UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Graduate School

School of Business, Economics & Law at the University of Gothenburg

Master of Science in Finance

Excess Cash holdings and Acquisitions

A study on Nordic firms

Hannes Sandström Lingjun Zhang

GM1060

A thesis presented for the *Master of Science in Finance*

Supervised by Prof. Martin Holmén

Gothenburg, 2020

Abstract

By adapting a well-recognized model for estimating normal cash holdings, this study examines if Nordic public firms with excess cash have a higher likelihood of performing acquisitions. Given that firms have access to capital markets, firms should be able to fund positive net present value projects regardless of current cash levels. Literature does, however, show that firms with excess cash have a higher likelihood of performing acquisitions and that the acquisitions on average are value decreasing for shareholders. Previous research has focused on the U.S. hence our study contributes by studying a region which has not been comprehensively covered. We find that Nordic firms with excess cash have a statistically significant, at a 5% significance level, higher likelihood of becoming an acquirer in the subsequent year. Robustness tests with various types of excess cash variables also indicate higher acquisition likelihood among firm years with excess cash, which strengthens the validity of our results.

In addition to acquisition likelihood, we also study the development and distribution of cash holdings among Nordic public firms for the time-period 2004 to 2018. We observe that the mean, median, and aggregated cash ratio fell heavily in connection to the financial crisis 2008. Thereafter, the cash ratios reversed, which indicates a mean-reverting process. We also observe that the mean cash ratio has increased by 10%, the median cash ratio has decreased by 8%, and the aggregated cash ratio has decreased by 28% between 2004 and 2018. However, there has been a substantial net inflow of public firms, an increase by 91%, between 2004 and 2018, which limits the comparability between years.

Key words: Cash holdings, Excess cash, Mergers and acquisitions, Corporate governance, Agency conflicts, Free cash flow theories, Information asymmetries, Cash holding motives.

Acknowledgements

We would like to extend our deepest gratitude to our supervisor Prof. Martin Holmén at the School of Business, Economics and Law for his guidance and extensive knowledge in the field of corporate finance with emphasis on excess cash.

The authors also would like to thank each other for the collaborative teamwork, complementing abilities and encouragement during the work of this thesis. Altogether, it has been a great experience.

Table of Contents

1 Introduction

1.1 Background

According to Modigliani and Miller (1958), in a frictionless world, a firm can finance itself with equity or debt without any cost. If this had been true, firms would not have to hold any cash at all, and there would be no optimal level of cash holdings. However, the real world is imperfect, and frictions such as transaction costs, taxes, information asymmetries, and agency problems cause firms to have financial management policies. Easier explained, a certain level of cash is required to ensure that financial obligations can be settled and that profitable investments can be financed also when external financing is expensive or not available at all.

In recent years, the cash holdings development in the U.S. market has drawn much attention from the researchers. The interest has been particularly motivated by the fact that enterprises hold significant amounts of cash (La Rocca et al., 2017). Bates et al. (2009) find that the average cash ratio among U.S. firms has increased from 10.5% in 1980 to 23.2% in 2006. Cash holdings of European firms, especially of Nordic firms, has drawn less attention from the researchers. However, Bechert et al. (2016), find that the absolute cash level of the public firms incorporated in the EU-15 countries has increased from USD 400 billion in 1999 to over USD 900 billion in 2014, implying a CAGR of 5.8%. In this study, we want to provide additional insights into the topic of Nordic firms' cash holdings and its impact on investment decisions.

Opler et al. (1999) argue that firms with strong growth opportunities and riskier cash flows hold relatively high cash ratios and firms that have the greatest access to the capital markets hold lower cash ratios. To understand the reasons behind the cash holdings fluctuations and the consequences of having a high or low cash ratio, researchers study the determinants of cash holdings and the effects of excess cash on investment decisions. Jensen (1986) is one of the first to describe agency costs as an explanation to why some firms possess excess cash and are investing it at below the cost of capital. Opler et al. (1999) study the determinants of cash holdings and contribute with a model for estimating normal cash holdings which is widely used in the follow-up literature (e.g. Dittmar et al. (2003), D'Mello et al. (2008), Bates et al. (2009), Harford et al. (2014)). Harford (1999) examines excess cash and mergers and acquisitions for U.S. firms under the time-period 1977 to 1993 and finds evidence that firms with excess cash

are more likely to acquire other firms and that the acquisitions are more likely to decrease shareholder wealth. Literature also shows that in countries where there is less shareholder protection, firms possess more excess cash (Dittmar et al., 2003). In an international comparison of legal systems presented by La Porta et al. (1998), Sweden scores lower than the U.S. on the protection of shareholder rights.

Our study focuses on the relationship between cash holdings and mergers and acquisitions activity for Nordic public firms. We want to find the development of cash holdings among Nordic firms between 2004 and 2018 and if Nordic firms with excess cash are more likely to acquire other firms. The development of cash holdings will be studied by examining how different cash ratios have developed during the time-period. The acquisition likelihood will be tested by first finding the determinants of cash holdings i.e. what factors influence the level of cash kept in firms by performing cross-sectional regressions during an estimation-window, 2004 to 2008. Secondly, we will estimate normal cash holdings for all firm years during a subsequent period 2009-2018 and compare it with actual cash ratios to distinguish firm years with excess cash. Lastly, we will perform likelihood regressions with mergers and acquisitions data as dependent variable and excess cash and control variables as explanatory variables.

By studying the development of cash holdings, how excess cash distributes among Nordic firms and what impact it has on acquisition likelihood, we aim to provide valuable insights for both practitioners and academia.

1.2 Research question

This thesis examines the development and distribution of corporate cash holdings among Nordic firms and how excess cash affects mergers and acquisitions likelihood.

The research question is defined as：

What are the effects of excess cash on mergers and acquisitions among Nordic firms?

1.3 Research contribution

Our study contributes to the existing literature by investigating up to date data for a region which is not comprehensively covered in the literature about excess cash and mergers and acquisitions. We also apply another regression method, a fixed effect estimator, when estimating acquisition likelihood which we have not observed in the literature but which we argue gives more robust results.

1.4 Thesis outline

The remainder of this thesis is structured as follows: Section 2 covers the theoretical framework and empirical evidence. Section 3 develops our research hypotheses based on previous findings. Section 4 presents our data and describes the methodological approach for estimating excess cash and the relationship between excess cash and acquisition likelihood. Section 5 presents the results and analysis. Section 6 covers the discussion of the results, including the limitations and potential topics of future research. Section 7 concludes the thesis.

2 Theoretical framework and empirical evidence

This section covers the theoretical framework and empirical evidence for determinants of cash holdings and the effects of excess cash holdings on investment decisions. The theoretical framework includes optimal capital structure theories and theories regarding agency conflicts. The empirical evidence includes results from numerous empirical studies.

2.1 Theoretical framework

In a world characterized by perfect capital markets, cash holdings are irrelevant since if firms have a deficit of cash, they can always raise funds at zero cost to continue operating and investing (Opler et al., 1999). However, the perfect markets do not exist in the real world, and Opler et al. (1999) therefore argue that management are maximizing shareholder value when the marginal benefit of cash holdings equals the marginal cost of those holdings. The cost includes the lower rate of return of total assets, relative to other investments of the same risk, and sometimes also tax disadvantages. The difference between the return on cash and the

interest that would have to be paid to finance an additional dollar of cash is often called the cost-of-carry (Dittmar et al., 2003).

The benefits of holding cash are lower transaction costs to (1) raise new funds and that the (2) firms can use their current cash when external financing sources are very costly or not available. (3) Firms can also acquire benefits by taking advantage of future changes in the interest rate or bond prices by their cash holdings. Keynes (1936) refers to the first benefit as the transaction cost motive, the second benefit as the precautionary motive and the third benefit as the speculative motive. Opler et al. (1999) mention that in general, managers and shareholders have different views about the costs and benefits of cash holdings. Agency theory can, therefore, be an explanation to why firms do not hold the amount of cash that maximizes shareholder value.

The first two motives, transaction cost motive and precautionary motive, are derived from what has been commonly referred to as the trade-off theory which is a theory to derive optimal cash holdings (Dittmar et al., 2003). While the speculative motive comes from the uncertainty of the future interest rate, i.e. economic players will hold a certain level of cash to avoid capital loss or achieve capital gains by adjusting the capital structure in a timely manner (Keynes, 1936). In addition, there is the financing hierarchy which suggests that there is no optimal level of cash, based on arguments similar to the pecking order theory of capital structure, instead levels of cash increase and debt decrease when a firm becomes more profitable (Dittmar et al., 2003). Opler et al. (1999) study firms' cash holdings under the time-period 1952 to 1994 and find strong support for the trade-off theory. We therefore focus our literature review on the trade-off theory and agency conflicts.

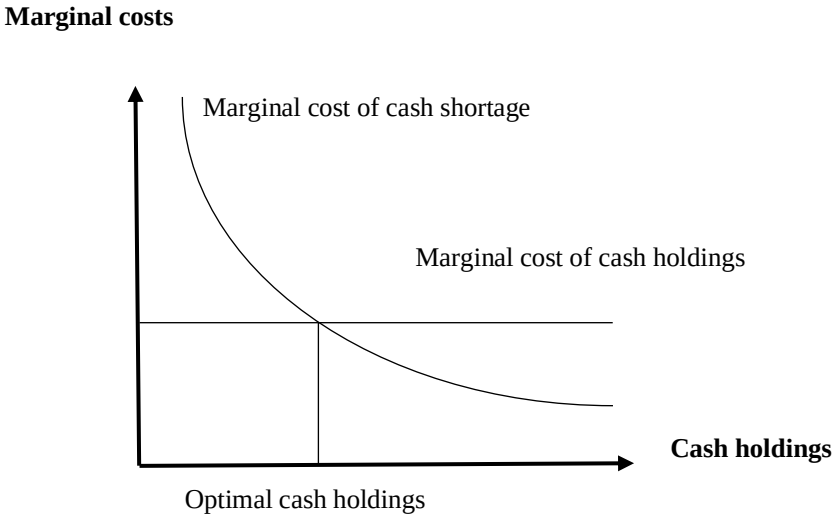
2.1.1 Transaction cost motive

Opler et al. (1999) argue that the main determining parameter for the level of cash in a firm is the ambition of keeping transaction costs as low as possible. Transaction costs incur when a firm needs to increase their cash balances by issuing shares or debt, or by liquidating assets. Opler et al. (1999) argue that unless a firm has non-core assets that are very easy to liquidate, it will prefer to access money through the capital markets by issuing debt or stock, which induces brokerage costs. The fixed costs of accessing money through capital markets motivate firms to raise funds infrequently and keep a buffer of cash. The relationship between

the marginal cost of holding cash and the marginal cost of being short of cash is presented in Figure 1. Opler et al. (1999) argue that a greater shortage of cash generates higher marginal costs since a small shortage can be solved by only decreasing investments or dividends while a greater shortage is more likely to demand external funds which are more costly. The optimal level of cash is therefore given by the intersection between the marginal cost of cash shortage and the marginal cost of cash holdings.

Figure 1: Model of optimal cash holdings

This figure presents the optimal amount of cash. The intersection of the marginal cost of cash shortage and marginal cost of cash holdings represents the optimal cash level. The marginal cost of holding cash is constant whereas the marginal cost of cash shortage is decreasing with cash holdings.



Miller et al. (1966) present a deterministic model for cash holdings in firms. They add the important aspect that firms most often have very fluctuating cash balances; they build up cash when operating receipts exceed expenditures, and the balances decline when it is the opposite relation. In the model of Miller et al. (1966), it is assumed that the net cash flows are completely stochastic. They also assume zero lead-time, which means that firms can access external capital immediately. The main contribution of the model is that firms should have a policy of actions, which contain a return point when the cash balances either reach an upper bound, a cap, or a floor in order to minimize the transaction costs.

