Copenhagen Business School

Master's thesis

M.Sc. in Applied Economics and Finance

"A study of the development of corporate cash holdings among U.S. and Danish firms before and after the financial crisis. "

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Abstract

The presence of large amounts of cash on U.S.-firms' balance sheets in the recent years has drawn attention to the topic corporate cash holdings. Coming out of the biggest financial crisis since the great depression, this study provide empirical evidence for how the crisis has changed the dynamics behind the firm's cash holding level. This study also includes Danish firms, where cash levels have fallen in the post-crisis period, contrary to the development among the U.S-firms, which is also in interest for this study.

By reviewing existing literature and conducting a meta-analysis, 12 firm-specific variables are constructed to investigate the dynamics, and thereby to explain the contrary development in the two home markets. 9733 U.S firms and 107 Danish firms are included in the sample, whereas financial and utility firms are excluded. The variables are first tested in the pre-crisis period (Q1 2004 – Q2 2007) and then in the post-crisis period (Q3 2009 – Q4 2013), where significant country-specific differences are found.

The results indicate strong support for precautionary motives for holding cash among U.S. in the post-crisis period based on significant findings on cash flow, cash flow volatility, size, repurchase of own stocks and their impact on cash holdings. However, these large holdings due to precautionary motives can indicate presence of agency problems among U.S. firms, possibly due to managerial discretion or managers catering towards creditors rather than its shareholders. Furthermore, panel data regressions find strong support for pecking order theory to predict levels among U.S. firms, meanwhile trade-off theory appears better to predict the cash levels among Danish firms. This indicates U.S.-firms are more dependent on internally generally funds, which is supported by the relatively weaker creditor protection rights in the U.S. compared to Denmark. Given the complex and wide range of factors that influences holding levels, these findings should, however, be interpreted as some of many contributing causes to the contrary holding development in the two countries in the after crisis period.

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1.1 Introduction

"The one thing I will tell you is the worst investment you can have is cash. Everybody is talking about cash being king and all that sort of thing. Cash is going to become worth less over time."

Warren Buffet

Cash can be described as a two-edge sword. On the one hand cash is the lifeblood of corporations; it ensures smooth operations and ability quickly to new opportunities. But on the other hand, cash will always have an opportunity cost; the interest earned on the piles of cash will never match the cost of capital of a corporation. Therefore, the optimal level of corporate cash holdings have consistently remained been a highly discussed topic within the study of corporate finance. Coming out of the worst economic crisis since the big depression, the subject of corporate cash holdings is more relevant than it has been in a long time.

The financial crisis made a significant impact not only on the world economy, but maybe even more profound on corporations. Despite a recovery of corporate profit in the recent years, the impact of the crisis left significant marks on the corporations' balance sheets. While financial institutions have been heavily deleveraged due to new regulations all across the western world, non-financial corporations have in the same period piled up enormous amounts of cash. March 31th 2014 Fortune reported on U.S. firms:

"Non-financial firms are holding more cash on their balance sheets than ever, with 1.64$ trillion in cash, at the end of 2013".

Especially in the U.S, corporate cash holdings have been growing steadily every year since the crisis, despite a solid comeback of corporate profits and record-high levels of the Dow Jones and S&P-index. These historically high cash holdings raise the interesting question why the cash is not being spent, i.e. on investments or on dividends back to its shareholders, and whether there has been a systematically change in some of the traditional cash holding determinants, caused by the crisis.

As a student in Denmark I also find it interesting to compare this development in corporate cash in U.S. with Danish firms. Here, in contrast, the levels of cash holdings in Danish listed firms decreased quickly back to pre-crisis level after a jump in 2010. Even though the financial crisis originated in the U.S., the chock on the Danish economy and Danish corporations was very profound too. Just like in the U.S., a significant drawback in the Danish economy took place caused by the crisis i.e. GDP, unemployment, housing market and stock market.

Despite similarities and tight correlations between the two economies, the development in corporate cash holdings in Denmark differed significantly from the American corporations, after the crisis. What is the reason for this given the two economies' close relatedness? In the effort of investigating the underlying reasons for this difference, I will first take a closer look at the "traditional" dynamics and determinants behind corporate cash holdings; i.e. I will discuss the general "drivers" for corporations to hold cash. By having a clear understanding for cash motives I will discuss the financial crisis' impact both in the US and Denmark as well at its followed partial recovery. Such theory can help me develop reasonable hypotheses which I later on will test. Here it is relevant to see if any cash determinants are more significant in any of the two countries. Also it is interesting to see whether these cash determinants are playing a different role in each of the two countries, i.e. if any of the determinants yields a positive relationship to cash holdings in one country while a negative one in the other country and the possible implications of this.

1.2 Research Questions

The main purpose of this thesis is to answer the following research questions. By framing the main research question first, relevant sub questions will subsequently following to help answering the main research question.

Main question: What could explain the contrary development in post-crisis cash holdings among U.S.- and Danish firms, given the close relatedness between the two economies?

To create the basic theoretical for this thesis sub question 1 is asked:

Sub question 1: Which theoretical perspectives could explain the levels of corporate cash holdings?

Given the overall theoretical perspectives on cash holdings, I would like to narrow the scope and review what the literature says about the traditional cash holding determinates. So sub question 2 is as following:

Sub question 2: What are the "traditional" determinants for corporate cash holdings and what are the empirical findings on these?

As this study is in relation with the financial crisis, a thorough understanding of the crisis and its effect on corporations in U.S. and Denmark is necessary. Therefore it's necessary to address the crisis in general and its impact on corporations:

Sub question 3: In which way did the financial crisis affect corporations and how can the period of the crisis be defined?

As there clearly are difference between Danish and U.S. listed firms that might be relevant to explain the holding development, descriptive statistics on this should addressed:

Sub question 4: What are the firm-specific differences between U.S. and Danish firms ?

And finally, to answer the main research question to the best extent as possible, a suitable methodology is critical.

Sub question 5: What are the best statistical model(s) that can **measure and explain** the changes in dynamics in cash holding determinants in U.S. and DK, respectively?

1.3 Thesis outline

In general, the structure of this thesis is built around the presented sub questions, as answering them one by one in the mentioned order, enables me to answer the main research question.

Therefore, this thesis starts with reviewing the most relevant literature on corporate cash holdings, where the most dominants theoretical prediction/proposition are presented and discussed. The literature review continues by presenting and discussing specific cash holding determinants along a meta-analysis, which will be essential for the later course of this research.

From then on, a background on financial crisis and its implication on corporations will be addressed as this, along with the literature review, creates the basis for my hypotheses for this thesis.

Thereafter, the data applied for this research as well as a descriptive analysis will be presented and discussed, followed by a thoroughly derived and described methodology of the statistical analysis. The results from the regression models are presented and from then on, along with a full discussion and the implications of the results. Finally, conclusions and suggested further research are outlined.

1.4 Scope and Limitations

This thesis is part of a two-year program M.Sc. in Applied Economics and finance at CBS and attempts to answer the above mentioned research questions. I started to collect data and relevant literature in ultimo September 2014 and completed this research in mid April 2015.

The scope is defined as all publicly listed firms in the U.S. and Denmark given by the Compustat database, except utility and financial firms which have been excluded as they typically are under strict regulation on how much cash they are required to hold (Foley, et al., 2007). This exclusion has been based on The North American Industry Classification System (NAICS-code) of the firm given by Compustat. The database has given me access to all income statements, balance sheet and cash flows items of each firm. I cannot, however, rule out that there might mistakes or missing values in the data. Along with various academic research articles, which are primarily obtained from The Social Science Research Network, these sources have created the basis for this research.

The timeframe has been defined as the period before the crisis and the period after the crisis. Even though the primary focus is on the after crisis period, having a before crisis period enables me to investigate the *changes* compared to the after crisis period.

Most of the academic articles on cash holdings have been conducted before the crisis; however fewer papers have conducted research on cash holdings in relation to the recent crisis. This is yet another motivation for conducting this research.

2 Literature review

In the following section, relevant finance literature on corporate cash holdings will be reviewed and discussed. The section will help me create the basis of hypotheses that eventually can help me answering my research questions.

The section is divided into five parts; the first part outlines the history and definition of cash, second part addresses the most prevalent theoretical proposition in relation to cash holdings, the third part will review investor protection rights in relation to cash holdings, the fourth part will address the main corporate determinants for holding cash, while the fifth part will review and compare studies on these determinants in a meta-analysis.

2.1 Cash – its history and definition

2.1.1 Cash – A medium of exchange

According to Investopedia and British museum[1], money has been part of human history for about 3000 years. Before that time, historians believe that the so-called Barter system was used to facilitate trade. In the barter system, people traded goods and services directly for other goods and services. In this system, the trade between two parties could only occur if the one of the party had and wanted what the other party wanted, and logically vice versa. If person A had a bucket and wanted to exchange it for an axe, this person would have to find someone who wanted bucket but also wanted exchange his or her axe. As the chances for this could be minimal, the person would have to alter the deal until someone would agree with him or her.

As more easily traded goods got introduced as a medium of exchange, the speed of trade and business increased. This included animal skins, salt and weapons, although the unit levels were still negotiable. As the first country to use recognizable coins, China started using miniature replicas of weapons and tools casted in bronze. Apparently this took place around 1100 B.C. Later, Lydia (now West-Turkey) created the first minted coins around 600 B.C.

[1]See bibliography for exact internet source

As coins were a far more efficient form of medium of exchange in the economy than goods, paper money got introduced, first in China and later in the rest of the world. Interestingly enough, where the American note says today "In God We Trust", the Chinese note back then said:"All counterfeiters will be decapitated.".[2] As the Chinese introduced cash around 600 B.C., cash was not used in Europe before 1600 A.D. Then private banks issued cash to its depositor and borrower as it was easier to carry around and could at any time be exchanged at its nominal value to gold or silver coins.

As economic activity in Europe increased, it became apparent that the money supply should not be limited to holding precious metals. Also, as people would more likely trust notes issued the government rather than private institutions, central banks were established.

Today, it is the central banks that issue both coin and cash in an economy.

2.1.2 Cash – an definition

What do we really mean by "cash"? Depending on who you ask, the term can be interpreted in various ways. Most people understand cash as bank notes or coins in some currency, i.e. physical money, which is probably the most common understanding of the term. Another common understanding is also money deposited on a checkable account; the money is ready for payment immediately. However, from a book keeping or financial perspective, cash can also be referred as to the most liquid items among the current assets on a balance sheet. Next to cash, this also includes also money market accounts and other short-term investments that can be liquidated very quickly. Therefore, cash can be defined as a medium of exchange that that can be accessed *immediately or near-immediately to* pay for a good or a service. As a consequence hereof, the term corporate cash holdings is therefore in this thesis defined as the variable "cash and short-term investments" in the Compustat database. Another common term for this definition is "cash and equivalents".

