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U.S. Corporations are Sitting on Piles of Cash. What is the Situation in Norway? Which Determinants Might Explain the Causes of Norwegian Cash Holding?

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Abstract

In the past three decades cash holding for U.S. firms have more than doubled. The goal of this thesis is to examine if the cash phenomenon in the U.S. is also existent in Norway. We investigate publicly traded firms in Norway over the period 1996 to 2016. More specifically, we examine the evolution of cash holdings over time, which determinants might explain the causes of cash holding and whether there are differences across industries.

The findings show that the cash ratio increased in Norway from 20.3% in 1996 to 23.4% in 2006, a trend similar to the one in the U.S. documented by Bates, Kahle, and Stulz (2009). During the financial crisis we document a 7% decline in the cash ratio in Norway, while it remained high in the U.S. Norwegian firms have an overall higher leverage ratio than U.S. firms, and we identify a negative relation between cash holding and leverage. The findings also reveal that smaller firms and firms that are financially constrained hold higher cash levels. Cash increases with R&D spending and high market to book values, which both measures growth opportunities. Furthermore, we find substantial variation in cash levels across the seven industries studied. The IT- and Healthcare sectors are the ones holding the most cash. Of the typical arguments for holding cash we find the precautionary motive most relevant.

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1 Introduction

Media have devoted much attention to the dramatic increase in cash holdings for U.S. firms. At the end of 2016, U.S. companies held $1.84 trillion in cash, of which 70%, $1.3 trillion, were being held overseas. The top five cash holding companies are all in the tech sector, with Apple holding the most, a record high of $246.1 billion (Ajzenman & Lane, 2017), resulting in a cash to asset ratio of 73% (Apple Inc., 2017). *The Financial Times* reported that Apple, Microsoft, Alphabet, Oracle and Cisco have more than half a trillion USD of unused cash in their accounts. The numbers are enormous, and it raises the question why these are not invested for future growth? Traditionally firms have been borrowers not savers.

Bates et al. (2009, p. 1985) reports a doubling in cash holding from 10.5% in 1980 to 23.2% in 2006 for U.S. firms. They argue that the increase is driven by a decline in inventory and capital expenditure and an increase in research and development expenditure and cash flow risk. In this thesis we compare the Norwegian cash holding to the U.S. The differences between the countries in terms of corporate governance, legal system and taxation may lead to differences in the development of the cash holdings. Dittmar, Mahrt-Smith, and Servaes (2003) finds that firms with weaker investor protection holds twice as much cash as firms in countries with stronger investor protection. La Porta, Lopez De Silanes, Shleifer, and Vishny (1998, p. 1116) show that common law countries (U.S.) generally have the strongest investor protection compared to civil law countries (Norway). However, Bøhren and Ødegaard (2000, p. 12) finds better investor protection in Norway than what is found in many common law countries. Foley, Hartzell, Titman, and Twite (2007, pp. 582-583) suggest that multinationals keep their cash overseas to avoid repatriation tax. While Pinkowitz, Stulz, and Williamson (2013, pp. 26-27) argue that this only applies for research and development intensive multinationals.

In the second chapter of this thesis a literature review introduces the four main motives for cash holding. The first motive is the transaction motive introduced by Keynes (1936, p. 153), which argue that firms hold on to cash to avoid transaction costs. Transaction costs occur when converting a nonfinancial asset into cash and uses the cash for payments. The second motive is the precautionary motive, also introduced by Keynes (1936, p. 153), where firms keep money as a buffer against, for example, industry shocks, competition, and acquisitions. The third motive is the tax motive, which springs from the tax incentives that multinationals face by

repatriating foreign income (Foley et al. (2007, pp. 582-583). The fourth motive is the agency motive argued by Jensen and Meckling (1976) where managers keep cash to pursue their own objectives instead of maximizing shareholder value. Agency problems may become more severe in firms with large cash holding.

The aim of this thesis is twofold. First, we investigate whether we find the same rising trend of cash holding in Norway. We create a dataset of publicly traded firms in Norway from 1996 to 2016. The results show that Norwegian firms increase their cash holding from 1996 to 2006, whereas the ratio falls by 7% after the financial crisis. We also document a rise in the leverage ratio when cash ratio falls. Second, we examine the relationship between cash holding and known firm characteristics to understand the causes of cash holdings and if certain firms hold more cash. Our results show that firms with strong growth opportunities, small firms, and financially constrained ones hold more cash than others. Firms with good access to the capital market, such as large firms hold less cash. When examining industries, we find that the IT sector and the Healthcare sector have the highest cash to asset ratios, which is consistent with the U.S. findings. We also find that cash increases with research and development expenditures and decreases with acquisitions. However, in both cases our data faces limitations because of few observations. As far as we know, no previous research has investigated this topic in Norway. This thesis is our contribution to this field.

We structure the rest of our thesis as follows: Chapter 3 discusses the sample and describes the data. Chapter 4 first presents the time-series of cash holding and net debt. Secondly it examines if the trend is driven by certain types of firms and industries. In Chapter 5 we perform our main regression analysis on multiple firm characteristics to see how they affect the cash ratio. Chapter 6 discusses the future prospects of cash holding and Chapter 7 concludes the thesis.

2 Literature Review

The literature on corporate cash holding have identified four motives for firms to hold cash. These are discussed in the following section, along with some country-specific differences between Norway and the U.S.

2.1 The Transaction Motive

The first motive for holding cash is the transaction motive introduced by Keynes in 1936. He describes that the motive for holding cash arises from the cost of converting nonfinancial assets into cash. Firms keep cash in order to finance transactions since the receiving of money and the spending of money is not perfectly synchronized (Tobin, 1956, pp. 241-242). In a world of a perfect capital market the motive would not exist since there are no transaction costs. However, in reality, the transfer of funds between the time of receiving and the time of expenditure comes with transaction costs (Tobin, 1956). According to Opler, Pinkowitz, Stulz, and Williamson (1999), if a firm is short of liquid assets it faces the following options; raise funds in the capital markets, liquidate existing assets, reduce dividends and investments or renegotiation of existing financial contracts. All of the options incur a transaction cost, and according to this motive firms with high transaction costs are more likely to hold more cash. According to the Pecking-order hypothesis firms would rather utilize their cash holding before increasing their debt, thus it is expected that cash decreases when debt increases (Stewart C. Myers, 1984, p. 576). Opler et al. (1999) also describe that the optimal amount of cash is where the marginal cost of liquid assets equals the marginal cost of liquid asset shortage.

The first formal transaction-based model of the demand for money was developed by Baumol (1952, pp. 545-556) and Tobin (1956, pp. 241-242). In the model a decision maker invests his money in an interest-bearing asset and a non-interest-bearing cash balance. The model measures the trade-off between the opportunity cost of holding cash and the transaction cost of investing in the asset. As the transaction costs of incurring funds from the interest-bearing asset to the cash balance increases, the demand for money increases. One of the significant limitations of their model is that it assumes that the demand for cash is consistent over time and can be predicted with certainty. Miller and Orr (1966) further adapts this model by including the variability of cash flows. It depicts the same relationship as Baumol and Tobin, while also finding that the demand for money is an increasing function of the variability of the cash flows.

Mulligan (1997) finds that there are economies of scale in the demand for cash. Large firms are less likely to hold large amounts of cash while small firm are expected to hold more. Bates et al. (2009, p. 1988) find the same evidence for economies of scale. They further argue that the increase in cash partly can be explain by the decrease in net working capital which contains assets that are substitutes for cash. These assets can be converted into cash relatively quickly at lower costs. Their findings also reveal that dividend paying firms hold less cash than non-dividend paying firms, since the former can reduce their dividend in order to raise cash. Finally, Bates et al. (2009, p. 1989) suggests that firms have become more efficient in handling transactions, and therefore reducing the transactions-based requirements and demands for cash holding.

2.2 The Precautionary Motive

The second motive for holding cash is the precautionary motive which states that firms accumulate cash as a buffer to be prepared for unknown shocks in their finances (Keynes, 1936, p. 153). Keynes also introduces another reason for holding cash under the precautionary motive, called the speculative motive. By having large cash holdings firms can undertake valuable investment opportunities as they arise. There are also opportunity costs to holding cash, firms have to decide between the profitability of current or future investments. Keynes along with Almeida, Campello, and Weisbach (2004) points out that the importance of cash is influenced by the firms access to external funds. Firms with easy access to the capital market, such as large firms, are financially unconstrained and is expected to hold lower cash balances. Whereas firms that do not have easy access to the capital market, financially constrained firms, are expected to hold larger cash balances.

Opler et al. (1999, p. 44) and later Bates et al. (2009) finds that firms with riskier cash flows and poor access to external capital hold more cash. They also find that cash increases with market to book ratio and research and development expenditures which are proxies for investment opportunities. Bates et al. (2009) further finds that firms with higher growth opportunities hold more cash since it is costlier for them to be financially constrained because they can miss out on positive NPV projects.

A number of studies finds evidence that cash holding is related to whether a firm is financially constrained or not. For example, Almeida et al. (2004) researched the relationship between financial constraint and corporate liquidity demand for manufacturing firms over a 30-year period. In their research, they measured financial constraint by payout policy, asset size, bond ratings, commercial paper ratings and an index that combines different measures. They found that financially constrained firms had a positive correlation between the cash holding and the cash flows, this was not found for financially unconstrained firms. Han and Qiu (2007) expanded the model to include the uncertainty of future cash flows. They found that firms that were financially constrained responded with increasing their cash balances when there was an increase in cash flow volatility. On the other hand, financially unconstrained firms did not show this kind of sensitivity in their cash balances when there was an increase in cash flow volatility. The model of Acharya, Almeida, and Campello (2007, p. 517) show that "a financially constrained firm will prefer saving cash (as opposed to reducing debt) if investment opportunities tend to arrive in low cash flow states". For these firms, cash can serve as a hedge since it will be difficult to obtain external financing. On the other hand, Bates et al. (2009) argue that if debt is constraining enough, firms will use cash to reduce debt. Both Bates et al. (2009) and Opler et al. (1999) finds strong evidence for a negative correlation between leverage and cash holdings.

Another interesting finding related to the precautionary motive was uncovered by Pinkowitz and Williamson (2002, p. 15), they researched the market value of cash held by U.S. firms. They found that the estimated value of a marginal dollar was relatively higher than its book value. The market value of $1 was estimated to be around $1.20, which indicates that the market values cash at a premium. They describe that growth opportunities and investment uncertainty are factors that increases the market value of cash. On the other hand, financial distress is a factor that reduces the market value of cash. Bates, Chang, and Chi (2018) further supports this statement in their article where they research the increase in the value of cash over time. They find that the market value of cash has increased in the past three decades, where $1 was valued at $0.61 in the 1980's, at $1.04 in the 1990's and $1.12 in the 2000's (Bates et al., 2018, pp. 755-756).

2.3 The Tax Motive

The tax motive emphasizes on that companies hold cash because of the tax cost associated with repatriating foreign income. Foley et al. (2007, p. 604) finds evidence that the U.S. multinationals that would trigger high tax cost have higher cash holdings. By leaving cash reserves overseas they avoid the tax costs associated with bringing foreign income back to the U.S. The researchers also find that within the same firm, affiliates who faces repatriation cost hold more cash than affiliates that do not. However, Pinkowitz et al. (2013) suggests that the tax motive only applies to multinationals that are R&D intensive. Their findings also provide evidence that the tax motive cannot be the whole story of the increase in cash in the U.S. The Homeland Investment Act of 2004, was designed to reduce the cost of repatriating foreign income but failed to do so.

Furthermore, Desai, Foley, and Hines (2006, pp. 522-523) argue that multinational firms in the Information Technology sector have more flexibility to retain earnings abroad or shift profit to low tax jurisdictions. These firms are often characterized by high profit-margin and intangible assets such as intellectual property that is easy to transfer. Today, Apple Inc. has the largest overseas cash balance of all the U.S. companies, with approximately $252 billions (Webb & Gurman, 2018). In 1999, 59% of U.S. firms with significant foreign operations had branches in so-called “tax haven” countries (Desai et al., 2006, p. 514).

2.4 The Agency Motive

The agency explanation for cash holdings stems out of the conflict of interest between the firms stakeholders. Adam Smith (1776) warned about the separation of ownership and control since managers lack the same incentives as an owner to operate the firm in the most efficient way. If left un-monitored, managers will pursue their own interests, and not maximize shareholder value (Jensen & Meckling, 1976, p. 308). Jensen (1986, p. 323) further suggest that large cash holdings allows managers to avoid using external financing, and thus allowing them to pursue their own objective by investing in pet projects and unprofitable investments, without being monitored. Liquid assets can be turned into private benefits at lower cost than other assets (S. C. Myers & Rajan, 1998, p. 733). Shleifer and Vishny (1989, p. 123) identifies entrenchment strategies where managers make themselves irreplaceable or costly to replace. Shleifer and

Vishny (1997, p. 737) define corporate governance as "the ways in which the suppliers of finance to corporations assure themselves of getting a return on their investment". Corporate governance mechanisms help mitigate agency problems by aligning the interests of managers and shareholders. Concentrated ownership gives the manager incentive to work and large shareholders incentives to monitor. Nonetheless some dispersion of ownership is important to diversify risk since large shareholders represents their own interest which may not reflect the interests of other stakeholders.