2.1.2 Precautionary motive

Information asymmetries and agency costs of debt can limit firms' possibilities of accessing external funds. This is a problem when firms with high information asymmetries have cash shortage and at the same time want to invest in positive net present value projects (Opler et al. 1999). To reduce the likelihood of ending up in this situation, firms are motivated to hold enough cash to not be dependent on capital markets. This is what Keynes (1936) and Opler et al. (1999) call the precautionary motive for holding cash.

Myers et al. (1984) argue that information asymmetries entail outsiders to discount securities at a higher rate than insiders. They also argue that if insiders have more information than outsiders and the information is very favorable, then it may even be cases when management refuse to issue shares and decide to not invest in a positive net present value project since the cost of diluting old shareholders at an unfair price is considered higher than the gains of the project. This can, however, be a positive signal to outsiders since the decision of not issuing equity can indicate a higher value of the firm than outsiders have realized. Contrary, issuing shares is often considered as bad news or at least, less good. Myers et al. (1984) expect a firm that has given up an investment opportunity because of "the financing trap" to rearrange the firm's capital structure until next time the firm has a positive net present value project. Since information asymmetries can change over time, it is valuable for firms to build up a cash buffer by external funds when information asymmetries are small (Myers et al., 1984). Opler et al. (1999) argue that keeping a buffer becomes most valuable in a downturn situation when outside funds become more expensive, but when there can be attractive investment opportunities. However, if the firm does not succeed in finding attractive growth opportunities, the holdings of cash can make investors worse off.

Regarding the agency costs of debt, Opler et al. (1999) argue that these costs arise when the interest of debtholders differs from the interest of shareholders. It can also occur when the interest for one group of debtholders differs from the interest of another group of debtholders. Because of these agency costs, firms with high leverage find it more difficult and costly to raise new external funds. Highly levered firms with different types of debt holders can also find it difficult to renegotiate current debt agreements in a situation of financial distress. The most obvious way to decrease the risk of having these types of agency cost of debt problems is to keep leverage low (Opler et al., 1999).

According to Opler et al. (1999), models of optimal holdings of cash can differ in the way the costs of being financially constrained and how the marginal cost of holding cash is calculated.

2.1.3 Agency conflicts

Jensen (1986) describes agency conflicts as an explanation of why some firms hold more cash than required from a shareholder perspective. He points out that management want to keep excess cash to be less dependent on capital markets, increase their discretion, benefit their careers and, to reduce the risk of their firm-specific human capital. For these reasons, managers have incentives to keep excess cash and invest it under the cost of capital while shareholders want dividends if the money can be better used somewhere else (Jensen, 1986). Jensen (1986) also takes the fact that capital markets punish dividend cuts with stock price reduction as proof for the agency costs of free cash flow. The argument is that investors seem to be worried that the money is not used in the best interest of themselves.

Another driver for agency conflicts is incentives schemes (Jensen, 1986). Changes in compensation are often directly related to growth in sales, which lead to agency conflicts regarding the optimal size of a firm. In that case, management have incentives to grow the firm beyond the optimal size from a shareholder perspective. Another reason for management to grow the firm beyond what is optimal from a shareholder perspective is that it can be career promoting (Jensen, 1986). In the literature, the agency costs of debt have been commonly discussed, but the advantages of debt in making managers more efficient and decreasing the risks of agency conflicts have been ignored (Jensen, 1986). Jensen (1986) argues that debt can be an effective substitute for dividends since promises about a permanent dividend increase are weak and easy to break. By issuing debt in exchange for equity, managers have higher commitment to keep their promises since debt obligations are stricter than dividends. If a firm defaults on paying interest and principal payments in time, recipients of debt payments can take the firm into bankruptcy court. Debt is therefore reducing agency costs of free cash flow. Jensen's theory about agency costs is usually referred to as the free cash flow theory. His definition of free cash flow is the remaining cash flow after a firm has invested in all projects with a positive net present value (Jensen, 1986).

2.2 Empirical evidence

2.2.1 Transaction cost motive

Opler et al. (1999) study U.S. firms between 1971 and 1994 and find that cash balances exhibit a mean-reversion pattern. The findings are consistent with Miller et al.'s (1966) deterministic model of cash holdings.

Mulligan (1997) studies 12,000 firms listed on the New York Stock Exchange and the American Stock Exchange under the time-period 1961 to 1992 and finds that there are economies of scale in the process of accessing new cash. The implication is that transaction costs are not directly proportional to the size of a firm and this suggests that small firms should hold relatively more cash.

2.2.2 Precautionary motive

Opler et al.'s (1999) study of U.S. firms under the time-period 1971 to 1994 also shows that firms with stronger growth opportunities, riskier cash flows and more limited access to capital markets keep higher cash ratios than other firms. The results are explained by the precautionary motives. Firms hold cash to ensure that they will be able to continue fund positive net present value projects and meet their financial obligations when free cash flow is low and when external funds are expensive.

John (1993) investigates a sample of 223 firms from the Fortune 500 companies in 1980 and finds that firms with expected higher financial distress costs hold a greater amount of cash which is consistent with the precautionary motives. She argues that firms with high debt obligations are more vulnerable since interest and principal payments are hard financing contracts, whereas dividends and repurchases are soft financing contracts and easy to cut down. She defines financial distress as the point in time when a firm's cash holdings are unable to meet the liquidity requirements of the hard contracts.

2.2.3 Agency conflicts

Dittmar et al. (2003) study more than 11,000 firms from 45 countries and find that there is a relationship between corporate governance and excess cash holdings. In fact, they document that firms in countries where shareholders enjoy worse protection keep up to twice as much

cash compared to firms in countries with satisfying shareholder protection. They also document that factors that usually are determinants of cash holdings become less important in countries with worse shareholder protection. The findings are explained by the free cash flow theory by Jensen (1986).

Opler et al. (1999) test if excess cash causes firms to make expenditure decisions that they otherwise would not make. They study firms under the time-period 1971 to 1994 and find evidence that firms with excess cash invest more than other firms, after controlling for investment opportunities. However, they also document that the size of the investments, in general, is small and that the persistence of excess cash is high.

Lang et al. (1991) test the free cash flow hypothesis by Jensen (1986). They study a sample of 101 successful tender offers under the time-period 1980 to 1986 and distinguish between firms with good investment opportunities and firms without by using Tobin's Q. Their results show that bidder returns are significantly negatively related to cash flow for firms with poor investment opportunities but not for the other firms.

Harford (1999) examines the value creation of M&A activities for U.S. firms with and without excess cash for the time-period 1977 to 1993 and finds evidence that firms with excess cash are more likely to perform bids and that it, on average, is value decreasing. Harford views his findings as evidence for the free cash flow theory by Jensen (1986).

Another more recent study is performed by Bechert et al. (2016), who examine the effects of excess cash holdings on M&A in a European context for the time-period 2005 to 2014. Their results are in line with Harford's since they also find that firms with excess cash have higher likelihood of performing acquisitions under the subsequent year and that for each dollar of excess cash held, unexpected acquirers destroy one cent of the firm's market cap in the announcement period.

2.2.4 Tax motive

The empirical evidence regarding the tax motive varies. The hypothesis usually tested is if multinational firms with international affiliates hold more cash since they incur taxes when foreign earnings are retrieved. Foley et al. (2007) find that this hypothesis is true for U.S. multinational firms, while Pinkowitz et al. (2013) cannot confirm the same hypothesis. Instead,

Pinkowitz et al. (2013) find that multinational firms have higher consolidated cash balances because of their R&D intensity and not because of tax minimization purposes.

2.3 Distribution and development of cash holdings

Bates et al. (2009) study the development of cash holdings for U.S. firms under the time-period 1980 to 2006 and find that the average cash ratio (cash-to-assets) more than doubled during these years, from 10.5% to 23.2%. The holdings increase so much that at the end of the sample period, for an average firm, cash holdings are large enough to repay all debt obligations. Bates et al. (2009) also test if the increase can be explained by changes in firm characteristics during the time period. They find that, after controlling for changes in firm characteristics, the average cash ratio has increased by 0.46% per year. This means that changes in firm characteristics can explain some of the increased cash holdings but not everything. Bates et al. (2009) also examine if the increase of average cash holdings is driven by a minority of the firms, especially the largest, but find that the increase of cash ratios is significantly positive for all size quintiles. They also find that the average cash ratio for firms that pay dividends does not exhibit any time-trend at all, whereas the positive time-trend for firms that do not pay dividends is clear. They present the precautionary motive as an explanation of these findings.

Bates et al. (2009) also investigate the leverage during the time-period by studying how the net debt ratio, defined as debt minus cash divided by assets, has developed. They find that the net debt ratio has exhibited a significant decrease. For some years, from 2004 to 2006, the average net debt ratio is even negative, i.e. positive net cash. The decreased leverage is explained by the dramatic increase in cash holdings during the time period.

Moreover, Pinkowitz et al. (2013) study how the cash ratios for multinational and domestic U.S. firms have developed before and after the 2008 financial crisis. They find that U.S. firms hold abnormally high cash ratios after the financial crisis. They can also see that before the financial crisis, multinational and domestic firms had approximately the same cash ratio, but after the crisis, multinational firms had more than 3 percent units higher cash ratio than domestic firms. They also observe that average cash ratios increase more for U.S. firms compared to European firms having the financial crisis in 2008 as a threshold. At the end of the 1990s, the average cash ratio for U.S. firms is 1.01 percent units higher than for European firms. After the financial crisis, 2009-2010, it is 3.19 percent units higher.

Pinkowitz et al. (2013) also investigate the concentration of cash holdings for U.S firms from 2000 to 2010. They find that the holdings of cash are heavily concentrated and that the concentration exhibits an increasing trend. The Gini coefficient[1] for cash holdings among firms was 0.848 in 2000 and 0.864 in 2010. The Gini coefficient for non-cash assets was 0.882 in 2000 and 0.870 in 2010. As a comparison, the Gini coefficient for income in the U.S was 0.462 in 2000 and 0.468 in 2009.

3 Hypotheses

In order to answer our research question "what are the effects of excess cash on mergers and acquisitions among Nordic firms?", we will test the following hypotheses:

Hypothesis I: *Cash levels of Nordic firms have increased, in relative terms to assets, between 2004 and 2018.*

Studies by Bates et al. (2009) and Pinkowitz et al. (2013) show that the absolute cash holdings and average cash ratios for U.S. firms have exhibited an increasing trend between 1980 and 2010. We want to investigate if this trend also holds true for Nordic firms between 2004 and 2018. Examining the development of cash holdings also enables us to understand how persistent cash holdings are among Nordic firms. By comparing fluctuations and trends with macro events, such as the financial crisis, we aim to get some indications of how cash holdings are affected by these events and, if so, how long it takes for the cash levels to reverse.

Hypothesis II: *There is a dispersion of actual cash holdings relative to expected cash holdings, given certain firm characteristics, among Nordic firms.*

Jensen (1986) argues that there are agency conflicts between management and shareholders. Management have incentives to keep more cash than required from a shareholder perspective. Opler et al. (1999) also describe that agency conflicts can explain why firms do not hold the amount of cash which maximizes shareholder value. They expect firms where

[1] Gini coefficient is a statistical measure of inequality distribution. It is defined as a ratio of the areas on the Lorenz curve diagram. The coefficient ranges from 0 to 1, with 0 representing perfect equality and 1 representing perfect inequality.

agency conflicts of managerial discretion are more significant to hold more cash than other firms. In order to investigate if excess cash influences the likelihood of becoming an acquirer, we need to observe a dispersion in excess cash among the firm years in our sample. Excess cash is used as a proxy for managerial discretion and opportunity for management to make investments motivated by personal incentives.

Hypothesis III: *Nordic firms with excess cash are more likely to perform acquisitions.*

It had been interesting to study all types of spending items for firms with excess cash to examine if they tend to overspend which the free cash flow theory by Jensen (1986) implies. However, it is difficult to study all types of spending items, therefore we choose to investigate mergers and acquisitions. Firms are usually not participating in mergers and acquisitions on a regular basis, but when it happens, it is often substantial amounts involved, which makes it suitable as research item. According to the free cash flow hypothesis, firms with excess cash are more likely to acquire other firms, holding all other variables constant (Jensen, 1986). A study by Harford (1999) on the U.S. market confirms this hypothesis. We want to investigate if it also is the case for Nordic firms.

