cash flow volatility to be a result from mere correlation with the life-stage effect.

In their literature review of payout policy, Allen and Michaely (2003) state that the relative taxation of dividends (income tax) and share repurchases (capital gains tax) has the potential to influence corporate decision regarding payout policy, consistent with the findings of Chen, Grundy and Stambaugh (1990). Managers are able to increase the value of the company to its shareholder by minimizing their tax burden; therefore in tax jurisdictions where regular income and dividends are more heavily taxed than capital gains<sup>18</sup>, a company should distribute capital through share repurchases. Gottesman and Jacoby (2004) state that tax

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<sup>17</sup> Jensen (1986)

<sup>18</sup> This is the case in all of the Nordic countries, that are being included in my sample

advantages have been the main driver of the recent trend of establishing share repurchases as the dominant payout methodology.

Further the liquidity of a company's share price has been recognized to influence decisions related to payout policy. Barclay and Smith (1988) find that share repurchases have a negative impact on the liquidity of the repurchasing company's stock, because shareholders that tender their shares in connection with buybacks tend to be those that provide market liquidity rather than "corner"<sup>19</sup> shareholder. Additionally in studies including Wiggins (1994) and Singh, Zaman and Krishnamurti (1994) find that bid-ask spreads show a decline when buyback programs are announced.

Brav, Graham, Harvey and Michaely (2004) conducted an extensive survey on 384 CFO's with in-depth interviews with additional 23 in order to determine the key factors driving dividend and share repurchase decisions. Their findings indicate that the perceived stability of earnings affects dividend policy as Lintner (1956) suggested, however also that this relationship has weakened over time. They report that share repurchases appear to be made from the residual cash flow after accounting for investment spending. At the same time, maintaining a historical dividend level can lead to cuts in investment funding at times when companies face lower balances of internally generated capital.

Additionally, Brav, Graham, Harvey and Michaely (2004) state that most managers prefer to initiate payouts by using share repurchases rather than dividends, given the higher degree of flexibility associated with repurchases compared to dividends. Of the interviewed managers 22% expected negative market reactions to cutting share repurchases as opposed to 88% for cutting dividends. Further the study finds that institutional investors (alternatively pressure from large shareholders) are recognized as the primary motivation for initiating payouts by companies (in the form of dividends or repurchases).

Allen and Michaely (2003) find that repurchases have captured a large and ever increasing volume of corporate payouts since the 1980's, when dividends constituted a majority of the payouts. During the 1980's dividends grew at an average rate of 15%, compared to the 6% growth rate of the observation period (1980-1999) of their study. In 1999, repurchases represented the same level of magnitude as dividends in terms of absolute value.

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<sup>19</sup> Corner shareholders refer to shareholders that tend to hold their ownership positions in companies for long periods of time usually due to strategic rationale



## 2.2 Literature on share repurchase determinants

Research on share repurchases dates back to the 1980's. One of the first papers that took a stance on the underlying reasons why companies repurchase shares was a study by Jensen (1986), which stated that companies repurchase shares with excess cash<sup>20</sup> and excess cash flow. Stephens and Weisbach (1998) find support for the excess cash flow hypothesis presented by Jensen (1986), by stating that both expected and unexpected increases in cash flows are positively related to share repurchases, implying that companies actively adjust their repurchasing behavior according to their cash position. Their research implies that managers actively forecast the company's future requirements for capital, and choose an optimal financing mix of debt and equity (externally raised equity as well as retained earnings) that is used to cover the forecasted requirements.

In addition to the excess cash theory relying on the assumption that managers are able to forecast the investment expenditure and general capital requirements of the company, it also assumes that managers will distribute excess funds rather than using them for personal gain (e.g. empire building and perks) and/or otherwise negative net present value investments. However, Jensen and Meckling (1976), Blanchard et al. (1994), Bates (2005) as well as Dittmar and Mahrt-Smith (2007) state that managers tend to invest surplus cash unproductively if they are left to their own devices, implying that agency conflict can be expected to play a role in share repurchase decisions.

Vermaelen (1981) argues that companies repurchase their stock when the shares are perceived as being undervalued by the company's management. His findings suggest that share repurchases are used by company managements to signal undervaluation. The underlying theory states that when corporate insiders believe that the company is undervalued by the financial markets, they can use the company's cash holdings to acquire shares that are trading below their intrinsic value. This represents a positive net present value investment from the perspective of the remaining shareholders that do not tender their shares, because assuming the managers are correct and the value of the company subsequently rises, the upside will be captured by a smaller group of shareholders. If the shares of the company were overvalued by the financial markets, managers would not be willing to repurchase shares, because this would not result in the maximization of firm value. Vermaelen (1981) concluded that firms that repurchase shares tend to experience an increase in their stock price that, on average, is

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<sup>20</sup> Excess cash refers to cash flow that exceeds the company's current and expected investment opportunities

permanent. Ikenberry et al (1995) find support for the undervaluation hypothesis; however in addition finds that the full positive market reaction succeeding a repurchase announcement extends over several years.

The signaling hypothesis is supported by Stephens and Weisbach (1998) and Comment and Jarrell (1991) who find that firms repurchasing shares tend to have experienced negative share price development in months prior to the repurchase announcement, implying that undervaluation is a factor that “triggers” share repurchases. Karhunen (2002) finds evidence of a similar pattern when observing Finnish companies. A fundamental precondition of the undervaluation hypothesis is the existence of information asymmetries<sup>21</sup> between the company insiders and the market participants. Through information asymmetries the market value of a company may diverge from its intrinsic value, causing the firm to be undervalued at times. If the managers of the firm believe that the company’s stock is undervalued, they may acquire shares, which consequently signal the belief of undervaluation.

When a company repurchases shares it simultaneously increases the leverage ratio of the company. As a result of share repurchases the cash on the balance sheet is paid out to tendering shareholders and the book value of equity is reduced, while the amount of debt on the balance sheet remains the same, resulting in an increase in the leverage ratio. The optimal leverage theory of repurchases introduced by Bagwell and Shoven (1988) suggests that companies repurchase shares with the intention to increase the leverage ratio. They state that companies that have identified an optimal level of leverage, and due to an increase in retained earnings, face a proportionately high book value of equity, can choose to repurchase shares as a means of increasing the leverage back to the optimal level. Opler and Titman (1996) find support for the leverage theory in their study on the debt-to-equity choices of companies.

Bagwell (1991) presents a theory in which share repurchases act as a deterrent against hostile takeovers. The study finds evidence that a perceived threat of a possible takeover significantly increases share repurchase activities conducted by companies. The underlying rationale of the theory states that company shareholders have heterogenic perceptions of the intrinsic value of the company, which results in a broad range of reservation prices at which shareholders are willing to tender their shares. When a company repurchases shares, the first shareholders that are willing to tender their shares are ones with lowest reservation prices, leaving the

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<sup>21</sup> Information asymmetries refer to the difference in the level of material information that the insiders (the management) of the company hold, compared to external market participants, which results in a valuation that does not necessarily reflect the intrinsic value of the company. For more on information asymmetries please refer to Stigler (1961) – “The Economics of Information”.

remainder of the shareholder base having a higher average reservation price compared to the pre-repurchase situation. The increase in the average reservation price consequently increases the bid at which an acquirer is able to obtain majority consent from the shareholders. Bagwell (1991) cites in his research the case of Sears, where the company announced the initiation of a share repurchase program, targeting 10% of the share base, as a response to circulating rumors regarding a possible takeover.

The study by Hodrick (1996) can be seen to support the takeover deterrence theory by documenting that shareholders are heterogenic in their perception of company value, which results in an upward sloping supply curve for shares. Companies that face higher price elasticity are found to be those with larger institutional and smaller insider holdings. Brown and Ryngaert (1992) find support for the existence of heterogenic price perception in their study by creating an economic model to estimate the determinants of shareholder heterogeneity by examining the responses of shareholders to fixed-price self-tender offers and two-tier inter-firm tender offers in corporate acquisition situations.

Dittmar (2000) does not find significant relationship between open market repurchases and takeover deterrence, however does note the relationship appears to exist between fixed-price tender offers and Dutch auction tender offers. Billett and Hui Xue (2006) explain Dittmar (2000) results by showing that tender offers act as an effective defense during hostile takeover battles, while open market repurchases function as a preventive measure against unwanted bids.

Fenn and Liang (1997) and Jolls (1996) find that companies use open market repurchases to counter the dilution effects that result from the use of stock options in executive compensation. When a company gives its employees and managers stock options as a part of their remuneration, the company's management acknowledges that in a predefined period it is likely to become liable to provide shares to those that have exercised options. Further, stock options given to managers tend to have exercise prices below the prevalent share price, increasing the likelihood of dilution at maturity. Consequently, in order to provide the shares, the company must either issue new shares, or alternatively acquire currently trading shares through repurchases. In the case of a new share issue there would be limited funds directed to the company due to the fact that the exercise price of stock options will be lower than the price of the share, while the number of outstanding shares would increase. This proportionate increase in outstanding shares compared to financial income would lead to a dilution of earnings per share and likely a lower market value for the company.

Additionally, between the two alternatives for obtaining shares for options, the attractiveness of share repurchases is recognized given the negative stock price reaction following seasoned equity offerings (Masulis and Korwar (1986), Asquith and Mullins (1986)). In comparison, historically repurchases have resulted in positive stock market reactions (Dann (1981) and Vermaelen (1981)).

According to a survey conducted by Brav, Graham, Harvey and Michaely (2004), executives state that the earnings-per-share impact is an important factor in determining their repurchase decisions. When conducting share repurchases, the EPS of a company tends to increase because the number of shares increases proportionately more than the earnings decrease as a result of a decline in interest income arising from the lower cash position. In seasoned equity offerings, especially in cases where the shares are used as a part of employee remuneration and not corporate investments, the EPS impact tends to be negative. It is due to the aforementioned EPS impacts that companies are much more likely to rely on share repurchases as a means of obtaining shares to cover employee stock option compensation rather than seasoned equity offerings.

An interesting consideration that I would like to add to the discussion, is that despite the documented evidence of executive compensation via stock options having an impact on share repurchases, there exist factors that would suggest why this relationship should not necessarily hold as well as is empirically proven. The consideration relates to the fact that the optimal timing of share repurchases (i.e. at times when the company is perceived as being undervalued) does not coincide with the optimal exercising of executive (call) options.

Share repurchases are optimally executed when the share price of the company has decreased to a level that is perceived by the management as being below its intrinsic value. It is at this level that repurchasing shares makes for a good investment that managers would be willing to make, because repurchasing shares would maximize value for the remaining shareholders. Executive options, on the other hand, are exercised when the management believes that the share price of the company has increased to its intrinsic value or above. This is because the managers can expect the markets to realize the overvaluation in the passing of time, resulting in a decline in the share price.

Additionally it seems unlikely that managers are able to define under or overvaluation on the basis of small stock price movements that occur on the short-term, implying that it would take longer periods between the time managers choose to repurchase shares and exercise options.

If the managers choose to repurchase shares near the time of the exercising of the stock options at high prices, the management is likely to overpay for the repurchased shares, making the shareholders that choose to sell better off, rather than the shareholders that remain holding the shares. Therefore if the motive behind share repurchases according to the executive option theory is to prevent the decrease in firm value resulting from EPS dilution associated with seasoned equity offerings (assuming that financial markets participants place high emphasis on the level of EPS), acquiring shares at overvalued prices is likely to result in a decrease of firm value, because of the overpaying to shareholders exiting the firm.

Aboody and Kasznik (2000) find evidence that managers tend to time their voluntary disclosures to beneficially coincide with dates on which stock options are awarded. In such instances the management releases negative news on the company, resulting in a negative stock price reaction, which in turn will set the exercise prices of the awarded stock options at lower prices than pre-announcement. Lie (2005) finds similar evidence and documents negative abnormal share price performance leading to stock option award dates and a positive abnormal performance thereafter for US companies. He also finds that the trend of the abnormal stock price performance around times of stock option awards has intensified over time. Although Aboody and Kasznik or Lie do not present direct evidence for the previously mentioned argument, it does provide evidence of similar type of activity engaged by the managers of companies.

Maxwell and Stephens (2003) have identified a relationship between repurchases and wealth transfer between a firm's equity and debtholders. Corporate finance literature has identified the existence of agency conflicts between the equity and bondholders that can lead to a situation whereby an action by the company's management will result in the benefit of one stakeholders group at the expense of another<sup>22</sup>. Maxwell and Stephens (2003) observe wealth expropriation through reactions in stock prices and bond markets to share repurchases. Their studies found that on average bond returns fall by 18.5 basis points (at 1% significance level) around the time of the repurchase announcement, additionally bond ratings, following a repurchase announcement, are more likely to be downgraded than upgraded. Following a different methodology, a working paper by Yeh finds support for the wealth expropriation hypothesis, stating that repurchasing firms face an increased financial risk, a reduced investment and operating performance, leading to difficulties to pay back debt.

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<sup>22</sup> Conflicts of interest related to equity and debtholders have been documented by Fama and Miller (1972), Jensen and Meckling (1976) and Myers (1977)

A less frequently cited determinant for repurchases is the presence of agency conflicts (here proxied by insider holdings), despite its acknowledgement in the context of dividends. The underlying reason for the lower degree of acknowledgement, I believe, resides in the fact that the impact of agency conflicts on share repurchases can be argued to be both positive and negative.

On one hand companies that are characterized by large insider holdings, and hence low degree of agency conflict, are more likely to pay out accumulated capital through share repurchases, because the incentives of managers are more aligned with those of the company's shareholders. When the management's wealth is tied to the share price performance of the company, they are more willing to pass on wasteful investments such as empire building or excessive perks. Consequently the shareholders can be confident that the management will act in the best interest of the shareholders and maximize the firm value. As previously mentioned in the context of excess cash flow theory, managers tend to invest surplus cash unproductively if they are left to their own devices (Jensen and Meckling (1976), Blanchard et al. (1994), Bates (2005) as well as Dittmar and Mahrt-Smith (2007)), resulting in shareholders demanding excess capital to be returned in the hands of the owners.