Dittmar et al. (2003, p. 111) find cross-country evidence for the agency motive of cash. Corporations with weaker investor protection hold twice as much cash as corporations in countries with strong investor protection. Furthermore, Pinkowitz, Stulz, and Williamson (2006) and Dittmar and Mahrt-Smith (2007, p. 599) show that the value of cash is lower if the firm has poor corporate governance. Dittmar and Mahrt-Smith (2007, p. 601) also shows that these firms are more likely to accumulate cash and dissipate cash through unprofitable investments and acquisitions. Firms with good corporate governance has cash holdings better "fenced in".

2.5 Country-Specific Differences between Norway and the U.S.

Throughout this thesis, the results obtained for Norway will be compared to the findings from the U.S. Differences between the countries legal system, corporate governance and taxes may cause cash holding to evolve differently. This will be discussed in this section along with some similarities.

Norway is under civil law, while the U.S. is common law. La Porta et al. (1998, p. 1116) suggests that common law countries generally have the best investor protection, however Bøhren and Ødegaard (2000, p. 47) find better investor protection in Norway than what is found in many common law countries. Pinkowitz et al. (2006, pp. 2732-2736) measures shareholder rights by the "antidirector right index" developed by La Porta et al. (1998, p. 1123). The index takes a value from zero to six, where six represents the best shareholder protection. Norway receives a score of 4, while the U.S. gets a score of 5. Pinkowitz et al. (2006) further measure the quality of the institutions that supports the right of the investor with an index of law and order and an index for corruption, also developed by La Porta et al. (1998). Both indexes take values from 1 to 10, with 10 representing the highest investor protection. Both Norway and the U.S. score 10 on law and order, and on corruption Norway receives a score of 9.58 and the U.S. a score of 8.26. This suggests that shareholder rights are well protected and that the agency motive is less of an issue in Norway. Based on this and findings of Bøhren and Ødegaard, the agency motive will not be investigated any further. Bates et al. (2009) find no evidence for the agency motive in the U.S.

Other main features of the corporate governance system in Norway that is different from that of the U.S. is summarized as follows. The Norwegian Stock market have traditionally been dominated by a few large companies (in terms of market capital) and a substantial state ownership, where the Norwegian state is the single largest owner on the Oslo Stock Exchange. Internationals as a group is the largest owner and accounts for 30%. Non-financial domestic institutions hold about 25%, financial institutions and the Norwegian state hold roughly 18% each, and private persons hold 10% (Bøhren & Ødegaard, 2000, p. 19). In contrast, financial institutions in the U.S. hold 46%, private persons 49%, and international owners 5% (Nestor & Thompson, 2000, p. 21). Lee (2005, p. 40) describes the U.S. ownership structure as characterized by atomistic investors, meaning that the structure is composed by many small owners. Concentrated ownership is low in Norway by European standard (Bøhren & Ødegaard,

2000, pp. 42-43). The fractions of the three largest owners in Norway is respectively 29 %, 11%, and 7 %. Compared to the U.S. where its 13 %, 6 % and 3 % (Barca & Becht, 2001). The median owner in Norway lack both incentives and power to influence corporate governance (Bøhren & Ødegaard, 2000, p. 42). In 2016 the value of the companies listed on the OSE was 62% of GDP, compared to the U.S. with 146% (The World Bank, 2016).

In both the U.S. and Norway, foreign income is subject to a credit system.[1] Under a credit system, taxes in the foreign country of the subsidiary are credited against taxes in the home country of the parent company. The credit system permits deferral and only when income is repatriated is the company subject to the tax in the home country (De Mooij & Ederveen, 2003). The tax system in the United States gives U.S. multinationals incentives to keep cash abroad, due to double taxation (Foley et al., 2007, pp. 582-583). Norway practices the credit system, but the taxpayer receives a tax relief based on taxes paid in the host country, hence these tax incentives does not apply for Norwegian firms and the tax motive will not be investigated any further (KPMG Law Advokatfirma, 2016, p. 13). In December 2017, President Donald Trump signed a new tax reform which end the double taxation and deferral of taxes. This could reduce the importance of the tax motive in the U.S. in the future. This will be further discussed in section 5.2.

[1] Norway have practiced the credit system since 1992. Prior, tax treaties were based on the exemption method (KPMG Law Advokatfirma, 2016, p. 13).

3 Sample Selection and Data Description

This thesis draws heavily on the methodology that was originally developed by Bates, Kahle and Stulz (2009). They analyze a sample period from 1980 to 2006 and gathered their data from the Compustat North America Database. Our sample consists of all listed and delisted firms on the Oslo Stock Exchange (OSE) in the period of 1996 to 2016. We also include firms on Oslo Axess, a smaller stock exchange created in 2007 (Eikrem, 2007). Hereafter, when referring to OSE both exchanges are included. All data is annual observations collected from DataStream in Norwegian kroner, with the exception of stock prices that are gathered from Oslo Børsinformasjon (OBI). The sample period starts in 1996 since DataStream had little available data prior this. The benefit of this sample period is that we can observe the effect of the financial crisis of 2007-2008 and the fall in oil price in 2014. We have included the firms' financial statement information from before being listed where this was available in DataStream. These observations are excluded in our regression analysis in section 5 due to data requirements for the stock price.

All firms on the OSE are grouped into sectors according to the Global Industry Classification Standard developed by MSCI and Standard & Poor's in 1999. In our sample, firms in the Financial sector (GICS-40) and the Real Estate sector (GICS-60) are excluded because they may carry cash to meet capital requirements.[2] Utilities (GICS-55) are also excluded since their cash holding can be subject to regulatory supervision. Telecommunication Services (GICS-50) and Information Technology (GICS-45) are merged together due to too few firms in the Telecommunication Sector. Firms are required to have at least three years of observations and positive values for the book value of total assets and sales revenue. After removing the aforementioned, the sample ends up as a panel dataset containing 7 industries, 373 firms and 3728 observations. Figure 1 presents the median firm size by industry over the entire period. The figure reflects the composition of the Norwegian Stock market, were a few large companies are much bigger than the others. For instance, the average firm size of Statoil, the Energy sector and Norway's biggest company, is approximately 460 million NOK. The mean size of firms in the same sector in our sample is measured to 16 million. The largest firm in the Consumer Staples industry, Orkla, is measured at 60 million NOK in assets, while the mean firm in the same sector holds 9 million. Table 1 shows the number of unique firms in each industry per

[2] The Real Estate Sector is the newest industry sector, splitting real estate firms from the financial sector. Added to the GICS on the 31st of August 2016.

year. The table shows that the Healthcare sector (GICS-35) has very few firms early in the period. Due to the low number of firms, we acknowledge that there might be some outliers that overrepresent the industry.

Figure 1: Industries by Firm Size

The graph displays the median of total assets per industry for the whole sample period, denoted in millions. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

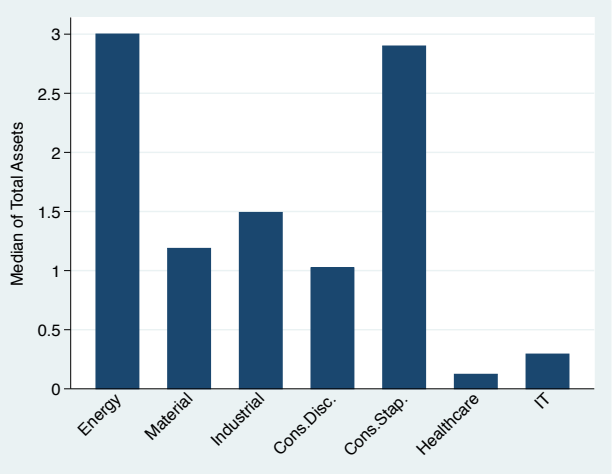


Table 1: Distribution of Firms Across Industries per Year

The table shows the distribution of firms in the sample listed by industries per year. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 373 firms.

		Industry Sector (GICS)						
Year	Total	10	15	20	25	30	35	45
1996	147	25	15	51	21	5	2	28
1997	161	28	15	57	23	5	2	31
1998	172	30	15	57	24	5	4	37
1999	169	29	12	50	20	8	3	47
2000	160	30	9	44	19	9	3	46
2001	159	34	10	38	19	8	4	46
2002	162	36	10	38	18	11	4	45
2003	160	40	10	33	14	11	6	46
2004	183	53	8	38	13	15	7	49
2005	198	62	10	37	13	18	10	48
2006	206	68	12	43	9	18	10	46
2007	214	73	11	44	10	20	11	45
2008	200	69	11	43	8	20	11	38
2009	195	70	11	42	7	19	14	32
2010	195	74	11	39	8	18	14	31
2011	190	72	11	38	9	18	14	28
2012	190	72	10	40	9	19	12	28
2013	180	65	10	39	9	15	13	29
2014	171	64	10	34	8	13	12	30
2015	161	61	10	32	7	12	12	27
2016	155	58	10	31	7	11	11	27

The cash ratio can be defined in several ways. Bates et al. (2009, p. 1991) measure the ratio by dividing cash and marketable securities by the book value of total assets. Opler et al. (1999, p. 15) divides cash and marketable securities by net assets, which is total assets minus cash and marketable securities. Foley et al. (2007, p. 585) further suggests using the logarithm of the ratio of cash and marketable securities to net assets. According to them this reduces the problem of outliers. We base our analysis on the cash ratio of Bates et al. (2009), while in the regressions of Table 12, we use both this ratio and the log of cash to net assets ratio as the dependent variables.

The motives for corporate cash holding were described in detail in section 2. The explanatory variables included in the regression analysis in section 5 are mainly based on the transaction and precautionary motive. These will be discussed briefly in the following section. **Firm size** is measured as the log of book value of total assets and is influenced by both the transaction motive and the precautionary motive. Bates et al. (2009, p. 1988) and Mulligan (1997) presents economies of scale in the demand for money. Larger firms tend to have good access to the capital market, therefore we expect to see a negative correlation between firm size and cash holding. **Net Working Capital** (NWC) can be a substitute for liquid assets, this lowers the transaction cost and it is expected to decrease the cash holding. The NWC ratio is measured as current assets minus current liabilities. The ratio is calculated by subtracting cash and marketable securities from the NWC and dividing by the book value of total assets. **Market to book** (MTB) measures a firms future investment opportunities. In order to not forgo profitable investment opportunities firms keep cash as a buffer. A high MTB ratio would suggest a high cash ratio. The ratio is calculated as the market value divided by the book value of total assets. The market value is measured as book value of assets minus book value of equity plus the market value of equity, while the market value of equity is measured as the share price times common shares outstanding. **Research and development** (R&D) also measure a firms growth opportunities. The R&D ratio is measured as the R&D expenditures divided by sales. Norwegian firms were not obliged to report R&D expenses up until 2005 when the IFRS (International Financial Reporting Standard) was implemented (Lovdata, 2002; Regnskapsloven, 1998, § 3-9), but some firms still reported it. Due to the small amount of observations for this variable, R&D is excluded from the main regression and included in a separate regression that can be found in the Appendix Table A2. Firms that pay **dividends** are expected to have good access to the capital markets. The precautionary motive should be less important for these firms as they would need to hold less cash. We create a dividend dummy

equal to 1 if the firm pays a common dividend that year and 0 if not. **Capital expenditures** have an ambiguous relationship with cash holding so the relation could be both positive and negative. If capital expenditure increases the amount of assets that can be used as collateral, the demand for cash is reduced. On the other hand, high capital expenditure can lead to financial distress costs, which would increase the demand for cash. The capital expenditure ratio is created by dividing capital expenditure by total assets. The **acquisition** expenditures share the same ambiguous relationship with cash holding as capital expenditure. This suggests that they will share the same sign on their coefficients. Like R&D, we have few observations for acquisitions and it will be in a separate regression model in the Appendix Table A2. The **leverage** ratio is measured as long-term debt plus short-term debt and the current portion of long term debt divided by the book value of total assets. The leverage ratio could also have a positive and negative impact. Acharya et al. (2007) suggests that highly levered firms will have difficulties obtaining external financing, which is why they keep cash to hedge against financial distress. On the other hand, Bates et al. (2009) argue that firms use cash to reduce debt if distressed enough. We also include an **industry dummy** for each industry.

Table 2 below provides statistics by industry and Table 3 on the next page provides the definitions and summary statistics of all variables used in this thesis.