4 Methodology

4.1 Data

All data, except CPI data, is downloaded from S&P Capital IQ. For all firm data, we set a geographical criterion to only include firms with headquarter in Denmark, Finland, Norway or Sweden. We exclude Iceland in our data collection since it has few listed firms and the sample of M&A participating firms would be very small. We also set a primary industry classification criterion to only include Energy, Real Estate, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Information Technology and Communication Services. We exclude Financials, Utilities and firms without an industry classification. Financials are excluded because many of these firms keep cash as their inventory, and their cash holdings are also subject to meet statutory capital requirements (Opler et al., 1999). Utilities are excluded since they often are subject to regulatory supervision (Opler et al., 1999).

We collect data for all active and inactive equities in order to avoid survivorship bias. However, we only include firm years with a reported market capitalization on the last trading day that year. We include all types of Nordic firms that are publicly traded which include firms at all lists, e.g., Nasdaq, Nasdaq First North, Spotlight Stock Market, Nordic Growth Market and Nordic MTF among others. Unreported data points are replaced with 0 if the company has reported data points for other financial reporting items the given year.

The sample for our estimation period, 2004-2008, includes 3,485 firm years. Industrials and Information Technology are the most frequent industries with 26.9% and 22.1% of the total firm years. Swedish firms constitute 46.1% of the firm years. Detailed industry composition and country composition for the estimation period sample is presented in Appendix, Table 6 and Table 7. For the second period 2009-2017, where we regress excess cash and control variables on acquisition data during 2010-2018, the sample size is 7,364 firm years. Also, for this period, Industrials and Information Technology are the most frequent industries with 26.6% and 17.4% of the data. The ratio of Swedish firms is higher for the second period, with 54.2% of the total firm years. Detailed industry composition and country composition for the second-period sample is presented in Appendix, Table 8 and Table 9.

Mergers and acquisitions data are downloaded from S&P Capital IQ. The transaction announced date range is 1/1/2010 - 12/31/2018, and we only include transactions with closed status. After downloading the data, we also exclude all transactions where the buyers do not have a reported market capitalization on the last day for the transaction announcement year. After excluding, there are 3,946 mergers and acquisitions transactions in our sample.

We download CPI data from OECD.org for the four Nordic countries to enable deflating certain data to a common year. The CPI data is primarily used when investigating the development of cash holdings and assets for the time-period 2004-2018, but it is also used for certain variables in our model for estimating normal cash holdings.

4.2 Defining excess cash

We apply the same definition as Opler et al. (1999). Excess cash is the amount of cash held by a firm that exceeds the predicted amount by our model. The model for estimating predicted cash holdings is described later in this chapter. Throughout the whole report, we refer to cash as cash plus short-term investments.

4.3 Model for Normal Cash Holdings

The literature shows that different firms have different needs of cash and marketable securities. To find the determinants of normal cash ratios, we apply the same method as previous research (Opler et al., 1999; Bates et al., 2009; Harford, 1999; Pinkowitz et al., 2013). We set an estimation period, 2004-2008, where we regress firms' cash ratios on several firm characteristics. After that, the coefficients from the estimation period are used to estimate expected cash ratios for a subsequent period. For us, the period where we estimate normal cash ratios is 2009-2018.

It is important that the coefficients given certain firm characteristics do not change significantly between the estimation period and the subsequent period for this model to serve its purpose. We therefore control for that by performing regressions on the second period as well.

There are differences among previous studies in the choice of firm characteristics to use as determinants of cash holdings. We include the same variables as Opler et al. (1999). In addition, we use two variables that cover short-term equity and debt issuance effects in line with Bates et al. (2009). Adding together the variables from Opler et al. (1999) and Bates et al. (2009), the following determinants of cash holdings have been identified:

1. **Industry cash flow risk.** Higher cash flow volatility implies a higher demand for cash as a buffer since the risk for unexpected cash deficit is higher. Therefore, firms in industries with higher cash flow volatility are expected to have higher cash ratios. Industry cash flow risk, i.e., industry cash flow volatility, is measured by taking the average standard deviation of cash flow within an industry for the five previous years. Firm years when there are less than three years of data within the five-year estimation window are excluded. Cash flow is defined as net income plus depreciation and amortization subtracted by common dividends paid.
2. **Cash flow.** Firms with high cash flow to assets accumulate more cash and are therefore expected to hold more cash. Cash flow is calculated by adding depreciation and amortization to net income and deducting common dividends paid.
3. **Market-to-book ratio.** The market value of assets in relation to the book value of assets can be used as a proxy for growth opportunities. Firms with high market-to-book ratio

are expected to have higher cash ratios to reduce the risk of missing out investment opportunities because of being financially constrained. It is measured by subtracting book value of equity from the book value of assets and adding the market capitalization. Thereafter it is divided by total assets.

4. **Firm size.** It is, in relative terms, less costly for larger firms to issue debt or equity because of the fixed costs in the process. Thus, larger firms are expected to have lower cash ratios. We define firm size as the natural logarithm of the book value of assets deflated to 2008 million U.S. dollars using CPI data for the four countries.
5. **Net working capital.** Working capital are assets that substitute for cash. Thus, firms with high net working capital are expected to have lower cash ratios. The calculation is straightforward, net working capital is divided by book value of assets.
6. **Capital expenditures.** The literature is not unanimous about capital expenditures. Firms are expected to accumulate less cash in years with high capital expenditures. Also, firms with high investments in fixed assets can achieve a higher debt capacity, which reduces the need for holding cash. On the other hand, capital expenditures can be seen as a proxy for growth opportunities and, as we have previously explained, those firms are expected to have higher cash ratios. We define capital expenditures as capital expenditures divided by book value of assets.
7. **Leverage.** Literature is ambiguous here as well. On one hand, it might be tempting for highly leveraged firms to use available cash to reduce leverage before issuing new debt to lower their marginal costs. On the other hand, firms with higher leverage can have a higher need of keeping a cash buffer to not default on debt payment obligations. Leverage is defined as debt divided by the book value of assets.
8. **Payouts.** Firms that pay dividends and repurchase stock are expected to be less risky than other firms. They are therefore expected to have lower cash ratios. We define payouts as the sum of total dividends paid, repurchase of common stock and repurchase of preferred stock, divided by assets.
9. **Acquisitions.** Similar to capital expenditures, firms with high acquisition spending are expected to accumulate less cash. However, acquisitions can also generate higher debt capacity, which reduces the motivation of holding a high cash ratio. We define acquisitions as cash acquisitions divided by assets.

10. **Net equity issuance.** Firms which issue equity in a given year are expected to hold more cash since most often equity is not issued on a yearly basis and the money is used up over several years. It is defined as net equity issuance divided by assets.
11. **Net debt issuance.** Similar to net equity issuance, debt issuance is often done infrequently, and the money is used up over more than one year. Thus, firms with high net debt issuance in a given year are expected to hold more cash. We calculate it by taking net debt issuance divided by assets.

Table 1: Summary of variables

This table presents summary statistics for the cash holdings and cash holding determinants during the estimation period 2004 to 2008. The sample consists of public firms in Denmark, Finland, Norway and Swedish firms. *CR* is cash and short-term investments divided by the book value of assets. *IndSigma* is the average standard deviation of cash flow within an industry, defined by S&P Capital IQ industry classifications, for the five previous years. *CF* is cash flow divided by assets. *MTB* is the market-to-book ratio of assets. *Size* is the natural logarithm of assets deflated to 2008 million U.S. dollars. *NWC* is the net working capital divided by assets. *CapEx* is capital expenditures divided by assets. *Lev* is leverage, defined as debt divided by assets. *Payout* is the aggregated dividends and repurchases of common stock and preferred stock divided by assets. *Acq* is the cash acquisitions divided by assets. *NetEqI* is the net equity issuance divided by assets. *NedDebtI* is the net debt issuance divided by assets.

Variable	Obs.	Mean	Std.Dev.	Median	Min	Max
CR	3485	.177	.203	.097	0	.998
IndSigma	3485	.117	.05	.093	.047	.227
CF	3485	-.022	.278	.041	-2.804	1.857
MTB	3485	2.003	1.988	1.448	.014	21.634
Size	3485	4.847	2.229	4.754	-3.27	11.431
NWC	3485	.084	.183	.063	-.919	.986
CapEx	3485	.054	.081	.028	0	.521
Lev	3485	.225	.206	.184	0	1
Payout	3485	.032	.085	.007	0	3.151
Acq	3485	.024	.063	0	-.053	.438
NetEqI	3485	.107	.953	0	0	54.581
NetDebtI	3485	.121	5.527	0	-2.789	326.163

Opler et al. (1999) also include Research and Development expenses as parameter but unfortunately there is not sufficient data about it for Nordic firms. However, this should not reduce the robustness of our model since the purpose of including it would be to indicate growth opportunities, but some previous researchers have considered market-to-book ratio as a better proxy. The correlation between R&D and market-to-book ratio can also cause multicollinearity.

We include binary variables for the respective country to control for fixed effects related to which country the firm operates in since legislation could affect the amount of cash that firms choose to hold.

Including all the variables above, the cross-sectional model estimated across all firms for every year becomes:

$$\begin{aligned} Cash\ ratio_i = \alpha &+ \beta_1 IndSigma_i + \beta_2 CF_i + \beta_3 MtB_i + \beta_4 Size_i + \beta_5 NWC_i + \beta_6 CapEx_i \\ &+ \beta_7 Lev_i + \beta_8 Payout_i + \beta_9 Acq_i + \beta_{10} NetEqI_i + \beta_{11} NetDebtI_i \\ &+ \lambda Country_i + u_i \end{aligned}$$

Where *Cash ratio* is cash divided by assets. *IndSigma* is the industry cash flow risk. *CF* is the cash flow deflated by assets. *MtB* is the market-to-book ratio of assets. *Size* is the natural logarithm of assets deflated by 2008 million U.S. dollars. *NWC* is the net working capital deflated by assets. *CapEx* is capital expenditures deflated by assets. *Lev* is debt deflated by assets. *Payout* is the total payouts deflated by assets. *Acq* is annual acquisition cash flow deflated by assets. *NetEqI* is net equity issuance deflated by assets. *NetDebtI* is net debt issuance deflated by assets. The *Country* dummy variables are defined as 1 if the headquarter lies in the given country and 0 if not.

Like Bates (2009), we use winsorizing to deal with outliers. We winsorize *IndSigma*, *CapEx* and *Acq* at the 1% tails. The top 1% of *Size* and *MtB* is winsorized. The bottom 1% of *CF* and *NWC* is also winsorized. We also winsorize *Lev*, so values above 1 are winsorized to 1 and values below 0 are winsorized to 0.

Similar to Opler et al. (1999), we use a Fama-MacBeth regression model, which is a cross-sectional regression model (Fama and Macbeth, 1973), to estimate the coefficients of firm characteristics on firms' cash ratio. It is a two-step model where first, independent cross-section regressions are performed for each year within the estimation period with cash ratio as the dependent variable. In the second step, the coefficients from the independent cross-sections are averaged over the time period[2]. The model works well when there are relatively large amounts of firms but relatively short time-series, as it is for our estimation period.

[2.] We download a Stata package with a built-in Fama-Macbeth feature which enables us to perform the two-step estimation model in a time-efficient way.

After performing the Fama-MacBeth regressions, we test the robustness of the coefficients by performing Between Estimator regressions on both time-periods and control if the results are similar. Between Estimator is a regression method when all variables first are averaged over the time-period, thereafter an ordinary least squares regression is performed on the averaged numbers.