Managers tend to value financial flexibility<sup>23</sup> as it gives them more freedom to pursue investment opportunities with less scrutiny. As the returning of capital to shareholders will reduce this flexibility, managers are likely to choose the distribution alternative that minimizes the reduction of their flexibility. Brav, Graham, Harvey and Michaely (2005) find that many executives view share repurchases as being a more flexible means of capital distribution compared to dividends. This perception is caused by the fact that future cuts in dividends are accompanied by negative stock price reactions (please refer to section 2.1 for the concept of "sticky dividend") whereas share repurchases are viewed by the financial markets as more of a non-recurring event. Therefore abstaining from repurchasing shares tends to produce a limited or no share price reaction (Jagannathan, Stephens and Weisbach (2000)).

Oswald and Young (2007) state that share repurchases act as a means of alleviating the agency costs related to the existence of surplus cash, because repurchases restrict the managements scope to waste corporate resources. Consequently they state that better managerial incentive alignment and closer monitoring of managerial activities by external

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<sup>23</sup> Pinegar and Wilbricht (1989) and Graham and Harvey (2001)

shareholders are important factors in stimulating repurchasing activities. Li and McNally (1999) study repurchasing activities of Canadian firms and find that companies that are more closely held compared to their counterparties, are more likely to repurchase shares. Higher monitoring by shareholders that are “close” to the company alleviates agency conflicts and make sure that the management distributes funds that are at risk being used in shareholder value destroying activities.

Harris and Glegg (2007) examine the relationship between the governance quality (a proxy for the existence of agency conflict) and share repurchases and find that companies with block shareholders, implying low agency conflicts, are more likely to repurchase shares. As the motive for the repurchasing activities they state that through share repurchases the management uses shareholder funds to eliminate blockholders, who are more likely to monitor them, thereby entrenching themselves.

On the other hand a case can be made why the relationship between insider holdings and share repurchases should be negative, which relates to the investment characteristics of the insider holders. It is important to recognize that the blockholders of companies generally choose to be blockholders and do not diversify their portfolios for a reason. This reason might be for example that the ownership has run in the family and has sentimental backing or that the company has been an investment case for a large investor. In either case, the blockholders are more likely to develop and actively influence the development of the company rather than seek partial exit through repurchases and therefore are less likely to tender their shares. Consequently blockholders are less likely to actively drive forward share repurchases in annual general meetings.

Insider holders (can be considered as the management or large blockholders) tend to have differing investment strategies compared to the average portfolio investor, because the typical insider is not well diversified. When the insiders are not well diversified it is more likely that they wish to actively keep down the general risk level of their company, which translates to holding larger portions of cash on the balance sheet, a higher equity ratio and a lesser focus regarding the return of capital to shareholders. This means that because the insiders have influence over the company’s decision to repurchase shares and given the fact that they do not want tender their share nor do they want other shareholders to tender theirs (as this would lead to a reduction in the company’s cash holdings and an increase in the company’s risk level), a company with large insider holdings would see fewer or no share repurchases.

These theories have not received support empirical studies, however in their research Oswald and Young (2007) find that institutional and board ownership are, while insignificantly, consistently negatively correlated with share repurchases.

### 2.3 Literature on cash holdings

The level of cash holdings and the concept of optimal cash holdings have received much attention in financial and accounting literature. In an interesting study<sup>24</sup> JP Morgan economists calculated that the cash holdings of corporations in developed countries have increased by more than USD 1 trillion between 2000 and 2004. The same paper recognizes that the development has been truly global, spanning across Europe and North America as well as Asia. Dittmar and Mahrt-Smith (2007) state that on average the balance sheet item cash and cash equivalents account for more than 13% of the total assets of publicly traded US companies.

Corporate finance textbooks say that under the conditions of perfect capital markets, firms do not have incentives to hold cash on their balance sheets as they would be able to raise financing at optimal market costs that reflect the investments risk level and return profile. When the assumption of perfect capital markets is omitted, firms show to have cash holdings at varying levels. Optimally, the liquidity (either via cash holdings and through available credit facilities) should be at a level whereby the company can comfortably cover near-term running expenses such as interest payments, operational expenses and capital expenditures, as well as a small “buffer” for unforeseeable expenses. Holding too little cash on the balance sheet may result in difficulties meeting maturing obligations, whereas holding too much cash will dilute the return that the shareholders expect to obtain from the operations, coupled with the cost of concerns arising from moral hazard. The theories that attempt to explain the determinants for cash holding levels can be divided into two camps – the transaction theory and the managerial opportunism theory.

A commonly cited explanation for why companies choose to hold cash and cash equivalents that appear to be exceeding the operational requirements is that cash provides for a source of low cost financing (Myers and Majluf (1984)). This rationale refers to the transaction cost

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<sup>24</sup>*Corporates are driving the global saving glut* – June 24<sup>th</sup>, 2005



theory of cash holdings, as coined by Keynes (1936). Financing in the form of internally generated capital is less expensive than externally obtained financing due to the presence of information asymmetries between the company's management and external financiers, costs related to agency conflict (Myers (1977); Jensen and Meckling (1976)) as well as other transaction costs. The thought implies that in the presence of imperfect markets, companies can minimize the costs of obtaining external financing through accumulating internally generated capital.

Accounting for the aforementioned costs related to raising external financing, retaining internally generated cash can increase firm value. Firms with significant cash holdings are more flexible to take advantage of investment opportunities as they arise. In given situations, due to high information asymmetries, a company might have to pass on positive net present value investment opportunities, because the external financing for the project is priced too high.

The trade-off theory of capital structure is often cited in connection with studies on cash holdings. The trade-off theory of capital structure states that companies choose a capital structure which is a balance between costs related to financial distress and the tax benefits arising from holding debt. Bates, Kahle and Stulz (2006) argue that cash holdings can be explained by a precautionary motive as companies that have low cash at hand are more likely to face costs related to financial distress, such as tougher payment terms on purchases, which supports the trade-off theory. Almeida, Campello and Weisbach (2004) show that companies facing financial distress tend to increase their cash positions at times of high cash flow.

Holding cash can have its pitfalls as is shown by the managerial opportunism theory. Jensen (1986) in his highly cited study finds that managers have a tendency to pursue activities that result in their private benefit at the cost of the shareholders. For example, managers have a motive to accumulate larger than optimal cash holdings as it reduces the overall risk level of the company. As the managers have much of their future income, and hence value tied in the company, leaving them poorly diversified. The managers can therefore reduce their overall risk by pursuing a more conservative capital structure and high liquidity. Secondly, managers will find it easier to finance investments using internally generated capital rather than external capital that tends to be accompanied with higher degree of scrutiny. Therefore large cash holdings are more likely to lead into wasteful investments.

Additionally holding large amounts of cash on the balance sheet of a company dilutes the returns on equity, because of the low return that cash accumulates on the company's bank account and the fact that often the interest which is earned on corporate cash reserves tends to be taxed at a higher rate than the interest earned by individuals. Investors place their funds in corporate equities with the expectation of a higher return compared to bank deposits.

Both the managerial opportunism and transaction cost theories of cash holdings lead to believe that there should exist a balance between the negative and positive effects of cash holdings that would result in an optimal cash holding level. At this level, the marginal benefit of having cash holdings equals their marginal cost.

A number of scientific papers have been published on cash holding level determinants. Baumol (1952) states that the optimal cash holding levels are in part determined by the transaction costs that incur when a company is faced with converting non-cash, less liquid assets to cash. In a frictionless economy where companies can obtain financing at fair terms, there is little reason to hoard excessive amounts of liquidity on to the balance sheet, thus decreasing the optimal value of cash holdings. Drobetz, Gruninger and Hirschvogel (2010) state that the assumption of frictionless capital markets should be relaxed in the explanation of corporate cash holdings because firstly, if the transaction costs would be incorporated to the cash model, the irrelevancy proposition of cash would no longer hold. Secondly, in reality information asymmetries exist (not in frictionless capital markets) and information asymmetries give rise to various problems such as adverse selection and moral hazard.

Using a sample of US companies Kim et al. (1998) find support for the low cost of financing hypothesis. They find that companies facing higher costs of external financing tend to hold more liquid assets than their counterparties. In addition Kim et al. (1998) find that companies with more volatile earnings as well as companies with relatively low return on assets tend to hold larger cash balances. Companies with more volatile earnings hold more cash, because internally generated cash can at times dry out, leaving more of the running expenses to be covered through current cash holdings. The results for companies with low return on assets may suffer from a degree of endogeneity, as holding large cash balances rather than employing that capital in operations can be a contributing factor to low return on assets.

Opler et al (1999) find that small firms, firms with growth opportunities as well as firms with volatile cash flows tend to hold larger volumes of cash balances. Small firms tend to find it more difficult to raise financing as they tend to be more risky and have more significant

asymmetries of information due to less analyst coverage. Firms with growth opportunities tend to hold more cash on their balance sheets to be able to respond to investment opportunities at short notice.

Ozkan and Ozkan (2004), using UK evidence, suggest that the ownership structure of companies plays a significant role in determining their cash holdings levels. Further they recognize that firms controlled by large family owners tend to amass larger quantities of cash on their balance sheets. Their hypothesis states that because large family owners tend to be poorly diversified, they choose to lower the risk level of their portfolio companies by encouraging large cash holdings on the balance sheets.

Chudson (1945) finds that the cash balances of companies tend to vary greatly by industry and that more profitable companies tend to hold more of their assets as liquid funds. As an example large industrial turnkey and EPC<sup>25</sup> companies tend to have a large portion of their assets as cash (15-30% of total assets) that largely arise from project related prepayments, whereas small good manufacturing companies tend to have smaller proportionate cash holdings. Vogel and Maddala (1967) show that larger companies have smaller cash holding when adjusted by total assets, which suggests that large companies can benefit from economies of scale and lower asymmetries of information when raising funds even in the short term.

Mello, Krishnaswami and Larkin (2007) study the determinants of cash holdings of companies by observing evidence from corporate spin-offs. Their findings state that the parent companies do not allocate cash to the spin-offs on the basis of total assets nor recognized industry cash target ratios. Their evidence shows that cash allocations increase with spin-off sales growth, lack of publicly rated debt and higher research and capital expenditures, while allocation decreases with higher net working capital ratios. Their research also suggests that companies hold less cash than is predicted by the trade-off theory.

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<sup>25</sup> EPC stands for engineering, procurement and construction

### 3. Hypotheses

In the research I will present two series of hypotheses. Firstly I will present the hypotheses on whether I believe the newly introduced excess cash model will present a stronger or a weaker relationship with share repurchases than previously definitions of the variable. Secondly I will present the hypotheses for the general determinants for share repurchases.

#### 3.1 New excess cash model hypotheses

The new excess cash model hypotheses section presents the hypotheses for the three new cash holding models in relation to the previously applied Oswald and Young (2007) model as well as the cash-to-total-assets variable. As Model 2 and cash-to-total-assets act as references for the research, no hypotheses will be presented to the variables.

##### 3.1.1 Model 1 hypothesis

Companies that hold larger amounts of excess cash on their balance sheets are more likely to repurchase shares and distribute capital to shareholders. If the definition of excess cash is flawed, i.e. the definition of excess cash does not truly capture the view of the company's management as to whether the company has excess cash, then the relationship of the variable is likely to be weaker against the activities that are assumed to be determined by variable, in this case share repurchases. If we are able to improve the variable definition and make the measurement of excess cash more accurate, the relationship between excess cash and share repurchases should theoretically be stronger. The hypothesis for Model 1 relationship with share repurchases is as following:

*H1: The coefficient of Model 1 is larger than the coefficient of Model 2 and cash-to-total-assets ratio*

*H0: The coefficient of Model 1 is smaller than the coefficient of Model 2 or cash-to-total-assets ratio*

### 3.1.1 Model 3 hypothesis

Similarly to the theory behind Model 1, if we are able to improve the variable definition and make the measurement of excess cash more accurate, the relationship between excess cash and share repurchases should theoretically be stronger. The hypothesis for Model 3 relation with share repurchases is as following:

*H1: The coefficient of Model 3 is larger than the coefficient of Model 2 and cash-to-total-assets ratio*

*H0: The coefficient of Model 3 is smaller than the coefficient of Model 2 or cash-to-total-assets ratio*

### 3.1.1 Model 4 hypothesis

Similarly to the theory behind Model 1 and 3, if we are able to improve the variable definition and make the measurement of excess cash more accurate, the relationship between excess cash and share repurchases should theoretically be stronger. The hypothesis for Model 4 relation with share repurchases is as following:

*H1: The coefficient of Model 4 is larger than the coefficient of Model 2 and cash-to-total-assets ratio*

*H0: The coefficient of Model 4 is smaller than the coefficient of Model 2 or cash-to-total-assets ratio*

## 3.2 Share repurchase determinant hypotheses

The corporate finance literature offers a number of explanations on why companies choose to repurchase shares. For the present thesis I have chosen to investigate the excess cash, undervaluation, leverage, takeover deterrence, executive compensation and the agency conflict hypotheses. Although the wealth transfer hypothesis was presented in the literature review section, it is excluded from the study due to two main reasons. Firstly the study of the hypothesis relies mainly on the observation of abnormal bond returns that are subject to

significant bias due to infrequent trading. Secondly, as the study is limited to Northern European data, the volume of data faces a significant reduction if only companies that have public debt are included in the sample. Section 3 briefly summarizes the fundamental assumptions of the theories and defines the hypotheses tested in this study.