Table 2: Variable Statistics by Industry

The table displays statistics by industry, the mean and median values for the firm characteristics variables. Firm size is reported in millions NOK. "Med." is short for Median. N is number of observations. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

		Cash Ratio		Leverage		MTB		Firm Size		R&D		Capex		NWC	
GICS	N	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.
10	1113	0.15	0.10	0.38	0.40	1.25	1.03	16.29	3.00	0.061	0	0.135	0.079	-0.077	-0.039
15	231	0.15	0.08	0.28	0.26	1.29	1.05	21.77	1.18	0.002	0.001	0.056	0.043	0.057	0.068
20	868	0.13	0.09	0.35	0.34	1.34	1.06	4.18	1.49	0.013	0	0.093	0.057	-0.033	-0.037
25	275	0.13	0.10	0.29	0.26	1.68	1.34	2.78	1.02	0.022	0	0.080	0.052	-0.042	-0.070
30	278	0.08	0.04	0.37	0.34	1.38	1.19	9.08	2.89	0.021	0	0.053	0.042	0.090	0.125
35	179	0.50	0.51	0.13	0	3.92	3.04	0.40	0.12	48.47	0.118	0.031	0.008	-0.034	0
45	784	0.29	0.24	0.13	0.05	2.97	1.84	4.42	0.30	6.403	0.017	0.052	0.028	-0.054	-0.026

Table 3: Variable Definitions and Summary Statistics

This table reports the definitions of all the variables that are used in the analysis. For each variable we summarize the number of observations (N), mean, standard deviations (SD), minimum value and maximum value. Variables for Firm Size are denoted in millions of NOK.

Variable	Definition		N	Mean	SD	Minimum	Maximum
Acquisitions	The ratio of acquisitions to the book value of assets.		2600	0.0119	0.0563	-0.7668	0.7868
Capex	The ratio of the capital expenditure to the book value of assets.		3728	0.0878	0.1265	0	1.7224
Cash Ratio	The ratio of cash and short-term investments (also called marketable securities) to total assets.		3728	0.1858	0.2022	0	1
Dividend Dummy	A dummy variable equal to one if the firm paid common dividend that year, and zero if not.		3728	0.3259	0.4687	0	1
Firm Size	Book value of total assets in millions.		3728	9.0212	45	0.000650	974
Leverage	Calculated as total debt divided by book value of total assets. We measure total debt as (long-term debt + short-term debt and current portion of long term debt).		3728	0.2964	0.2598	0	2.9767
Market to Book	Calculated as: (book value of assets – book value of equity + (share price* common shares outstanding)) / book value of total assets.		2858	1.7841	2.5478	0.0804	82.8149
Net Leverage	Calculated as: (total debt - cash and marketable securities) / the book value of total assets.		3728	0.1105	0.3907	-1	2.7597
NWC	Net working capital, calculated as (current Assets – current liabilities – cash and marketable securities) / book value of total assets.		3728	-0.0366	0.2445	-4.3970	1.0333
R&D	Research and development divided by revenue.		1731	5.2064	96.55	0	3307
2006 Dummy	A dummy variable equal to one if the year is 2006 or below, and zero if the year is 2007 or higher.	Before & incl. 2006:	1877	0.5034	0.5000	0	1
		After 2006:	1851				

4 Analysis of Cash Holding Over Time

We start our analysis by illustrating how cash holding and debt have changed over time. Following that, we assess whether cash is related to specific firm characteristics such as firm size, dividend policy and accounting performance. Lastly, we examine if certain industries hold more cash. We compare our results for publicly traded firms in Norway to those obtained by Bates et al. (2009) for the U.S as we proceed.

4.1 The Evolution of Cash Holding and Net Debt Over Time

Column 2 in Table 4 reports the number of firms included per year and the third column the aggregated cash ratio. This ratio is measured as the sum of cash divided by the sum of book value of assets. The fourth and fifth columns report the average and median cash ratios which is measured as cash and marketable securities divided by the book value of assets.

Table 4: Average and Median Cash and Leverage Ratios

The following table displays average and median cash and leverage ratios. Aggregated cash ratio is the sum of cash divided by the sum of total assets. Cash Ratio is measured as cash and marketable securities divided by total assets and the leverage ratio is calculated as leverage to total assets. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Year	N	Aggregated Cash Ratio	Average Cash Ratio	Median Cash Ratio	Average Leverage	Median Leverage	Average Net Leverage	Median Net Leverage
1996	147	0.051	0.203	0.115	0.280	0.259	0.076	0.137
1997	161	0.046	0.204	0.124	0.259	0.248	0.055	0.131
1998	172	0.044	0.172	0.109	0.281	0.264	0.109	0.158
1999	169	0.045	0.178	0.099	0.305	0.301	0.126	0.188
2000	160	0.065	0.194	0.112	0.295	0.246	0.101	0.151
2001	159	0.070	0.175	0.103	0.294	0.266	0.118	0.181
2002	162	0.052	0.174	0.103	0.310	0.272	0.136	0.171
2003	160	0.066	0.209	0.131	0.277	0.240	0.068	0.095
2004	183	0.062	0.218	0.138	0.274	0.224	0.056	0.067
2005	198	0.063	0.228	0.160	0.239	0.175	0.011	0.015
2006	206	0.063	0.234	0.143	0.269	0.269	0.034	0.103
2007	214	0.052	0.202	0.117	0.300	0.313	0.098	0.175
2008	200	0.052	0.167	0.096	0.339	0.323	0.172	0.260
2009	195	0.055	0.174	0.098	0.329	0.329	0.155	0.219
2010	195	0.059	0.160	0.104	0.320	0.288	0.160	0.186
2011	190	0.052	0.157	0.090	0.318	0.300	0.161	0.211
2012	190	0.050	0.169	0.093	0.316	0.282	0.147	0.207
2013	180	0.078	0.170	0.094	0.302	0.265	0.132	0.183
2014	171	0.069	0.167	0.098	0.298	0.254	0.131	0.126
2015	161	0.066	0.163	0.095	0.299	0.247	0.136	0.127
2016	155	0.065	0.170	0.101	0.304	0.247	0.133	0.130

Figure 2A document the three cash ratios over time. The average and median cash ratios share a similar trend while the aggregated cash ratio is relatively stable. The average cash ratio in Norway was 20.3% in 1996 and increases gradually, reaching a peak of 23.4% in 2006. Similarly, the cash ratios for U.S. firms are 19.3% in 1996 and increases to 23.2% in 2006 (Bates et al., 2009, p. 1991). After 2006 the cash ratio for the U.S. remains stable at 21% until 2010 which was the end of the period for the study conducted by Pinkowitz et al. (2013, p. 30). The cash ratio for Norwegian firms on the other hand, displays a sharp decline after 2006. The cash ratio falls to 16.7% in 2008, indicating that the effect of the financial crisis is causing cash levels to fall. The levels remain stable, and in 2016, the cash ratio is 17%. To determine if the trend is statistically significant, the cash ratio is regressed on a time- and a constant variable. The results presented in Table 5 indicates that the cash ratio on average decreases with -0.18 % per year, while median cash ratio decreases with -0.13%. Both have *p*-values below 0.01 and are therefore statistically significant.

Figure 2 A & B: Cash, Median and Aggregated Cash Ratio & Leverage Ratio

Figure 2A: Cash Ratio Variables

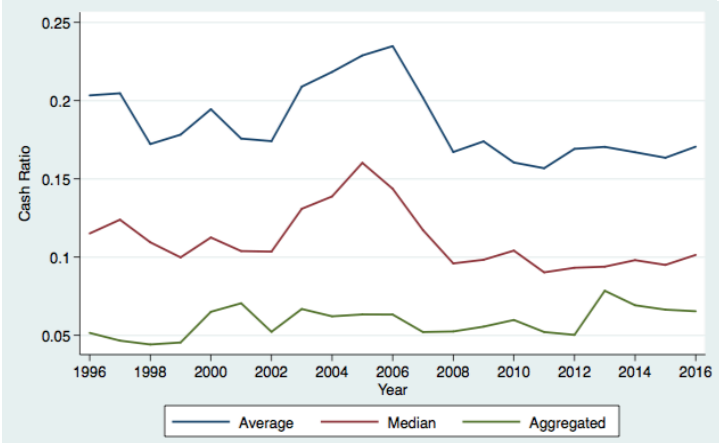


Figure 2B: Leverage vs Cash Ratio

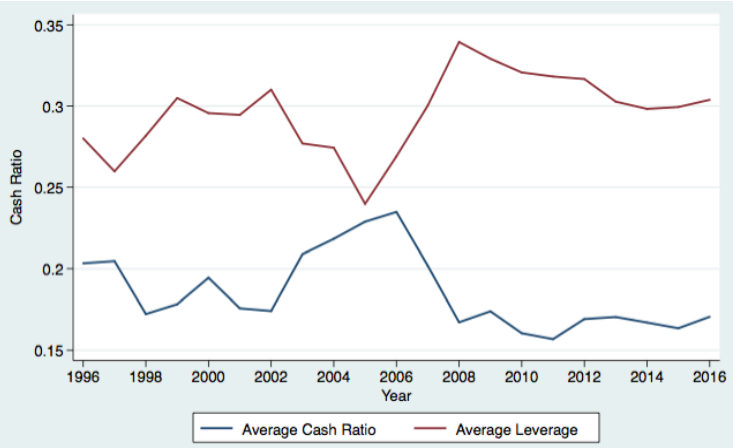


Figure 2A displays the average-, median- and aggregated cash ratios over time. Figure 2B displays cash ratio and leverage ratio over time. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Moving on, columns 6 and 7 in Table 4 shows how average and median leverage ratios changes over time. Leverage is calculated as long-term debt plus debt in current liabilities divided by the book value of assets. Figure 2B illustrates the time series of the cash- and leverage ratios and presents a negative correlation between cash and debt. Consistent with the pecking order theory, debt rises when cash falls (Stewart C. Myers, 1984, p. 576). The leverage ratio decreases from 28% in 1996 to 23.9% in 2005. It increases to 33.9% in 2008 during the financial crisis

before it falls to 30.2% in 2013 where it remains stable. The leverage ratio for Norwegian firms are higher than what Bates et al. (2009, p. 1991) finds for U.S. firms. In 1996, the leverage ratio is 19.3% and increases to 23.2% in 2006. The last two columns in Table 4 measures the average net leverage where we subtract cash and marketable securities from debt before dividing by the book value of total assets. The ratio fluctuates over the whole sample period, from 7.6% in 1996 to the lowest value of 1.1 % in 2005. Notably, three years after, net leverage increases to 17.2% and stabilizes towards the end of the period to 13.3%. Bates et al. (2009, p. 1991) find a decreasing trend for U.S. firms from 16.4% in 1980 to -1% in 2006. We repeat the regression on a time- and constant variable and the results for Models 3 and 4 in Table 5 indicate that average net leverage increases yearly by 0.36% and 0.13 % for the median. Only the average net leverage is statistically significant. While not reported, we find a significant increase in the cash ratio when we divide our period into subperiods. The cash ratio increases by 0.43% each year for cash ratios before 2006. An article in *Dagens Næringsliv* by Ehling (2010) commented that cash holding in Norwegian companies had increased for ten years before the financial crisis, this is consistent with the trend we find until 2006 in Figure 2A. They further describe that it is almost exclusively financially constrained firms that is behind this growth, and for these firms "cash is hedge". Cash ratio falls after the financial crisis, so it seems the buffer they keep to protect from shocks are being used. The aggregated cash ratio follows a stable trend but increases from 2012 to 2014. *Hegnar* reported that heavyweights such as Statoil, Marine Harvest and Seadrill drove the aggregated cash ratio up as they doubled their cash holding in this period. The cash holding per stock for companies at the OSE had never been higher (Berg Johansen, 2014).

Table 5: Regressions Estimating a Time Trend in Cash and Net Leverage Ratios

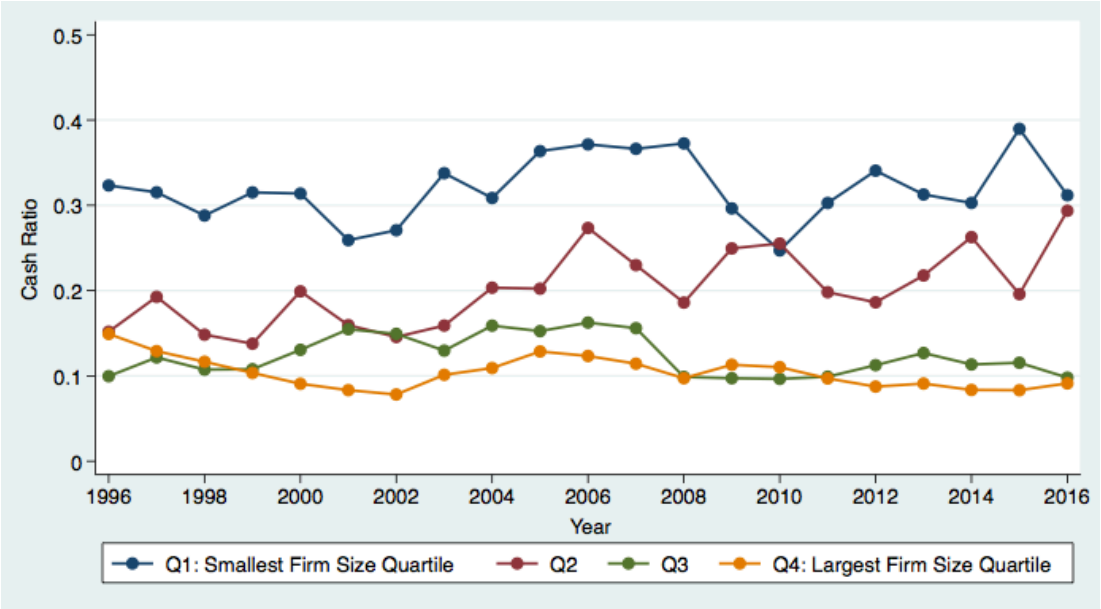
The table shows the results from regressions of the cash- and net leverage ratio on a time- and constant variable measured in years. Above each column the dependent variable is given. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The t-statistics are reported in parenthesis. *P*-values are reported as: * p <0.10, ** p<0.01, *** p<0.001. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Model	(1)	(2)	(3)	(4)
Dependent Variable	Average Cash Ratio	Median Cash Ratio	Average Net Leverage	Median Net leverage
Time	-0.00179**	-0.00133***	0.00364***	0.00135
	(-3.16)	(-3.66)	(3.33)	(1.24)
Constant	3.778***	2.785***	-7.189**	-2.559
	(3.33)	(3.81)	(-3.28)	(-1.17)
Adj. R^2	0.20%	0.18%	0.30%	0.03%
N	3728	3728	3728	3728

4.2 Cash holding by Firm Size Quartiles

In this subsection we explore if cash holding can be explained by firm size. The firms in the sample are divided into quartiles based on the book value of assets. Quartile 1 represents the smallest firms and quartile 4 the largest firms. The median value of firms in the smallest quartile is approximately 117 000 NOK in assets. For the second quartile 630 000 NOK, and the third 2.2 million NOK. The median for the largest quartile is 12 million NOK in assets. Figure 3 illustrates the average cash ratio over time for all four quartiles.