After finding the coefficients of firm characteristics on cash holdings, we estimate normal cash holdings for 2009 to 2018 for each firm. We do this by calculating each firm characteristic under each firm-year the same way as for the estimation period. Then, each firm characteristic under the second period is multiplied by the coefficient from the estimation period regression. This is summed together with the intercept of the cash ratio from the estimation period regression. After doing this, we have an expected cash ratio for each firm-year under the second period. We winsorize expected cash ratios above 1 to 1 and expected cash ratios below 0 to 0 to avoid potential unrealistic expectations.

4.3.1 Correlation tests

In this section, the selected dependent and independent variables are tested to observe whether there is a correlation between them. We find that cash flow and firm size have the highest correlation of the explanatory variables; the magnitude of 0.370 is though still moderate. Therefore, we decide that no change of the estimation model is required. The correlation matrix is presented in Appendix, Table 10.

4.4 Model for estimating acquisition likelihood

When testing the hypothesis about the likelihood of becoming an acquirer for firms with excess cash compared to firms without excess cash, we assign 1 for the firm years with excess cash and 0 for the other firm years. Like Harford (1999), we include control variables to decrease the risk of omitted variable bias in our estimation model. The control variables are firm characteristics that are hypothesized to also influence the likelihood of becoming an acquirer. The following control variables are identified by Harford (1999) and included in our model:

1. **Sales growth.** Historical revenue growth can indicate future investment activity; hence, firms with high sales growth during the most recent time-period are more likely of

becoming an acquirer in the nearest future. We define sales growth as the 1-year percentual total revenues growth.

2. **Firm size.** Since larger firms in general have more potential targets than the smaller ones, they have a higher likelihood of performing acquisitions. Firm size is defined as the natural logarithm of assets deflated to 2008 million U.S. dollars.
3. **Net working capital.** Investments in fixed assets are negatively correlated with increased net working capital. Thus, firms with high net working capital are less likely to perform acquisitions. It is defined as net working capital divided by assets.
4. **Market-to-book ratio.** Similar to the regression of cash ratio determinants, the market-to-book ratio can be used as a proxy for growth opportunities. Therefore, firms with high market-to-book ratio are expected to have a higher likelihood of becoming acquirers. We define market-to-book the same way as in our previous regressions.
5. **Leverage.** Firms with high leverage face more financial constraints and are therefore less likely of performing acquisitions. Leverage is defined as debt divided by assets.

To reduce yearly noise and get more robust control variables, we use the average over the last four years for all control variables except firm size in the estimation model. All independent variables are measured one year before the acquisition year since otherwise, it is a risk that the numbers of the acquired firms are included in the financial reports for the acquirer. We also include binary variables for each year within the time period to capture the effect of potential mergers and acquisitions waves. The dependent variable is 1 if a firm performs at least one acquisition under a given year and 0 otherwise. The estimation model is given below:

$$\text{PR}||(\text{M\&A } Act_{it} = 1) = \Phi(\beta_1 Excesscash_{it} + \beta_2 Salesgrowth_{it} + \beta_3 Size_{it} + \beta_4 NWC_{it} + \beta_5 MTB_{it} + \beta_6 Lev_{it} + \lambda year_{it} + u_{it})$$

In line with previous studies, we test the robustness of our results by performing additional regressions with other types of excess cash variables. In addition to the excess cash dummy variable described above, we also categorize the firms into quarters and perform the regression. We also perform a regression with excess cash as a continuous variable.

We decide between a fixed effect estimation model (also called within estimator) and a random effect estimation model to test if firms with excess cash are more likely to perform acquisitions. A fixed effect estimation model refers to a model where the group means (firm

means in our estimation model) are fixed. The assumption for using fixed effects is that individual-specific effects are correlated with the explanatory variables. We perform a Hausman test to determine which estimator to use. The Hausman test shows that the random effect estimator is not consistent for our data; hence, fixed effect is the estimator we use. Since the firm means are fixed, the fixed effect model excludes firms which either always (every year) perform acquisitions or never perform acquisitions. This is also the reason why the reported probabilities of becoming an acquirer from the fixed effect estimator should not be interpreted as the true probabilities for the whole population. Rather, the probabilities show the acquisition likelihood for firms that at least once, but not every year, acquire other firms.

To estimate the likelihood of becoming an acquirer, we use a logit model instead of a probit model. The models are similar, but the difference lies in logit uses the cumulative distribution function of the logistic distribution, whereas probit uses the standard normal distribution. The logistic distribution has heavier tails than the standard normal distribution. We cannot test the distributions of the error term since we are only assuming an underlying distribution, therefore also the standard errors are assumed. Most often, it does not matter which of these models are used, but we use the logit model since it is easier to combine with the fixed effect feature in Stata. We also choose to use the observed information matrix as standard errors for the logit regressions to better capture the "true" standard errors in our sample.

4.5 Descriptive statistics

Here we describe the methodology to test our three hypotheses:

Hypothesis I: *Cash levels of Nordic firms have increased, in relative terms to assets, between 2004 and 2018.*

The procedure to test the first hypothesis is straightforward. We will compare how the mean, median and aggregated cash ratio have developed between 2004 and 2018.

Hypothesis II: *There is a dispersion of actual cash holdings relative to expected cash holdings, given certain firm characteristics, among Nordic firms.*

To investigate the second hypothesis, we study the distribution of excess cash among the firm years in our sample for the time-period 2009 to 2018. We do this by examining the probability density function for all firm years' excess cash. In addition, Gini coefficients for

excess cash are investigated to give a reliable measure of the concentration of excess cash among the firm years. The excess cash ratio for each firm-year is given by subtracting the expected cash ratio from the actual cash ratio.

Hypothesis III: *Nordic firms with excess cash are more likely to perform acquisitions.*

In order to examine if firms with excess are more likely to acquire other firms, we perform a fixed effect logit regression where excess cash, together with control variables, are regressed on acquisitions under the subsequent year. We perform regressions with different types of excess cash variables to get more robust results. However, the primary independent variable we use is a dummy variable indicating if a firm-year has excess cash or not.

5 Results and Analysis

5.1 Development of cash holdings

In order to enable comparisons between years, all numbers in this section have been deflated to 2018 million U.S. dollars with the help of CPI statistics for each Nordic country.

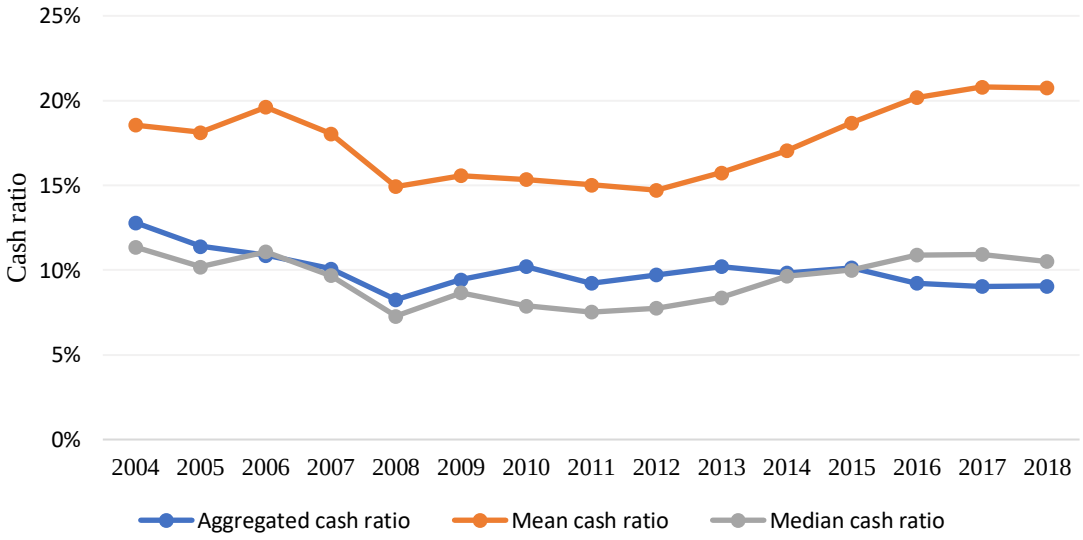
As presented in Figure 2, the mean cash ratio is significantly higher than the median cash ratio and the aggregated cash ratio during the time-period 2004 to 2018. The mean cash ratio is in the range 15% to 21%, the median cash ratio is in the range 7% to 11% and the aggregated cash ratio, defined as the sum of cash holdings divided by the sum of assets, is in the range 8% to 13%. The big difference between the mean cash ratio and the median cash ratio indicates that cash holdings are highly concentrated among Nordic public firms.

In unreported results we also study the development of average, median and aggregated book value of assets together with average, median and aggregated cash holdings during the same time-period to enable further analysis of why the cash ratios increase or decrease during the time-period. These results show that both average total assets and average total cash have decreased between 2004 and 2018. The average of assets has decreased by 25% and the average of cash by 46%. Thus, measured by assets, Nordic public firms 2018 on average are 25% smaller compared to those 2004 and the average cash holdings have decreased even more. We also observe that the median of assets has decreased by 60% between 2004 and 2018 and that the median of cash has decreased by 56%. In other words, median assets and median cash have

more than halved between 2004 and 2018. Aggregated assets for Nordic public firms increased by 51% between 2004 and 2007, from USD 846 b to USD 1,276 b, but thereafter remained relatively stable. In 2018 the aggregated assets amounted to USD 1,252 b. Aggregated cash holdings increased by 19 % between 2004 and 2007, from USD 108 b to USD 128 b. Thereafter, it dropped by 25 %, to USD 96 b, at the financial crisis 2008. After the financial crisis, aggregated cash reversed, and 2010 the aggregated cash holdings were USD 127 b. Thereafter, we see a negative trend with USD 113 b in aggregated cash holdings 2018. Considering these results, it is clear that the decreased aggregated cash ratio between 2010 and 2018 is caused by decreased aggregated cash holdings rather than increased aggregated assets.

Figure 2: Development of cash ratios

This figure presents the development of aggregated cash ratio, mean cash ratio and the median cash ratio for our sample of public firms in Denmark, Finland, Norway and Sweden. Cash ratio is cash plus short-term investments divided by the book value of assets. The data are based on 12,432 firm years over the time-period 2004 to 2018.



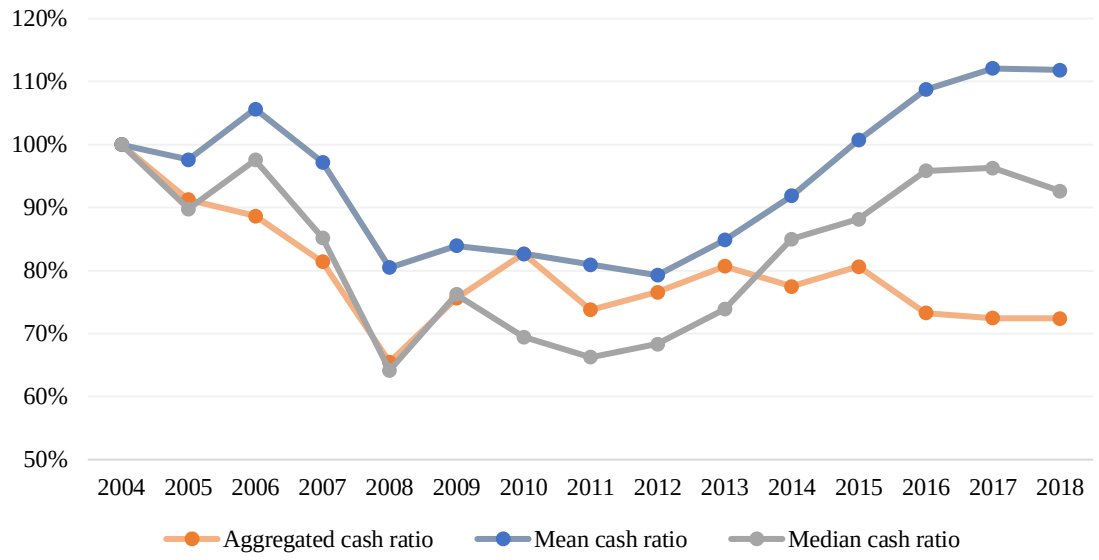
In Figure 3, where all cash ratios are indexed to 100% in 2004, we observe that highest fluctuations occur in connection to the financial crisis 2008 where the cash ratios first fell heavily and thereafter reversed. This phenomenon can be partially explained by the precautionary motive for holding cash, which implicates that firms tend to retain cash after recovering from a financial crisis. Thus, the cash ratios seem to exhibit a mean-reverting pattern.