### 3.2.1 Excess cash hypothesis

When a company's cash exceeds its operational requirements and proportionally (dependent on the planned mix of financing) the prospective investment opportunities, the company can be considered to be in possession of excess cash. The managers of the firm can choose to retain generated cash on the balance sheet or alternatively distribute it to shareholders. Excess cash therefore enable the distribution of funds through repurchases and therefore as the amount of excess cash increases on a company's balance sheet, the more likely it is that the company will distribute it to shareholders in the form of share repurchases. The hypotheses on the excess cash flow theory are stated as following:

*H1: Positive excess cash position is positively correlated with occurrence of share repurchases*

*H0: Positive excess cash position is not or is negatively correlated with occurrence of share repurchases*

Due to the fact that the hypothesis relies on the concept of *excess cash*, which is documented to range heavily among industries and corporate situations, it is important that a strong foundation for the concept of excess cash is established. On the basis of this foundation I apply various econometric models to determine the optimal level and excess level of cash of individual companies. The variable design will be covered in further detail in Section 4.

### 3.2.2 Undervaluation hypothesis

The undervaluation hypothesis, alternatively known as the signaling hypothesis, is another commonly cited theory for share repurchases. The signaling hypothesis refers to the situation where managers take advantage of their perceived undervaluation of the company to acquire shares through repurchases. The theory assumes that corporate managers are in possession of private information that is material to the intrinsic value of the firm, resulting in information asymmetries between managers and financial market participants. If the information of the managers suggests that the company's intrinsic value is higher than the market currently values, the managers will be willing to repurchase shares.

By repurchasing shares at, or alternatively at a premium to the current market price the managers signal to the market participants the existence of this information resulting in a positive stock price reaction. The undervaluation of companies is commonly proxied by stock market performance of the preceding 3 months<sup>26</sup>. The undervaluation theory hypothesis predicts the following relationships:

*H1: Undervaluation of companies is positively correlated with share repurchases*

*H0: Undervaluation of companies is not or is negatively correlated with share repurchases*

### 3.2.3 Leverage hypothesis

The leverage hypothesis states that companies use repurchases as a method for adjusting their capital structure in situations where the balance sheet carries more equity than is considered optimal by the company's management and shareholders. The hypothesis relies on the assumption that management has recognized a target capital structure (or a range of capital structures) that they wish to remain at, but due to, for example, positive earnings that the company has retained on the balance sheet, the company's proportionate equity financing increases. As a response the company can subsequently repurchase a portion of its outstanding shares using cash from the balance sheet to decrease the equity ratio. Alternatively a company could take on more leverage through bank loans or issuing public

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<sup>26</sup> The 3 month return has been applied by previous studies, however I also tested a 6 and 1 month returns in the regressions, but the results proved less conclusive

debt, however this places the company's operations under higher scrutiny and if the company doesn't have sufficient investment opportunities, this action, is likely to be greeted by a negative stock price reaction as opposed to a positive share reaction associated with share repurchase announcements. The leverage theory hypothesis predicts the following relationships:

*H1: Positive deviations from optimal equity ratio are positively correlated with share repurchases*

*H0: Positive deviation from optimal equity ratio are not or are negatively correlated with share repurchases*

#### 3.2.4 Takeover deterrence hypothesis

Companies have been recognized to fend off potential acquirers by repurchasing shares. Stock repurchases are a way for the corporate managers to increase the average reservation price of the shareholder base, because shareholders are willing to sell their shares at varying prices, resulting in an upward-sloping supply curve Bagwell (1990). This is because when a company acquires shares from the existing shareholders through repurchases, the shareholders that first tender their shares are the ones with the lowest reservation prices. The remaining shareholders consist of individuals that have a higher reservation price for the shares. This means that when a potential acquirer places a bid on the company, the higher average reservation price reduces the likelihood of a high enough bid for the acquirer to succeed in the takeover. The takeover deterrence theory hypothesis predicts the following relationships:

*H1: Presence of takeover activity/rumors is positively correlated with share repurchases*

*H0: Presence of takeover activity/rumors is not or is negatively correlated with share repurchases*

#### 3.2.5 Executive compensation hypothesis

Companies that have stock options related to executive compensation tend to favor repurchases as a method for distributing capital to shareholders, because of the non-dilutive



characteristics of share repurchases. When companies distribute capital via dividends, the company's value per-share and earnings-per-share decrease, because funds are paid out of the company (that also result in a decrease in interest income) while the number of outstanding shares remains the same. Alternatively with share repurchases the per-share value of the company remains the same, while the earnings-per-share increases (the decrease in shares tends to be proportionately less than the decrease in earnings arising from lower interest income).

Share repurchases also provide the company with treasury shares that can be used to cover the exercise of executive stock options. In cases where the company does not have treasury shares in its possession, shares need to be either created through a share issue, or alternatively repurchased. The executive compensation theory hypothesis predicts the following relationships:

*H1: Presence of executive options is positively correlated with share repurchases*

*H0: Presence of executive options is not or is negatively correlated with share repurchases*

### 3.2.6 Insider ownership hypothesis

Companies that are characterized by high insider holdings are less likely to repurchase shares. This is because the insiders of companies want to keep down the risk level of the company, because they have substantial portions of their wealth tied within the company. The risk level of the company would however see an increase following share repurchases, because share repurchases results in a reduction of liquid assets as well as the equity ratio. The insider ownership theory hypothesis predicts the following relationships:

*H1: Presence of high insider ownership is negatively correlated with share repurchases*

*H0: Presence of significant insider ownership is not or is positively correlated with share repurchases*

### 3.2.7 Control variables

The reason why the empirical study is based on a variety of theories and criteria is that share repurchases appear to be determined by the simultaneous existence of several factors, suggesting that companies choose to repurchase shares when a range of conditions are met. There are numerous variables that have been previously recognized to impact share repurchase decisions that need to be controlled for the study. These variables include firm size, market to book ratio, dividend payments and stock market liquidity.

Firm size is controlled, because of its interconnectedness with the undervaluation hypothesis. According to the undervaluation hypothesis companies repurchase shares when the company is perceived as undervalued by the management, and a prerequisite condition for this hypothesis is the existence of information asymmetries. Information asymmetries have been recognized to be more significant in small companies than in large companies. According to Vermaelen (1981) small companies are likely to suffer from greater asymmetries of information, because small firms tend to be covered by fewer market analysts. Consequently small firms are more likely to be undervalued at times, thus more likely to repurchase stock. Firm size and share repurchases are expected to exhibit the following relationships:

*H1: Firm size is negatively correlated with share repurchases*

*H0: Firm size is not or is positively correlated with share repurchases*

Firm size can theoretically have an opposite effect on share repurchases as large firms tend to be associated with large, mature companies that face little growth opportunities, while small companies tend to be growth companies with plentiful investment opportunities. Companies that have significant positive net present value investment opportunities are generally less likely to distribute excess capital through share repurchases, because the funds can be used more efficiently through investments. Alternatively companies with few investment opportunities and excess cash are more likely distribute capital to shareholders in order to mitigate the costs of agency conflict to the company's market value. The potential for positive NPV investments increases a company's market value over its book value; hence investment opportunities of companies are controlled using market-to-book ratio. Investment opportunities and share repurchases are expected to exhibit the following relationships:

*H1: Investment opportunities are negatively correlated with share repurchases*

*H0: Investment opportunities are not or are positively correlated with share repurchases*

Dividend payments are controlled, due to their substitute-characteristics with share repurchases. Low or no dividend paying firms are more likely to repurchase shares as a method of affecting the shareholder's tax burden, than companies that pay high dividend. According to the taxation hypothesis companies should pay out excess capital to shareholders in a way that minimizes the present value of the shareholders personal-tax liability. Given that capital gains tax rates tend to be lower than income tax rates; in jurisdictions where repurchases are taxed using capital gains tax, while dividends are taxed using income tax, companies should distribute the majority of funds using repurchases. Dividend payments and share repurchases are expected to exhibit the following relationships:

*H1: Dividend payments are negatively correlated with share repurchases*

*H0: Dividend payments are not or are positively correlated with share repurchases*

Stock market liquidity of companies has been recognized to impact repurchasing activities of companies through empirical studies. Brav, Graham, Harvey and Michaely (2005) find that 50% of managers believe that stock liquidity is an important factor in repurchasing shares. The rationale behind the effect states that companies that have a very small "free float" are less likely to repurchase shares, because reducing the number of traded shares will result in a higher liquidity discount. Alternatively, companies that have large "free float" are more likely to repurchase share given the marginal liquidity discount impact.

The stock market liquidity is however not included in the regression equation given the limited information from both the Thomson Financial and the Datastream database. The variable to measure stock market liquidity would have been either *average number of monthly trades to outstanding shares* or *average number of weekly trades to outstanding shares*, which would have both measured the portion of the outstanding shares that are traded in a given period of time. Both databases however lacked information on these variables to a significant extent.

Alternative measures for stock market liquidity would have been based on ownership data rather than stock market trades. Percentage owned by strategic owners could have acted as a proxy for stock market liquidity, as the higher percentage of a company is owned by a strategic, long-term holder the fewer shares are available to contribute to daily trades, and hence lowering the liquidity of the stock. Percentage owned by strategic shareholders-data is available from certain data sources such as Lionshare, however due to database restrictions; I was unable to source this data for the analysis.

## 4. Data and Methodology

The data and methodology section begins with (4.1) an overview of the sample selection and the adjustments that were made to the final sample. Section 4.2 covers descriptive statistics related to the sample and section 4.3 cover the variable design, which is especially important in testing the excess cash hypothesis. In section 4.4 I cover some robustness checks on the new independent variables through the use of instrumental variables. Finally in section 4.5 I present the regression equation that is used in the determination of share repurchases.

### 4.1 Sample selection and adjustments

The empirical study is based on the actual value of share repurchases of companies listed on the Nordic Stock Exchanges. The sample period covers 9 years between 2000 and 2009. The data on repurchases is sourced from the Thomson Financial-database, as well as the balance sheet items, income statement items and other disclosed corporate information applied in the research. The stock price data is obtained from the Datastream-database. The takeover and takeover rumor data is gathered from the SDC Merger and Acquisitions database. The industry divisions are made on the basis of the OMX Group divisions.

Obtaining data on share repurchases is somewhat problematic due to the lack of consistent disclosure requirements, which in part explains the limited number of research coverage of share repurchases in comparison to, for example, dividend policy. For obtaining data on repurchases one alternative is to observe the repurchase authorization announcements that companies issue after annual general meetings, however this announcement is not a guarantee that the company will actually purchase any shares from the market. Thus there can be a significant deviation between the announced number and the actually repurchased number of shares.

Alternatively one can observe the compulsory stock exchange notifications that companies issue once they have repurchased shares during a given trading day. As a part of the notification, the companies must announce the number of shares acquired, the average price as well as the percentage that the repurchases represented of the daily volume. This information is extremely useful, however is extremely arduous to source, as this must be done

manually for each company over the observation period. Companies also tend to repurchase shares over a time period rather than on an individual day<sup>27</sup>, which means that one sourcing the data might need to record tens to theoretically even hundreds of repurchase announcements per company for a given year.

A third, widely used method especially in US studies, has been to observe the cash flow statement item titled “purchase of own stock”. The item has the tendency to overestimate the size of repurchase activities, because in addition to repurchases, it includes conversion of share classes (when companies convert e.g. B-class shares to A-class shares) and the retirement of preferred shares. A fourth methodology would be to manually obtain actual value of repurchases from the notes of annual reports; however this alternative does not remain a feasible alternative at the chosen sample size and observation period (not to mention the fact that some companies appear not to separately mention share repurchases in their annual reports in any case).

The methodology chosen for this research has been to obtain repurchase values using the cash flow item “purchase of own stock”. The aforementioned problems related to the methodology are mitigated through excluding from the sample companies that: have two or more share classes and companies that have outstanding preferred shares. The impact of the exclusion is negligible as very few companies in the Nordic region have dual share classes and preferred shares.

The Thomson Financial Database has a tendency to suffer from poor data quality mainly when observing small cap companies. To make sure that the sample did not suffer from a small company bias due to the lack of low observation rates of repurchasing activities, the data was additionally completed through manually going through annual reports of those companies that returned a #N/A.

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<sup>27</sup> Stock exchanges also place restrictions on the number of shares companies are allowed to repurchase as percentage of the average daily volume with the intention of preventing large shifts in the price

## 4.2 Sample description

The chosen sample for the study is, as explained in the introduction, the public companies of the five Nordic Stock Exchanges<sup>28</sup>. The number of observed years is limited to nine, because companies have not been allowed to conduct share repurchases before 2000 in Sweden (1997 for Finland, Norway in 1999 and Denmark in 1995). In 2009 the number of companies that were included in the total data sample was 613. The number of companies in other given years deviates somewhat from the 613, because of public takeovers and new IPO's.

Figure 1 – General descriptive statistics of full data sample

The below table summarizes the full data sample by industry and country division in the year 2009. The industry division follows the OMX Group division.

Industry	Finland	Denmark	Oslo	Stockholm	Reykjavik
Consumer Discretionary	19	20	10	35	1
Consumer Staples	8	8	14	9	5
Energy	1	4	51	6	1
Healthcare	8	18	14	29	1
Industrials	41	41	36	65	3
Information Technology	27	10	23	45	1
Materials	15	9	10	13	1
Telecommunication Services	2	1	2	5	1
Sum	121	111	160	207	14
Total no. Of companies	613				

The sample sizes from the above table indicates that it is feasible to conduct country specific regressions on Finland, Denmark, Oslo and Stockholm, whereas the limited number of public companies on the Icelandic Stock Exchange does not give reason to believe that significant results could be achieved.