[2] Investopedia. See bibliography for exact source.

2.2 Main theoretical propositions

2.2.1 Cash holdings in perfect markets – MMI theorem

Corporate cash holdings would be an irrelevant field of studies in a Modigliani-Miller world with perfect capital markets. With the assumption of no transaction costs, liquidity premium and full information symmetry of market information, firms that need money for new investments could easily go to the capital markets to raise funds or sell some assets with no extra costs involved. Hence, holding of liquid assets would not have mattered as there would not be any opportunity costs of holding them, i.e. the market value of the firm would therefore remain unchanged whether the firm held cash or not.

Same can be said about the choice of capital structure. However, if let's say, taxes are included, then leverage yields advantages to the firm, but only to a certain point as financial distress costs will occur at some point. I.e. there will a trade-off between the financial distress costs, equity and debt and an optimal capital structure could be found. And same could be said about cash holdings; there is a marginal benefit of holding cash, but only to a certain point where the costs of holding it or not holding it, thus trade-off theory is relevant.

2.2.2 Static trade-off theory

Setting assumption of perfect capital markets aside, cash holding can consequently avoid the firm the costs of raising money or selling its assets in a situation where the firm needs finance. Therefore, it is costly to be short of liquid assets. These "shortage costs" can take form in a number of ways as they are reducing the overall flexibility of the firm. I the literature the main liquid asset shortage costs are described as the lack of ability to make profitable investments, costs of selling assets, abnormally high financing and hedging costs and cut in dividends to shareholders which could force the firm to raise costly funds in the capital markets (Opler, et. al

1999). Miller and Orr (1966) also argue that liquid asset shortage also affects the economies of scale in cash management.

It is costly raise to new funds, no matter which way a firm chooses. Therefore, firms will not seek external finance frequently and the firm will use its liquid assets as a buffer. Thus, no matter the level of net debt (Total debt-cash) *there is an optimal level of liquid assets*. This is the main hypothesis behind static trade-off theory in relation to cash holdings.

(Opler, et. al 1999) models an equilibrium for corporate cash holdings where the mentioned "shortage costs" are put in relation to the opportunity costs of holding liquid assets. This trade-off model shows the *optimal level* of holding of liquid assets to be where the marginal cost of holding liquid assets, i.e. the marginal opportunity cost, equals the marginal cost of liquid asset *shortage*. The model has two important assumptions. One is that the marginal cost of holding liquid asset, or the opportunity cost of holding liquid assets, is constant while the marginal cost of liquid asset shortage is decreasing. As greater shortage has greater costs as more investment opportunities are lost or more funds needs to be raised. Consequently, for a given amount of liquid assets, a higher probability of running short of liquid assets, will shift the marginal cost of shortage curve to the right and increase the holdings of liquid assets, as a new optimal level will be found.

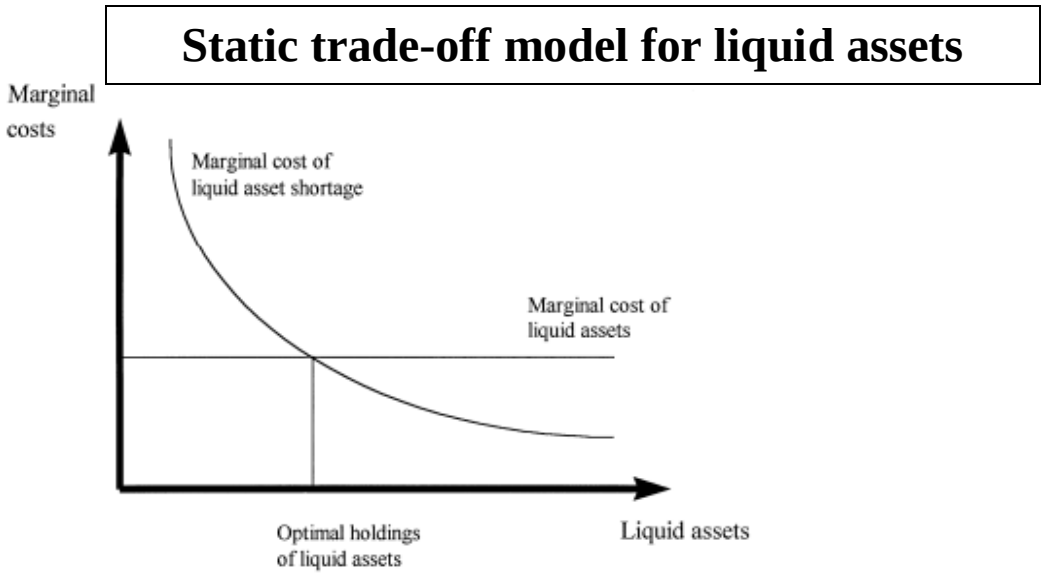


Figure 1 - Static trade-off model

The figure shows the optimal holding of liquid assets, derived by the intersection of the marginal cost of holding liquid assets (constant) and the marginal cost of liquid asset shortage (declining). Source: Opler, et. al., 1999, page 8.

A firm can reduce its probability of running out of liquid assets by having a lower leverage or by hedging (Opler, et. al 1999). The authors consequently argues that, the question on whether it is smarter to add another unit liquid asset instead of decreasing leverage or increasing hedging should be addressed.

Opportunity cost of holding cash in a low-interest environment

Likewise, it is relevant to mention how deposit interest rates would affect the level holding liquid assets. As the marginal opportunity cost, or marginal cost of holding liquid assets, can be defined as the difference between the return of what the firm would get if it spends the money on project and the interest earned on the cash deposit. In today's low- interest environment some corporate depositors have negative interest rates, hence they need to pay the bank to have the deposit in the bank.[3] In such environment, all else equal, one would expect the optimal level of liquid assets to shift leftwards as the opportunity cost of holding cash now are higher.

[3] News article in Berlingske Business February 6th 2015, see bibliography.

2.2.3 Financial hierarchy order

Contrary to the static trade-off model, the alternative prediction is that there is *no optimal level* of cash holdings. Given the extension of pecking order, also called financial hierarchy theory, on cash holdings, the firm's cash holdings will always be the net debt (total debt – cash).

The pecking order explains that the firm will always use internal resources as the first source of finance. Then, if more cash is not available, the firm will issue debt, and if this is not available, equity will be issued as final source. This theory is based on that the *cost of financing* increases with asymmetric information, with equity being the source with the highest degree of information asymmetries.

Therefore, in relation to cash holdings, a firm's cash holdings will always be a buffer between the retained earnings and the investment needs for the firm. If a firm have enough internal resources they will use its cash for investment purposes', repay its debt, pay dividends or otherwise just accumulate cash. If a firm does not have enough internal resources for a new project, it will issue debt to finance it. As a consequence, the cash holding level of the firm is determined of the amount of retained earnings and the investment decisions in the firm.

Pecking Order theory has therefore a number of assumptions on a firm's cash holdings, given its circumstances. The basic one is that firms with high operational cash flow will have high cash holdings, as they have a higher probability to be able to accumulate cash after debt service, investment expenses and dividend payments are made. A second assumption is that so-called "growth companies" with many investment opportunities will have bigger holdings than those that are not, as they prefer financing these opportunities with internal funds. A third is that a firm's leverage decreases its cash holdings as investment needs is exceeding the retained earnings in the firm and is in need of debt.

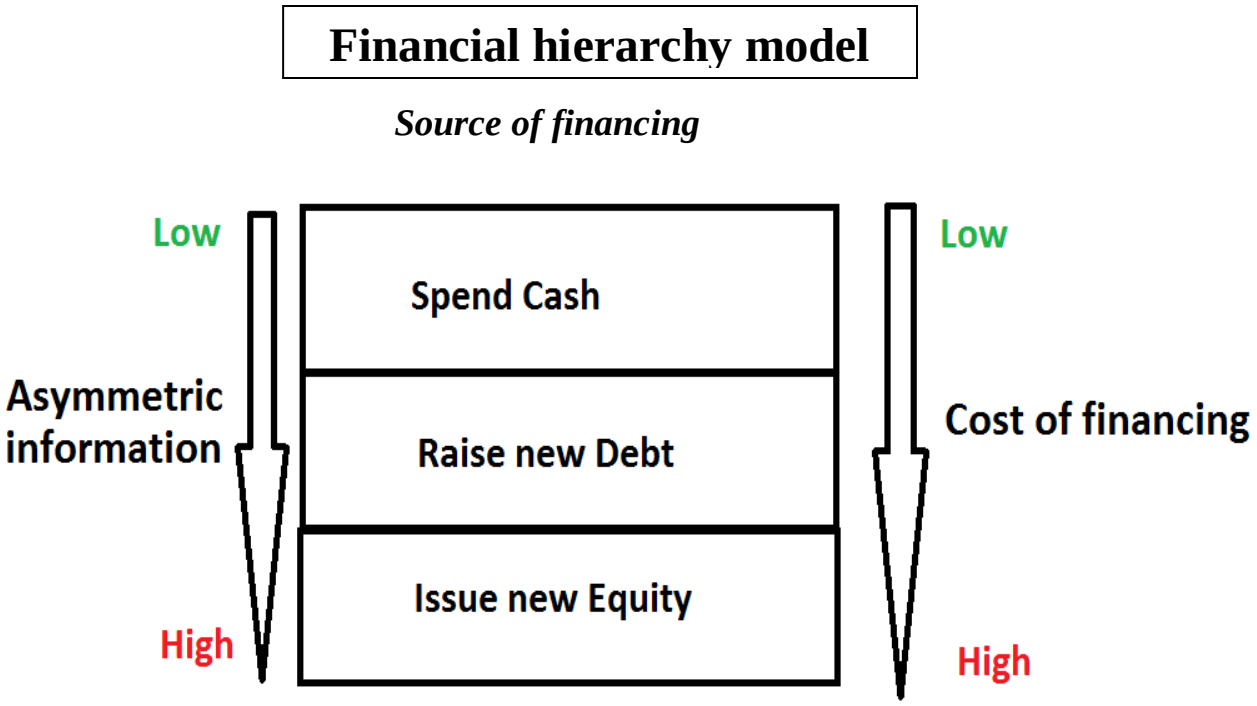


Figure 2 - Financial hierarchy model

As shown in the figure, the financial hierarchy model suggests that the cost of financing increases with the level of asymmetric information in the sources of financing. Source: Own contribution

2.2.4 Agency problems

2.2.4.1 Agency costs of debt

Supporting Pecking Orders hypothesis on using internal resources before external funds is the agency cost of debt. These costs arise when debt holders and shareholders or debt holders among themselves have different interests. Especially when firms already are highly leveraged, these costs occur but can also occur under normal circumstances. Examples of these costs can lead to underinvestment, due to expensive debt or terms that are only benefitting the debt holders. To avoid such agency costs the firm can either choose to have low leverage or to have more liquid assets. Logically, growth companies with many profitable opportunities are the type of firms that

would suffer the most with high agency costs of its debt, and they would therefore hold more cash to compensate for this.