Figure 3: Average Cash Ratios by Firm Size Quartile



The figure displays average cash ratio by firm size quartiles. Firms are divided into size quartiles based on the book value of assets. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

The cash to assets ratio were on average 31% for the smallest quartile, 19% for the second smallest quartile, 12% for the third quartile and the largest size quartile had a mean of 10%. The smaller firms' cash ratio is the highest throughout the period, and peaking in 2015 at 38%, compared to the largest firms with 8% in the same year. The largest total increase is found in the second smallest quartile where cash ratio rose from initially 15% to 29% in 2016. From Figure 3 one can observe three sudden declines in cash ratio for the two smallest quartiles which may be associated with different market shocks in the period. The burst of the Dotcom bubble in 2000, the financial crisis in 2008 and the steep fall in oil price in 2014. In contrast to the largest quartiles which are more stable throughout. The cash ratio for the third quartile increased

slightly from 1996 to 2007, however average cash ratio in 2016 is almost the same as it was 20 years earlier. The largest firms' cash ratio declined by -5% during the whole period. In addition to variation among the quartiles, there is also substantial variation within each quartile. The standard deviation for small firms is 26%, in contrast to 7% for the largest firms. Bates et al. (2009, pp. 1992-1993) and Gao, Harford, and Li (2013) also find that the increase in cash ratio is driven by small firms for the U.S. In section 2.1 the transaction motive implies that economies of scale decreases cash holding. Table 7A presents the regression results on a time- and constant variable for each asset quartile. The smallest two quartiles have positive slope coefficients indicating an increase in cash ratio, while the largest firm quartile have a negative slope coefficient. However, the coefficient for quartile 1 and 3 is not statistically significant. Table 6 presents the average leverage by asset quartiles for the whole period and by subperiods.

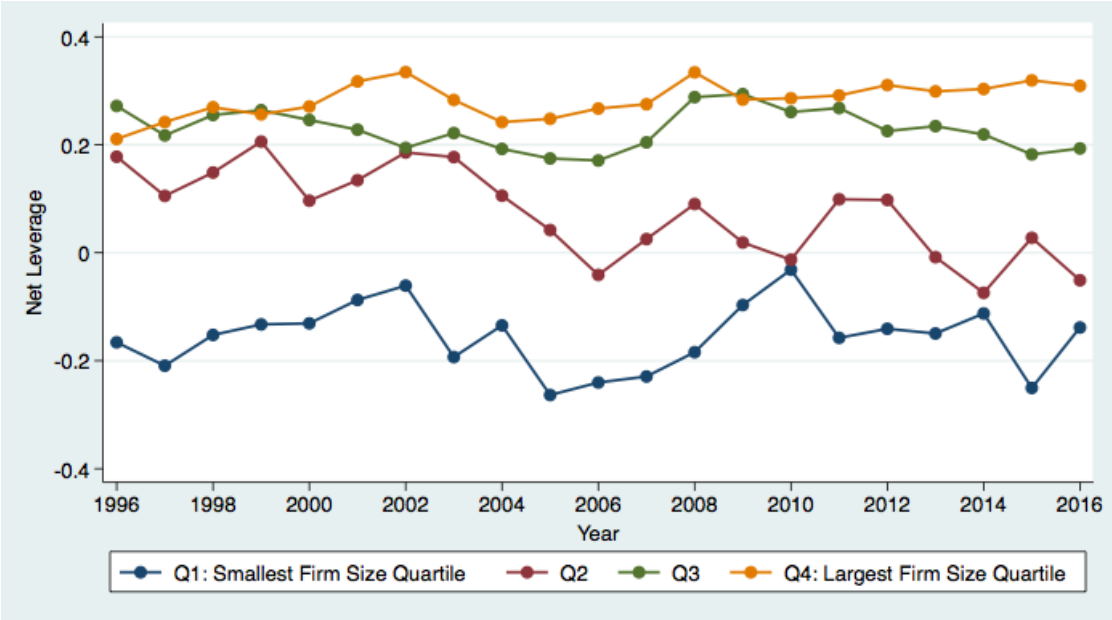
Table 6: Average Leverage by Firm Size Quartile – Sub periods

The table shows the average leverage ratio by firm size quartile for the entire period and four subperiods; 1996-01, 2002-06, 2007-11 and 2012-2016. Firms are divided into size quartiles based on the book value of assets. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Leverage by Size Quartile	1996-2016	1996-2001	2002-2006	2007-2011	2012-2016
Q1	0.16	0.16	0.15	0.17	0.17
Q2	0.28	0.31	0.28	0.27	0.23
Q3	0.35	0.36	0.34	0.37	0.33
Q4	0.39	0.38	0.38	0.40	0.39

The table shows that leverage increases with firm size which is consistent with both the precautionary- and the transaction motive. A noticeable difference across the quartiles is that the largest firms have more than double the debt to asset ratio than the smallest firms. The financing policy for large firms rely more on debt than smaller firms. For the whole period, the smallest firms have on average 16%, the second and third quartile respectively 28 % and 35%, and the largest firm 39%. Net debt decreases for the second and third quartiles which is displayed in Figure 4, while the largest and smallest quartiles increases. The regression results in Table 7B show that the second smallest and the largest quartiles has a statistically significant time trend. Bates et al. (2009, p. 1993) report that the net debt falls sharply for small firms in the U.S., but not for the largest firms.

Figure 4: Average Net Leverage by Firm Size Quartiles



The figure displays average net leverage by firm size quartiles. Firms are divided into size quartiles based on the book value of assets. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Table 7 A & B: Regression Estimating a Time Trend in Cash Ratios and Net Leverage per Size Quartile

The tables show the results from the regression of the cash- and net leverage ratios on a time- and constant variable measured in years for each size quartile. Firms are divided into size quartiles based on the book value of assets. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The dependent variable is the average cash ratio. The t-statistics are reported in parenthesis. *P*-values are reported as: * p <0.10, ** p<0.01, *** p<0.001. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Table 7A

Dependent Variable	Average Cash Ratio			
Size Quartile	1	2	3	4
Time	0.00129	0.00491***	-0.00109	-0.00156***
	(0.85)	(4.21)	(-1.56)	(-3.55)
Constant	-2.276	-9.650***	2.319	3.238***
	(-0.75)	(-4.13)	(1.65)	(3.67)
Adj. R^2	0%	1.8%	0.20%	1.2%
N	932	932	932	932

Table 7B

Dependent Variable	Average Net Leverage Ratio			
Size Quartile	1	2	3	4
Time	0.0000469	-0.00999***	-0.0006	0.00292*
	(0.02)	(-4.42)	(-0.37)	(2.14)
Constant	-0.252	20.12***	1.434	-5.577*
	(-0.05)	(4.44)	(0.44)	(-2.04)
Adj. R^2	-0.1%	2%	-0.1%	0.4%
N	932	932	932	932

4.3 The Role of Dividend Payment and Accounting Performance

We examine how dividend payment and accounting performance impact cash holding in this subsection. Firms that do not pay dividends and those with negative net income are both seen as proxies for financially constrained firms. Before presenting the cash ratio findings, we give an overview of the number of firms for each variable over the period. This is illustrated in Table 8 and Figures 5 A and B.

Table 8: Number of Firms by Dividend Payment and Accounting Performance

The table shows number of firms that paid common dividend, did not pay common dividend, had negative net income, positive net income and total firms each year. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Dividend Paid	63	66	75	56	49	44	44	48	51	61	61
Non Dividend Paid	84	95	97	113	111	115	118	112	132	137	145
Negative Net Income	36	46	55	67	76	78	84	60	62	59	75
Positive Net Income	111	115	117	102	84	81	78	100	121	139	131
Total	147	161	172	169	160	159	162	160	183	198	206

continued	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	All
Dividend Paid	66	68	47	58	60	54	61	67	66	50	206
Non Dividend Paid	148	132	148	137	130	136	119	104	95	105	346
Negative Net Income	82	97	87	98	97	83	66	82	87	75	324
Positive Net Income	132	103	108	97	93	107	114	89	74	80	324
Total	214	200	195	195	190	190	180	171	161	155	373

Figure 5 A & B: Number of Firms by Dividend Payment and Accounting Performance

Figure 5A: Dividend Payment

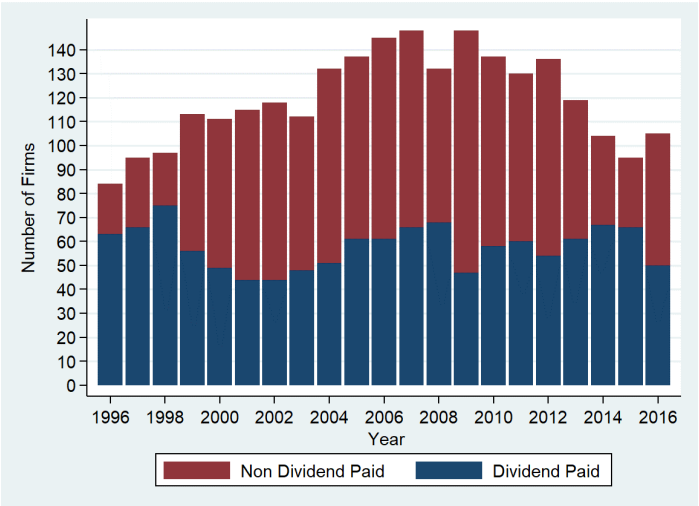


Figure 5B: Accounting Performance

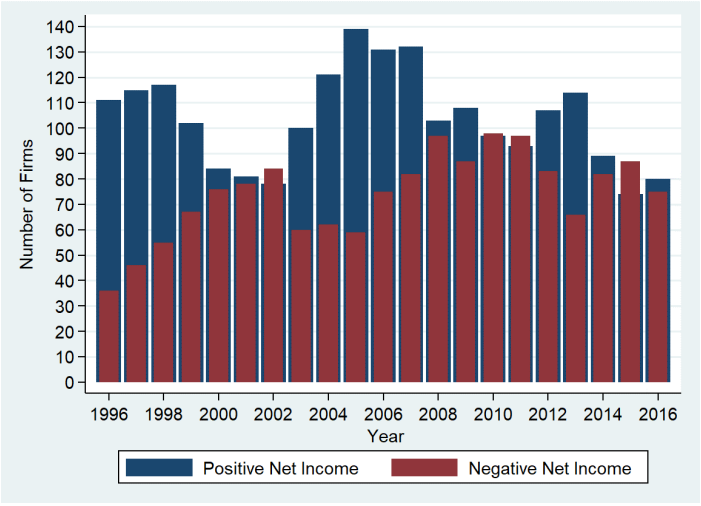


Figure 5A shows number of firms that paid dividend and did not pay dividends each year. Dividend payers are all firm-year observations that paid common dividends. Figure 5B shows number of firms that have positive net income and negative net income. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample.

The two figures and the table above show that there were more firms with positive accounting performance prior the financial crisis. After the financial crisis, the number of firms not paying dividends were very high, and firms with negative net income increased. It is important to note the number of listed firms[3] on the OSE almost decreases by half from 2007 to 2016, which also could cause the change. Table 9 provides an overview of the role of dividends and accounting performance. The trend is also illustrated in Figure 6. Column two shows the cash ratio for firms that paid common dividend that year and the third column show the ratio for those who did not.