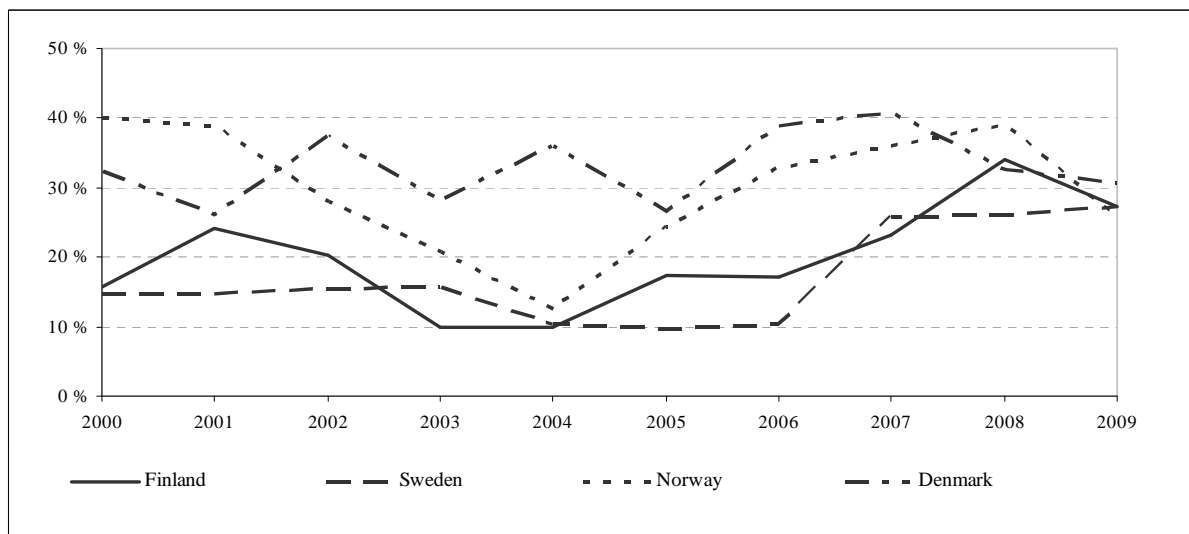
From the table we can also see that there exists significant variance in terms of industry between the Nordic stock exchanges. The Finnish and Danish stock markets are dominated by industrials, Oslo with Energy and Sweden is much more diversified in terms of industry focus. This means that the Drobetz, Gruninger and Hirschvogel (2010) model, which takes

<sup>28</sup> The pooled regressions use the data from the Helsinki, Stockholm, Oslo, Copenhagen and Reykjavik stock exchanges, however the country regressions do not include Reykjavik given the small number of listed companies on the exchange

into account the industry variation in the analysis of cash holdings will consider the structural differences in the country regressions and is therefore more likely to report more consistent results for the excess cash hypothesis.

Figure 2 – Percentage of companies conducting share repurchases by country

The graph below shows the percentage of companies conducting repurchasing activities by country. If a company of a given stock exchange has the cash flow item “*purchase of own stock*” greater than 1 (companies with preferred shares and two or more classes of shares are excluded), it is considered to have repurchased shares.



From the above graph it can be seen that there exists significant differences in the percentage of companies conducting repurchases on an annual basis, while interestingly towards the year 2009 the percentages appear to converge to around 30%. It could have been expected that the percentage of companies repurchasing shares would have been the highest in those countries that have allowed repurchasing activities the earliest (Denmark in 1995 and Finland in 1997), because in these markets the investors and companies would have “grown accustomed” to share repurchases, however this does not seem to be the case.

Denmark shows the highest percentage of repurchases in 2000, but declines from 40% to 13% in 2004. Finland and Sweden show steady development, increasing from around 16% to almost 30%, representing a near doubling in percentage of companies conducting repurchases. Percentage of repurchasing companies in Denmark fluctuates between 27 and 40%.



### 4.3 Research methodology

The methodology of the research can be considered to be divided into two parts: excess cash variable formation (through a multivariate regression analysis) and share repurchase regression analyses. Both parts apply a Tobit-model due to the required censoring arising from the definition of the dependent variable<sup>29</sup>.

As previously mentioned I apply four optimal cash holding models to obtain four model definitions for the concept of optimal cash holding. These optimal cash holdings are consequently applied to calculate the deviations of a company's actual cash position from the optimal position. The optimal cash holding regressions are conducted by pooling together all of the observations<sup>30</sup> from the data sample and running Tobit regressions<sup>31</sup> on the consolidated data. The pooling of data results in optimal cash holding models that ignore differences between observation periods and countries.

The pooling of periodic and country-specific data is done with the purpose of simplifying the analysis. There however exist strong arguments why this simplification would not result in a bias in the analysis. Firstly the differences in the effectiveness of the Nordic capital markets are very limited<sup>32</sup> and therefore do not give rise to differences in cash holding levels between the countries. The pooling of data points over time is theoretically more sensitive, because through development of economic conditions over time, one could expect companies to hold larger cash balances at times of economic uncertainty to mitigate the increased risk and hold less cash economies are doing well. However, as was discovered by Opler et al (1999), companies tend to have long-term cash target ratios, from which they may deviate in the short-term. Therefore it is actually more meaningful to have a regression equation that looks at the cash balances of companies over time in the same sample to.

Using the four derived econometric functions for optimal cash holdings, the observation value for each observation is calculated, which is then deducted from the actual cash holding to obtain a positive deviation when the company is in possession of excess cash and a negative deviation when the company has less cash than in considered optimal.

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<sup>29</sup> First part applies as its dependent variable value of repurchased share divided by total market value of outstanding shares, whereas part two applies a cash holdings divided by total assets.

<sup>30</sup> Pooling together the annual observations as well as the country observations

<sup>31</sup> Equation presented in section 4.4.1

<sup>32</sup> Financial Integration in the Nordic-Baltic Region, IMF (2007)

The calculated excess cash data alongside the independent variables for the other theories are applied in a multivariate Tobit-regression to determine what factors contribute to share repurchase determination. Each cash holding model is applied in a separate regression equation with other share repurchase theories to test for their comparative explanatory power. I observe the significance level of the cash holding models against the cash-to-total-assets ratio to determine whether the refined independent variable measuring the excess cash theory is as significant in explaining the occurrence of share repurchases.

#### 4.4 Variable design

The present study applies largely the same variables, apart from the definition of excess cash, that a number of share repurchase determinant studies have applied in the past, Dittmar (2000), Oswald and Young (2007) as well as Vermaelen (1981) amongst others. Given the fact that the study aims to test whether the existing evidence on share repurchase determination applies in the Nordic countries, the same variables must be applied to make sure the study obtains comparable results.

##### 4.4.1 Excess cash variable

Much of the variable design section is focused on the design of the independent variable measuring excess cash. Section 4.4.1 presents the regression equations of the four cash holding models, discusses the individual variables of the cash holding models as well as presents the analysis on the regression results.

###### *4.4.1.1 Excess cash models*

Finance and accounting research has come up with a number of optimal cash holding models that are often based on very similar designs given the established foundation of theories. The chosen four models can be very much seen as iterations to one another, as four to five of the independent variables across the models are the same.

Model 1 is based on the Drobetz, Gruninger and Hirschvogel (2010) research on optimal cash holdings and is the primary cash holding function of the current thesis. Their study investigates the market value of corporate cash holdings in connection with firm-specific and time-varying information asymmetries. One difference that however exists between the original cash holding model presented by Drobetz, Gruninger and Hirschvogel (2010) and the one used in the current thesis is the lack of R&D expenditures per net sales ratio. In the original study R&D expenses are used as a proxy for information asymmetries<sup>33</sup>. The thesis uses a model where this independent variable is left out as for most of the companies in the sample the Thomson Financial database lacked data on R&D expenditures.

The model will be applied in the regressions with the title “*Model 1*”. The model is constructed as following:

Model 1:

$$\begin{aligned} \frac{CashHoldings_{it}}{Assets_{it}} = & \gamma_0 + \gamma_1 \frac{Market_{it}}{Book_{it}} + \gamma_2 \frac{NetWorkingCapital_{it}}{Assets_{it}} + \gamma_3 \frac{OperatingCashFlow_{it-1}}{Assets_{it-1}} + \\ & \gamma_4 \frac{NetDebt_{it-1}}{NetAssets_{it-1}} + \gamma_5 \frac{CapitalExpenditure_{it}}{Sales_{it}} + \gamma_6 LNMarketCap_{it} + \gamma_7 CFUncertainty_{it} + \\ & \gamma_8 Industry_{it} + \gamma_9 Dividend_{it} + \varepsilon_{it} \end{aligned}$$

In the equation all asset components are net of cash<sup>34</sup>. The dependent variable is the natural logarithm of cash divided by total assets. The independent variables of the regression include market-to-book-ratio (market value of equity divided by the book value of equity), net working capital divided by total assets, operating cash flow<sup>35</sup> divided by total assets, net debt<sup>36</sup> divided by net assets, capital expenditures divided by sales, the natural logarithm of market capitalization, cash flow uncertainty<sup>37</sup>, industry dummy<sup>38</sup> and a dividend dummy.

Model 2 is the model applied by Oswald and Young (2007) in their study of share repurchases. Oswald and Young (2007) recognized the discrepancy between the volume of

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<sup>33</sup> Aboody and Lev (2000) find that information asymmetries are higher in R&D intensive companies

<sup>34</sup> Apart from cash holdings

<sup>35</sup> Measured by EBITDA (earnings before interest, taxes, depreciation and amortization)

<sup>36</sup> Interest bearing liabilities less cash and cash equivalents, excluding pension liabilities

<sup>37</sup> Measured by stock return volatility

<sup>38</sup> The industry dummy variable will be split as per the industry classification in Figure 1

cash holding studies and the limitations of the existing excess cash studies of repurchases. They improved the variable design of the excess cash hypothesis of share repurchases using a regression model for estimating the optimal cash level of companies. In the applied model, excess cash is measured following the research on cash holdings by Dittmar and Mahrt-Smith (2007) and Opler et al (1999) <sup>39</sup> referring to a surplus of cash exceeding the requirements of general business operation and capital expenditure programs.

The model will be applied in my regressions with the title “*Model 2*”. Their cash holdings research applies the following regression:

Model 2:

$$\frac{CashHolding_{it}}{Assets_{it}} = \gamma_0 + \gamma_1 \frac{Market_{it}}{Book_{it}} + \gamma_2 \frac{NetWorkingCapital_{it}}{Assets_{it}} + \gamma_3 \frac{OperatingCashFlow_{it-1}}{Assets_{it-1}} + \gamma_4 \frac{NetDebt_{it-1}}{NetAssets_{it-1}} + \gamma_5 \frac{CapitalExpenditure_{it}}{Sales_{it}} + \gamma_6 LNMarketCap_{it} + \gamma_7 Dividend_{it} + \varepsilon_{it}$$

In the equation all asset components are net of cash as in model 1. The dependent variable is the natural logarithm of cash divided by total assets. The independent variables of the regression include market-to-book-ratio, net working capital divided by total assets, operating cash flow<sup>40</sup> divided by total assets, net debt divided by net assets, capital expenditures divided by sales, the natural logarithm of market capitalization and a dividend dummy. The model therefore does not account for differences across industries, which means that the industry consideration is not mitigated. Additionally the model equation does not take into consideration the uncertainty of cash flows, which was recognized to influence the cash holding levels of companies by Almeida, Campello and Weisbach (2004). Given the limitations of the model therefore should prove to be a less efficient measure of optimal cash holdings to model 1.

Model 3 is based on the research by Almeida, Campello and Weisbach (2004) and relies more on cash flow based determinants. In their 2004 study, they used the cash holding model to

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<sup>39</sup> Oswald and Young (2007) apply a cash holding model that is slightly modified from that used by Dittmar and Mahrt-Smith (2007), while citing their work in the research.

<sup>40</sup> Measured by EBITDA (earnings before interest, taxes, depreciation and amortization)

determine the liquidity demand of companies and whether they are able to raise financing from external markets. The model will be applied in my regressions with the title “*Model 3*”. The model is constructed as following:

Model 3:

$$\frac{CashHolding_{it}}{Assets_{it}} = \gamma_0 + \gamma_1 \frac{OperatingCashFlow_{it-1}}{Assets_{it}} + \gamma_2 Tobin'sQ_{it} + \gamma_3 \frac{CapitalExpenditures_{it}}{Sales_{it}} + \gamma_4 LNMarketCap_{it} + \gamma_5 \Delta NetWorkingCapital_{it} + \gamma_6 \Delta ShortTermDebt_{it} + \gamma_7 Acquisitions_{it} + \varepsilon_{it}$$

All *asset* components in the equation are net of cash. The dependent variable is the natural logarithm of cash divided by total assets. The independent variables of the regression include operating cash flow<sup>41</sup> divided by total assets, Tobin's Q (enterprise value<sup>42</sup> of company at market prices divided by total assets at book value), capital expenditures divided by sales, company size measured by natural logarithm of market capitalization, change in net working capital, change in short term debt<sup>43</sup>, acquisitions (a dummy variable showing a value of 1, when a company conducted acquisitions during the observation year and 0 if no acquisitions were made).

Model 4 of the present thesis is a model created by D'Mello, Krishnaswami and Larkin (2007) for their research on cash allocation to corporate spin-offs. It has a similar structure to the previous models, but applies the independent variables sales growth and total debt to total assets less cash, that are omitted from other models. The model will be applied in my regressions with the title “*Model 4*”. The model is constructed as following:

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<sup>41</sup> Measured by EBITDA (earnings before interest, taxes, depreciation and amortization)

<sup>42</sup> Enterprise value of a company is the sum of the market value of equity, market value of debt, minority interest, less non-operational cash

<sup>43</sup> Including short-term interest bearing debt and short-term maturities of long-term debt

Model 4:

$$\frac{CashHolding_{it}}{Assets_{it-1}} = \gamma_0 + \gamma_1 \frac{Market_{it}}{Book_{it}} + \gamma_2 \frac{NetWorkingCapital_{it}}{Assets_{it}} + \gamma_3 \frac{OperatingCashFlow_{it}}{Assets_{it}} + \gamma_4 \frac{NetDebt_{it-1}}{NetAssets_{it-1}} + \gamma_5 \frac{CapitalExpenditure_{it}}{Sales_{it}} + \gamma_6 SalesGrowth_{it} + \varepsilon_{it}$$

As in previous cash models, all *asset* components in the equation are net of cash. The dependent variable is the natural logarithm of cash divided by total assets. The independent variables of the regression include market-to-book-ratio, net working capital divided by total assets, operating cash flow<sup>44</sup> divided by total assets, capital expenditures divided by total sales, total debt divided by net assets and sales growth.