2.2.4.2 Agency costs of managerial discretion

Cash holdings are also central in another form of agency costs that firms might be facing; agency costs of managerial discretion. As management may hold cash to can to pursue their own goals and objectives and not the firm's, agency costs occur at shareholders expense. The literature emphasizes three main objectives that effect agency cost of managerial discretion; risk aversion, financial flexibility and the so-called empire-building behavior.

The first subject is the risk aversion of management. The more risk averse the management is, the more likely it is to hold on to more cash as it is better prepared for rough times. If management's risk aversion is not perfectly aligned with shareholders, agency costs will occur.

The second subject is the management's interest in holding more cash so it has greater financial flexibility. Larger holding of cash enables the management to spend money on what they want without being subject to capital market monitoring. If they would have to raise debt or equity to spend money, they would have been s debt is under capital market discipline. Therefore, large cash holdings might be unfavorable of the firm as the capital markets are not sure about the true intension behinds management's desire for cash.

The final I will mention, is the so-called "empire-building" hypothesis among managers. Jensen (1986) argues management might accumulate cash because it does not want to pay back to its shareholders, but keep the funds in the firm to have more assets under control. Rather than paying dividends to its owners, managers tend to over-invest based on poor investment decisions or simply just accumulate cash, to control more assets. This happens in times when the firm is facing fewer positive NPV (Jensen, 1986).

One could argue that all of these agency problems are particularly relevant in the U.S. financial crisis, given high levels of holdings after the financial crisis.

2.2.5 Precautionary motives for holding cash

The final theoretical perspective I will review is the precautionary motive(s) or reason(s) for holding cash. One can say that this proposition is mostly interrelated with the transaction cost motive and the agency problem, as a precautionary reason for holding cash, simply put, is to prevent unforeseen cash shortfall in an unpredictable environment. This could be either sizeable losses or times when access to capital markets is costly. Again, the two keywords for the precautionary reasons for holding care are therefore *unforeseen contingencies*. According to Han et. al., (2006), holding cash for precautionary reasons can lead to suboptimal holding levels, particularly among financially unconstrained firms as they find no systematic relationship between holdings cash flow volatility. Therefore, one can argue that precautionary motives can benefit particular stakeholders over the other, hence agency problem can emerge. For example high cash levels might be in managers' and banks' best interest, but at the expense of the shareholders interest.

Based on various definitions of precautionary motives of in the literature, precautionary motives can be summed up as motives for holding cash that can lead to s a suboptimal level of holding cash in order to cope with unseen situation in the future.

2.2.6 Sub-conclusion - theoretical perspectives

As reviewed, there are 4 main theoretical predictions for holding cash. First, is the static trade-off theory or transaction cost motive where an optimal level is found based on the factors effecting the marginal costs and cost of cash shortage. Second, the pecking order theory prediction, where the cash level will only reflect the retained earnings and financing needs in the firm, third and fourth are agency problems and precautionary motives for holding cash that can lead to suboptimal levels.

2.3.1 Investor protection rights

To add to the complexity of the dynamics behind corporate cash holding levels, it is also relevant to address the legal protection right of investors.

There is no doubt that there are wide differences among countries when it comes to the legal rights, i.e. the laws, which protects investors' interests as well as the effectiveness of the judicial system in a particular country. This is important as it affects the ability and the cost of obtaining external finance, which again affects the cash holding decisions in the firm. One of the most acknowledged research on the governing of investor protection is La Porta et. al. (1998)' article "Law and Finance". In their article they examine the quality and enforcement of investor protection laws in 49 different countries. They conduct their research by scoring and then ranking the investor protection rights in each different country within 3 different areas; shareholder rights, creditor rights and enforcement. In the following paragraphs, I will look more into author's findings on shareholder and creditor right in U.S. and Denmark, respectively, as the *implications* of these aspects will be addressed later in this study.

2.3.2 Shareholder protection rights – Denmark vs. U.S.

According to the authors, the common law countries, hereunder U.S., has the strongest legal protection of shareholders based on 9 constructed variables that measures shareholder protection laws. To be more specific, the variables where U.S. scores better than Denmark are the following; allowing proxy votes to by mailed, minority shareholder rights, preemptive right to new issues, and finally anti-director rights. Based this clear finding of La Porta et. al. (1998) I can conclude that U.S. does have stronger legal protection rights for shareholders compared to Denmark.

2.3.3 Creditor protection rights – Denmark vs. U.S.

For creditor right, on the other hand, La Porta et. al. (1998) find that the German-origin countries, Denmark included, have the strongest protection laws. Based on 6 variables, Denmark scores

better than U.S. on 4 of them. For example, one important difference is that Danish firms are required to maintain a certain level of capital in order to avoid automatic liquidation. Furthermore, in Denmark there are also restrictions for management to seek protection from creditors by filing from reorganizing. This is not the case in the U.S. Based on the authors' findings, there is little doubt that the legal protection rights for creditors are stronger in Denmark, compared to U.S.

2.4 Empirical literature study

So far, dominant theoretical perspectives including investor protection rights have been reviewed to help explain cash holdings levels. However, from a researcher's point of view, it's hard to predict cash holding levels through these perspectives alone. The complexity and contradiction in the theories lead researchers measure the by investigating *several* factors influencing cash holdings. By constructing proxy variables that influenced cash holdings, researchers could measure the simultaneous impact on holdings. For example market to book ratio would be a proxy for growth opportunities and intangible asset ratio as uniqueness of the firm. By conducting such analysis, researchers find out how each variable impacted cash holdings, and thereby argue which theoretical prediction that was more dominant in explaining holdings.

One of the "milestone studies" conducted on corporate cash holdings is Opler, et. al (1999). In their analysis, they investigated the cash determinants on 915 American listed firms from 1971-1994, which is a longer time period than most of other studies on this field. Overall, this study finds support for static-tradeoff model suggesting that firms do have an optimal level of holdings, but also that firms that do well tend to accumulate more than the static-tradeoff model would imply. The paper concludes that that firms with greater growth opportunities, riskier cash flow, asset uniqueness and smaller firms tend to hold more cash. Meanwhile leverage, working capital ratio, capital expenditures and dividend spending affect cash holdings negatively. Most of these findings are consistent with the transactional/static trade-off theory; however this will be addressed along with an interpretation of the determinants impact on holdings in the next section.

2.4.1 Determinants for cash holdings

In this section the traditional determinants for cash holdings will be presented and discussed according to the reviewed theoretical propositions. The literature review on each of the variables will be followed with a meta-analysis of the *findings* on each of the mentioned determinants in the literature.

Growth opportunities

By strong growth opportunities means that is it perceived that the firm is facing many profitable investment opportunities. When a firm has strong growth outlooks, the firm can either spend internal funds to finance the investment or to seek external funds to finance it. If outside funding is not existing or too expensive if accessible, the firm could be forced to forgo positive NPV projects. To avoid situation where firms need to cancel profitable investments, they tend to hold more liquid assets such as cash. The cost of being short of cash for growth firms are therefore higher and should therefore hold more cash, which is also true according static trade-off theory.

Also, as Myers and Majuf (1984) points out, firms whose value is mainly driven by their growth opportunities tend to have larger information asymmetry. Consequently, these firms also tend to have more agency costs associated with debt which again discourages shareholders make positive NPV projects. According to financial hierarchy, growth firms should therefore hold more cash to avoid underinvestment.

To further elaborate on Myers and Majuf (1984) point, Saddour (2006) correctly mentions that growth firms have higher financial distress costs as positive NPV projects would disappear in case of a bankruptcy. To avoid these costs, growth firms hold more cash.

Asset Specificity/Uniqueness

Cash holdings are also depending on the uniqueness of its assets. By selling assets firms can raise funds to finance activities and investments. If the firm's assets are costly to convert to cash, firms tend to hold more cash. Firms with mostly firm-specific assets on their balance sheet come under this category. To avoid high liquidation costs when funds are needed, firms with high costs of selling assets are therefore holding more cash (John, 1993). This hypothesis is also accordance with static trade of theory. Dittmark and Servaes (2003) claims that asset specificity can be seen as a proxy for asymmetric information so as firms with high levels of intangible assets and/or R&D expenses can be seen as" more opaque".

Leverage

One substitution of having large cash holdings is to issue debt. If a firm faces short fall of cash, a firm can take on more debt, if it has the ability to do so. According to Ansic and Hey (1993), leverage can therefore be seen as proxy for a firm's ability to issue debt. By having the ability to issue debt, a firm is therefore less dependent of having large cash holdings. From a static trade-off perspective firm's this suggests that cash is expected to be negative correlated with cash holdings. However, higher leverage also increases the probability of financial distress and bankruptcy. To make up for potential incurring financial distress costs, highly levered firms are expected to hold on to more cash. Therefore, the static trade-off model is not clear in predicting the relationship between leverage and cash holdings.

From a pecking order perspective, leverage is negative related with cash holdings. If a firm has investment projects but little retained earnings, the firm will issue debt. Logically when the leverage increases, the cash holdings will fall. On the other hand, when a firm has more retained earnings after all investment needs are funded, the firm will repay debt and accumulate cash.

Size

The size of the firm is also impacting the level of cash holdings. In general, it is expected that the information symmetry is smaller for larger firms, as they have a greater ability to produce and spread information about themselves (Shah, 2011). Therefore, larger firms are expected to have

easier access to the capital markets and thus lower transaction costs of external funding. Furthermore, the literature suggests that the probability of bankruptcy is smaller for larger firms as they are more diversified (Titmann et. al., 1988). Thus, financial distress costs are expected to be lower for larger firms, which again reduce the need for high levels of cash holdings. Miller and Orr (1996) also suggest that larger firms will have economies of in cash management which reduces the need for large cash holdings. From a static trade-off perspective, all mentioned hypothesis suggests that size is negatively related to cash holdings.

The alternative hypothesis is that cash holdings are positively related to firm size. From a pecking order theory perspective, larger firms are in a better position to accumulate cash as they have presumably shown that they able to accumulated retained earnings, i.e. be more profitable, over time.