Table 9: Average Cash Ratios by Payment of Dividends and Accounting Performance

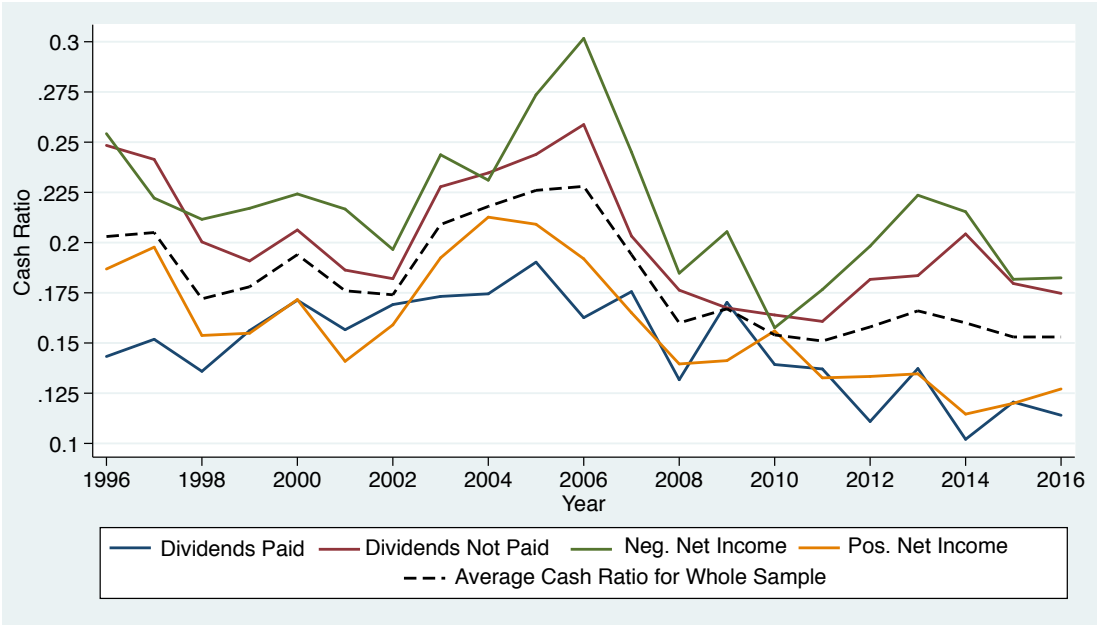
The table includes average cash ratios per year for the four variables. At the bottom is an average for the entire sample period. Dividend payers are all firm-year observations that paid common dividends, non-dividend payers if not. Firm-year observations with accounting losses are identified as the negative net income variable, otherwise positive net income. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Year	Dividend Payer	Non Dividend Payer	Negative Net Income	Positive Net Income
1996	0.143	0.248	0.254	0.187
1997	0.152	0.241	0.222	0.198
1998	0.136	0.200	0.211	0.153
1999	0.156	0.189	0.214	0.155
2000	0.171	0.206	0.219	0.171
2001	0.156	0.183	0.214	0.140
2002	0.169	0.177	0.192	0.155
2003	0.173	0.225	0.239	0.190
2004	0.174	0.235	0.229	0.212
2005	0.190	0.246	0.267	0.212
2006	0.162	0.265	0.315	0.189
2007	0.175	0.213	0.260	0.165
2008	0.132	0.185	0.196	0.139
2009	0.170	0.175	0.214	0.141
2010	0.139	0.169	0.158	0.162
2011	0.137	0.165	0.180	0.132
2012	0.111	0.192	0.208	0.139
2013	0.137	0.187	0.224	0.139
2014	0.102	0.208	0.212	0.125
2015	0.120	0.193	0.188	0.134
2016	0.114	0.197	0.195	0.147
All Years	0.147	0.204	0.216	0.164

[3] Excluding Financial firms, Utilites and Real Estate.

The cash ratio for the firms that pay dividend increases gradually from 14.3% in 1996 to 19% in 2005. Afterwards it decreases to 11.4% in 2016. The regression results in Table 10 show that there is an average decrease in cash ratios for dividend paying firms of -0.19% each year over the time period. The *p*-value is significant at a 1% level. Almeida et al. (2004, pp. 1777-1779) describe that firms that pay dividend are more likely to have good access to the capital market. This would make the precautionary motive of section 2.1. less important for these firms and they would hold less cash. Our findings match this theory, we found that firms that pay dividends are the firms that hold the least cash of the four variables of Table 9. While on the other hand, the cash ratio for the firms that do not pay dividend is much higher. In 1996 the cash ratio for the non-dividend paying firms were 24.8% and ends up at 19.7% in 2016. In between, it peaks at 26.5% in 2006 and hits bottom at 16.5% in 2011. The coefficient from the regression in Table 10 suggests that the firms that do not pay dividends has a yearly decrease in cash ratio of -0.18%. It is also higher than dividend paying firms for all years. This is coherent with the findings of Bates et al. (2009, p. 1995) on U.S. firms saying that constrained firms hold larger cash balances. When comparing the U.S. and Norway, the ratios for dividend payment are higher for the Norwegian firms than they are for the U.S. firms, but U.S. firms have higher cash ratios for firms that do not pay dividend.

Figure 6: Average Cash Ratios by Payment of Dividends and Accounting Performance



Dividend payers are all firm-year observations that paid common dividends, non-dividend payers if not. Firm-year observations with accounting losses are identified as the negative net income variable, otherwise positive net income. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Column four reports the average cash ratio for firms with a negative net income that year. These results fluctuate but has a slight decreasing trend. In 1996 the cash ratio for negative net income is high at 25.4%, peaks at 31.5% in 2006, hits the lowest value at 15.8% in 2010 and climbs up to 19.5% in 2016. The coefficient from the regression had a decreasing value of -0.18% each year during the time period, although not a statistically significant variable. As Figure 6 illustrates, firms with negative net income holds the most cash of these four variables. Column five reports the average cash ratio for firms with a positive net income that year, they hold the second to least cash of all four variables in Table 9. The cash ratio starts at 18.70% in 1996, peaks at 21.2% in 2004 and 2005, hits the lowest value in 2014 at 12.5% and slightly picks itself up to 14.7% in 2016. The coefficient for positive net income firms suggests a decrease of -0.24% each year. The negative net income cash ratios are all higher than the positive net income ratios and this finding is consistent with both theory and the results of Bates et al. (2009, pp. 1994-1995) for U.S. firms. Figure 6 shows the trend for the four variables and a dashed line for the average cash ratio of the whole sample. Something the graph displays really well is the effect of the financial crisis and the fall in oil price. Cash ratio falls for all during these events, but the cash ratio keeps decreasing for the unconstrained firms, while the financially constrained firms react oppositely and starts to horde more cash as they need cash for protection. Again, these findings support the precautionary motive.

Table 10: Regression Estimating a Time Trend in Cash Ratios by Payment of Dividends and Accounting Performance

The table shows the results from regressions of the cash ratio for the four variables, on a constant and time measured in years. The four variables are listed in the second row. The dependent variable is the cash ratio for the four groupings. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The t-statistics are reported in parenthesis. *P*-values are reported as: * p <0.10, ** p<0.01, *** p<0.001. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

Model	1	2	3	4
Dependent Variable	Dividend Payer	Non-dividend Payer	Negative Net Income	Positive Net Income
Time	-0.00198**	-0.00183*	-0.00187	-0.00247***
	(-2.95)	(-2.35)	(-1.73)	(-4.16)
Constant	4.117**	3.881*	3.963	5.111***
	(3.06)	(2.48)	(1.83)	(4.30)
Adj. R^2	0.60%	0.20%	0.10%	0.70%
N	1215	2513	1552	2176

4.4 Cash Holding Across Industries

In this section, we investigate whether there are variations in cash holdings across industries in Norway. According to Richard Lane, Moody´s Senior Vice President, this is the case in the U.S. He further states that "The technology sector today holds the most cash among US non-financial companies, accounting for 47% of the total, followed by healthcare/pharmaceuticals, consumer products, and energy" (Ajzenman & Lane, 2017). The cash to assets ratio for each industry in our sample is presented in Panel A of Table 11. Panel B summarizes the distribution of firms per industry.[4] The table shows there are substantial differences in number of firms between the different sectors and also the different sub-periods.

Table 11: The Average Cash Ratio and Distribution of Firms by Industry

Panel A reports the average cash ratio of firms in the different industries for the entire period and four subperiods; 1996-01, 2002-06, 2007-11 and 2012-2016. Standard deviation is given in the second column for each industry for the whole period. Panel B reports the distribution of firms for each industry the entire period and the four subperiods. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. Variable statistics per industry are found in Table 2, and variable definitions can be found in Table 3.

Panel A: The average cash ratio by industry

Industry	SD	Whole Period	1996-01	2002-06	2007-11	2012-16
Energy	0.16	0.148	0.126	0.180	0.143	0.141
Material	0.19	0.149	0.112	0.124	0.219	0.156
Industrial	0.12	0.130	0.142	0.152	0.105	0.116
Cons. Disc.	0.11	0.133	0.139	0.153	0.123	0.092
Cons. Stapl.	0.12	0.085	0.101	0.097	0.077	0.076
Healthcare	0.33	0.491	0.683	0.550	0.446	0.445
IT	0.23	0.295	0.319	0.325	0.263	0.247

Panel B: The distribution of firms by industry

Industry	Whole Period	1996-01	2002-06	2007-11	2012-16
Energy	108	40	74	91	73
Material	22	16	15	12	10
Industrial	88	62	51	47	42
Cons. Disc.	31	25	19	13	9
Cons. Stapl.	26	9	20	21	19
Healthcare	18	5	10	14	14
IT	80	58	57	49	32
All	373	215	246	247	198

Table 11 Panel A provides evidence for the variation in cash holding across industries. Measured over the full sample, the Healthcare sector has the highest average cash ratio of 49.1%, and the IT sector has the second highest with a cash ratio of 29.5%. Their standard

[4] Excluding Financial firms, utilities, real estate industries and merging IT and telecommunication industries.

deviations are 0.33 and 0.23 respectively. The Material sector has the third largest cash ratio of 14.9%, and a SD of 0.19. The average cash ratio for the Energy sector, the Industrial sector and the Consumer Discretionary sector, are respectively 14.8%, 13% and 13.3%, with a SD of 0.16, 0.12 and 0.11. The Consumer Staples sector has the lowest average cash ratio of 8.5%, and a SD of 0.12. All the industries, except for the Material sector have higher cash ratios in the first half of our sample, which is in line with the time trend documented in section 4.1. [5] To illustrate the time trend of the cash ratio and net leverage ratio for all industries, consider Figures 7 A & B.

Figure 7 A & B: Cash Ratio and Net Leverage by Industry

Figure 7A: Cash Ratio by Industry

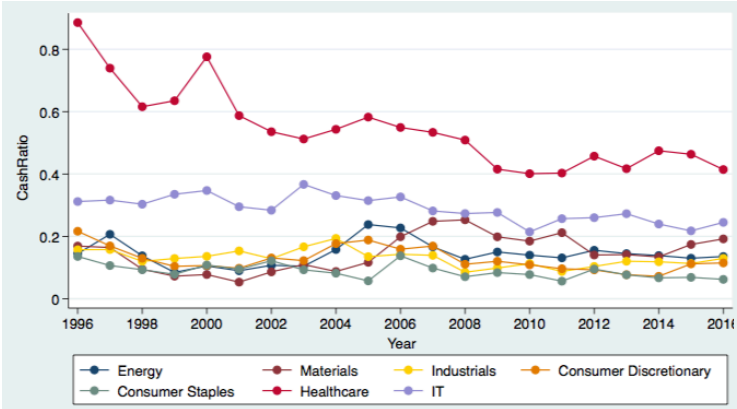
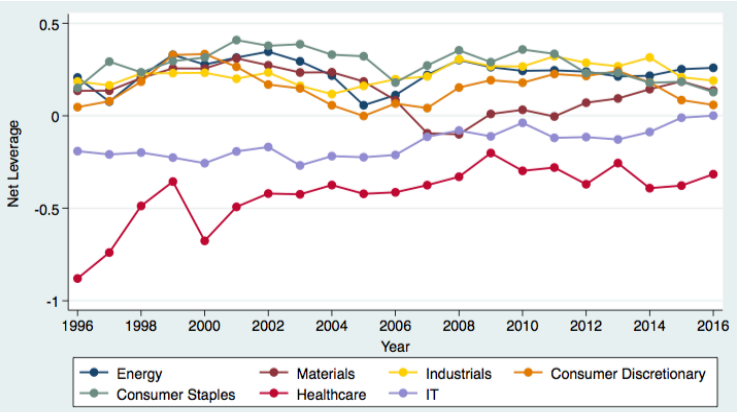


Figure 7B: Net Leverage by Industry



The figures show the cash ratios and the net leverage ratios for each industry. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

The cash ratio for the Healthcare sector is particularly high in the beginning due to the few firms with high cash ratios. The ratio falls in the following three sub-periods as the sector gains more firms but remains much higher than the other industries. The biopharmaceutical company Nordic Nanovector, which is the largest in the sector in terms of market capitalization, increased their cash ratio from 60% in 2012 to 97% in 2016. The cash ratio for the IT sector is also high the entire period but decreases during the collapse of the dotcom bubble in the 2000's. The number of listed firms in this industry decreases during the second half of the sample. Since 2007 over 30 IT companies have been acquired or taken off the Oslo Stock Exchange for a total value of 62 billion NOK (Bakken, Eidem, Linderud, & Hartwig, 2014).