#### 4.4.1.2 Excess cash regression methodology and data

The data sample for the model regression was obtained from the Thomson Financial database. The sample consisted of companies from the five Nordic stock exchanges<sup>45</sup>. The data excludes companies that operated in the financial services industry. The data quality was ensured by a number of tests to make sure that the value of observations fell within an economically meaningful range to make sure that the regression results would not be distorted by extreme outlier values.

For the regression on cash holdings the country and annual data were pooled together to obtain as robust regression results as possible. For the sake of simplicity we assume that no strong rationale to suggest why significant differences should exist between the cash holdings of Nordic companies. Also for the pooling of data over different time periods, cash holding levels have been recognized to exhibit a regression-to-the-mean type of behavior. This means that the cash holdings of companies fluctuate around an optimal level, whilst during a random year the cash position might not be optimal.

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<sup>44</sup> Measure by EBITDA (earnings before interest, taxes, depreciation and amortization)

<sup>45</sup> Helsinki (Finland), Stockholm (Sweden), Oslo (Norway), Copenhagen (Denmark) and Reykjavik (Iceland)

#### 4.4.1.3 Excess cash regression results

The below table shows the results for the optimal cash holding regressions using the four models presented in section 4.4.1.1.

Figure 3 – Results for the optimal cash holding model regressions

The below table presents the results from the optimal cash holding regression using the four regression models. The dependent variable is cash-to-total-assets. The Drobetz, Gruninger and Hirschvogel (2010) model is Model 1, Model 2 is the model applied by Oswald and Young (2007), Model 3 is the model applied by Almeida, Campello and Weisbach (2004) and Model 4 is the model applied by D'Mello, Krishnaswami and Larkin (2007). \*\*\* represents significance at a 99% confidence level, \*\* represents significance at a 95% confidence level and \* represents significance at 90% confidence level.

Variable	Predicted Sign	Model 1	Model 2	Model 3	Model 4
Market to Book	+	0.05*** (0.002)	0.05*** (0.002)		0.04*** (0.001)
NWC to Total Assets	+	0.14*** (0.012)	0.14*** (0.012)		0.12*** (0.012)
EBITDA to Total Assets	+	-0.20*** (0.015)	-0.20*** (0.015)	-0.23*** (0.015)	-0.22*** (0.013)
Net Debt to Net Assets	-	-1.08*** (0.103)	-1.09*** (0.103)		-0.10*** (0.010)
Capex to Net Sales	+	0.08*** (0.012)	0.07*** (0.012)	0.04** (0.013)	0.06*** (0.012)
Ln Market Capitalization	-	-0.01*** (0.003)	-0.01*** (0.003)	-0.01** (0.003)	
Dividend (Dummy)	-	-0.03*** (0.006)	-0.03*** (0.006)		
Cash Flow Volatility	+	0.17* (0.094)			
Industry (Dummy)	n/a	-0.01*** (0.001)			
Tobin's Q	+			0.03*** (0.002)	
Change in NWC	-			0 (0.000)	
Change in ST Debt	+			0.02*** (0.002)	
Acquisitions (Dummy)	-			0.06** (0.005)	
Sales Growth	+				0.04*** (0.004)
Constant		0.19*** (0.010)	0.17*** (0.007)	0.18*** (0.002)	0.14*** (0.004)
Sigma		0.16*** (0.010)	0.16*** (0.007)	0.14*** (0.002)	0.16*** (0.004)
Observations		4,134	4,134	4,096	4,134

The results of the Drobetz, Gruninger and Hirschvogel (2010) and Oswald and Young (2007) regressions resemble the predictions presented on each variable. Market to book ratio has a highly significant positive coefficient, which implies that companies with high market to book values tend to hold larger quantities of cash, most likely to enable them to better take advantage of investment opportunities as they arise. Net working capital (less cash) to total assets has a significantly positive coefficient, which supports the mentioned theory that states that companies with high NWC (less cash) levels tend to require higher quantities of cash at any given time due to the high liquid asset turnover. Through higher cash holdings managers can better cover their maturing liabilities in the short term.

Net debt to total assets has a highly significant negative coefficient, implying that companies with large debt holdings have lower cash holdings than companies with small debt holdings. This can be reasoned by the fact that companies that require cash for various uses can obtain it by raising more debt. After the debt on the balance sheet has increased the cash is put to uses, thus proportionately the net debt increases. The result is in line with the results of Drobetz, Gruninger and Hirschvogel (2010), despite the fact that the economic reasoning for the negative coefficient is not without its downfalls.

EBITDA to total assets, effectively measuring the cash flow that is generated by the assets of the company, shows a significant negative coefficient opposed to the prediction by the managerial opportunism theory. The theory states that companies that have high internal cash generation abilities are subject to less external scrutiny due to lower degree of monitoring by fewer creditors. This enables the managers to amass larger quantities of cash.

In the study by Opler et al (1999) finds that the coefficient for the cash flow variable is positive, implying that high cash flow generation leads to high cash holdings in companies. Despite the results of Opler the negative coefficient for cash flow is not unheard-of and a rationale for the negative relationship exists.

In a working paper Couderc (2005) obtains similar results and explains the theoretical rationale for the (significant) negative coefficient, which is supported by the transaction cost theory of cash holdings. In his view when internally generated funds are abundant (i.e. high cash flow generation) a given firm can finance its investment opportunities without problems and is less likely to face financial distress. This translates to a low requirement to hold significant portions of liquid funds on the company's balance sheet, however is contingent on



investment opportunities of the firm. Alternatively the company can return the capital, however this cannot be determined from the results.

The more common positive relationship is seen as arising from the managerial opportunism theory, which states that in situations where a company generates abundant cash flows, the management is less dependent on external financing. As external financing tends to be accompanied by higher scrutiny by the creditors, the independence from external financing can result in managers amassing large portions of cash, because their actions face lower degree of control.

Capital expenditure to sales ratio has a significant, small positive, coefficient. This implies that companies that invest more tend to invest more in the future as well. Additionally, companies that have invested highly in a given year will not necessarily be able to generate high cash flows from the young assets in the next year, resulting reserving higher quantities of cash on the balance sheet for running costs.

The natural logarithm of market capitalization has a negative significant coefficient, which supports the transaction cost theory capital. Previous research, such as Vogel and Maddala (1967), have identified that larger companies are better able to obtain financing over their smaller counterparties, which means that larger companies have less need to hold large quantities of cash on its balance sheet in case capital is required at a short notice.

Companies that tend to return capital to shareholders in the form of dividends hold smaller quantities of cash on their balance sheet, suggested by the significant negative coefficient. This is supported by the simple fact that if companies payout cash in the form of dividends, they see a reduction of cash on their balance sheet.

The most critical observations from Model 1 relate to the new variables, cash flow volatility and industry dummy, that are presented as an improvement to Model 3 (Oswald and Young (2007)). Stock return volatility, a proxy for cash flow volatility, has a significant positive coefficient, which implies that managers facing uncertain cash flows tend to hold larger quantities of cash on the balance sheet to create a buffer for cash flow shortfalls to enable them to cover maturing liabilities and potentially take advantage of arising investment opportunities. The 90% significance level implies that the variable belongs in the model for cash holdings.

The industry dummy shows a highly significant coefficient, however the term doesn't have a true economically meaningful interpretation.

The results of the Model 2 (Almeida, Campello and Weisbach (2004)) strongly follow the results of the original study apart from *Change in NWC* variable, which reports a non-significant near zero coefficient. Tobin's Q reports a similar result to the market to book ratio, given their similar nature. Change in short term debt shows a significant positive coefficient.

The results for the D'Mello, Krishnaswami and Larkin (2007) model resemble the results from Models 1, 2 and 3 for the variables they have in common. Sales growth shows the expected positive coefficient with high statistical significance (99%). The positive coefficient can be explained by the fact that companies facing high growth rates require high proportions of cash to support the growth of the top line.

The total debt to total assets variable has the expected negative coefficient with high statistical significance (99%). Comparing the variable coefficient with the net debt to net assets applied by models 1 and 2, shows an unexpectedly high variance.

#### 4.4.1.4 Cash holding model evaluation

After having established the four cash models it is reasonable to make some observations on their joint behavior by constructing a correlation matrix. From the below correlation matrix we can see some key issues that need to be taken into account when analyzing the consequent regression results.

Firstly with the table we can establish whether the cash models differ from the standard cash-to-total-assets ratio (CASH), because if they correlated perfectly, then cash-to-total-assets would indeed be a sufficient proxy for excess cash holdings, and the additional cash holding models would bring little contribution to the understanding of the excess cash theory. Secondly using the table we can establish whether the models differ from each other to a sufficient extent to provide a reasonable sphere of variance to the results in the subsequent regressions.

Figure 4 – Correlation matrix of independent variables for excess cash

The below table shows the correlation matrix for the four cash holding models and the cash-to-total-assets ratio. The correlations are calculated using the pooled data sample to calculate optimal cash holding estimates for each observation and calculating the correlations between the estimates.

	CASH	Model			
		1	2	3	4
CASH	1.000	0.803	0.967	0.792	0.427
1	0.803	1.000	0.823	0.662	0.299
2	0.967	0.823	1.000	0.756	0.443
3	0.792	0.662	0.756	1.000	0.242
4	0.427	0.299	0.443	0.242	1.000

From the correlation matrix above we can see that there is a clear motive to place the explanatory power of both the standard excess cash theory (cash divided by total assets as dependent variable) and the research by Oswald and Young (2007) to the test, as the cash-to-total-assets and the model applied by Oswald and Young (Model 2) correlate heavily with each other. This implies that the results from the research by Oswald and Young would have closely followed the results of previous research that has applied the mere cash-to-total-assets, while the other introduced models show a degree of variance.

Model 1, the model by Drobetz, Gruninger and Hirschvogel (2010), correlates less than Model 2 with the cash-to-total-assets. Also the fact that Model 1 is very similar to Model 2 (apart from the addition of the cash flow volatility and industry dummy variables) it is important that the correlation of the two variables deviates from 1. Model 3 and 4 also clearly correlate less with cash over total assets than Model 2, and therefore will be useful in testing the explanatory power of existing studies.

#### 4.4.2 Other independent variables

It is difficult to observe objectively the undervaluation of companies, which is why the study applies a commonly accepted proxy for undervaluation that correlates with valuation levels of companies. To observe the undervaluation many studies have previously employed two alternative variables. The first is the commonly used market-to-book ratio and the second is pre-event stock return. Market-to-book ratio is a very commonly used measure of

undervaluation largely due to the simplicity of its interpretation. When a company has a small market-to-book ratio, the value of the assets is close to their replacement value, implying low future value generation. When a company has a high market-to-book ratio, investors expect that the company will be able to create value from its assets that exceed their replacement value and are therefore willing to pay the higher price for the stock.

However as in the share repurchase-context, market to book ratio is used to control for investment opportunities many repurchasing studies apply another proxy for undervaluation which is 3 month pre-year end stock return. A prior 3 month period of negative stock market performance as a measure for undervaluation has been applied in a number of share repurchase studies such as Dittmar (2000) and Ishikawa and Takahashi (2010). The reasoning behind the variable states that in the presence of information asymmetries stock market participants at times potentially overreact, creating negative momentum that leads to stock prices below the intrinsic value, hence undervaluation. The stock market performance data is obtained using the Datastream database.

Testing of the leverage hypothesis of share repurchases requires the recognition of a target leverage ratio for companies in order to determine whether the year beginning leverage ratio falls short or exceeds the management set target. To obtain the target leverage level of a given company, the study applies a methodology used in Dittmar (2000) study whereby the companies are first categorized over time by industry, after which we calculate the median net debt to total assets of each industry. This median net debt to total assets value represents the target leverage level of a given industry, which is used to obtain the deviation of each observation at a given time. The industry division is conducted in the same fashion as in the excess cash variable, by using the industry division of the OMX-Group. The data items that are required for the variable are obtained from the Thomson One Banker database. A descriptive table for the net debt calculations can be found in Appendix D.

Takeover deterrence variable is a dummy variable, which appears as 1 when either a takeover rumor or a takeover attempt is recognized in a given observation year. The data therefore includes takeover rumors, unsuccessful takeover attempts (bidder withdraws or target declines) as well as takeover attempts that succeeded. I include successful takeovers because we are interested on whether companies use repurchases as a takeover deterrent, not only on occasions where the company was successful in deterring acquisitions. This also leads to another assumption by which the thesis differentiates itself from comparable works.

My thesis assumes that managers are aware of the threat of potential takeovers in advance. Previous studies have used takeover deterrence variable of the previous year<sup>46</sup> (t-1), which I perceive as being a fundamentally implausible. As the theory states that companies repurchase shares to react against takeover activity, it is unlikely that companies will repurchase shares due to takeover activity that potentially took place a year ago.

The data for takeover news and rumors is likely to suffer from non-public takeover processes and size bias. Often companies are approached by acquirers and will run a carefully managed private process with limited insiders. In some instances due to the low number of insiders the information regarding the takeover situation might not reach the market and would therefore not be included in the dataset. Additionally large companies due to their complexity are likely to have larger insider groups, a larger media following as well as multiple business units<sup>47</sup>, factors that are more likely to firstly lead into takeover situations and secondly, increase the likelihood of a leak. The data for the takeover rumors and attempts is obtained using the SDC database. The number of public takeovers and takeover rumors from the database amounted to 776.