In addition, we observe that the mean cash ratio has increased by 10%, the median cash ratio has decreased by 8% and the aggregated cash ratio has decreased by 28% between 2004 and 2018. The positive time-trend of the mean cash ratio is consistent with Bates et al. (2009) and Pinkowitz et al. (2013) studies of cash holdings among U.S. firms between 1980 and 2010.

The mean, median and aggregated cash ratios follow a similar trend until 2013. Thereafter, the mean cash ratio increases more than the median cash ratio, and the aggregated cash ratio exhibits a negative trend.

Figure 3: Development of cash ratios relative to 2004

This figure presents the development of average cash ratios, median cash ratios and aggregated cash ratios relative to 2004 for our sample of public firms in Denmark, Finland, Norway and Sweden. Cash is the aggregated cash and short-term investments. Assets are the book value of assets. The data are based on 12,432 firm years over the time-period 2004 to 2018.



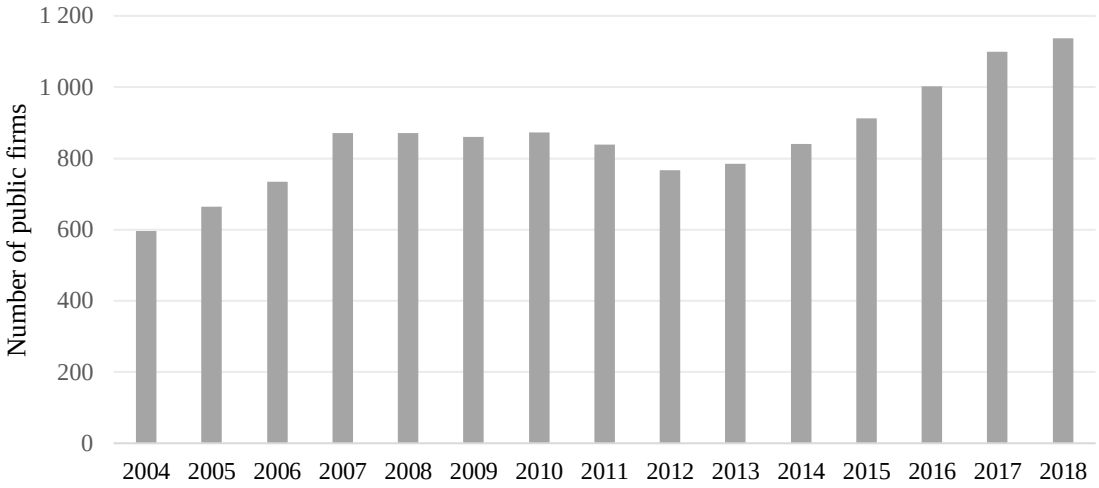
To enable a comprehensive analysis of the development of cash ratios and absolute assets and cash holdings, it is also important to consider the net inflow of public firms during the time-period (see Figure 4). We observe a high net inflow of public firms, an increase of 91% in total, between 2004 and 2018. Highest net inflow, in percentual and absolute terms, occurs during 2007, 2015, 2016 and 2017.

Considering the high net inflow of public firms during the time-period, it is surprising that aggregated assets and aggregated cash do not increase after 2010, especially since many firms that go public issue new shares in the process. Between 2010 and 2018, the total number

of public firms in the Nordics increases by 30% but aggregated assets only increase by 1% and aggregated cash holdings decrease by 10 %. These results indicate that the newly listed firms maybe relatively small in terms of assets and cash since otherwise, the high net inflow of public firms should, at least, have generated a small increase in aggregated assets and aggregated cash holdings between 2010 and 2018. However, it can also be the case that all firms, also the ones that have been public for many years, have become more asset-light and reduced their aggregated cash holdings, enough to compensate for the assets and cash from the newly listed firms. In addition, the lower interest rates 2018 compared to 2004 may also have an impact on the cash ratios for firms since the cost of debt financing has decreased during the time-period.

Figure 4: Development of public firms

This figure presents the development of public firms in Denmark, Finland, Norway and Sweden. The data are based on 12,432 firm years over the time-period 2004 to 2018.



We observe that the concentration of cash holdings among Nordic public firms is high, with a Gini coefficient between 0.88 and 0.92 for all years (Figure 10 in Appendix). If we compare the results with Pinkowitz et al. (2013) study of U.S. firms between 2000 and 2010, we find that the concentration of cash holdings among Nordic firms is higher. The Gini coefficient for U.S. firms is 0.85 in 2000 and 0.86 in 2010 (Pinkowitz et al., 2013).

5.2 Cash holdings determinants

The Fama-MacBeth regression for the estimation period, results presented in Table 2, generates statistically significant coefficients, at 5% significance level, for most of the predictors. The regression is based on data from 3,485 firm years and we use robust standard errors.

The coefficient for industry cash flow risk is positive and significant. This is in line with the literature since firms which operate in an industry with a high level of cash flow volatility are expected to hold more cash. The coefficient for cash flow is close to 0 and not statistically significant. Market-to-book ratio has a significant positive effect on cash ratios, which is consistent with previous research since firms with many investment opportunities are expected to hold more cash. The coefficient for firm size is negative and statistically significant, which confirms the hypothesis that there are economies of scale in the process of issuing new shares or debt. Also, net working capital has a significant negative effect on cash ratios. This is in line with literature since net working capital can be a substitute for cash. We also observe that capital expenditures have a statistically significant negative effect on cash holdings which is logical since, unless the new fixed assets are fully financed by debt, the expenditures will decrease cash holdings in the short run. Leverage also has a significant negative effect on firms' cash ratio. Theory is ambiguous about this item, but we can see that Nordic firms with higher leverage hold less cash. The only surprising direction of a coefficient is payouts ratio, which shows a positive relationship with cash ratio. According to the literature, firms that pay dividends are assumed to be less risky and hold less cash. One reason for the positive coefficient can be that firms that pay out dividends accumulate more cash and for Nordic firms, the dividends are often paid out under the first half of the calendar year. Acquisitions have a significant negative effect. The funding variables net equity issuance and net debt issuance have positive coefficients, but only the former is significant. In the model we include country coefficients for Denmark, Norway and Finland. Sweden represents the intercept and is not included as a separate predictor. The country coefficients for Denmark, Norway and Finland are all positive and significant. Since all coefficients of Denmark, Norway and Finland are positive, we can conclude that Swedish firms have the lowest cash ratio.

The Between Estimator regression, results shown in Table 2, for the estimation period generates similar coefficients as the Fama-MacBeth regression in direction, magnitude and significance, which indicate that our model is robust.

The Fama-MacBeth regression on the subsequent period 2009-2017 shows that the intercept is decreasing by 0.0426, but most importantly, the coefficients of firm characteristics remain similar. It suggests that our model will overestimate cash ratios for the subsequent period, but we will still have a robust model to sort cash-rich firm years from cash-poor firm years. The coefficients for industry cash flow risk, net working capital, acquisitions, net equity issuance and net debt issuance decrease slightly, but otherwise, the results are comparable to the estimation period. Both time-period regressions also show an R-square of 0.415. The selection of estimation time period is considered appropriate even if it had been optimal if also the intercept remained stable over the second period.

Table 2: Cash holding determinants

This table presents the results from Fama-Macbeth regressions and Between Estimator regressions on the estimation period 2004 to 2008, and the subsequent time-period 2009 to 2017 for Danish, Finnish, Norwegian and Swedish firms. Specification (1) presents the results from the Fama-Macbeth regression on the estimation period which also are the coefficients that are used to estimate normal cash holdings for the subsequent time-period. Specification (2) presents the results from the Fama-Macbeth control regression on the subsequent time-period. Specification (3) presents the results from the Between Estimator control regression on the estimation period. Specification (4) presents the results from the Between Estimator control regression on the subsequent time-period. The dependent variable is *Cash ratio* which is cash and short-term investments divided by the book value of assets. *IndSigma* is the average standard deviation of cash flow within an industry, defined by S&P Capital IQ industry classifications, for the five previous years. *CF* is cash flow divided by assets. *MTB* is the market-to-book ratio of assets. *Size* is the natural logarithm of assets deflated to 2008 million U.S. dollars. *NWC* is the net working capital divided by assets. *CapEx* is capital expenditures divided by assets. *Lev* is leverage, defined as debt divided by assets. *Payout* is the aggregated dividends and repurchases of common stock and preferred stock divided by assets. *Acq* is the cash acquisitions divided by assets. *NetEqI* is the net equity issuance divided by assets. *NedDebtI* is the net debt issuance divided by assets. Lastly, we have country dummy variables for three of the four countries. Sweden is not added as dummy variable and serves as intercept. The different regression methods and firm characteristics are described more detailed in the Methodology chapter. Standard errors are given in parentheses and significance at 1%, 5% and 10% is indicated by ***,** and *.

	(1) FMB 2004-2008	(2) FMB 2009-2017	(3) BE 2004-2008	(4) BE 2009-2017
IndSigma	0.5076***	0.4538***	0.3760***	0.6484***
	(0.0782)	(0.0614)	(0.1177)	(0.1062)
CF	-0.0068	0.0012	-0.0541	-0.0111**
	(0.0311)	(0.0143)	(0.0334)	(0.0047)
MTB	0.0183**	0.0219***	0.0179***	0.0198***
	(0.0053)	(0.0033)	(0.0042)	(0.0033)
Size	-0.0072***	-0.0070***	-0.0062**	0.0001
	(0.0008)	(0.0009)	(0.0027)	(0.0021)
NWC	-0.2197***	-0.1195***	-0.1973***	-0.0841***
	(0.0263)	(0.0090)	(0.0291)	(0.0273)
CapEx	-0.3064***	-0.2936***	-0.0800	-0.2989***
	(0.0340)	(0.0371)	(0.0614)	(0.0970)
Lev	-0.2721***	-0.2601***	-0.3245***	-0.3222***
	(0.0182)	(0.0141)	(0.0309)	(0.0224)
Payout	0.1908**	0.2147***	0.2122***	0.0004
	(0.0513)	(0.0446)	(0.0816)	(0.0034)
Acq	-0.4471***	-0.3985***	-0.4012***	-0.5558***
	(0.0550)	(0.0239)	(0.0879)	(0.1103)
NetEqI	0.2037**	0.1217***	0.0156	0.1669***
	(0.0598)	(0.0291)	(0.0277)	(0.0268)
NetDebtI	0.0864	0.0264	-0.0023***	-0.0289
	(0.0527)	(0.0201)	(0.0004)	(0.0329)
Denmark	0.0467***	0.0277***	0.0395**	0.0230
	(0.0057)	(0.0053)	(0.0162)	(0.0143)
Finland	0.0377***	0.0256***	0.0273**	0.0340***
	(0.0054)	(0.0031)	(0.0133)	(0.0107)
Norway	0.0529**	0.0571***	0.0729***	0.0435***
	(0.0152)	(0.0071)	(0.0124)	(0.0113)
Constant	0.1730***	0.1304***	0.1916***	0.0981***
	(0.0127)	(0.0053)	(0.0248)	(0.0222)
Observations	3,485	7,653	1,008	1,443
R-squared	0.4157	0.4148	0.3611	0.4758
Number of groups	5	9		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