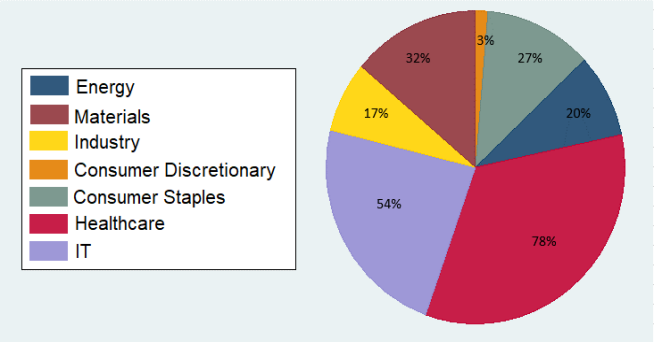
[5] The average cash ratio is 18% for the whole sample period. In the first half (1996-2006) average cash ratio is 20% and in the second half (2007-2016) it is 17%.

In the third subperiod, during the financial crisis, we see a decline in the cash ratios for all industries, except for the Materials sector, where the cash ratio increases. Norsk Hydro and Yara Internationals represents approximately the entire value of this sector, their cash ratio in the third sub-period is respectively 10% and 4%. It seems that the increase is driven by the smaller firms, such as Element, 58%, and Advocet Mining, 26%. The average net debt of the sector decreases in the same period. Of all the sectors, Energy is the most asset heavy and leveraged sector, hence it is expected to have a lower cash ratio (Bates et al., 2009; Opler et al., 1999). The sector is the largest at OSE in terms of market cap and number of firms. The average cash ratio is highest in the second sub-period and decreases from 22.6% in 2005 to 11% in 2008. The shift in cash ratio was accompanied by financial distress after the financial crisis in 2008 and the fall in oil prices in 2014. Net debt increases slightly over the whole period. The firm with the highest cash and marketable securities in the whole sample is Statoil with approximately 167 million NOK (2015). However, since their assets are approximately 948.9 million NOK, the cash ratio is "only" 17%. Statoil's cash ratio increased by 11% from 2009 to 2015. The Industrial sector can also be characterized as an asset heavy sector and the cash ratio decreases by -3% the entire period. Net debt declines by -14% from 1996 to 2011, but the net debt in 2016 is exactly the same as in 1996. The Consumer Discretionary sector is subject to high cyclical sensitivity as this is the first good or service people cut from their budget when times are tough. Their cash ratio decreases -10% the whole period. The Consumer Staples sector on the other hand, is non-cyclical so the cash ratio is expected to show a stable trend regardless of events, which Figure 7A confirms.

As mentioned initially, Bates et al. (2009, p. 2013) find that R&D intensive firms hold more cash. Molla (2017) further presents that tech companies are the ones spending the most money on research and development of the firms on the S&P500. This is supported by a statistical firm (The Statistical Portal, 2018) that describes the same trend on an international level, adding that both the IT sector and the Healthcare sector spends the most on R&D. Figure 8 describes that Healthcare and IT has the highest ratio of firms spending R&D within their industries. Higher cash holding is concentrated around R&D intensive firm, and the summary statistics for industries in Table 2 show the aforementioned industries also have higher market to book ratios, less debt and assets versus the remaining industries.

Figure 8: Percentage of Firms Within each Industry That Has R&D Expenditure

The figure shows the percentage of firms within each industry that reported R&D Expenditures. The sample includes all firm-year R&D observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 1731 observations for 343 firms. Variable definitions can be found in Table 3.



The results in section 4.2 showed that financially constrained firms held more cash than their counterparts. This is graphed in Figures 10 A, B, C & D, and it is clear that the non-dividend paying firms and those with negative net income have higher cash ratios. This holds for all industries except for the Consumer Staples sector, but as mentioned previously the increase in cash holding is not concentrated around this sector. The dividend-paying firms in the Consumer Discretionary sector also have a higher cash ratio than the non-dividend paying firms. The extreme volatility of the Healthcare sector is easy to see in these four figures, and the time trend in Figure 9B and Figure 9C specially shows that the increase in cash is mostly driven by firms in the Healthcare and the IT sectors. Lower profitability increases cash holdings as they hold cash as a buffer, supporting the precautionary motive. The non-dividend paying firms in the IT sector have on average a cash ratio of 57% versus 24% for the dividend paying firms, although their cash ratio more than doubles from 10% in 1996 to 22% in 2016. The results show that cash holding does vary between industries.

Figure 9 A, B, C & D: Average Cash Ratios by Payment of Dividends and by Accounting Performance per Industry

Figure 9A: Dividends Paid

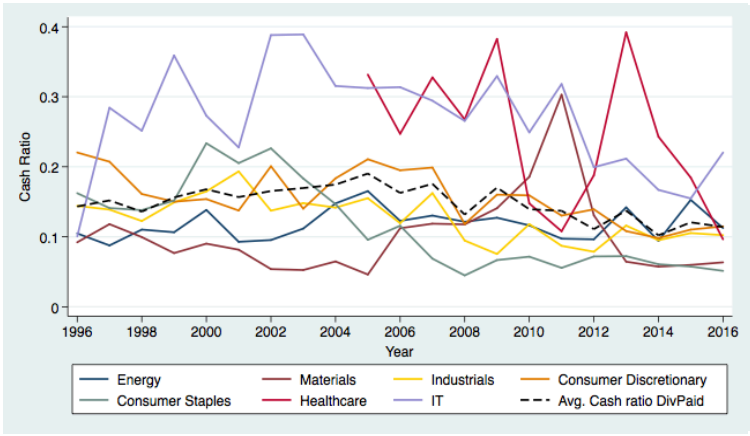


Figure 9B: Dividends Not Paid

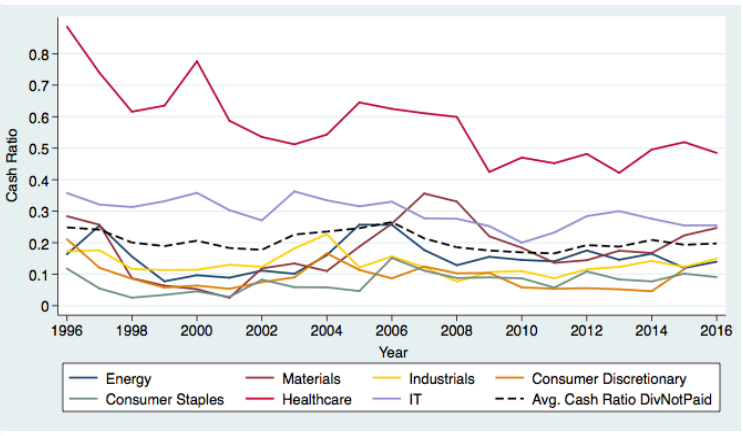


Figure 9C: Negative Net Income

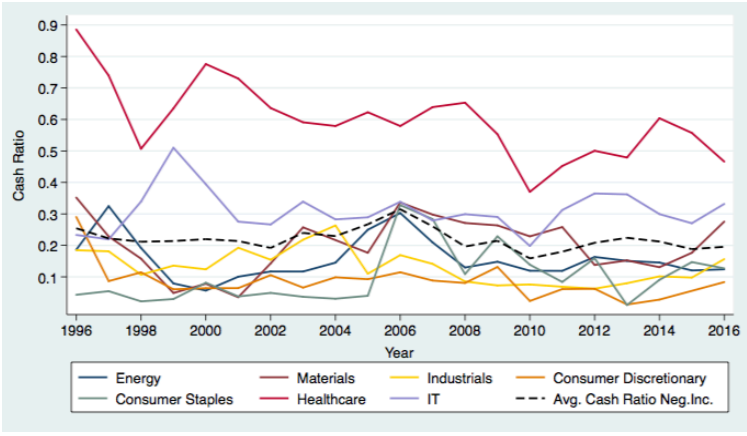
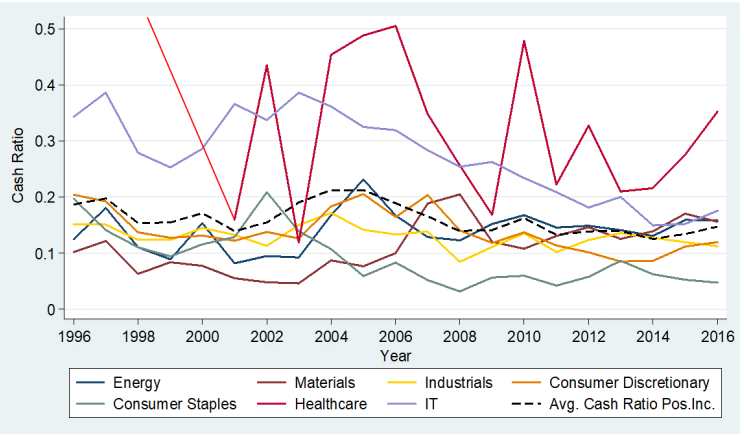


Figure 9D: Positive Net Income



The tables show the yearly averaged cash ratio by payment of dividends and by accounting performance for the seven industries. The tables also include a mean for all the industries in that specific category, displayed as a dotted line. Figure 9A displays the cash ratio for firms that paid common dividend that year. Figure 9B displays the cash ratios for firms that did not pay dividend that year. Figure 9C displays the cash ratio for firms that had negative net income that year, and Figure 9D displays the cash ratios for firms that had positive net income that year. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

5 The Determinants of Cash Holding

The previous section described the cash ratio over time. In this section we investigate whether cash holding can be explained by firm characteristics. We estimate eight regressions. The base model estimated is described below, where subscript *i* denotes the firm and subscript *t* denotes the fiscal year. Observations with missing values on explanatory variables are omitted. This reduces our sample to 2858 observations. The regression results are reported in Table 12 and the variable definitions in Table 3.

$$Cash\ ratio_{i,t} = \beta_0 + \beta_1 Market\ to\ book_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 NWC_{i,t} + \beta_4 Capex_{i,t} + \beta_5 Leverage_{i,t} + \beta_6 Dividend\ Dummy_{i,t} + \varepsilon_{i,t}$$

Model 1 in the first column of Table 12 is estimated on the entire sample period using cash ratio as the dependent variable. Consistent with the findings of Bates et al. (2009, pp. 2000-2005), the cash to asset ratio increases with market to book ratio and decreases with firm size, NWC, capital expenditure, leverage and dividend payment. However, the regression coefficient for capital expenditure is not statistically significant. The adjusted R^2 is 36%. To reduce the effect of outliers, Model 2 repeats Model 1 by using the natural log of the cash to net assets ratio as the dependent variable. This reduces our sample to 2844 observations. Changing the dependent variable results in a switch of the sign of the coefficient of capital expenditure which changes from negative to positive, but it is still not statistically significant. The coefficient of the dividend dummy is no longer statistically significant, but the sign coincides with theory. The R^2 falls to 28%, indicating that Model 1 have more explanatory power. Bates et al. (2009) finds similar results when using the natural log of the cash to net assets ratio as the dependent variable.

In Models 3 and 4 we examine whether the intercept of the model changes over time to assess whether cash ratio changes by factors that are not explained by the modeled firm characteristics. Model 1 and 2 are re-estimated by adding an indicator variable for time, the 2006 dummy. The variable takes the value of one for firm year observations until 2006, and zero after.

Table 12: OLS Regressions Estimating the Determinants of Cash Holding

The table shows the results from the regression of the cash ratio and several firm characteristics. Above each column the dependent variable is given. The dependent variables are the cash ratio and the cash to net assets ratio. Cash ratio is measured as cash and marketable securities divided by total assets. Log of cash to net assets is calculated as the log of the ratio of cash and marketable securities divided by (total assets – cash and marketable securities). The regression includes a time dummy and 7 industry dummies. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Missing values for some explanatory variables reduce the sample to 2844 observations. T-statistics are reported in parenthesis. The *p*-values are reported next to the coefficients as *, where * p<0.05, ** p<0.01, *** p<0.001. Variable definitions can be found in Table 3.