Cash Flow

Firms with high cash flows can use these as source of liquidity to finance new projects. From a static trade-off perspective these cash flows can be seen as a substitute for cash holdings and thus expect a negative relationship between cash flows and its cash holdings. Contrary to this is the traditional pecking order theorem, that firms with high cash flows will first use them to finance new investments, then repay debt, then pay dividends or purchase own shares and finally accumulate cash. Therefore, according to this perspective cash flow levels is expected to be positively related to cash holdings.

Liquidity/NWC

Levels of working capital in firms also affect cash holdings level. By working capital means the difference between the short term assets and short term liabilities in the firm. Short term liabilities easily be converted into cash and therefore can therefore be seen as a substitute for cash holding. Therefore, one could expect a negative relationship between levels of net working capital (CA-CL) which is accordance with trade-off theory (Al-Najjar, 2011). To add to this, Shah (2011), points out that it is expected that companies with short cash cycles can replenish its cash balance faster, and would therefore face lower risks for cash shortage. Thus, a negative

relationship between the cash conversion cycles and cash holdings is expected. For this thesis, only the levels of NWC will be investigated to test the liquidity hypothesis.

Debt structure

The distribution of long and short term debt also has an impact on the firm's level of cash holdings. According to Teruel and Solano (2008), firms that rely heavily on short term debt needs to renew and negotiate their credit periodically, and are therefore facing the risks associated with refinancing. Companies with high levels of short term financing are therefore expected to hold more cash in order to avoid the financial distress costs that they would incur if refinancing was unsuccessful. This is in accordance with static trade of theory too.

To strengthen the hypothesis above, Flannery (1986) and Kale and Noe (1990) also concluded that firms with higher information asymmetry will use a higher proportion of short term financing. According to Teruel and Solano (2008), this is confirmed by other empirical studies so that short term financing can be seen as a proxy for information asymmetry, and would therefore be positively related to holdings. This also makes sense from a pecking order perspective.

Capex. and acquisition spending

Investments made by the firm are also an important factor for determination of holdings. From a static trade-off perspective, firms want to have as low transaction costs of new capital assets or acquisitions as possible. Therefore it is expected that the investment level of the firm is positive related with cash holdings, as it would avoid spending costly external funds on these projects. On the other hand, financial hierarchy hypothesis would suggest that firms would primarily spend accumulated cash to finance new investment as it will always spend cash before issuing debt. Therefore cash holdings are expected to fall when new investments are made by the firm.

Cash volatility

Cash shortage is more likely in firms with high cash flow volatility. Cash flows can finance operations and investments, so highly unpredictable cash flows can at times put the firm in cash shortage situations. Consequently, in these situations the firm faces costs in terms of bankruptcy costs, forgone positive NPV-projects, forced liquidation costs and more. To avoid such costs, a firm with high cash flow volatility is expected to hold an extra buffer of cash. Therefore, a positive relationship with cash flow volatility is expected. For this thesis, the cash flow of the particular industry a firm is in, is applied in measuring the impact on cash holdings.

Dividends and repurchase of own stocks

Dividend payouts and repurchase of own stocks can affect cash holdings both ways. On one side, firms that pays dividend can raise funds easily at low costs according to Opler, et al. (1999) and would therefore not need to have large cash holdings. Also to the extent that dividends can be used as a substitute for cash, e.g. firms can cut back on holdings when facing cash shortage, dividends are also expected to be negative related to cash Shah (2011). Both hypotheses are in accordance with static trade-off theory. One the other side, cash holdings can also increase with dividend payments or repurchasing of own stocks. If a firm wants to be persistent in its dividend/repurchase strategy and not cut back when facing cash shortage, then the firm will hold large amount of cash. Then the firm can continue paying out dividends or repurchases despite its cash shortage. In this situation, cash holdings will be positive related with dividend/repurchase.

2.4.2 Other factors influencing cash holdings

The listed and discussed determinants are by far the more prevalent and dominant in the literature about cash holdings. First and foremost because they are the one with most impact cash holdings, and the proxy variables for them are accessible therefore possible to measure. However, as a complex matter the study of cash holding is, there are other factors influencing too. In the following, some of these factors will quickly be reviewed but not tested in this thesis.

Opler, et al. (1999) argues that an increase in the firm marginal tax rate increases cost of holding cash, as interest on cash holdings is taxed twice for shareholders (first on corporate level, then capital gain taxes). Furthermore, Teruel and Solano (2008) mention the importance of the firm's relationship financial institutions. Stronger relationship between banks and the borrowing firms reduces the information asymmetry and agency problems as the banks can establish more valuable information about their clients. Therefore the availability of credit as well as the conditions on the debt can improve for such firms. Another important finding is by Ramirez and Tadesse (2009) who claims that firms in countries that operate in countries with a culture of high uncertainty avoidance, e.g. low tolerance for uncertainty and ambiguity, will be less willing to take risk and therefore hold more cash as a hedge against unfortunate events. Their research therefore concludes that national culture can affect cash holdings; meanwhile that multi-nationality of firms can moderate the effect of national culture.

2.5 Meta analysis of findings on cash determinants

So what are the actual findings on the impacts of the various factors influencing corporate cash holdings? Since the milestone research of Opler et. al (1999), there have been conducted numerous of similar studies on cash holdings. To get a better understanding and overview over the impact of the discussed variables, a meta-analysis of the researchers' findings will be presented in the following paragraphs.

In all studies, the dependent variables have been the cash holding ratio, cash/total assets or the natural logarithm of it. Therefore, the *sign* in the meta-analysis indicates whether the constructed proxy variable (explanatory variable) has a positive or negative beta coefficient in the statistical model. For example according to Ali et.al (2013) market-to-book, proxy for growth opportunity, has a positive impact on cash holdings. To indicate the most prevalent sign of each of the variables, I have summarized the findings with the most dominant sign across all studies.

The meta-analysis consists of nine empirical studies, which have been made in the period from Opler et. al., 1999, until Liao et. al (2013). It is important to emphasize the papers have researched on cash holdings over different time periods and in different regions/countries.

Meta-analysis of cash determinants

Academic paper	Growth Opp.	Size	Leverage	Asset specificity/ Uniquness	Capex Spending
Opler et Al. (1999)	+	-	-	+	+
Ali et. Al. (2013)	+	-	-		+
Saddour (2006)	+	-	-	+	-
Belgithar et Al. (2011)	+	-	-		
Solano et al. (2008)	+	-	+		
Lioa et Al. (2013)	+	-	-	+	-
Dittmar et Al. (2005)	+	-		+	
Shah (2011)	+	+	-		
Shah (2013)	-	-	+		
Dominant sign:	**+**	**-**	**-**	**+**	***None***

Figure 3 *The figure shows the first half of the meta-analysis of the cash holding determinants among 9 different studies. The bottom line shows the most prevalent sign on the determinants among all of studies. Source: The mentioned studies.*

Academic paper	Cash Flow	Liquidity(NWC)	Cash flow Volatility	Dividend/repurchase	Debt maturity (Proportion of short term debt)
Opler et Al. (1999)	+	-	+	-	
Ali et. Al. (2013)					
Saddour (2006)	+	-	+	+	
Belgithar et Al. (2011)		-	+	-	
Solano et al. (2008)	+	-			+
Lioa et Al. (2013)			+	-	+
Dittmar et Al. (2005)	+	-			
Shah (2011)	+	-		+	
Shah (2013)	+	-	+	-	
Dominant sign:	**+**	**-**	**+**	**-**	**+**

Figure 4 *The figure shows the second half of the meta-analysis of the cash holding determinants among 9 different studies. The bottom line shows the most prevalent sign on the determinants among all of the studies. Source: The mentioned studies.*

As it appears in the analysis, growth opportunities have a positive influence on cash holding. It is also found that asset uniqueness, cash flow and cash flow volatility also positive related with cash

holdings. So does the proportion of short term debt. Meanwhile, as expected, most studies also indicate that size, liquidity and leverage have a negative impact on holdings. Interestingly enough, mixed results can be found on dividend/stock repurchase and Capex-spending.

It could have been interesting to look at the actual values so see the level of the impacts of each variable and calculate an average. However, it would not make sense due to the different regression methods and proxy variables the researchers have applied. For example some use the natural log of cash/assets as the dependent variable, while some does not. Also some researchers have used R&D expenses as proxy for asset specificity while other have used intangible asset ratio. Thus, the values would not be fully comparable.

2.5.1 Meta –analysis - put in perspective

As shown in the meta-analysis, some determinants seem very clear and consistent meanwhile others yield more mixed results. It amplifies the complexity of the dynamics behind corporate cash holdings, as well as possibly also omitted factors that are also influence holding levels. Furthermore, this meta-analysis also gives me a benchmark to which I will apply in constructing my hypotheses.

2.6 Cash holdings under abnormal conditions

So far, this thesis has shown that there are certain firm specific variables that influence their cash levels under normal conditions. It is therefore relevant for this thesis to understand how cash holdings are affected by a severe chock to the economy. To gain understanding of the impact of the crisis had on U.S. and Denmark and its corporations, a full section of the financial crisis and its impacts are outlined.

From then on, literature on corporate cash holdings in relation to the crisis will be reviewed and hypothesis will be presented.

3.1 The financial crisis – from the beginning

Before reviewing the financial crisis impact on cash holdings, I will now address the crisis in general. In this section I will outline the main events causing the crisis along with a discussion of the as impact it had on the U.S. and DK economy as well as corporations.

One of the early signs of the crisis was the liquidation of two of Bear Stearns hedge funds in July 2007. These hedge funds, primarily invested in so-called subprime mortgage loans[4], had lost more than 90% of its investor capital and filed for bankruptcy on July 31th (Kacperczyk et., al., 2007). This caused more than a 3 billion dollar in loss for investors. The liquidations of these two hedge funds could be seen as the true danger of investing in these rotten mortgage loans.

In the short aftermath of the bankruptcy of the two hedge funds, a number financial institutions reported severe losses on their subprime mortgage loan portfolio. However, these mortgage instruments where not only on banks' balance sheets; investment banks had been repacked these loans as CDO's and sold these "investment packages" to insurance companies, public and private mortgage banks as well as investment banks. As so many financial institutions were exposed to these subprime mortgages, a huge distrust in the financial markets emerged resulting in a liquidity and credit crisis for the involved parties. As a consequence, the British bank Northern Rock got bailed out by its government due to insolvency in February 2008, followed by a FED-supported sale of Bear Stearns to JP Morgan in March 2008. Also the interbank rate fluctuated a lot in this period, indicating the severe distrust between banks.

Followed by the sale of the bankrupt Bear Stearns was the default of the giant investment bank Lehman Brothers in September 2008. Despite having reduced leverage factor from 32 to 25, the bank had a combined loss of 6,74 $ billions in the second and third quarter, primarily driven by write downs on loans (Lartey, 2012). Unsuccessful negotiations with potential takeovers and a feasible bailout plan by the government, the bank declared bankruptcy on September 15th 2008. Following Lehmann's collapse, a meltdown of the global financial markets just started.