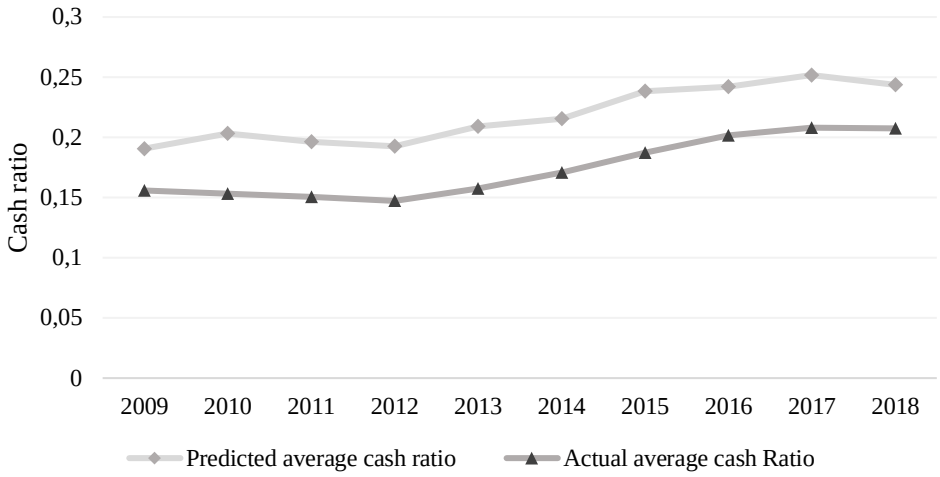
5.3 Distribution of excess cash holdings

When we compare predicted average cash ratios with actual average cash ratios, Figure 7, we can see that actual cash ratios are approximately 4 percent units lower than the predicted average cash ratios throughout the time-period. As mentioned in subsection 5.2, this difference is not surprising since we can see that the determinants of cash holdings, especially the intercept, are decreasing in magnitude between our estimation period 2004 to 2008 and the period 2009 to 2018 where we estimate normal cash holdings. The expected cash ratios are subtracted from

actual cash ratios to get excess cash for all firm years. In the time-period between 2009 and 2018, the average excess cash ratio is -4.5% for Swedish firms, -5.5% for Danish firms, -4.2% for Finnish firms and -3.8% for Norwegian firms.

Figure 7: Actual average cash ratios compared to expected average cash ratios

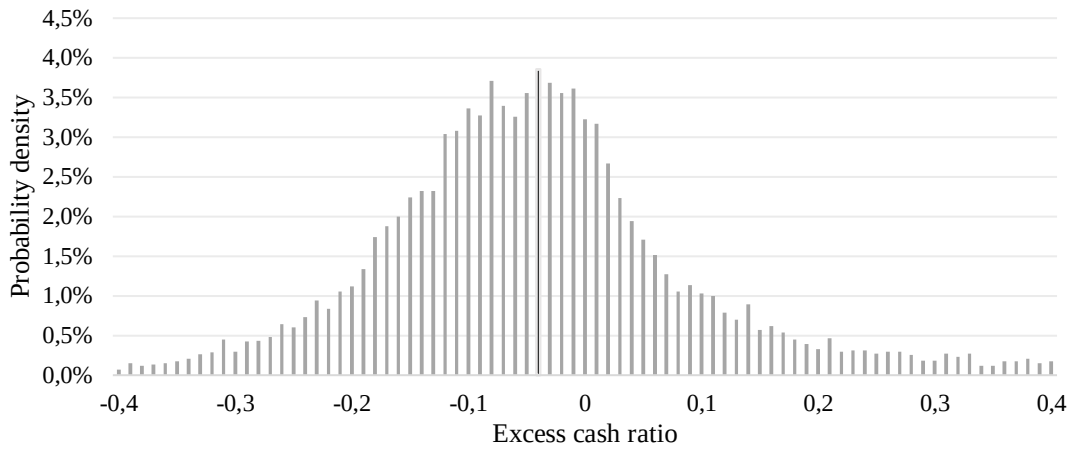
This figure presents the development of actual average cash ratios and expected average cash ratios between 2009 and 2018 for Danish, Finnish, Norwegian and Swedish firm and involves 8,742 firm years. The average actual cash ratios are the average of cash and short-term investments divided by assets. The expected average cash ratios are the average of the normal cash ratios. In the methodology chapter we describe more detailed how normal cash ratios have been calculated.



The distribution of the excess cash ratios is illustrated in Figure 8. As a result of a large number of observations, the distribution tends towards normal distribution but is slightly skewed right. The sample contains 2,677 cash-rich and 6,065 cash-poor firm years, and the majority of results (69%) shows a negative excess cash ratio, as is the average of -4.6%. Based on the entire distribution, the quartile thresholds are as follows: Q1: -0.1291; Q2: -0.0543; Q3: 0.0190. To sum up, we can see a high dispersion of excess cash among the firm years.

Figure 8: Distribution of Excess Cash

This figure presents the distribution of excess cash ratio across the 8 742 firm years in the period from 2009 to 2018 for our sample of public firms incorporated in the Nordic context. The distribution is based on the results from the previously introduced model of normal cash holdings. Bin widths are 0.01% and tails are capped at +/- 0.4% excess cash over assets.



By analyzing absolute excess cash levels in our sample, we also find a negative average excess cash of USD -51.1 m. The absolute quartile thresholds are as follows: Q1: USD -17.46 m; Q2: USD -1.63 m; Q3: USD 0.57 m. It is in line with the previous reasoning and provides additional support to confirm Hypothesis II, that there is a high dispersion of excess cash.

To investigate if positive excess cash is concentrated on a minority of firms in given years, we calculate Gini coefficients of positive excess cash holdings for our sample. Results are reported in the Appendix (Figure 11) and indicate a high concentration of excess cash in the period 2009 to 2018. The Gini coefficients for the year 2016, 2017 and 2018 are observed slightly lower than the previous years in the chosen period. One inference is that the number of firms holding positive excess cash increased in the most recent years. As shown in Appendix Figure 11, the proportions of the firm years from 2016 to 2018 are among the highest in the 10 years. More firms hold positive excess cash, therefore, lead to the less concentration of the excess cash distribution.

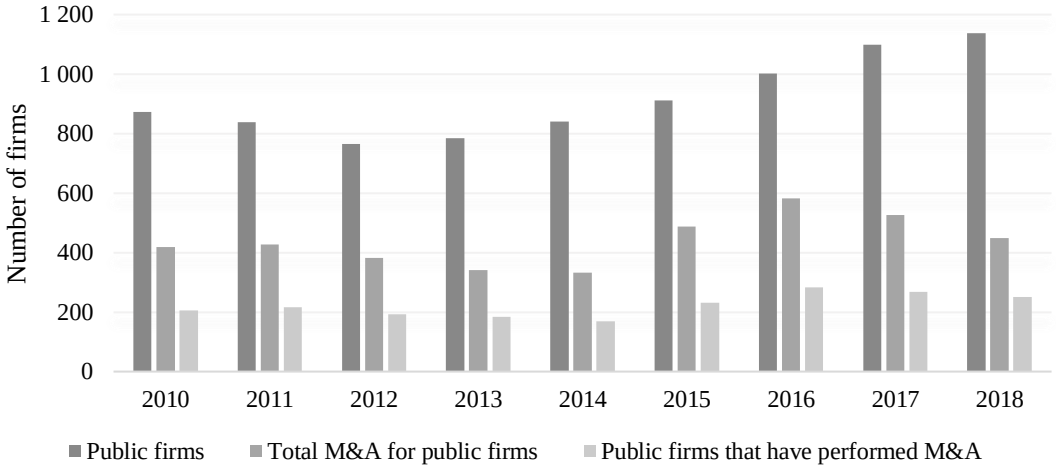
The high concentration of excess cash is in line with previous results in subsection 5.1 which indicates that cash holdings among Nordic public firms exhibit high concentration. It is also consistent with Pinkowitz et al. (2013) findings that cash holdings for U.S. firms between 2000 and 2010 were profoundly concentrated.

5.4 Impact of excess cash on mergers and acquisitions

The number of mergers and acquisitions when the acquirer is a public firm amounts to 3,946 deals under the time-period 2010 to 2018. Yearly acquisition data is presented in Figure 8. For each year it is between 19% and 26% of the total number of public firms that acts as a buyer in at least one mergers and acquisitions deal. We can see that there is a concentration of firms that actively perform acquisitions since the number of acquiring firms in relation to the total number of deals is in the range 47% to 56% throughout the time-period. We identify a negative trend in the number of deals between 2010 and 2014. However, between 2014 and 2016 the number of deals increased by 75%.

Figure 8: Development of mergers and acquisitions

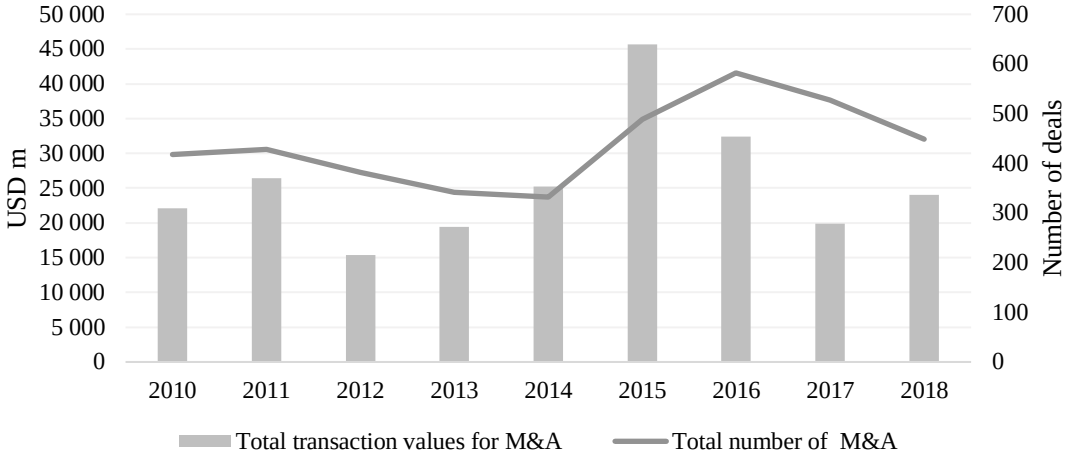
This figure presents the development of closed mergers and acquisitions transactions between 2010 and 2018 where the buyer is a public Danish, Finnish, Norwegian or Swedish firm. We use the announcement date as time criteria. The total number of mergers and acquisitions amounts to 3,946 where these criteria are met. The table also presents the number of public Danish, Finnish, Norwegian and Swedish firms that have performed at least one mergers and acquisitions deal in a given year. The table also shows the total number of public firms in Denmark, Finland, Norway and Sweden during the time-period.



The total transaction values, Figure 9, are also fluctuating during the time period. It is though difficult to draw any conclusions from this since only around half of the deals have a reported transaction value.

Figure 9: Development of aggregated transaction values

This figure presents the development of total transaction values for closed mergers and acquisitions transactions between 2010 and 2018 where the buyer is a public Danish, Finnish, Norwegian or Swedish firm. We use the announcement date as time criteria. The total number of mergers and acquisitions amounts to 3,946 but only approximately half of the transaction have a reported transaction value. The table also presents the total number of mergers and acquisitions transactions when these criteria are met.



The fixed effect logit estimation involves 7,364 firm years before exclusion of firms which either always or never perform acquisitions and 4,185 firm years after exclusion. The results are presented in Table 3. It shows a statistically-significant, at a 5% significance level, coefficient for the excess cash dummy variable. Thus, having excess cash is statistically significantly associated with a higher probability of performing at least one acquisition in the upcoming year. Regarding the magnitude, it is more adequate to look at the probabilities than the coefficients. We can see that holding all other variables constant at their mean value, a firm that goes from not having excess cash to having excess cash increase their probability of acquiring other firms in the upcoming year by 5.1 percent units, from 40.1% to 45.2%, as presented in Table 4. This represents an increase in likelihood by 12.7%. Because of the exclusion of 790 firms (3,179 firm years), the reported probabilities should be interpreted as the likelihood of becoming an acquirer for firms that have at least once but not every year acted as a buyer in a mergers and acquisition deal. The results are in line with previous research by Harford (1999) on U.S. firms. It is though difficult to compare the magnitude since he does not use a fixed effect estimator.