Model	1	2	3	4	5	6	7	8
Dependent Variable	Cash/Assets	Log (Cash/ Net Assets)	Cash/Assets	Log (Cash/ Net Assets)	Cash/Assets	Log (Cash/ Net Assets)	Cash/Assets	Log (Cash/ Net Assets)
Intercept	0.504***	0.0432	0.493***	-0.0800				
	(21.21)	(0.23)	(19.69)	(-0.40)				
Market to Book	0.0142***	0.0879***	0.0142***	0.0880***	0.0108***	0.0667***	0.0108***	0.0664***
	(12.19)	(9.41)	(12.20)	(9.42)	(9.54)	(7.20)	(9.53)	(7.18)
Firm Size	-0.0178***	-0.110***	-0.0172***	-0.103***	-0.0145***	-0.0853***	-0.0129***	-0.0747***
	(-10.27)	(-7.87)	(-9.65)	(-7.19)	(-8.20)	(-5.90)	(-7.20)	(-5.07)
NWC	-0.215***	-1.674***	-0.217***	-1.698***	-0.213***	-1.531***	-0.221***	-1.582***
	(-15.55)	(-15.02)	(-15.61)	(-15.15)	(-15.78)	(-13.79)	(-16.25)	(-14.17)
Capex	-0.0404	0.136	-0.0454	0.0788	-0.0188	0.126	-0.0341	0.0203
	(-1.46)	(0.61)	(-1.63)	(0.35)	(-0.70)	(0.57)	(-1.26)	(0.09)
Leverage	-0.321***	-2.300***	-0.322***	-2.311***	-0.286***	-1.979***	-0.290***	-2.003***
	(-25.01)	(-22.28)	(-25.05)	(-22.36)	(-22.05)	(-18.61)	(-22.35)	(-18.83)
Dividend Dummy	-0.0182**	-0.0554	-0.0196**	-0.0710	-0.00386	0.0574	-0.00693	0.0363
	(-2.93)	(-1.11)	(-3.12)	(-1.40)	(-0.62)	(1.13)	(-1.12)	(0.71)
2006 Dummy			0.00812	0.0922			0.0247***	0.170***
			(1.38)	(1.94)			(4.31)	(3.62)

(continued)

Table 12 - *continued*

Model	1	2	3	4	5	6	7	8
Dependent Variable	Cash/Assets	Log (Cash/ Net Assets)	Cash/Assets	Log (Cash/ Net Assets)	Cash/Assets	Log (Cash/ Net Assets)	Cash/Assets	Log (Cash/ Net Assets)
Energy Dummy					0.441***	-0.381	0.413***	-0.574**
					(16.77)	(-1.77)	(15.29)	(-2.59)
Materials Dummy					0.440***	-0.584**	0.408***	-0.800***
					(16.40)	(-2.66)	(14.75)	(-3.53)
Industrials Dummy					0.414***	-0.577**	0.383***	-0.792***
					(16.79)	(-2.85)	(14.94)	(-3.76)
Consumer Discretionary Dummy					0.396***	-0.652**	0.360***	-0.896***
					(15.79)	(-3.17)	(13.70)	(-4.15)
Consumer Staples Dummy					0.418***	-0.950***	0.392***	-1.133***
					(15.37)	(-4.27)	(14.08)	(-4.97)
Healthcare Dummy					0.658***	0.826***	0.635***	0.667**
					(26.14)	(4.01)	(24.74)	(3.17)
IT Dummy					0.464***	-0.172	0.432***	-0.389
					(19.42)	(-0.88)	(17.37)	(-1.90)
Adj. R^2	36%	28.3%	36%	28.4%	68.9%	77.6%	69.1%	77.7%
N	2858	2844	2858	2844	2858	2844	2858	2844

The coefficient for the 2006 dummy is positive in both models indicating that the changes in the cash ratio from 1996-2006 cannot be explained by changes in firm characteristics, however neither coefficient is statistically significant. The other coefficients are very similar in terms of sign, size and significance levels. The adjusted R^2 remains the same.

We perform four additional regressions to assess the effect of the different industries. We re-estimate the previous four models and include a dummy variable for each industry by their GICS-code. All the industry dummies are included in the model so the intercept is removed to avoid multicollinearity. The coefficients of the Healthcare dummy and the IT dummy indicate that these have a sizeable impact on cash ratio compared to the other industries. Particularly Healthcare whose coefficient is 0.68. The statistical significance of the IT dummy is sensitive to whether the dependent variable is the ratio of cash to assets or the log of the ratio of cash to net assets. In Models 6 and 8 it changes from positive and statistically significant to positive and not significant. The sign, size and statistical significance of the other coefficients remain almost the same, except for the coefficients for the dividend dummy which loses its significance in all four models. The 2006 dummy changes from positive and not statistically significant, to positive and significant. The adjusted R^2 is 68% in Model 5, 77% in Model 6 and very similar in the last two models.

To sum it up, we find a positive and significant coefficient on the market to book ratio across all models. The variable is a proxy for growth opportunities and confirms the precautionary motive for cash holdings. The results are consistent with Bates et al. (2009), they argue that cash is more valuable for these firms since their cost of financial constraint is greater. The relationship between cash ratio and leverage is negative and significant and leverage has the largest impact on the cash ratio of all the explanatory variables. Both Opler et al. (1999) and Bates et al. (2009) find strong empirical evidence for the negative relationship and argue that financially constrained firms will use cash to reduce debt. However, Acharya et al. (2007) suggest that the hedging argument increases leverage, but we find no evidence of a positive relationship between leverage and cash ratio. Cash holding decreases significantly with firm size in all estimated models and the evidence provided is in accordance with the economies of scale in the demand for cash, supporting the transaction motive. The results provided for the NWC ratio shows it decreases cash holding significantly across all models. Again, we see that the findings are compatible to the findings in the U.S. and confirms the transaction motive for holding cash. The relationship between the cash ratio and whether a firm pays dividend is

negative in most models, but only significant in some. Firms that pay dividend have greater access to the capital market making the precautionary motive less important for these firms. The results for capital expenditure shows that the slope of the coefficient decreases with the models holding the cash ratio as the dependent variable and increases with the log of cash to net asset ratio, although it is not statistically significant in any models. Bates concludes that the decreasing capital expenditure is one of the main drivers of cash holding in the U.S., but we fail to provide evidence for this for publicly traded firms in Norway. Further, we estimate Model 1 for each year in our sample period to examine whether the determinants differ from theory in any singular year. All coefficients have the same signs, except for capital expenditure and the dividend dummy which changes from negative to positive some years, but these are not statistically significant. The results are presented in Table A1 in the Appendix.

Bates et al. (2009) identifies the increased R&D expenditure as one of the main drivers behind the increase in cash holding in the U.S. In their model, acquisition activity is also included which they find decreases cash holding. We perform three additional regressions including R&D and Acquisitions to the base model. The results are presented in Table A1 in the Appendix. The two variables were excluded from the original analysis due to too few observations. By including them in the regression the number of observations reduces from 3596 to 1354. Pinkowitz et al. (2013, p. 27) show the increase is concentrated around multinationals with R&D expenditures and the U.S. is reported as the country that has the highest R&D spending in the world (Desjardins, 2017). [6] Since R&D is an important determinant in the U.S. findings, we wish to examine the impact on the small sample of Norwegian firms reporting this variable. The results find that R&D significantly increases the cash ratio for publicly traded firms in Norway. Notably, a very small coefficient of 0.000121 as opposed to the U.S. coefficient of 0.066. As expected, acquisition activity has a negative effect, but is not statistically significant. The adjusted R^2 is 40%. When including only acquisitions in Model 1, the coefficient becomes significantly negative, and the number of observation increases to 2137. Running Model 1, with only R&D, the sign and significance is almost the same and the number of observations increases to 1449. Both models yield an adjusted R^2 of 39%. These results are difficult to compare to the U.S. due to the huge differences in observations. In addition, Norway does not have the same magnitude of R&D intensive

[6] Desjardins (2017) also reports they are in the top of R&D spending in percentage of GDP as well, in 2015.

multinationals as the U.S. Because of the limitations our data faces for these variables we cannot present evidence with the same strong correlation with cash as found in the U.S.

We acknowledge that our analysis faces certain other limitations as well. The highest R^2 in Models 1-4, including only the firm characteristics is 36%. This indicates that 64% of the change in cash ratio can be explained by other factors not included in our model. Both Bates et al. (2009, p. 1999) and Opler (1999) concludes that cash flow volatility increases significantly with cash, and we recognize the inclusion of this variable may have increased the explanatory power of our models. Adding more variables to the regression is something to be considered for future research.

6 Future Prospects on Cash Holding

Before we conclude our thesis, we will discuss the future prospects of cash holdings. Numerous studies have suggested that the tax motive for cash can explain much of the $1.3 trillion that is being held overseas by U.S. firms. In the U.S., foreign income is taxed, but they are not paid until income is repatriated to the home country (Petroff, 2018). This has resulted in corporations leaving hundreds of billions of dollars of profit overseas. However, in December of 2017, the Trump administration implemented new tax laws which ends the double taxation and forces the firms to pay a one-time tax on all overseas cash they've kept since 1987, regardless if they bring the money home or not (Petroff, 2018). After paying this they will be able to bring back the money to the U.S. In this new tax legislation, Trump also lowered the corporate tax rate from 35% to 21% (Petroff, 2018). This law has been passed as an incentive to boost business in the U.S. Experience from earlier attempts, shows that this was actually not what happened as most firms, as an example, used this cash to increase payout to the shareholders and reduce debt. But the effect of this new legislation might be lowered cash holdings for firms that keep cash due to the tax motive in the future. So far, we have not found evidence that firms in the industries we look into in this thesis has brought cash back to the U.S. yet. But we did find that a few financial firms have paid the repatriation tax, such as Citigroup, who reported a $18 billion quarterly loss for the fourth quarter of 2017, after paying $22 billion in repatriation taxes according to Reuters. Goldman Sachs reported their first quarterly loss in six years, paying $4.4 billion in repatriation taxes and Bank of America had their first quarterly loss since 1992 of $2.6 billion in repatriation taxes (Segarra, 2018).

Although there might be some changes in the U.S. regarding the cash holding levels due to this tax legislation, we suspect it is highly unlikely that this will affect the publicly traded firms in Norway. For the future evolution of cash holdings in Norway we can only speculate, but we believe it will show a slow steady increase. After the oil price fell in 2014 over 40 000 jobs disappeared from the Energy sector (NRK, 2018). With the oil price slowly increasing again, the forecast for the Norwegian economy looks brighter. An article from *Hegnar* by Parr (2018) states that "Statoil's cash balance is 'flowing over with cash'". Even though the economy is improving, Norway has felt the effect of the dependence on one industry and the Norwegian Government states that Norway needs to become greener, smarter and more innovative and develop more sectors to profit from (Regjeringen, 2016).

7 Conclusion

The topic of this thesis has been to investigate the cash holding for publicly traded firms in Norway between 1996 and 2016. By using the methodology of Bates et al. (2009) we have examined the evolution of cash over time, across industries and measured the impact of specific firm characteristics on the cash ratio.

We capture a broken time trend for the cash ratio where in the first half, from 1996 to 2006, there is a secular increase in the cash ratio which is very similar to the trend for U.S. firms found by Bates et al. (2009). After the financial crisis the cash ratio in Norway falls by 7% and stays stable throughout. However, the cash ratio for U.S. firms remains high (Pinkowitz et al., 2013). The financial crisis seemed to have a larger impact on Norwegian firms, and as the cash ratio lowered, the leverage ratio increased. We also find that Norwegian firms have higher leverage ratios than U.S. firms overall which could indicate better access to the capital market in Norway. When studying the cash ratio related to firm size we find that the increase in cash is primarily driven by small firms. The cash to asset ratio for small firms is more than twice that of the large firms over the entire period. In contrast, the leverage ratio for the largest firms is twice that of small firms. Larger firms have better access to the capital markets, hence their need for holding cash is lower. When investigating the relationship of cash holding between financially constrained and unconstrained firms, the results show that financially constrained firms such as firms with poor accounting performance and those who do not pay dividend hold more cash. We determine that having cash may be useful for these firms in the presence of financial distress. When breaking the analysis down to an industry level, we document large variations among the seven industries where we find that the Healthcare and IT sectors hold the most cash. After documenting where the cash increase is concentrated we perform several regression analyses to understand how certain firm characteristics explain the variations in cash holdings. We find that leverage and net working capital have the largest negative impact on cash holding. Firm size and dividend payments also have a negative impact. On the other hand, cash holding increases significantly with higher market to book ratios. This is a measure of growth opportunities. The causes we find the most important in explaining the cash ratio for publicly traded firms in Norway, are similar to those Bates et al. (2009) finds for the U.S. They find that one of the main reasons for the increase in the cash to assets ratio are that R&D expenditures have increased. We also find a positive relation with cash and R&D in Norway,

but in a much smaller scale than what is found in the U.S. Norwegian firms were not obligated to report R&D expenses prior to 2005. There is also fewer R&D intensive firms in Norway, resulting in very few observations for this post.

In the end, publicly traded firms in Norway and the U.S. display the same drivers behind the cash ratios. The transaction motive is important in explaining the drivers behind economies of scale. Out of the four motives for keeping cash, we conclude that the precautionary motive is the most important for firms in Norway. We did not find that the tax motive had much significance for Norwegian firms, but it does affect cash levels in the U.S. a great deal. After the recent changes in the tax legislation in the U.S. it will be interesting to follow the U.S. cash holdings in the future. Whether this change will consequently 'bring home' the cash and make America great again is another topic for future research.

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9 Appendix

Figure A1: Number of Firms per Year

The figure shows yearly number of firms that were publicly traded in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. Variable definitions can be found in Table 3.

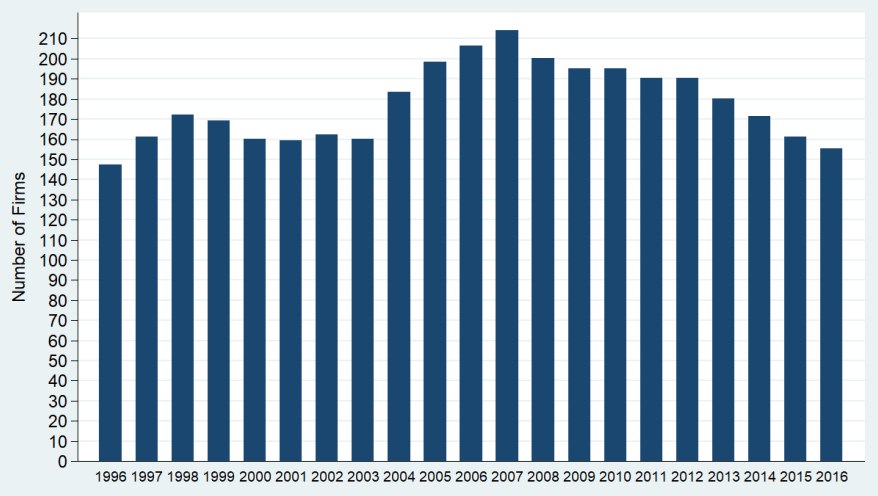

Figure A2: Average Total Assets by Industry

The graph displays the mean of total assets per industry for the whole sample period, denoted in millions. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 3728 observations for 373 firms. Variable definitions can be found in Table 3.