Executive compensation variable is a dummy variable, which appears as a 1 when the company is recognized to have dilutive stock options in the year end prior to observation. The presence of stock options for compensation purposes is done by excluding companies that have outstanding preferred shares (which is done also for the purpose of obtaining the dependent variables), convertible debt or warrants that could also explain the presence of dilution. After doing the adjustments, the companies that show dilutive options are ones that have outstanding compensation related stock options. All of the data items for the variable can be obtained from the Thomson One Banker database.

Insider ownership variable is measured as closely held shares divided by total shares outstanding. The Worldscope item “closely held shares” includes both shares owned by the company’s management as well as shares owned by large shareholders that are considered as insiders. The reason why it is useful to include both management share holdings and large external shareholdings is that both of the holdings influence the costs of agency conflict within a company. Management shareholdings align their incentives to resemble those of the

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<sup>46</sup> For example when observing the repurchasing activities of a company in 2005, comparable papers used takeover activity that occurred in 2004, whereas I use the activity of 2005

<sup>47</sup> Companies that have multiple business units are likely to see a larger number of takeover rumors, as the rumors include also those instances whereby the acquirer is interested to acquire the single division rather than the full company

shareholders more closely, whereas large shareholders spend more time following the actions of the management, thus placing their actions to higher degree of scrutiny.

#### 4.4.3 Dependent variables

The dependent variable in share repurchase studies has always been a key concern from a research point of view, because, as discussed, reliable data on share repurchases is difficult to come by. In the present study two alternative dependent variables are applied to the observation of share repurchases: value of stock repurchases divided by year end market value and value of stock market repurchases to year average market value<sup>48</sup>. Due to the fact that we apply a cash flow statement item to determine the value of repurchases, we cannot know exactly at what point in time the shares were repurchased. One needs timing data to determine the relative size of the repurchases compared to the total market capitalization at the time of purchase in order to make a comparison between companies. Past studies by, for example, Dittmar (2000) have applied the year end market value in their calculation of the dependent variable however there are multiple reasons why a year average market value would be a better variable.

Firstly, the market value at the end of the year might be a poor proxy for the price at which the company shares were purchased. If a company acquires shares at a significantly lower price during the year and the stock prices sees an appreciation towards the year end, the proportionate value of the repurchased shares are diluted by the increase of the denominator. This would cause the dependent variable to be distorted.

Alternatively, given the past few years of market turbulence and unexpected declines in share prices, it is possible that companies have repurchased shares preceding a market decline. Consequently this would inflate the proportional value of repurchased value to total market value.

By applying a year end average market value, the dependent variable can partially capture especially large stock market movements during the year. The better capturing leads to an observation of a more truthful proportional value that the managers of a given company are willing to repurchase. To improve the comparability with previous studies, the regressions

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<sup>48</sup> Calculated as an average of daily closing market values

will apply both repurchased value to year end market value and repurchased value to year end average market value.

#### 4.5 Instrumental variables and variable robustness

When presenting new variables and variable designs to explain theories, it is commonplace to conduct some form of robustness checks on whether the new variables are actually causing the change in the dependent variable. In some instances the correlation between a new independent and a dependent variable might be misinterpreted as causality, whereas in reality the correlation might arise from the new variable correlating strongly with an existing explanatory variable, giving rise to an instrumental variable problem. In other cases the causality between an independent and a dependent variable can be misunderstood, as it might be actually that the dependent variable is causing the changes in the independent variable.

In the study of excess cash and share repurchases the risk of instrumental variables is present as the value of the excess cash is determined by variables that also act as determinants to share repurchases. For example the independent variables from the repurchase regression equation market-to-book ratio, size, cash flow and leverage are similarly found in a number of the excess cash models. The aforementioned will create a correlation between the excess cash variable and a number of the independent variables in the repurchase determinant regression equation.

The risk of omitted variable bias in the current research can be considered minor given the strong foundation of existing research on both the determinants of excess cash as well as share repurchases. With both theories the model definition has been developed over time, and therefore one can make the decision that further investigation into the definition of the models should fall outside the scope of the research.

#### 4.6 Regression model and equations

The study applies a multivariate Tobit-regression to investigate the impact of the excess cash hypothesis, insider ownership as well as the other relevant hypotheses on share repurchases.

The rationale behind the use of a Tobit-regression is the fact that the model is designed to estimate linear relationships between variables in cases when there is either a right- or left-censored <sup>49</sup>dependent variable. In the study I apply a dependent variable that is confined to a range between 0 and 1, thus requiring the censorship of values that fall outside the given range.

I test the stated hypotheses (Section 3) using a multivariate Tobit-model presented below:

$$\begin{aligned}
 RP_{it} = & \alpha_{it} + \beta_1 Cash_{it} + \beta_2 CashFlow_{it} + \beta_3 Leverage_{it-1} + \beta_4 Option_{it} \\
 & + \beta_5 UnderValuation_{it} + \beta_6 Takeover_{it} + \beta_7 InsideOwnership_{it} + \beta_8 Payout_{it} \\
 & + \beta_9 MB_{it} + \beta_{10} Size_{it} + \varepsilon_{it}
 \end{aligned}$$

The above model emulates the equation used by Dittmar (2000) with the exception of the term *InsideOwnership*, which is the independent variable measuring the effect of insider holding. In the equation *i* represents a company under observation, whereas *t* represents time measured by the fiscal year. The dependant variable RP can take two forms: value of share repurchases during financial year divided by year end market capitalization of equity, or alternatively divided by the year average market capitalization of equity. For further details on the independent variables, please refer to section 4.4 that deals with variable definition in detail. The model differs from the originally applied model through one variable which was stock market liquidity.

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<sup>49</sup> Right-censoring refers to the exclusion of values at or above a given threshold, whereas left-censoring refers to the exclusion of values at or below a given threshold



## 5. Results

The results section of the paper is structured as following: first I will present the results of Tobit-regressions on share repurchase determinants using a combined dataset over time<sup>50</sup> applying the four cash holding models, the cash over total assets-ratio as well as the independent variables described in section 3. The table shows the results for two alternative dependent variables: value of share repurchases divided by the year end market capitalization and value of share repurchases divided by the average of year end market capitalizations<sup>51</sup>. These results can be found in section 5.1, figure 5.

Secondly I will present the results from a combined dataset over time for the four individual Nordic Stock Exchanges applying the four cash holding models, the cash over total assets-ratio as well as the independent variables described in section 3. The table shows the results for two alternative dependent variables: value of share repurchases divided by the year end market capitalization and value of share repurchases divided by the average of year end market capitalizations<sup>52</sup>. These results can be found in section 5.2, figure 6.

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<sup>50</sup> A combined dataset over time refers to the combination of all observations over time into a single dataset

<sup>51</sup> Average of t=0 and t=-1 year ending market capitalizations

<sup>52</sup> Average of t=0 and t=-1 year ending market capitalizations

## 5.1 Regression results using a pooled data sample

Figure 5 – Results of Tobit regressions on share repurchases using pooled sample

The table below depicts the results from the Tobit regression of a combined dataset over time. The independent variables are shown on the left-hand column. The dependent variables of the regressions are “Repurchased value to YE Mcap” and “Repurchased value to YE Mcap average”. The “Expected sign” column shows the expected sign of the variables regression coefficient, determined on the basis of the hypotheses. The coefficient is the value in line with the name of the independent variable. The standard deviation is the number in brackets below the coefficient. \*\*\* represents significance at a 99% confidence level, \*\* represents significance at a 95% confidence level and \* represents significance at 90% confidence level.

Variable	Expected sign	Repurchased value to YE Mcap					Repurchased value to YE Mcap average				
Model 1	+	0.14*** (-0.022)					0.10*** (-0.019)				
Model 2	+		0.15*** (-0.022)					0.12*** (-0.019)			
Model 3	+			0.17*** (-0.024)					0.12*** (-0.02)		
Model 4	+				0.22*** (-0.022)					0.17*** (-0.019)	
CASH	+					0.12*** (-0.025)					0.08*** (-0.022)
CASH FLOW	+	0.28*** (-0.03)	0.30*** (-0.03)	0.26*** (-0.029)	0.32*** (-0.028)	0.29*** (-0.03)	0.24*** (-0.026)	0.25*** (-0.025)	0.22*** (-0.025)	0.26*** (-0.024)	0.25*** (-0.026)
LEVERAGE	-	-0.03* (-0.014)	-0.02 (-0.014)	-0.01 (-0.014)	-0.07*** (-0.011)	-0.04** (-0.014)	-0.03** (-0.012)	-0.02 (-0.012)	-0.02* (-0.012)	-0.06*** (-0.009)	-0.04*** (-0.012)
OPTION	+	0.03*** (-0.005)	0.03*** (-0.005)	0.03*** (-0.005)	0.03*** (-0.005)	0.03*** (-0.006)	0.03*** (-0.005)	0.03*** (-0.005)	0.03*** (-0.005)	0.02*** (-0.005)	0.03*** (-0.005)
UNDERVALUATION	-	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.03*** (-0.009)	-0.03*** (-0.009)	-0.03*** (-0.009)	-0.03*** (-0.008)	-0.03*** (-0.009)
TAKEOVER	+	0.06*** (-0.01)	0.06*** (-0.01)	0.06*** (-0.01)	0.06*** (-0.01)	0.06*** (-0.01)	0.05*** (-0.009)	0.05*** (-0.009)	0.05*** (-0.009)	0.05*** (-0.009)	0.06*** (-0.009)
INSIDE OWNERSHIP	-	-0.04*** (-0.012)	-0.04*** (-0.012)	-0.04*** (-0.012)	-0.05*** (-0.012)	-0.05*** (-0.012)	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.04*** (-0.01)	-0.04*** (-0.011)
PAYOUT	+	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.004)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)
MB	-	-0.02*** (-0.002)	-0.02*** (-0.002)	-0.02*** (-0.002)	-0.02*** (-0.002)	-0.01*** (-0.002)	-0.01*** (-0.002)	-0.01*** (-0.002)	-0.01*** (-0.002)	-0.01*** (-0.002)	-0.01*** (-0.002)
SIZE	+	0.04*** (-0.004)	0.03*** (-0.004)	0.03*** (-0.003)	0.03*** (-0.003)	0.03*** (-0.004)	0.03*** (-0.003)	0.03*** (-0.003)	0.02*** (-0.003)	0.02*** (-0.003)	0.02*** (-0.003)
Constant		-0.23*** (-0.015)	-0.21*** (-0.013)	-0.18*** (-0.012)	-0.18*** (-0.012)	-0.20*** (-0.014)	-0.19*** (-0.013)	-0.18*** (-0.012)	-0.16*** (-0.011)	-0.16*** (-0.011)	-0.17*** (-0.012)
sigma		0.10*** (-0.003)	0.10*** (-0.003)	0.10*** (-0.003)	0.10*** (-0.003)	0.10*** (-0.003)	0.09*** (-0.003)	0.09*** (-0.003)	0.09*** (-0.003)	0.08*** (-0.003)	0.09*** (-0.003)
Pseudo R2		0.5239	0.5261	0.5332	0.5663	0.5016	0.6100	0.6174	0.6165	0.6566	0.5907
Observations				3,670					3,670		

The results from the combined data set using both average and year end market capitalization repurchase dependent variables are presented in figure 5. On the basis of the regression results one can confirm the hypothesis for the excess cash theory – repurchases and excess cash holdings show a positive correlation. This suggests that companies in possession of excess cash tend to distributed capital to shareholders in the form of share repurchases. The four cash models and the simple CASH (cash-to-total-assets) variable show similar results, with all

highly significant positive coefficients, suggesting that the conclusions from previous research has not suffered from a significant variable definition problem.

Interestingly enough, no two models or the cash-to-total-assets variable result in the same coefficient (measured to two decimals), which suggests that meaningful differences exist between the models and these differences have a measurable impact on the correlation between the defined excess cash and share repurchases. Comparing the results from the newly introduced Model 1 to the Model 2, that has previously been applied to research on the excess cash theory, suggests that the relationship between share repurchases and excess cash is similar albeit slightly weaker than previously assumed, evidenced by the lower regression coefficient. The coefficient of the CASH variable, initially used by Jensen (1986), is however lower compared to all excess cash definitions derived from the excess cash models, suggesting that the effect of excess cash on share repurchases is more substantial than is suggested by a simple cash-to-total-assets variable and that the improvement in the variable design of excess cash brings meaningful insight to the understanding of share repurchases.

Models 3 and 4 with respective coefficients of 0.17 and 0.12 versus 0.22 and 0.17 show stronger relationships with share repurchases than Models 1 and 2. Especially the results for Model 4 show a surprisingly strong relationship (nearly twice the coefficient of cash-to-total-assets) that stands out from the other models. Among the independent variables lacking in Models 3 and 4 (but applied in Models 1 and 2) is the dividend dummy, which appears to have a significant impact on the regression results. This is most likely due to the close substitutive relationship<sup>53</sup> between share repurchases and dividends and as the dividend is not accounted for in the models 3 and 4, they show a stronger relationship.

When comparing the significance of the cash models through a comparable statistic such as the t-value, Model 4 shows the highest significance using both *Repurchased value to Mcap* as well as *Repurchased value to Mcap average* as dependent variables with respective t-values of -10.00 and -8.95. The second highest significance is shown by Model 3 with respective t-values of -7.08 and -6.00. The t-values of Models 1 and 2 do not show substantial difference, but are both noticeably higher than the t-value of CASH variable (Model 1 and 2 ranging between 5.36 and 6.83 and CASH ranging between 3.64 and 4.80).

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<sup>53</sup> As documented by Grullon and Michaely (2002) the increase in share repurchase activity in the United States has partly been financed with potential increases in dividends. They find that the share repurchase activity over the last two decades has helped the average total payout ratio of firms to stay relatively constant despite the decline in the average dividend payout ratio.