For the control variables, we can observe statistically significant coefficients for net working capital, market-to-book ratio, leverage and some of the years. Regarding the significant

coefficients for years, we can see that firms have the highest likelihood of becoming an acquirer 2016, which is logical considering that 2016 is the year with most deals. The robustness of our model is strengthened by the fact that most of our control variables have significant coefficients with directions in line with the expectations. We get relatively low pseduo R-squares, 0.023, for the fixed effect logit. However, it is not unusual that corporate finance regressions generate low pseudo R-squares and the sample size of acquisitions and firm years are limited.

Table 3: Determinants of mergers and acquisitions activity

This table presents the results from a Fixed Effect Logit estimation for Danish, Finish, Norwegian and Swedish firms under the time-period 2010 to 2018 and involves 7,364 firm years before exclusion of firms which either always or never perform acquisitions and 4,185 firm years after exclusion. The dependent variable is a dummy where 1 represents that a firm has performed at least one mergers or acquisitions transaction and 0 if not. All explanatory variables are measured on the year before the acquisition year. *ExcCashDummy* is a dummy for excess cash, 1, or not, 0. *Salesgrowth* is the 4-year average of the 1-year percentual total revenues growth. *Size* is the natural logarithm of assets deflated to 2008 million U.S. dollars. *NWC* is the 4-year average of net working capital divided by assets. *MTB* is the 4-year average of the market-to-book ratio of assets. *Lev* is the 4-year average of leverage, defined as debt divided by assets. Lastly, we have yearly dummy variables. We use the observed information matrix as standard errors. The regression method and firm characteristics are described more detailed in the Methodology chapter. Standard errors are given in parentheses and significance at 1%, 5% and 10% is indicated by ***,** and *.

VARIABLES	(1) MAAct
ExcCashDummy	0.230**
	(0.111)
Salesgrowth	-0.002
	(0.005)
Size	-0.073
	(0.079)
NWC	-1.568**
	(0.623)
MTB	0.134***
	(0.043)
Lev	-1.783***
	(0.510)
Y_2010	0.415***
	(0.154)
Y_2011	0.476***
	(0.150)
Y_2012	0.279*
	(0.151)
Y_2013	0.055
	(0.153)
Y_2014	-0.150

	(0.154)
Y_2015	0.355**
	(0.146)
Y_2016	0.513***
	(0.140)
Y_2017	0.200
	(0.136)
Y_2018	-
Observations	4,185
Number of Firms	584
Pseudo r-squared	0.023

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Acquisition likelihood

This table presents the acquisition likelihood (marginal effects) for firms with excess cash compared to other firms, holding all else variables constant at their mean. Fixed Effect Logit estimation is used, and complete coefficients results are presented in Table 2. The regression is based on data for Danish, Finish, Norwegian and Swedish firms under the time-period 2010 to 2018 and involves 7,364 firm years before exclusion of firms which either always or never perform acquisitions and 4,185 firm years after exclusion. The dependent variable is a dummy where 1 represents that a firm has performed at least one mergers or acquisitions transaction and 0 if not. The following explanatory variables are included and measured one year before the acquisition year. *ExcCashDummy* is a dummy for excess cash, 1, or not, 0. *Salesgrowth* is the 4-year average of the 1-year percentual total revenues growth. *Size* is the natural logarithm of assets deflated to 2008 million U.S. dollars. *NWC* is the 4-year average of net working capital divided by assets. *MTB* is the 4-year average of the market-to-book ratio of assets. *Lev* is the 4-year average of leverage, defined as debt divided by assets. Lastly, we have yearly dummy variables. We use the observed information matrix as standard errors. The regression method and firm characteristics are described more detailed in the Methodology chapter.

Number of obs	= 4,185
ExcCashDummy	Probability
at	
0	0.401
1	0.452

5.5 Robustness tests

To increase the validity of our results, we conduct several robustness tests where the results are unreported. When we categorize the firm years into quartiles based on their excess cash, the coefficient remains positive but is no longer significant. The probability of becoming

an acquirer is 41.2% for the lowest quartile, 43.1% for the second quartile, 45.0% for the third quartile, and 47.0% for the fourth quartile.

In addition to the regressions where we use categorical excess cash variables, we also regress M&A activity on the continuous excess cash for each firm-year. The coefficient is positive and significant but only at a 10% significance level. Holding all other variables constant at their average, firms with excess cash ratios of 25% have a 44.6% likelihood of becoming an acquirer. It is 22.5% higher than firms with negative excess cash of -25%, which only have a 36.4% likelihood of becoming an acquirer.

6 Discussion

6.1 Development of cash holdings

If we try to analyse more deeply the reasons behind the movements of the different cash ratios for Nordic firms during 2004 to 2018, it is obvious that the financial crisis had an immediate negative effect on cash ratios. However, mean cash ratios stayed low until 2012 when they started to increase again. The deterministic cash holding model from Miller et al. (1966) suggests that firms should have a policy of actions with a returning point when cash holdings reach a floor. Therefore, it is surprising that the mean cash ratio does not reverse until four years after the financial crisis broke out. Maybe, the firms' policy of actions contained parts that were not possible to execute during the extreme capital market conditions that followed. If firms did not realize how limited the funding sources could be during a perfect storm the precautionary motive for holding cash increases after the financial crisis. Thus, also the optimal cash ratio for firms should increase after the financial crisis which can explain why firms on average hold 10% higher cash ratio 2018 compared to 2004. It is more difficult to provide an explanation to the decreased median cash ratio between 2004 and 2018. Given that the precautionary motive for holding cash increases after the financial crisis, the median cash ratio should also increase. The large net inflow of pubic firms can be an explanation to the ambiguous results where the newly listed firms maybe less profitable and accumulate less cash. Maybe also the lower interests 2018 compared to 2004 have an impact on the cash ratios for firms since the cost for debt financing has decreased.

6.2 Distribution of excess cash holdings

When performing control regressions on the cash holding determinants for the second period, 2009 to 2017, we find that the determinants, especially the intercept, are decreasing in magnitude compared to the estimation period, 2004 to 2008. The most likely explanation to this is the consequences of the financial crisis, where average cash ratios remained low under several years and therefore had larger impact on the subsequent period.

6.3 Impact of excess cash on mergers and acquisitions

We find that excess cash is significantly positive related, at a 5% significance level, to subsequent acquisition likelihood. Similar to Harford (1999), we provide Jensens (1986) free cash flow theories as potential explanation to the higher subsequent acquisition likelihood among firm years with excess cash. The results indicate that firms with excess cash are overspending which can be a problem if the acquisitions, like Harfords (1999) study showed, have a negative impact on shareholder value. If agency conflicts are the source behind the overspending, issuing debt in exchange for equity can be a solution to the problem since then managers have higher commitment to keep their promises because debt obligations are stricter than dividends (Jensen, 1986). However, increasing leverage has its own negative consequences. Another solution could be to increase the instruments of corporate governance as letting the board of directors approve major business decisions. However, this solution can have negative consequences in terms of taking away focus of managing the business for the management. Also, maybe the board of directors has too little knowledge about the business and the industry to perform better decisions than the management from a shareholder maximization perspective. Both proposed solutions to decrease agency conflicts in terms of overspending show that there are no easy solutions, with solely positive consequences, to overcome the problem. Nevertheless, it is still important for shareholders and other stakeholders of a firm to be aware of the potential agency conflicts related to excess cash holdings and acquisitions. Furthermore, we cannot exclude the possibility that the company has a plan to acquire in the subsequent year and it may hoard cash in the previous year to meet the demand of future investment.

6.4 Limitations and future research

Our results are limited by the relatively small datasets for the specific Nordic market compared to the datasets for the U.S. or the broader range of Europe countries (e.g., EU-15). S&P Capital IQ integrated the fundamental information of companies well since the early 2000s, but we do not know whether all mergers and acquisitions transactions have been reported in the database. Hence, there is a risk that the data is incomplete. This potential issue is, however, not unique for our study.

Secondly, though the model we used is widely accepted and applied in the literature in the past two decades, it is essential to bear in mind that the model cannot eliminate all estimation errors. As pointed out by Bechert et al. (2016), the expected results are dependent on the chosen estimation period, and it is difficult to determine an estimation window that is optimally representative of the evaluation period. To form an optimal window, the relationship between cash holdings and firm characteristics in the estimation and the evaluation period should keep stable. As discussed in Section 5 and shown in Table 2 and Table 3, we find that these relationships are relatively stable in our sample. However, in the M&A section, the results which build on the estimation of excess cash may be affected by the differences between the estimation period and the acquisition evaluation period.

Regarding the potential future extension of our study, we suggest to exam if Nordic firms with excess cash pay a higher premium for mergers and acquisitions than other Nordic firms. Also, it had been interesting to study announcement returns for Nordic firms with excess cash compared to other Nordic firms since Harford (1999) show that firms with excess cash undertake value-destroying acquisitions. However, Lie et al. (2018) present results inconsistent with the common belief that cash holdings induce value-destroying acquisitions. They distinguish between cash and stock acquisitions and examine acquisitions announced between January 1985 and December 2015 in the U.S. market. They find that the negative relation between excess cash and announcement return is absent in the sample of acquisitions financed with cash, but the relation is attributable to the sample of acquisitions financed with stock, which presumably could be undertaken even with limited cash holdings. Hence, future research should preferably also consider the acquisition payment method when analyzing the effect of cash holdings on acquirers paid premium and announcement returns.

7 Conclusion

Hypothesis I: *Cash levels of Nordic firms have increased, in relative terms to assets, between 2004 and 2018.*

We can confirm that the average cash ratio has increased, by 10 %, between 2004 and 2018. However, both median cash ratios and aggregated cash ratios have decreased, by 8% and 28%. The high net inflow of public firms during the time-period decreases the comparability between years.

Hypothesis II: *There is a dispersion of actual cash holdings relative to expected cash holdings, given certain firm characteristics, among Nordic firms.*

We can confirm the second hypothesis because excess cash is dispersedly distributed among the firm years. Some firms keep more cash than expected and some firms keep less cash than expected. On average, firms keep negative excess cash which was anticipated since we can see that the determinants of cash holdings, especially the intercept, are decreasing in magnitude between our estimation period 2004 to 2008 and the period 2009 to 2018 where we estimate cash holdings. We can, however, see that the distribution of excess cash skews towards excess cash, which implies that excess cash is concentrated at a fewer number of firm years.

Hypothesis III: *Nordic firms with excess cash are more likely to perform acquisitions.*

The third hypothesis is confirmed since our results show that there is a statistically significant, at 5% significance level, positive relationship between excess cash and subsequent acquisition likelihood for Nordic firms. Robustness tests with various types of excess cash variables also indicate higher subsequent acquisition likelihood among firm years with excess cash which further strengthens the validity of the results.

To sum up, we conclude that the average cash ratio for Nordic public firms has increased by 10% between 2004 and 2018. We also conclude that firms with excess cash have a significant, at 5% significance level, higher acquisition likelihood than other firms.

References

Baskin, Jonathan (1987). *Corporate liquidity in games of monopoly power,* Review of Economics and Statistics 69, 312-319

Bates, T. W., Kahle, K. M., & Stulz, R. M. (2009). *Why do U.S. firms hold so much more cash than they used to?* Journal of Finance, 64(5), 1985-2021.

Baumol, W. J. (1952). *The transaction demands for cash: An inventory theoretic approach.* Quarterly Journal of Economics, 66(4), 545-556.

Bechert & Schwarz (2016). *The Effect of Excess Cash on M&A Evidence from Europe.* Master thesis in Finance at Stockholm School of Economics.

Berk, J., and DeMarzo, P. (2017). *Corporate finance* (4. Global ed.). Harlow: Pearson.

Breuer, W.; Rieger, M.O., Soypak, K.C. (2016). *Corporate Cash Holdings and Ambiguity Aversion*. In: Review of Finance

Chan LKC, Lakonishok J, Sougiannis T (2001). *The Stock Market Valuation of Research and Development Expenditures.* J Financ 54:2431-2456

Dittmar, A., Mahrt-Smith, J., & Servaes, H. (2003). *International corporate governance and cash holdings.* Journal of Financial and Quantitative Analysis, 38(1), 111-133.