In the short aftermath, the interbank rates continued to rise despite the government efforts to inject liquidity into the banking system. This again led to a freeze in the credit system as the

[4] A high-interest mortgage loan type for individuals that did not qualify for traditional mortgage loans

lending volume fell drastically, according to Ivashina & Scharfstein (2010). In order to strengthen the confidence in the financial sector, the U.S. government initiated TARP (Troubled Asset Relief Program) which was signed by law in October 2008. The program allowed the U.S. government to buy or assets and equities or insure assets in financial institution up to 700$ billion. Following the announcement, the interbank lending rates fell as some more confidence in the credit market was gained. However, the severe consequences of the credit crunch were already spread in the global financial system causing a global financial crisis.

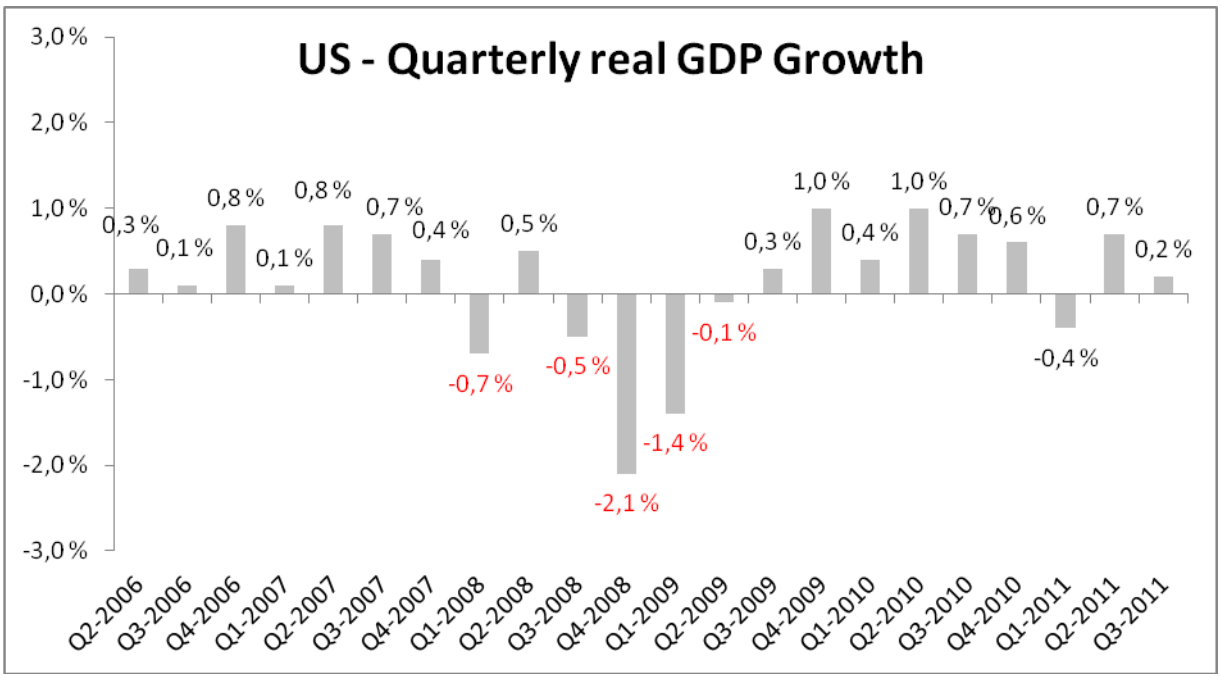


Figure 5: *The figure shows the quarterly GDP growth in the U.S., adjusted for inflation, % change from previous quarter from Q2 2006 to Q3 2011. Source: OECD iLibrary, Statextracts database*

As shown, the impact of the financial crisis on the U.S. economy was profound, particularly in the period of Q3 2008 to Q1 2009. Annualized and not adjusted for inflation the U.S. economy had a negative GDP growth of 2,0 %, 8,3% and 5,4%, respectively. Stock markets also fell rapidly in this period, with the S&P 500 falling to its lowest levels in ten years[5].

[5] Google Finance, see appendix 1 for source.

Before addressing the direct consequences the crisis had on corporations, a brief background on financial crisis in Denmark will be addressed. This will also help us understand the true impact it had on cash holdings.

3.2 Financial crisis in Denmark

Many would characterize the economic situation in Denmark to be very good, both in terms of growth, unemployment, solid wage development and consumer development in the pre-crisis period (Rangvid, 2014). Just like in the U.S., Denmark had experienced a solid rapid growth in the housing market with prices going up by 200% for commercial real estate, 105% (owner flats) and 85% (single family house) from 2000 to 2007 (EVM, 2013)[6]. As implied by Rangvid (2014), this strong and rapid growth in the housing was partially caused by pro-cyclical regulatory policy of the financial sector, enabling buyers to finance their new homes with interest-only mortgages.

The unseeingly sustainable high growth lead high level of "optimism", both among politicians, credit institutions, credit agencies, businesses and households (EVM, 2013). This widespread optimism affected institutions, households and business to underestimate the real risk on different types of assets (Rangvid, 2014). With an overheated Danish economy, it was not doubt that a housing bubble was looming. Meanwhile the housing bubbles rose, the National bank and the Danish FSA underestimated both the solvency and the liquidity risks in the Danish commercial banks (Rangvid, 2014). Thus, the seriousness of the crisis was not predicted by relevant institutions and authorities.

When the global financial crisis escalated to Denmark in Q3 2008, essential parts of the Danish Banking sector was heavily hit. Particularly medium and small sized banks that were largely exposed to the commercial real estate loans as well as owner occupied flat loans. Another problem was the huge deposit deficit facing both large and small banks (Rangvid, 2014). This had leaded Danish banks raise liquidity in the international money markets in the years leading

[6] Erhvervs og vækstministeriets (in English: The Danish Ministry of Business and Growth) presentation on the causes, consequences and lessons of the financial crisis in Denmark 2013, page 6. See bibliography.

up to the crisis. As these sources of liquidity suddenly dried up in autumn 2008, the whole banking sector was faced severe liquidity issues on top of loan impairments.

One of Denmark's biggest banks, Danske Bank, was particularly in trouble. In addition to the bank's high equity leverage, the bank had expanded its business including its real estate lending to Ireland and the Baltic's through acquisitions and fusions. As it would turn out, these countries had big housing bubbles. In 2008, the bank had accumulated a deposit deficit of 350 billon DKK, which was more than half of the combined deposit deficit in the Danish Banking sector. (EVM, 2013). The bank was therefore in a very vulnerable situation, facing severe liquidity problems followed by massive loan impairments. Given the size of the bank, it would have put the whole Danish economy at risk if the bank would not meet its obligations (EVM, 2013). However, the government bailed out Danske Bank, along with many other banks, thought a government guaranteed loan. This solved the liquidity problem of Danske Bank.

A total of 62 banks ceased between 2008 and august 2013 and 6% sector balance disappeared in during this period (Rangvid, 2014).

Just like in the U.S., the crisis had severe effects on Danish economy, causing a deep recession. For 6 consecutive quarters, Denmark experienced negative real GDP growth with the quarters from Q4 2008 to Q2 2009 being the worst quarters.

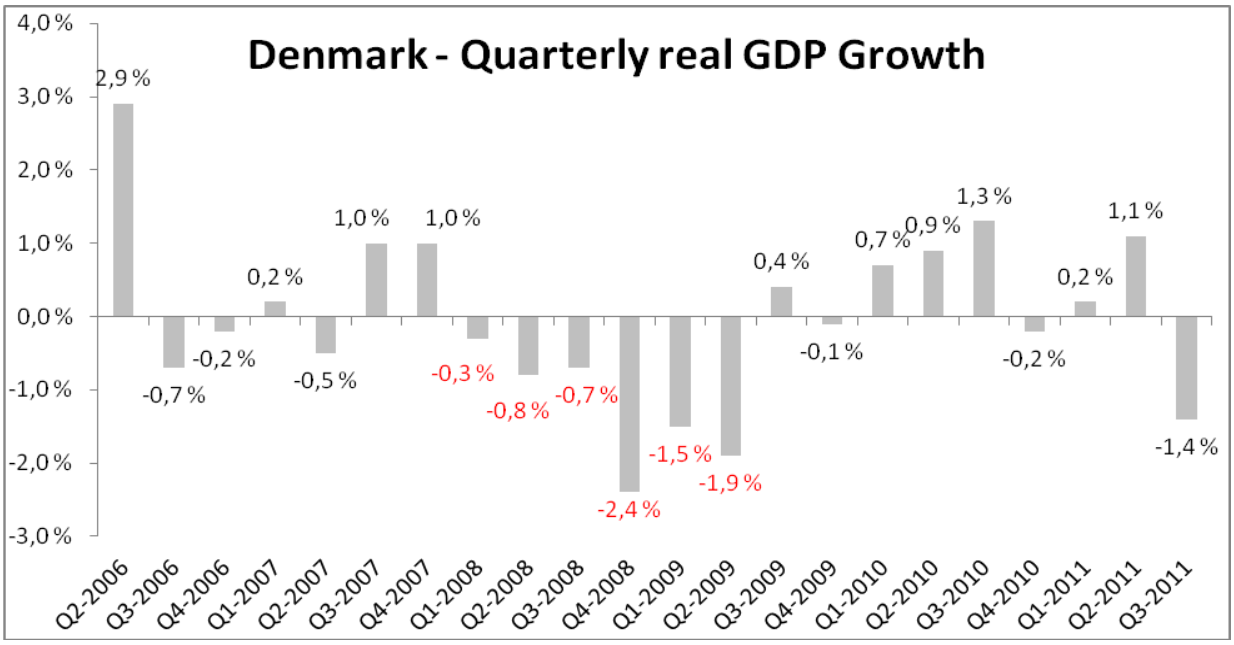


Figure 6 *The figure shows the quarterly GDP growth in Denmark, adjusted for inflation, % change from previous quarter from Q2 2006 to Q3 2011. Source: OECD iLibrary, Statextracts database*

3.3 Financial crisis' impact on corporations and cash holdings

This section will provide a short review and analysis of the general impact the crisis had on corporations as well as the existing literature on cash holdings in relation with the crisis. As the focus for this thesis is the post-crisis period, literature covering the effects coming from out of the crisis will be emphasized. Even though the literature is a bit limited and still ongoing in this period, there are still some valuable researches covering the effect of the financial on cash holdings. In combination with the meta-analysis this review will enable me to determine the hypotheses.