Insider holdings show a highly significant negative coefficient as expected on the basis of the hypothesis. This is one of the most interesting findings as it stands against empirical findings from Oswald and Young (2007) research. It appears that in Nordic countries the managerial opportunism and agency conflict issues are not as significant force in determining corporate payouts, perhaps due to higher shareholder protection; and that investment characteristics of insiders have a larger effect on repurchases.

Most of the independent variables from the regression show significant results, with the exception of the Leverage hypothesis, which while showing the expected coefficient, has a low degree of significance. In light of the results we accept the null hypothesis for the leverage hypothesis. Cash flow, executive compensation, undervaluation and payout variables all show significant results with the expected signs. These results are consistent with both dependent variables as with the four excess cash models and cash-to-total-assets ratio. Therefore the hypotheses for the cash flow, executive compensation, undervaluation and payout theories are accepted.

With the results from figure 5 we can accept the null hypothesis for the Model 1. The coefficient of Model 1 is significant and lower than the coefficient of Model 2<sup>54</sup> with both dependent variables. The results suggest that if we assume that Model 1 is better at predicting excess cash levels, then the relationship between excess cash and share repurchases is weaker than previously suggested. For Models 3 and 4, we can accept the stated hypothesis as the coefficients are significant and larger than both Model 2 and the cash-to-total-assets ratio.

For the share repurchase determinants in the Nordic region we can accept the excess cash hypothesis through the significant positive coefficient on all independent variable measures. This suggests that the previous research on the excess cash hypothesis has been proven correct, suggesting that companies with excess cash tend to distributed capital to shareholders in the form of share repurchases. We can also accept the hypotheses for the cash flow, option, undervaluation, takeover and insider ownership hypotheses through the broadly significant, as predicted coefficients. The leverage hypothesis shows very volatile results in terms of significance which leads to the acceptance of the null hypothesis. On the basis of the results we cannot confirm that companies use share repurchases as a method for adjusting their capital structure in situations where the balance sheet carries more equity than is considered optimal by the company's management and shareholders.

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<sup>54</sup> However the coefficient is higher than the coefficient of the cash-to-total-assets ratio, we nevertheless accept the null hypothesis as coefficient is lower than the coefficient of our second point of comparison, Model 2

## 5.2 Regression results using the country samples

Figure 6 – Results of Tobit regressions on share repurchases using country sample

The table below depicts the results from the Tobit regression of the country sample. The independent variables are shown on the left-hand column. The dependent variables of the regressions are “Repurchased value to YE Mcap average”. The “Expected sign” column shows the expected sign of the variables regression coefficient, determined on the basis of the hypotheses. The coefficient is the value in line with the name of the independent variable. The standard deviation is the number in brackets below the coefficient. \*\*\* represents significance at a 99% confidence level, \*\* represents significance at a 95% confidence level and \* represents significance at 90% confidence level.

Variable	Expected sign	Helsinki					Stockholm					Oslo					Copenhagen				
Model 1	+	0.09*** (-0.027)					0.18*** (-0.041)					0.11* (0.056)					0.11** (0.051)				
Model 2	+	0.14*** (-0.025)					0.14** (-0.047)					0.11* (0.057)					0.13** (0.052)				
Model 3	+	0.14*** (-0.029)					0.16** (-0.05)					0.16** (0.053)					0.15** (0.056)				
Model 4	+	0.17*** (-0.037)					0.25*** (-0.048)					0.30*** (0.053)					0.18*** (0.045)				
CASH	+	0.11*** (-0.031)					0.10** (-0.052)					0.04 (0.062)					0.09 (0.059)				
CASH FLOW	-	0.14*** (-0.042)	0.13*** (-0.039)	0.10** (-0.039)	0.14*** (-0.04)	0.13** (-0.041)	0.40*** (-0.068)	0.42*** (-0.068)	0.38*** (-0.066)	0.47*** (-0.067)	0.41*** (-0.069)	0.26*** (0.071)	0.27*** (0.071)	0.22** (0.069)	0.30*** (0.063)	0.28*** (0.071)	0.27*** (0.062)	0.30*** (0.062)	0.27*** (0.060)	0.29*** (0.058)	0.30*** (0.063)
LEVERAGE	-	-0.03 (-0.018)	0 (-0.017)	0 (-0.019)	-0.06*** (-0.014)	-0.02 (-0.019)	-0.05 (-0.029)	-0.06** (-0.031)	-0.06** (-0.03)	-0.09*** (-0.024)	-0.09** (-0.031)	-0.10** (0.033)	-0.09** (0.035)	-0.07** (0.033)	-0.09** (0.028)	-0.11*** (0.034)	-0.03 (0.027)	-0.01 (0.030)	-0.00 (0.031)	-0.07** (0.021)	-0.03 (0.029)
OPTION	+	0.02** (-0.007)	0.02** (-0.006)	0.02** (-0.006)	0.01** (-0.007)	0.02** (-0.007)	0.03** (-0.011)	0.03** (-0.011)	0.03** (-0.011)	0.03** (-0.011)	0.03** (-0.011)	0.03** (0.015)	0.03* (0.015)	0.03** (0.015)	0.02 (0.014)	0.03* (0.015)	0.05*** (0.012)	0.05*** (0.012)	0.05*** (0.012)	0.05*** (0.012)	0.05*** (0.012)
UNDEVAL.	+	-0.03** (-0.013)	-0.03** (-0.013)	-0.03** (-0.013)	-0.03** (-0.013)	-0.03** (-0.013)	-0.02 (-0.019)	-0.03 (-0.02)	-0.03 (-0.02)	-0.02 (-0.019)	-0.03 (-0.02)	-0.04* (0.023)	-0.04* (0.023)	-0.04* (0.022)	-0.04* (0.021)	-0.04* (0.023)	-0.07** (0.024)	-0.06** (0.024)	-0.06** (0.024)	-0.06** (0.024)	-0.07** (0.024)
TAKEOVER	+	0.03** (-0.011)	0.03** (-0.011)	0.03** (-0.011)	0.04*** (-0.011)	0.03** (-0.011)	0.09*** (-0.021)	0.09*** (-0.021)	0.09*** (-0.021)	0.10*** (-0.021)	0.10*** (-0.021)	0.04 (0.025)	0.04* (0.025)	0.04* (0.024)	0.02 (0.023)	0.04* (0.025)	0.10*** (0.026)	0.09*** (0.026)	0.09*** (0.026)	0.09*** (0.025)	0.10*** (0.026)
INSIDE OWN.	-	-0.05*** (-0.016)	-0.05*** (-0.015)	-0.05*** (-0.015)	-0.06*** (-0.016)	-0.06*** (-0.016)	-0.13*** (-0.029)	-0.14*** (-0.03)	-0.14*** (-0.029)	-0.14*** (-0.029)	-0.15*** (-0.03)	-0.02 (0.038)	-0.02 (0.038)	-0.02 (0.037)	-0.01 (0.035)	-0.02 (0.038)	0.01 (0.023)	0.00 (0.023)	0.00 (0.023)	0.00 (0.023)	0.00 (0.023)
PAYOUT	+	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.01** (-0.003)	0.02** (-0.007)	0.02** (-0.007)	0.01** (-0.007)	0.02** (-0.007)	0.02** (-0.007)	0.03** (0.014)	0.03** (0.014)	0.03** (0.014)	0.03** (0.013)	0.03** (0.014)	0.01 (0.009)	0.01 (0.009)	0.01 (0.009)	0.01 (0.009)	0.01 (0.009)
MB	+	-0.01*** (-0.003)	-0.01*** (-0.003)	-0.01*** (-0.003)	-0.01*** (-0.003)	-0.01*** (-0.003)	-0.02*** (-0.004)	-0.02*** (-0.004)	-0.02*** (-0.004)	-0.02*** (-0.004)	-0.02*** (-0.004)	-0.02** (0.008)	-0.02** (0.008)	-0.02** (0.008)	-0.02** (0.008)	-0.02** (0.008)	-0.01** (0.004)	-0.01** (0.004)	-0.01** (0.004)	-0.01** (0.004)	-0.01** (0.004)
SIZE	n/a	0.02*** (-0.004)	0.02*** (-0.004)	0.01** (-0.004)	0.01** (-0.004)	0.01*** (-0.004)	0.05*** (-0.007)	0.04*** (-0.007)	0.04*** (-0.007)	0.04*** (-0.007)	0.04*** (-0.007)	0.02** (0.012)	0.02* (0.012)	0.02 (0.011)	0.02** (0.011)	0.02 (0.012)	0.03*** (0.009)	0.03*** (0.009)	0.03** (0.008)	0.03*** (0.008)	0.03*** (0.008)
Constant		-0.11*** (-0.018)	-0.10*** (-0.015)	-0.08*** (-0.015)	-0.07*** (-0.015)	-0.10*** (-0.017)	-0.25*** (-0.028)	-0.23*** (-0.027)	-0.20*** (-0.025)	-0.21*** (-0.025)	-0.22*** (-0.028)	-0.20*** (0.047)	-0.18*** (0.044)	-0.16*** (0.040)	-0.16*** (0.038)	-0.17*** (0.045)	-0.24*** (0.030)	-0.22*** (0.026)	-0.20*** (0.025)	-0.21*** (0.025)	-0.22*** (0.026)
sigma		0.05*** (-0.004)	0.05*** (-0.004)	0.05*** (-0.004)	0.05*** (-0.004)	0.05*** (-0.004)	0.11*** (-0.007)	0.11*** (-0.007)	0.11*** (-0.007)	0.11*** (-0.006)	0.12*** (-0.007)	0.10*** (0.009)	0.11*** (0.009)	0.10*** (0.008)	0.10*** (0.008)	0.11*** (0.009)	0.11*** (0.006)	0.11*** (0.006)	0.11*** (0.006)	0.11*** (0.006)	0.11*** (0.006)
Pseudo R2		1.102	1.2488	1.2065	1.1632	1.1202	0.5799	0.5623	0.5649	0.5876	0.5517	0.6665	0.6661	0.7047	0.8613	0.6663	0.5238	0.5297	0.5363	0.5693	0.5127
Observations		918	918	918	918	918	1493	1493	1493	1493	1493	490	490	490	490	490	783	783	783	783	783

The above table (figure 6) depicts the results from the Tobit-regressions using country specific data. Similarly to figure 5, each of the alternative models for the independent variable measuring excess cash is regressed together with the other determinant variables in their own separate regressions, using both average and year end market capitalization repurchase dependent variables. As an observation to the results of figure 6 compared to figure 5 - the results broadly suffer from lower significance levels, which is likely due to the lower sample sizes for the individual countries.

Observing the performance of the cash models, in terms of coefficient significance, in explaining repurchases across countries, it can be stated that on average the cash-to-total-assets appears to once again downplay the impact of the excess cash theory, consistent with the regression results in figure 5. The cash models in every single regression provide a coefficient that is as significant or more significant compared to the cash-to-total-assets. It is also interesting to observe that the cash-to-total-assets gives a noticeably lower coefficient on average than the cash models, which implies that, *ceteris paribus*, excess cash has a larger impact on repurchasing activities of companies than was previously considered using cash-to-total-assets.

There are interesting differences between the country regressions when it comes to the significance of the specific model coefficients. The introduced Model 1 has the highest statistical significance in the Helsinki and Stockholm stock exchanges both with statistically significant coefficients at 99% confidence levels, while the significance of the coefficients in Oslo and Copenhagen is notably lower at respective confidence levels of 90% and 95%. It is difficult to make judgements regarding the foundations for these differences given the similar structure of the Nordic stock exchanges<sup>55</sup>, the similar late adoption of share repurchases and the similar Nordic taxation<sup>56</sup>. One potential reason could arise from the fact that companies in Denmark and Norway have on average more consistently distributed capital via share repurchases over time<sup>57</sup>, which could mean that the distribution in Denmark and Norway is less sensitive to changes in company financials, leading to weaker correlations and lower significances.

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<sup>55</sup> Please refer to figure 1

<sup>56</sup> Corporate and Individual (top rate) tax rates in the Nordic countries respectively: Finland 25% and 51%, Sweden 26% and 57%, Norway 28% and 48% and Denmark 26% and 55%

<sup>57</sup> Please refer to figure 2

Similarly to the results in figure 5, the models and cash-to-total-assets show significant variety in coefficients suggesting the meaningful differences exist between the explanatory relationship between definitions of excess cash and share repurchases. In Finland the Model 1 coefficient is smaller (and significant) than the coefficients of Model 2 and cash-to-total-assets. This suggests that the relationship between excess cash and share repurchases is weaker than would be suggested by the methodologies of Oswald and Young (2007) and Jensen (1986), leading to the acceptance of the null hypothesis for the excess cash theory in Finland. Models 3 and 4 show significant (99%) coefficients (0.14 and 0.17 respectively) that are both larger than the cash-to-total-assets coefficient. The coefficient of Model 4 is larger than the coefficient for Model 2, suggesting the largest relationship. Therefore the null hypothesis for Model 4 is rejected and accepted for Model 3.

In Sweden the coefficient for Model 1 is 0.18, which is noticeably higher than the coefficient for Model 2 (0.14) and for cash-to-total-assets (0.10). Model 1 is significant to 99% significance level, while Model 2 and cash-to-total-assets are significant to 95% level. In the Sweden the relationship between excess cash and share repurchases appears to be larger than previous methodologies would suggest and simultaneously larger than in the other Nordic markets. Models 3 and 4 show significant (99%) coefficients (0.16 and 0.25 respectively) that are both larger than the cash-to-total-assets and Model 2 coefficients. The null hypotheses for Models 1, 3 and 4 are all rejected, suggesting that in Sweden the relationship between excess cash and share repurchases is strong.