D'Mello, Ranjan & Krishnaswami, Sudha & Larkin, Patrick J., (2008). *Determinants of corporate cash holdings: Evidence from spin-offs,* Journal of Banking & Finance, Elsevier, vol. 32(7), pages 1209-1220, July.

Egan, M. (2019), *Corporate America's mountain of cash is shrinking*. Retrieved Jun 10, 2019 from https://edition.cnn.com/2019/06/10/investing/corporate-cash-buybacks-tax-cuts/index.html

Foley, F. C., Hartzell, J. C., Titman, S., & Twite, G. (2007). *Why do firms hold so much cash? A tax-based explanation.* Journal of Financial Economics, 86, 579-607.

Harford, J. (1999). *Corporate cash reserves and acquisitions.* Journal of Finance, 54(6), 1969-1997.

Harford, J., Klasa, S. J., & Maxwell, W. F. (2014). *Refinancing risk and cash holdings*. Journal of Finance, 69(3), 975-1012. https://doi.org/10.1111/jofi.12133

Jensen, M. C.(1986). *Agency cost of free cash flow, corporate finance, and takeovers.* American Economic Review, 76(2), 323-329.

John, Terese A., (1993). *Accounting measures of corporate liquidity, leverage, and costs of financial distress*, Financial Management 22, 91-100.

Keynes, J. M. (1936). *The General Theory of Employment, Interest, and Money.* London: Harcourt Brace.

Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1998*). Law and Finance. Journal of Political Economy*, 106(6), 1113-1155. doi:10.1086/250042

La Rocca T, Staglianò R, La Rocca M, et al. The value of SME's cash holdings in Europe. The role of internal and external moderators[J].

Lang, Hsien Ping Larry and Walkling, Ralph August and Stulz, Rene M.(1991), *A Test of the Free Cash Flow Hypothesis: The Case of Bidder Returns.* Journal of Financial Economics, Vol. 29, pp. 315-335.

Lie, E., & Liu, Y. (2018). *Corporate Cash Holdings and Acquisitions. Financial Management,* 159-173. Mizruchi, M. S. (1982). The American corporate network, 1904-1974 (Vol. 138).

Modigliani, F. and Miller, M.H. (1958). *The Cost of Capital, Corporation Finance and the Theory of Investment.* The American Economic Review, 48, 261-297.

Myers, S. C., & Majluf, N. S. (1984). *Corporate financing and investment decisions when firms have information that investors do not have.* Journal of Financial Economics, 13, 187-221.

Modigliani & Miller (1961). *Dividend Policy, Growth, and the Valuation of Shares*, The Journal of Business, 412-413

Mulligan, C. B. (1997). *Scale economies, the value of time, and the demand for money: Longitudinal evidence from firms.* Journal of Political Economy, 105(5), 1061-1079.

Myers, Stewart C., *Capital Structure Puzzle (July 1984)*. NBER Working Paper No. w1393.

Miller, M. H., & Orr, D. (1966). *A model of the demand for money by firms.* Quarterly Journal of Economics, 80(3), 413-435.

Moody's Research Announcement (New York, June 10, 2019), *US companies' cash holdings down 15.2% as capex, dividends, buybacks and acquisitions hit new record highs*

Opler, Tim & Pinkowitz, Lee & Stulz, Rene & Williamson, Rohan. (1999). *The determinants and implications of corporate cash holdings*, Journal of Financial Economics, Elsevier, vol. 52(1), pages 3-46.

Pinkowitz, L., Stulz, R. M., & Williamson, R. (2013). *Is there a U.S. high cash holdings puzzle after the financial crisis?* Fisher College of Business Working Paper Series. Ohio State University.

Waters, R. (2018). *US companies' massive cash hoard is finally coming down.* Retrieved November 28, 2018 from https://www.ft.com/content/2c0cf0a4-f25a-11e8-ae55-df4bf40f9d0d

Weidemann, Felix. (2015). *A State-of-the-Art Review of Corporate Cash Holding Research.* SSRN Electronic Journal. 10.2139/ssrn.2764845.

Worldbank. (2018). *GDP ranking*. Retrieved August 18, 2019, from www.data.worldbank.org: http://data.worldbank.org/data-catalog/GDP-ranking-table

Appendix

Table 5: Terms and Definitions

This table presents definitions of selected terms used in this paper. The list of data items is not exhaustive but only includes terms which are used ambiguously in the literature.

Term	Definition
Assets	Book value of assets.
Acquirer	Firm that acts a buyer in a mergers and acquisitions deal.
Cash	Cash plus short-term investments.
Cash flow	Operating income before depreciation minus interest, taxes and dividends.
Cash ratio	Cash deflated by assets, unless defined otherwise.
Cash-poor	Negative excess cash.
Cash-rich	Positive excess cash.
Debt	Long-term debt plus debt in current liabilities.
Excess cash	Actual minus predicted cash ratio.
Firm	We use this term interchangeably with the term company.
Leverage	Debt deflated by assets.
Market value of assets	Book value of assets minus book value of equity plus market value of equity.
M&A	Mergers and acquisitions.
Net debt issuance	Long-term debt issuance minus long-term debt reduction.
Net equity issuance	Sale minus purchase of common and preferred stock.
Public firm	Firm whose shares are traded on a stock exchange.
S&P Capital IQ	Global database comprising financial data of active and inactive companies.
Target	Firm that is the subject of an mergers and acquisitions deal.
The Nordic	Including Denmark, Finland, Norway, Sweden and Iceland, but in this thesis, Iceland is excluded in the data collection

Table 6: Sample Composition by Industry – Estimation period

Sample composition by primary industry for the firm years in the Estimation Period 2004-2008. The classifications are from S&P Capital IQ.

Industry	Firm years	Percent
Communication services	215	6.2
Consumer discretionary	354	10.2
Consumer Staples	187	5.4
Energy	244	7.0
Health Care	348	10.0
Industrials	936	26.9
Information Technology	769	22.1
Materials	214	6.1
Real Estate	218	6.3
Total	**3,485**	**100**

Table 7: Sample Composition by Country – Estimation period

Sample composition by headquarter country for the firm years in the Estimation Period 2004-2008. The information comes from S&P Capital IQ.

Country	Firm years	Percent
Denmark	479	13.7
Finland	572	16.4
Norway	827	23.7
Sweden	1,607	46.1
Total	**3,485**	**100**

Table 8: Sample Composition by Industry – Second period

Sample composition by primary industry for the firm years in the Second Period 2010-2018. The classifications are from S&P Capital IQ.

Industry	Firm years	Percent
Communication services	461	6.3
Consumer discretionary	812	11.0
Consumer Staples	392	5.3
Energy	414	5.6
Health Care	1,066	14.5
Industrials	1,959	26.6
Information Technology	1,281	17.4
Materials	465	6.3
Real Estate	514	7.0
Total	**7,364**	**100**

Table 9: Sample Composition by Country – Second period

Sample composition by headquarter country for the firm years in the Second Period 2010-2018. The information comes from S&P Capital IQ.

Country	Firm years	Percent
Denmark	994	13.5
Finland	1,043	14.2
Norway	1,338	18.2
Sweden	3,989	54.2
Total	**7,364**	**100**

Table 10: Correlation matrix for cash holding determinants

This figure presents the correlation for the dependent and independent variables used in the Fama-Macbeth regression for the estimation period 2004-2008 for Danish, Finnish, Norwegian and Swedish firms and includes 3,485 firm years. Cash ratio is cash and short-term investments divided by the book value of assets. IndSigma is the average standard deviation of cash flow within an industry, defined by S&P Capital IQ industry classifications, for the five previous years. CF is cash flow divided by assets. MTB is the market-to-book ratio of assets. Size is the natural logarithm of assets deflated to 2008 million U.S. dollars. NWC is the net working capital divided by assets. CapEx is capital expenditures divided by assets. Lev is leverage, defined as debt divided by assets. Payout is the aggregated dividends and repurchases of common stock and preferred stock divided by assets. Acq is the cash acquisitions divided by assets. NetEqI is the net equity issuance divided by assets. NedDebtI is the net debt issuance divided by assets. The different firm characteristics are described more detailed in the Methodology chapter.

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) CR	1.000											
(2) IndSigma	0.300***	1.000										
(3) CF	-0.187***	-0.081***	1.000									
(4) MTB	0.284***	0.162***	-0.231***	1.000								
(5) Size	-0.319***	-0.294***	0.370***	-0.278***	1.000							
(6) NWC	-0.297***	-0.214***	0.265***	-0.125***	0.153***	1.000						
(7) CapEx	-0.105***	-0.091***	0.030	-0.020	0.125***	-0.077***	1.000					
) Lev	-0.395***	-0.243***	-0.044**	-0.163***	0.309***	0.098***	0.222***	1.000				
) Payout	0.070***	-0.007	0.043*	0.087***	0.112***	0.026	-0.027	-0.111***	1.000			
0) Acq	-0.125***	0.009	0.051**	-0.038*	0.068***	-0.016	-0.073***	0.050**	-0.034*	1.000		
1) NetEqI	0.081***	0.040*	-0.269***	0.117***	-0.132***	-0.133***	0.090***	0.028	-0.036*	0.001	1.000	
2) NetDebtI	-0.016	-0.003	-0.076***	0.169***	-0.049**	-0.049**	0.101***	-0.007	-0.007	-0.002	-0.002	1.000

< 0.05, ** $p < 0.01$, *** $p < 0.001$

Figure 10: Gini Coefficients of Cash Holdings

This figure presents the development of cash concentration as measured by the Gini coefficients of cash holdings across 16,096 firm years from 2004 to 2018 for our sample of public firms incorporated in the Nordic context.

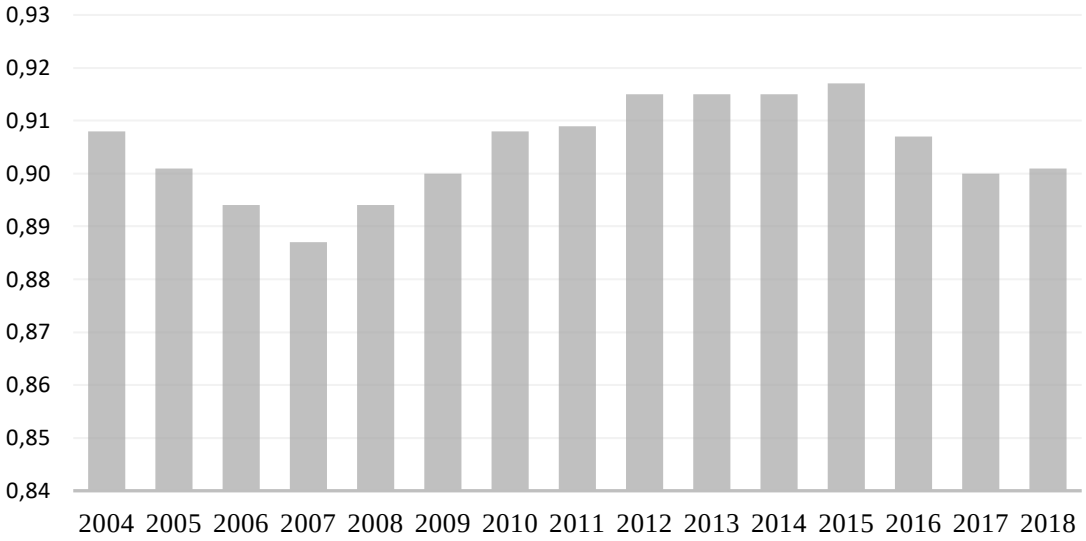


Figure 11: Gini Coefficients of Positive Cash Holdings

This figure presents the Gini coefficients of positive excess cash holdings across 2,675 firm years between the period 2009 to 2018, and correspondingly the proportion of firm years in each year.