3.3.1 General implication on corporations

As the financial crisis was wide-spread, the effects on corporations were inevitable. Firstly, external finance suddenly became much more limited due to the liquidity and credit crisis in the banking sector. As a consequence, banks were suddenly were forced to deleverage or raise new equity in order to survive, and naturally this would effects the bank's lending supply. Refinancing and renewal of credit lines suddenly became a huge issue for corporations, as banks cut back on lending. According to Campello et. al (2010), the credit crunch affected corporations both in terms of limited financing in general as well as a higher cost of finance.

Second effect, which is reflected in the GDP numbers, is the reduction in demand of goods and services. Many people had lost their jobs, and have experienced significant value loss on their home. As businesses and households were forces to hold back on spending, this obviously chocked most corporations and their operations and investment plans.

Finally, it is worth mentioning how the financial markets influenced the corporations. The enormous fluctuations in the stock markets increased uncertainty for corporations. Both the American and Danish stock markets experienced higher volatility levels than normal during the crisis, reflecting the panic in the financial markets. In relation to this, is an investigation on whether high cash holdings are a result of higher sensitivity towards cash flow volatility in the post-crisis period. Such investigation will be conducted later in this paper.

3.3.2 Effect on cash holdings

Hahle and Stulz (2012) studied the impact of the crisis on corporations' access to capital and investment. They find that both capital expenditures and corporate borrowing fell drastically during the crisis, however not more higher for bank-dependent, highly levered firms as one would expect. Given the dried up credit markets, the authors expect a substitution from debt finance to equity finance, but find not support for this hypothesis. Instead corporations increased

their cash holdings as an alternative way of financing. This applies particularly to bank dependent firms' hoard up cash, compared to unlevered firms. Finally, the authors find that cash heavy firms decrease their investments more than highly levered firms following the Lehman bankruptcy, which can imply the lack of growth opportunities due to the drop in demand.

Ivashina and Becker (2014) investigate the effects of the chock in the banking lending supply during the crisis. They find that banks apply much tighter credit standards after the Lehman fall compared to pre-crisis. Their studies show that credit supply from banks is very cyclical to the macro environment, and therefore fell drastically during the crisis. On the other hand, bonds and commercial paper tend to be less sensitive to the macro environment. Therefore during a crisis, *larger firms* tend to shift from banking credit borrow to bonds *because they have the opportunity to do so.* Hence, it is expected that *smaller firms needs to increase holdings as* it is harder for them to access to the bond markets.

Furthermore, Pinkowitz et al. (2013) also investigate crisis' impact on cash holdings. They find that *cash holdings will rise for the most profitable firms* in a post-crisis period. Such cash accumulation is consistent with the view of lack of investment opportunities and reluctance of managers to pay out to the shareholders, hence agency problems emerge.

Finally, is a research article on the Asian financial crisis and its effect on cash holdings (Song et., al., 2007). They find that Asian firms hold more cash in the post-crisis period as they become more "conservative"; they reduce M&A and capex-activities, and are more sensitive towards cash flow volatility in the post crisis period. Their results applies all firms, not dependent on how financially constrained the firm is. Therefore, their results are partially consistent with precautionary motives for holding cash. Finally, they also *find that dividend paying firms increase cash holdings more* by decreasing investments relative to non-dividend paying firms, which can also be interpreted as a precautionary reason to ensure dividends to be paid out in the future.

3.4 Definition of period of the financial crisis

In this section the time period of the financial crisis will be discussed and determined. Defining the actual period of the crisis also enables me determine the pre-crisis period as well as the post-crisis period, which is essential this research.

As addressed earlier, the main impact of the financial crisis on corporations was the difficulty to obtain external finance. As a result of this, many companies faced a liquidity issues as they couldn't refinance or obtain new loans to finance operations and make new investments. For corporations, the financial crisis is therefore often referred as the liquidity crisis. One way to measure these the liquidity issues that corporation faced is to analyze the development of the so-called TED Spread.

The TED Spread is defined as the difference between the interbank interest rate, LIBOR denoted in Eurodollar, and the U.S. government bond. Both papers have a 3- month maturity. The spread indicates the perceived credit risk among banks. While the U.S. Government bond is considered to be risk-free, the Libor indicates the risk of lending to commercial banks. Therefore if the gap between the two rates increases, it is an indication that lenders think the risk of default on interbank loans is increasing and are seeking towards safer investments like the U.S. government bond.

In the period 2003-2013 period, the Ted Spread typically fluctuated around 35-50 basis points, while the curve had a peak of 465 (!) basis points during the last quarter of 2008.

Van der Kooij (2014) defined the period of the crisis to be from end of Q2 2007 until end Q2 2009 based on analyzing the Ted Spread development between 2003 and 2013. In his analysis, he calculated the average TED Spread in this period to be 35 basis points with an standard derivation of 15 basis points. He defined the period of the crisis where the spread stayed above its 95% confidence interval. As seen in the figure 7, the Ted Spread broke the 95 % confidence interval in mid 2007 and did not go below the limit before mid 2009.

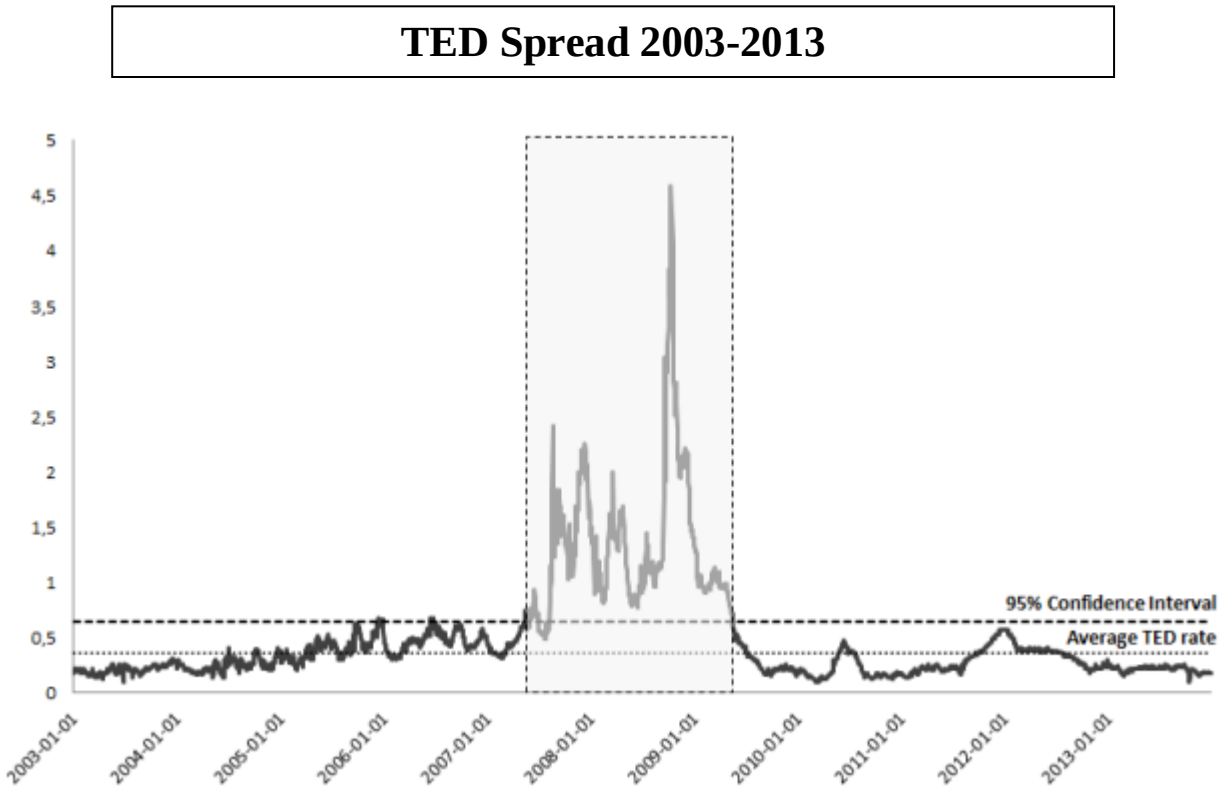


Figure 7 - *The figures shows the TED-spread development from 2003 to 2013. The shadowed grey area is the defined period of the financial crisis (mid 2007 – mid 2009), based on the time period where the Ted Spread is above its 95% confidence interval. The Y-axis indicates the TED spread itself in %. Source: Van Der Kooij (2014), page 21.*

Again, the Ted Spread is a good measurement of the health of the U.S. credit market. As this study is based on quarterly financial data, I define the financial crisis in the U.S. as the period between Q3 2007 to Q2 2009, both quarters included.

3.4.1 Period of the crisis in Denmark

To define the period of the crisis in Denmark, one could first argue that the Danish economy and listed corporations in general are very exposed to the U.S. economy. One would expect that especially large cap companies in Denmark would be directly hit since they have access to the U.S. credit markets. However, to conduct a more accurate time definition of the crisis, the Danish equivalent to the U.S. Ted Spread should be applied.

The Danish equivalent would be the spread between the LIBOR with 3 month maturity, which is the interbank rate, and the overnight indexed swap rate (OIS), which is a fixed rate for overnight lending between banks (Gunnarsson, 2013). No principal is exchanged in the OIS and it is traded only at maturity, therefore very little default risk is perceived.