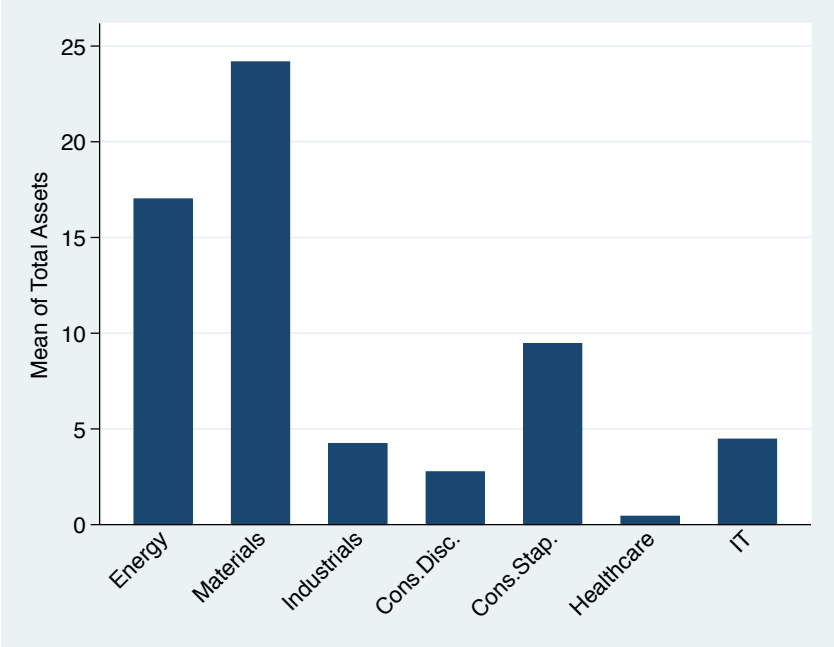

Table A1: Regressions of the Cash Ratio on Firm Characteristics by Year

The regression is a replication of the regression reported in Table 12, but this regression is run for every year in the sample period. The dependent variables is the cash ratio. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The sample includes 2858 observations for 373 firms. Missing values for some variables reduce the sample to 3575 observations. T-statistics are reported in parenthesis. The *p*-values are reported next to the coefficients as *, where * p<0.05, ** p<0.01, *** p<0.001. Variable definitions can be found in Table 3.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Intercept	0.468**	0.665***	0.436***	0.547***	0.515***	0.320**	0.236*	0.227*	0.447***	0.273*	0.337**
	(3.12)	(4.94)	(3.41)	(5.62)	(3.74)	(2.76)	(2.18)	(1.99)	(3.80)	(2.37)	(2.90)
MTB	0.0280	0.00955	0.0172	0.000932	0.00192	0.0335***	0.0908***	0.0510***	0.0342***	0.0417***	0.0355***
	(1.69)	(1.27)	(1.42)	(0.60)	(0.34)	(3.54)	(4.21)	(4.81)	(4.07)	(5.74)	(4.55)
Firm Size	-0.0137	-0.0229*	-0.0116	-0.0203**	-0.0194	-0.00558	-0.00646	-0.00115	-0.0165	-0.00794	-0.00861
	(-1.36)	(-2.30)	(-1.23)	(-2.73)	(-1.96)	(-0.64)	(-0.84)	(-0.14)	(-1.91)	(-0.99)	(-1.05)
NWC	-0.351***	-0.491***	-0.407***	-0.379***	-0.134	-0.101	-0.192**	-0.256***	-0.228***	-0.313***	-0.230**
	(-3.97)	(-6.39)	(-5.53)	(-5.94)	(-1.73)	(-1.26)	(-2.97)	(-4.30)	(-3.94)	(-4.30)	(-3.13)
Capex	-0.182	-0.177	-0.0281	-0.251*	0.0144	-0.287*	-0.0670	-0.379	0.0497	-0.0285	0.00233
	(-1.40)	(-1.36)	(-0.28)	(-2.29)	(0.09)	(-2.45)	(-0.99)	(-1.50)	(0.27)	(-0.21)	(0.02)
Leverage	-0.284**	-0.379***	-0.285***	-0.270***	-0.255***	-0.316***	-0.292***	-0.350***	-0.303***	-0.234**	-0.321***
	(-3.29)	(-5.33)	(-4.64)	(-6.44)	(-4.81)	(-4.81)	(-5.48)	(-5.32)	(-4.74)	(-3.13)	(-4.40)
Dividend	-0.0479	-0.0564	-0.0597*	0.00663	-0.0000597	-0.00999	0.00121	0.00431	-0.0135	0.00532	-0.0327
Dummy	(-1.48)	(-1.80)	(-2.11)	(0.27)	(-0.00)	(-0.32)	(0.04)	(0.13)	(-0.45)	(0.20)	(-1.24)
Adj. R^2	39%	53%	34%	40%	22%	36%	38%	48%	45%	45%	39%
N	86	105	136	134	117	122	126	117	118	120	137

Table A1 - Continued

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Intercept	0.500***	0.453***	0.390***	0.281*	0.418***	0.333**	0.482***	0.412***	0.506***	0.352**
	(4.05)	(4.28)	(3.42)	(2.48)	(3.92)	(2.71)	(4.41)	(3.66)	(4.87)	(3.27)
MTB	0.0173	0.0592***	0.0330***	0.0313***	0.0117**	0.0367***	0.0182***	0.0301***	0.0560***	0.0317***
	(1.73)	(3.59)	(4.54)	(4.52)	(3.22)	(5.25)	(3.77)	(5.31)	(5.84)	(6.04)
Firm Size	-0.0165	-0.0166*	-0.0107	-0.00298	-0.0140	-0.00777	-0.0179*	-0.0137	-0.0247***	-0.00856
	(-1.86)	(-2.25)	(-1.31)	(-0.38)	(-1.81)	(-0.86)	(-2.25)	(-1.67)	(-3.43)	(-1.13)
NWC	-0.268**	-0.302***	-0.248***	-0.254***	-0.216***	-0.144**	-0.0833	-0.0753	-0.0614	-0.113
	(-3.25)	(-5.24)	(-3.71)	(-4.31)	(-3.44)	(-2.71)	(-1.02)	(-1.23)	(-1.03)	(-1.97)
Capex	-0.0289	-0.121	0.101	0.162	-0.0541	-0.00297	0.0286	-0.0735	-0.0772	-0.103
	(-0.22)	(-0.94)	(0.56)	(1.12)	(-0.27)	(-0.02)	(0.21)	(-0.43)	(-0.68)	(-0.48)
Leverage	-0.351***	-0.382***	-0.416***	-0.415***	-0.299***	-0.343***	-0.267***	-0.258***	-0.162**	-0.293***
	(-4.77)	(-6.46)	(-6.19)	(-7.06)	(-5.19)	(-5.42)	(-4.56)	(-4.53)	(-2.75)	(-5.83)
Dividend	-0.0142	-0.0127	-0.0104	-0.0527	0.00974	-0.0673*	-0.0289	-0.0562*	-0.0300	-0.0882**
Dummy	(-0.48)	(-0.52)	(-0.35)	(-1.88)	(0.34)	(-2.12)	(-0.99)	(-1.99)	(-1.17)	(-3.17)
Adj. R^2	27%	44%	42%	38%	33%	42%	34%	42%	46%	43%
N	159	169	161	152	160	157	145	145	146	146

Table A2: Regressions Estimating Research and Development and Acquisitions

This regression is a replication of Model 1 in Table 12, only this regression includes the R&D and Acquisition variables. The dependent variable is the cash ratio. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The table includes 3728 observations for 373 unique firms. Missing values for some variables reduce the sample to 2137 observations for 373 firms. T-statistics are reported in parenthesis. The *p*-values are reported next to the coefficients as *, where * p<0.05, ** p<0.01, *** p<0.001. Variable definitions can be found in Table 3.

Model	1	2	3
Dependent Variable	Cash/Assets	Cash/Assets	Cash/Assets
Intercept	0.451***	0.467***	0.494***
	(12.56)	(13.16)	(17.09)
MTB	0.0244***	0.0222***	0.0212***
	(13.08)	(11.91)	(13.36)
Firm Size	-0.0144***	-0.0151***	-0.0175***
	(-5.64)	(-5.94)	(-8.59)
NWC	-0.170***	-0.167***	-0.204***
	(-8.52)	(-8.33)	(-13.41)
Capex	-0.0789	-0.0840	-0.0607
	(-1.56)	(-1.62)	(-1.81)
Leverage	-0.334***	-0.337***	-0.314***
	(-17.22)	(-17.23)	(-21.39)
Dividend Dummy	-0.0382***	-0.0407***	-0.0226***
	(-3.99)	(-4.23)	(-3.34)
R&D	0.000121**	0.000124**	
	(2.83)	(2.78)	
Acquisitions	-0.151		-0.147*
	(-1.70)		(-2.29)
Adj. R^2	40.9%	39.3%	39.2%
N	1354	1449	2137

Table A3: Regression of the Cash Ratio Trend over Time for Different Time Periods

This regression is estimated on the dependent variable of the cash ratio over time. The sample includes all firm-year observations of publicly traded firms in Norway during the time period 1996-2016. The regressions are run on three different time periods; before 2007, after 2006 and after 2013. All observations are required to have positive book value of total assets and sales revenue. Financial firms, Real Estate and Utilities are omitted from the sample. The table includes 3596 observations for 355 unique firms. Missing values for some variables reduce the sample to respectively N= 1877, 1851 and 487. T-statistics are reported in parenthesis. The *p*-values are reported next to the coefficients as *, where * p<0.05, ** p<0.01, *** p<0.001. Variable definitions can be found in Table 3.

Model	1: <2007	2: >2006	3: >2013
Dependent Variable	Cash/Assets	Cash/Assets	Cash/Assets
Year	0.00436**	-0.00205	-0.00169
	(2.95)	(-1.27)	(0.16)
Intercept	-8.531**	4.298	-3.246
	(-2.89)	(1.32)	(-0.15)
Adj. R^2	0.4%	0%	-0.2%
N	1877	1851	487

Table A4: Stata Variables Explained: In order of how they are listed in Stata

Variable	Definition
GICS	Global Industry Classification Standard
FIRM	Firm names
YEAR	Year
STCP	Short-Term Debt and Current Portion of Long Term Debt
LTD	Long Term Debt
TA	Book value of Total Assets
CSTI	Cash and Short-Term Investment (Marketable Securities)
C	Cash
CA	Current Assets
CL	Current Liabilities
R	Revenue
DA	Depreciation and Amortization
D	Dividends
CAP	Capital Expenditures
NI	Net Income
E	Total Shareholder Equity
RD	Research and Development
ACQ	Acquisitions
LEV	Leverage: ((stcp + ltd) / ta)
NETLEV	Net Leverage ((stcp + ltd) – csti / ta)
LSIZE	Firm Size – Log(book value of total assets)
NWC	Net working capital: (ca - cl - csti) / ta
CAPEX	Capital Expenditures Ratio: cap / ta
CR	Cash Ratio (CSTI/TA)
lnCR	log(Cash Ratio)
NA	Net Assets: ta - csti
CRNA	Cash/Net Assets: csti/ NA
lnCRNA	log(Cash/Net Assets): log(csti/NA)
TimeDum2006	Dummy, where 1 if years before 2006, 0 if years are after 2006.
RnD	Research and Development / Revenue: rd/r
acqTA	Acquisitions / Book value of total assets: acq/ta
EnergyDum	Dummy variable 1 if GICS = 10 Energy Sector, 0 if not.
MaterialsDum	Dummy variable 1 if GICS = 15 Materials Sector, 0 if not.
IndustrialsDum	Dummy variable 1 if GICS = 20 Industrial Sector, 0 if not.
ConsumerDisDum	Dummy variable 1 if GICS = 25 Consumer Discretionary, 0 if not.
ConsumerStapDum	Dummy variable 1 if GICS = 30 Consumer Staples sector, 0 if not.
HealtchareDum	Dummy variable 1 if GICS = 35 Healthcare sector, 0 if not.
ITDum	Dummyvariable 1 if GICS = 45 IT and Telecom. Sectors, 0 if not.
Annreturn	Annual Return
Anndividend	Annual Dividends

Stockprice	Stock Price at end of the year
Noshares	Number of Common Shares Outstanding
CSO	Noshares/1000
PCSO	Price * Common Shares Outstanding
MTB	Market to Book: (ta - e + pcso) / ta
DivDum	Dummy variable, where 1 if div paid, 0 if dividends were not paid.
Quartsize	Total Assets divided into 4 quartiles