The results for Norway and Denmark are more difficult to interpret given the lower significances, likely due to the smaller sample sizes in the country specific regressions. The key observations one can make from the results is that the regressions on the cash-to-total-assets give non-significant coefficients that would suggest that the excess cash theory does not hold in Norway and Denmark when studies with Jensen's original methodologies. Model 4 has large positive coefficients (99% significance level), while the other models have lower and less significant coefficients. In Norway we reject the null hypothesis for Model 3 and 4 with the positive coefficients that are larger than Model 2 and cash-to-total-assets, while being significant at respective significance levels of 95% and 99%. For Model 1 in Norway we accept the null hypothesis. Similarly in Denmark we reject the null hypothesis for Models 3 and 4 (respective significance levels of 95 and 99%), while accepting the null hypothesis for Model 1.

Again comparing the significance of the cash models through a comparable statistic, the t-value Model 4 shows the highest significances with t-values ranging between 4.00 and 5.66 (least significant in Oslo and most in Stockholm). The second highest significance is shown by Model 3 with a t-value range of 2.68 to -4.83. The t-values of Models 1 and 2 once again do not show substantial difference between them (Model 1 ranging between 1.96 and 4.39 and Model 2 ranging between 1.93 and 5.60), but are both noticeably higher than the t-values of the CASH variable (ranging between 3.64 and 4.80).

The results for insider ownership vary significantly across the Nordic stock exchanges. In Finland and Sweden the coefficient for insider ownership is negative as predicted. The coefficient values are significant and between -0.05 and -0.06 for Finland and -0.13 and -0.16 in Sweden, suggesting that the negative relationship is more significant in Sweden than in Finland. In Norway the coefficient for insider ownership is of the correct sign, however it is close to zero and not significant. In Denmark the theoretical relationship is the weakest as the coefficients are broadly zero and in the case of Model 1 positive, the opposite to the prediction.

For the share repurchase determinants one can accept the excess cash hypothesis for all Nordic countries. While the hypothesis is accepted in all countries, it should be sad that the relationship between excess cash and share repurchases appears to hold the best in Sweden and Finland, with slightly weaker relationship in Denmark and Norway<sup>58</sup>.

We can also accept the hypotheses for the cash flow, option, undervaluation, takeover and insider ownership hypotheses through the broadly significant, as predicted coefficients. The leverage hypothesis shows very volatile results in terms of significance which leads to the acceptance of the null hypothesis.

While the study is able to determine the coefficients of the various cash holding models as well as their respective significances, the study does not make firm conclusions on the explanatory power of the share repurchase models because of the difficulty of explaining the Pseudo  $R^2$  values of the Tobit regressions. In the case of continuous distributions the log likelihood is the log of the density of the continuous distribution. Due to the fact that density functions can take values exceeding 1, the log likelihood values can be either positive or negative. This can be explained as per below:

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<sup>58</sup> However, as previously stated, part of the lower significance can be attributable to the lower sampled sizes in the respective countries



If  $L1 > 0$  and  $L0 < 0$ , then  $L1/L0 < 0$ , and  $1 - L1/L0 > 1$ .

If  $L1 > L0 > 0$  and then  $L1/L0 > 1$ , and  $1 - L1/L0 < 0$ .

As the above formula can give pseudo R2 values greater than 1 or smaller than 0 for Tobit regressions, which makes the value difficult to interpret. As the formula for pseudo R<sup>2</sup> is closely related to chi-squared measure<sup>59</sup> one could make more meaningful comparisons applying the latter measure, however the available analysis tools do not provide outputs for the values of L1 and L0, which disables the use of chi-squared measure. This is an acknowledged limitation of the present thesis and an aspect of the study that could be improved in future studies.

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<sup>59</sup> Chi-squared is calculated as  $2(L1-L0)$

## 6. Conclusion

The section begins with (6.1) the main conclusions of the study and continues with suggestions for further study.

### 6.1 Conclusion

According to existing corporate finance literature - companies that have more cash on their balance sheet than they structurally require for operational purposes are more likely to distribute capital to shareholders in the form of share repurchases. In the current thesis I examined whether the aforementioned theory of excess cash holds in the Nordic region for a range of five different definitions of excess cash. The findings of my research suggest that the relationship between share repurchases and excess cash holdings is positive and stronger than evidenced by the previous research by Jensen (1986) and Stephens and Weisbach (1998), whilst in-line or slightly weaker than suggested by Oswald and Young (2007).

Previous research by Jensen (1986), Stephens and Weisbach (1998), Oswald and Young (2007) and many others has recognized the existence of the positive relationship between excess cash and share repurchases, however has at the same time relied on an insufficient measure of excess cash. The impact of the improved variable design for the excess cash theory does not fundamentally change the previous conclusions, however add to their robustness.

The significant positive relationship between excess cash holdings and share repurchases persists in all of the observed Nordic markets<sup>60</sup>. The results for the specific Nordic countries show little variance<sup>61</sup>, suggesting that the capital distribution practices are very similar across the region. The main factors driving the decision for Nordic companies to conduct share repurchases according to the research are excess cash, excess cash flow, takeover deterrence and the presence of investment opportunities. In Finland and Sweden the evidence for agency conflict (inside ownership) and executive compensation also appear strong.

The evidence for the leverage theory of share repurchases is very weak across the Nordic region. A possible reason for the difference in the results of the leverage theory against

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<sup>60</sup> Finland, Sweden, Denmark and Norway

<sup>61</sup> The results for the individual country regressions are however subject to relative small sample sizes, giving rise to some meaningful coefficient results in Denmark and Norway

previous studies could relate to the fact that previous studies have been broadly conducted using US data. In the US companies rely significantly more on bond financing compared to Europe where companies rely more on bank financing. Given the fact that bond financing is very covenant light compared to bank lending<sup>62</sup>, bond financed companies will likely find it easier to distribute capital to shareholders and therefore US based companies are more flexible operating environment to adjust their capital structure through share repurchases.

## 6.2 Suggestions for further study

The present study is an attempt to determine whether the definition of excess cash in previous research on share repurchases has lead to misleading conclusions regarding the importance of the excess cash hypothesis in explaining the determinants of share repurchases. The study touches upon many themes that make for interesting research topics, however they fall outside the defined scope. In many cases the data limitations that the present study was subject to, can create opportunities to further refine the presented research questions and related methodologies.

A key limitation to the study is the amount of data available in the Nordic region due to the relatively late introduction of share repurchases as a means of distributing capital to shareholders and the sheer size of the capital markets compared to many other financial markets and regions. These two factors limit the ability to make significant comparisons in the repurchasing behavior of companies over time as the annual sample sizes tend to become too small. With data from larger capital markets one could answer a question such as – do companies that announce the replacement of dividends with share repurchases continue to distribute similar yields on equity post the announcement?

As the results of the study reveal, there exists differences in the determinants of share repurchases between the Nordic countries. I suggest that the differences are unlikely to arise from taxation, industry structure of the capital markets or the adoption patterns<sup>63</sup> of share repurchases. Further research could be made on the source of these differences. One could

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<sup>62</sup> Bank lending tends to have significantly more covenants that restrict the actions of managers

<sup>63</sup> Due to the fact that the Nordic countries accepted share repurchases as a form of capital distribution roughly in the same time period

speculate that differences in cultures, ownership policies, corporate governance, and common investor types could give rise to differences in capital distribution policies. As an example, the Swedish market is home to public market investors that hold “activist investor”-policies<sup>64</sup> such as Investor AB, AB Industrivärden, Cevian Capital AB, Triton Partners (Triton Advisers (Nordic) AB) etc., that could have an impact on the broader Swedish market when it comes to corporate governance and capital distribution policies.

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<sup>64</sup> Activist investors traditionally acquire substantial stakes (3-10%) in public companies, which they lever to gain board and nomination committee seats. The investors then drive change in the target company, often ousting the incumbent management (or parts of it) and distribute capital to the shareholders.

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## 8. Appendix

### Appendix A – Key Definitions

#### Share repurchases

Share repurchases refers to the reacquisition of issued shares by companies from the capital markets. The transaction effectively represents a cash distribution to the shareholders willing to tender their shares. The end effects to the balance sheet are a reduction in cash assets, shareholders equity, while the income statement sees a reduction in interest income. As the repurchases are bought from the capital markets, the number of outstanding shares is also reduced. Share repurchases tend to have an accretive impact on the earnings per share of companies as the decrease in number of shares is usually proportionally larger than the reduction in interest income. There are three main methods that companies use to repurchase shares: open market repurchases, fixed price tender offers and Dutch actions, of which open market repurchases is the most commonly used technique.

#### Open market repurchases

Open market repurchases are the most common form of share repurchase. According to Grullon and Ikenberry (2000) approximately 90 – 95% of share repurchases take the form of open market repurchases. They also find that the average percentage of shares that is sought from the markets is approximately 7%. Under open market repurchases, once the company has received the authorization<sup>65</sup> from the annual general meeting to conduct share repurchases, the management has the option, not an obligation to buy shares within the predetermined time period. The shares are to be purchased from the financial markets at prevalent market prices, where each current shareholder has an equal opportunity to participate in the selling of the shares. Open market share purchase programs may run from a month to over a year's time.

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<sup>65</sup> Generally the annual general meeting defines the scope of the share repurchase program, including the number of shares that can be bought over the duration of the program, a daily limit to the number of shares that can be bought generally related to historical trading volumes, the time period during which the shares must be acquired and often, while not always, a price range at which the shares must be purchased

**Fixed price tender offer**

In fixed price tender offers the share repurchase program, once the company has received authorization from the annual general meeting (see footnote on open market repurchases) the management issues an offer to current shareholders. The offer states the price at which the share are to be bought, the targeted number of share that are to be bought under the offer, duration of the offer as well as any conditionality. As an example the conditionality may relate to a minimum number of shares under the tender.

**Dutch auction**

A Dutch offer is in many ways similar to Fixed price tender offers (see above), however the management issues an offer which includes a range of prices, rather than a single price, under which the company is willing to acquire shares. The shareholders are then invited to tender their shares at an indicated price level within the management communicated range. Once the offer period ends, a book of offers is built on the basis of tendering the shares of shareholders with the lowest indicated price first, after which moving up the price curve. Once the book is built, the company management can decide whether to execute on the auction or terminate the offer.

**Excess cash**

Excess cash refers to the amount of cash that companies hold on their balance sheets in excess of their theoretical, intrinsic optimal cash level. A number of company as well as industry factors are generally considered to contribute to a given company's cash holding level. Please refer to section 4.4.1.1 of the document for factors based on empirical studies.

## Appendix B – Drobetz, Gruninger and Hirschvogel (2010) original cash holding model

$$\begin{aligned}
\frac{CashHolding_{it}}{Assets_{it}} = & \gamma_0 + \gamma_1 \frac{Market_{it}}{Book_{it}} + \gamma_2 \frac{NetWorkingCapital_{it}}{Assets_{it}} + \gamma_3 \frac{OperatingCashFlow_{it-1}}{Assets_{it-1}} \\
& + \gamma_4 \frac{NetDebt_{it-1}}{NetAssets_{it-1}} + \gamma_5 \frac{CapitalExpenditure_{it}}{Sales_{it}} + \gamma_6 \frac{R\&DExpenses_{it}}{Sales_{it}} \\
& + \gamma_7 LNMarketCap_{it} + \gamma_8 CFUncertainty_{it} + \gamma_9 Industry_{it} + \gamma_{10} Dividend_{it} \\
& + \varepsilon_{it}
\end{aligned}$$

## Appendix C – Descriptive statistics for cash holding regression sample

Figure 7 – Descriptive statistics for cash holding regression sample

The below table summarizes the data sample that is used in the optimal cash holding regression. Incomplete data from the Thomson Financial reduces the size of the data sample. The sample was subject to some adjustments in the form of extreme values that arose from poor data quality, such as cash-to-total-asset values near or above 1, EBITDA to total assets below -1 and net debt to net assets values below -1. The sample is consolidated from the annual observations from the companies of the four Nordic stock exchanges.

	Mean	Median	25th percentile	75th percentile	Standard deviation
Cash to total assets	0,171	0,098	0,043	0,213	0,207
Market to book	1,289	0,818	0,448	1,494	1,648
NWC to total assets	0,047	0,037	-0,074	0,172	0,213
EBITDA to total assets	0,073	0,105	0,045	0,157	0,195
Net debt to net assets	0,004	0,003	-0,002	0,008	0,025
Capex to sales	0,095	0,035	0,015	0,072	0,214
Log of market capitalization	2,182	2,096	1,541	2,757	0,868
Dividend (dummy)	0,610	1,000	0,000	1,000	0,488
Cash flow volatility	0,032	0,027	0,020	0,038	0,028
Industry (dummy)	4,607	4,000	3,000	6,000	1,882
Tobin's Q	1,822	1,324	1,010	1,968	1,753
Change in NWC	0	-0,060	-0,587	0,396	12,625
Change in ST Debt	0	0,047	-0,122	0,277	1,247
Number of obs.	4131				

## Appendix D – Optimal leverage calculations

Figure 8 – Descriptive statistics for optimal net debt calculations

The below table presents the descriptive statistics for the determination of industry specific net debt to total assets values. The calculation of the deviation from optimal leverage position is calculated as company net debt to total assets less industry median net debt to total assets.

	Average	Median	Standard deviation	Number of obs.
Consumer Discretionary	0,147	0,171	0,290	768
Consumer Staples	0,182	0,246	0,269	328
Energy	0,245	0,292	0,315	451
Healthcare	-0,174	-0,184	0,614	610
Industrials	0,139	0,160	0,253	1735
Information Technology	-0,137	-0,129	0,316	1035
Materials	0,203	0,249	0,226	423
Telecommunication Services	0,192	0,186	0,226	83
Utilities	0,118	0,246	0,409	26
Total	0,070	0,115	0,365	5459