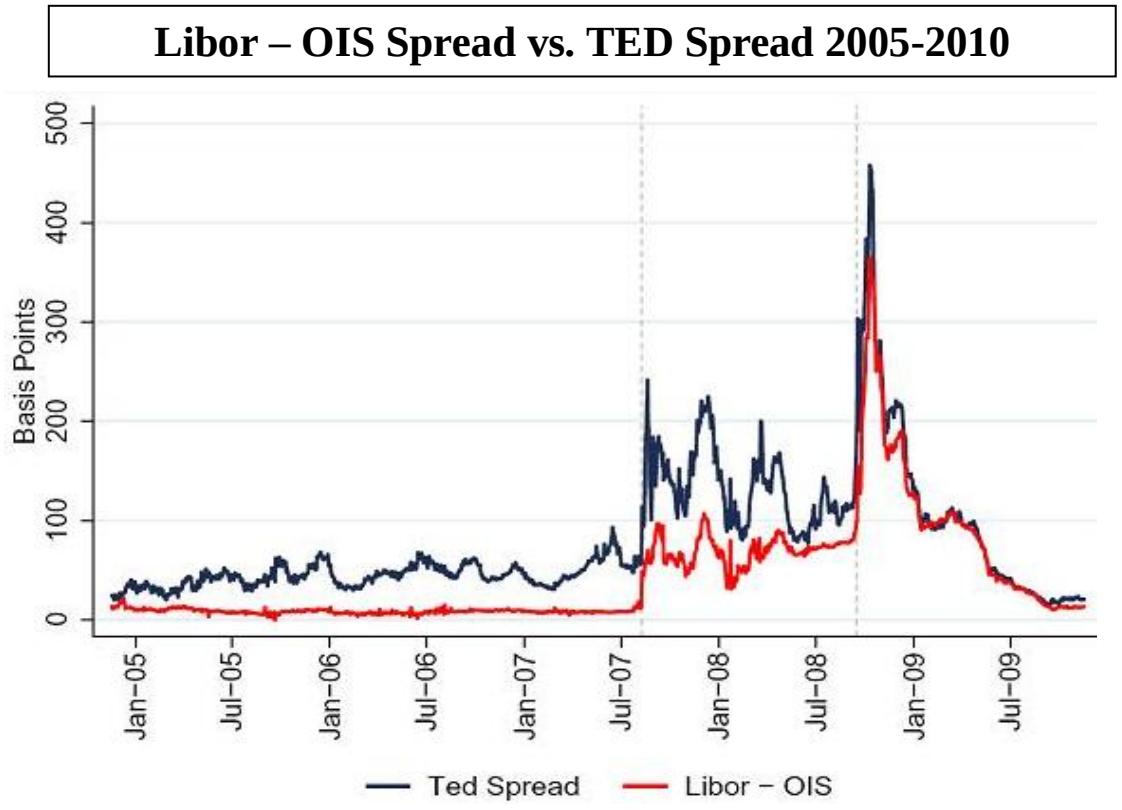


Figure 8 – *The graph shows the tight correlation between the Ted Spread (in blue) and the Libor-OIS spread (in red) between 2005 and 2010. Source: Centre for Economic research' policy portal: voxeu.org*

As seen in figure 8, the Libor OIS spread is highly correlated with the U.S. Ted Spread. Based on this, time period of financial crisis in Denmark is therefore defined as the same as in the U.S.; from Q2 2007 until Q2 2009.

As the period of the financial crisis in the two countries have been determined, the pre- and post crisis period can also be defined. Given the availability of data, the pre-crisis period is defined as the period from Q1 2004 to Q2 2007 (both quarters included), while the post-crisis period is defined as the period from Q3 2009 to Q4 2013 (both quarters included).

4 Hypotheses

Given the literature review including the meta-analysis and the section about the financial crisis, my hypotheses on the cash holding determinants can now be presented. Testing the hypothesis will enable me hypotheses will enable me to further gain understanding about the dynamics that could explain the contrary holding development in the two countries. As shown, the hypotheses are divided into a pre-crisis period (Q1 2004 – Q2 2007) diagram and a post-crisis period (Q3 2009 –Q4 2013) diagram.

Here are the pre-crisis hypotheses which are primarily based on the meta-analysis:

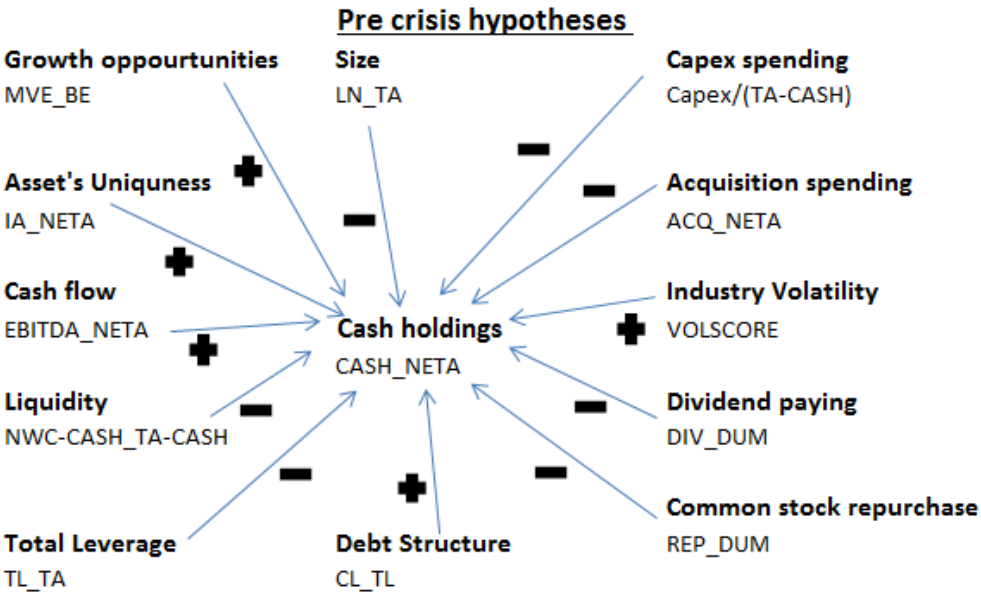


Figure 9 - *The figure shows the expected relationship between various firm-specific determinants and cash holdings for the pre-financial crisis period. Source: Own contribution*

Subsequently, here are the post-crisis hypotheses where both the meta-analysis and the literature review on the crisis is taken into consideration. Highlighted in red circle are expected changes.

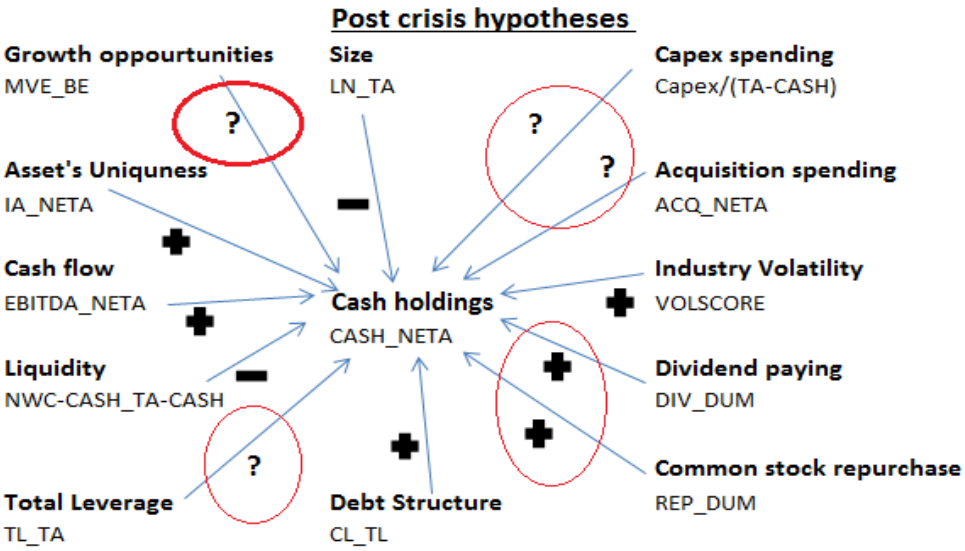


Figure 10 - *Likewise, the figure shows the expected relationship between various firm-specific determinants and cash holdings for the post-financial crisis period) Source: Own contribution*

5. Data

All data is downloaded from the database Compustat, which have given me access to all necessary financial historical data. Accurate and trustworthy data is essential in conducting thorough analysis. Compustat database is very acknowledged and used by researchers all across the world consistently referred to in various research papers. Access to the database is given through CBS's cooperation with Wharton Research Data Center in the U.S.

As mentioned in the scope and limitation section, all publicly listed companies in Denmark and the in U.S. in the defined pre-crisis and post-crisis period, except financial and utility firms, have been included in this thesis. Inclusion of 2003 data in the pre-crisis period would possibly been beneficial, but the dataset with all U.S.-listed firms was already very large, and it would slow down my processing of all the data. Again, quarterly corporate data have been collected, i.e. items from the income statement, balance sheet as well as cash flow statement.

The final dataset consists of a total of 107 Danish firms and 9733 American firms.

5.1 Variables

In the following table is the revisited list of all of the firm specific cash determinants and its definitions. Thereafter, each of the proxy variables will briefly be commented on its construct.

VARIABLES

Firm specific measure	Proxy measure	Definition of variable
Cash holding level (1)	*CASH_NETA*	*(Cash / (Total Assets- cash)*
Cash holding level (2)	*LnCASH_NETA*	*Ln(CASH/TA-CASH)*
Growth oppourtunities	MVE_BE	MV equity/(TA-TL)
Asset's specificity	IA_NETA	Intangible assets/(TA-Cash)
Size	LN_TA	LN(TA)
Cash flow	EBITDA_NETA	EBITDA/(TA-CASH)
Liquidity	NWC-CASH_TA-CASH	(NWC-CASH)/(TA-CASH)
Total Leverage	TL_TA	TL/TA
Debt Structure	CL_TL	Current Liabilities/TL
Capex spending	Capex/(TA-CASH)	CAP_NETA
Acquisition spending	ACQ_NETA	Acquisitions/(TA - CASH)
Industry Volatility	VOLSCORE	Score given (0.00-1.00) depending on volatility for that specific NAICS code
Dividend paying or not	DIV_DUM	If dividend paid that year : value 1, if not: 0
Common stock repurchase	REP_DUM	If stocks repurchase that year: value 1, If not: 0

Figure 11 – *The figure shows all of the firm specific cash determinants along with its proxy measure and definition construct. Source: Own contribution*

5.1.1 Definition of variables

Cash holding level

As input of to the level of cash holdings is the Compustat's variable "Cash and short term investments" been applied. What is mean my "short term investments" is highly liquid marketable securities, that can be liquidated in to cash in short time. By dividing the cash variables by "Total Assets" less "Cash and short term investments", the level of cash in a particular quarter is reached. For the sake of the robustness test in panel data study, the variable also takes form in natural logarithm of the variable.

Growth opportunities

The proxy measure variable for growth opportunity is the market price of the equity in the firm divided by the book value of the equity. This variable can also be seen as a proxy of overvaluation and to some extend information asymmetry.

Asset Specificity/Uniqueness

The uniqueness/asset-specificity of the firms is measured by the amount of intangible assets the firm holds, relative to its total assets less cash. As it is hard to evaluate the true value of an intangible asset, such as brands, copyrights, goodwill and so forth, the intangible can also be seen as a proxy for information asymmetry.

Size

The size variable is constructed by taking the natural logarithm of total assets of the firm. By taking the natural logarithm, the span of variation gets reduced and rescales the absolute numbers.

Cash flow

The level of cash flow is simple measured by dividing earnings before interest, taxes, depreciations and amortization, EBITDA, divided by total assets less cash. In short, it measures the profitability of the operations of the firm.

Liquidity

Liquidity is measured by the level of net working capital (Current assets minus current liabilities) less cash divided by total assets less cash.

Total Leverage

The leverage of the firms is defined as the total liabilities relative to the total assets of the firm.

Debt Structure

Debt structure, or short term debt ratio, is defined as the proportion of current liabilities to total liabilities in the firm.

Capital expenditures

The level of firm's spending on capital expenditures as the actual spending relative to total assets less cash.

Acquisition spending

Defined identically to Capex. variable; acquisition spending relative to total assets less cash.

Industry volatility

Industry volatility indentifies the cash flow volatility on the industry that the firm belongs. The standard deviation of EBITDA of every industry (based on the NAICS-code) on quarterly basis from 2003 to 2013 has been calculated, and a score from 0 to 1 is given. Values closer to 0 indicates that the firm belong to a low-volatile industry, and thus values closer to 1 indicates that the firm belongs to a high-volatile industry. The reason a score was given, and not the absolute volatility numbers, was the very huge span (with many outliers) between the industries which might have distorted the regression study. The score system reduces the span.

Dividend dummy

If the company has paid out a dividend in a particular year, value of 1 of the variable is given for all of the quarters that particular year. If not, 0 is given for all quarters. This method is applied to ensure there is no distinction between firms that pays out on a quarterly basis and those that pays out annually.

Repurchase dummy

Same method as for dummy dummies; value of 1 is given if own stock were repurchased that year, and value of 0 if not.

6 Descriptive Analysis

In this section descriptive statistics regarding the abovementioned variables will be analyzed and discussed, hence relevant graphs and statistics will be presented for each of the two countries.

This part will present the overall development in cash holdings in the two countries as well as the descriptive statistics of the firm-specific data sample in this study. This is an important first step compare and analyze both the development and to point out specific differences between the two countries. Based on the defined period of the financial crisis this section is divided into a pre-crisis section and a post-crisis section.

6.1 Pre crisis – period (Q1 2004- 2007Q2)

The following graph shows the average (based on Q1-Q4 for each year) aggregate cash holding levels in listed companies in U.S. and Denmark, respectively. Hence the sum of all cash holding on the balance sheets of companies as a ratio of sum of total assets. Looking into the development of this ratio can be seen as the "big picture" of how cash holdings have changed in the period.

6.1.2 Aggregate cash holding development among U.S. – listed firms

As figure 12 shows, despite relatively stable levels, a gradual decline in the aggregate cash holding ratio from about 10% to below 9% from 2004 to 2008.

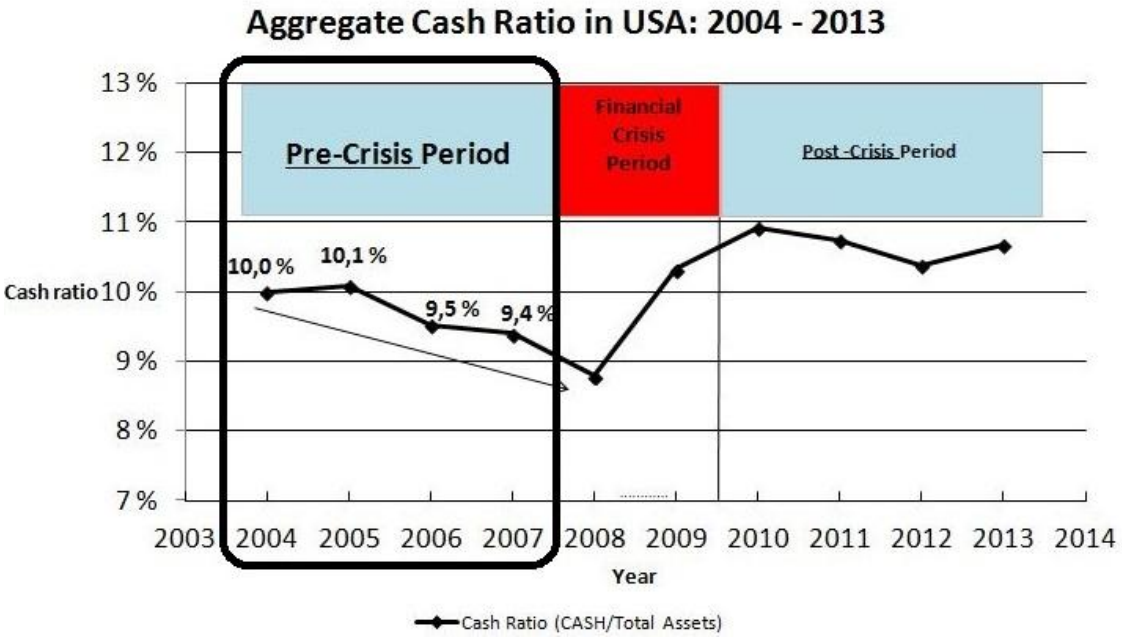


Figure 12 - *Aggregate cash ratio of all U.S. listed companies in the period of 2004 – 2013 both years included. Source: Compustat.*

6.1.3 Aggregate cash holdings development among DK – listed firms

The aggregate levels of cash in listed Danish firms are apparently more volatile than the American ones, going from 7,8% in 2006 to 10,8% in 2007. However, trend wise the aggregate levels is also declining going from 9,4% in 2004 to 8,2% as the average aggregate level in 2008.

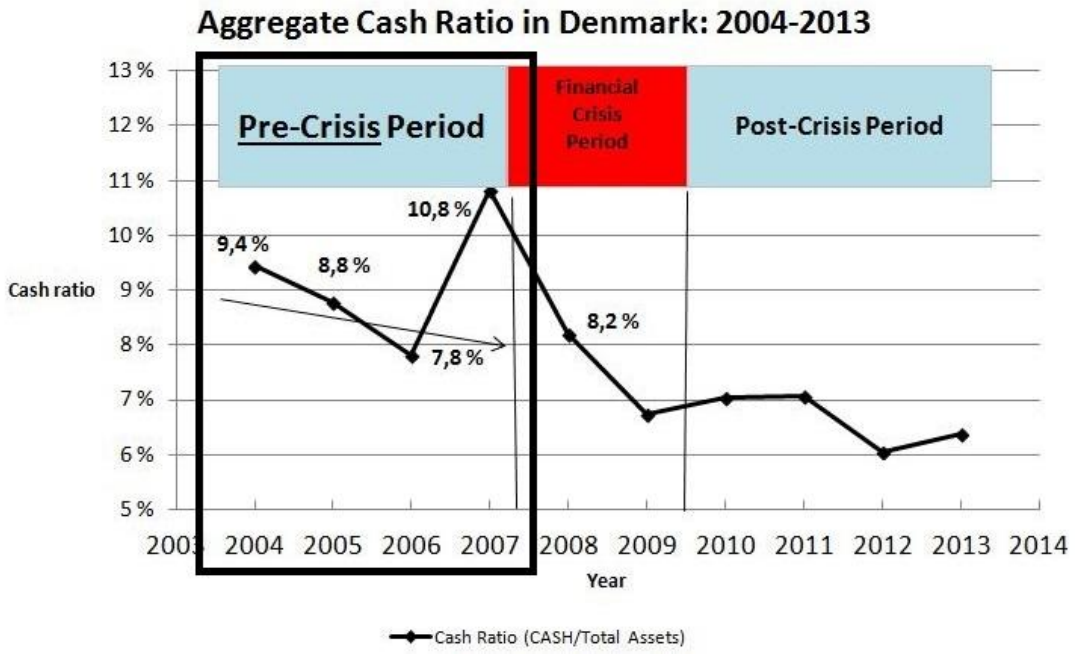


Figure 13 - *Aggregate cash ratio of all Danish listed companies in the period of 2004 – 2013 both years included. Source: Compustat.*

6.1.4 Descriptive statistics of firm-specific variables

As I now have established a view on the "macro development" of corporate cash holdings in U.S. and Denmark, I will now investigate the constructed firm-specific proxy variables in the two countries. As introduced in part 3, these are also the main data for this thesis. Such analysis will help me get a first impression of the data sample as well as a possibility to point out some differences that would be interesting in relation to the hypotheses.

As there are outliers in the data set, the table includes various quartile levels to give most accurate picture of the data sample. It would be interesting to see some of the average values as well; however some of these values would not be giving the right impression due to outliers.

Firm specific variables - before crisis (Q1 2004 - Q2 2007)

	DK				US			
VARIABLES	25% Quartile	Median	75% Quartile	Std.dev.	25% Quartile	Median	75% Quartile	Std. dev.
CASH_TA	0,013	0,048	0,161	0,185	0,037	0,129	0,356	0,255
CASH_NETASSETS	0,029	0,073	0,255	0,923	0,038	0,148	0,551	1,235
Growth_ MarketBook	1,115	2,015	4,050	4,421	1,249	2,215	3,904	20,321
Size_LogTA	5,882	7,089	8,544	1,953	3,336	5,180	6,914	2,683
Leverage_ TLTA	0,359	0,527	0,643	0,320	0,283	0,492	0,711	4,799
Debt structure_CLTL	0,378	0,651	0,785	0,293	0,343	0,621	0,911	0,307
CashFlow_NetAssets	0,000	0,022	0,046	2,202	-0,012	0,024	0,049	10,738
Capex_NetAssets	0,000	0,009	0,041	0,246	0,007	0,021	0,051	0,152
AcqusitionSpend_NetAssets	0,000	0,000	0,007	0,036	0,000	0,000	0,010	0,248
Liquidity_NWC -CA_NetAssets	-2,050	-0,910	0,434	0,790	-3,264	-1,907	-0,595	2,102
IntangibleAssets_NetAssets	0,000	0,025	0,123	0,136	0,000	0,078	0,320	0,233
Industry Vol Score.	0,083	0,083	0,500	0,264	0,249	0,500	0,800	0,193
	Sum of dummies	% of total obs.			Sum of dummies	% of total obs.		
DividendDummy	105	10,0 %			18945	25,7 %		
Repurchasedummy	167	15,9 %			11467	15,6 %		
Total # of observations:	1050				73667			

Figure 14 - *Overview of statistics on the firm-specific variables in Denmark and the U.S. in the pre-crisis period. Source: Compustat.*

As shown in figure 14, U.S. companies has a generally higher cash holding level than Danish firms, regardless of whether cash is a ratio of total assets less cash or only total assets. Growth opportunities, where market to book has been used as proxy, shows the levels are pretty similar in both countries. As size is measured in DKK and USD, respectively, the absolute numbers in the statistics are lower for the U.S. firms. However given an exchange rate of 5,5 DKK it is evident that the median size of a Danish firm in this sample is actually higher than the U.S. firms. The reason for this is the inclusion of all U.S.-listed firms which includes many small cap firms out of the total 9733 U.S. firms. In terms of leverage and levels of short term debt, both values are slightly higher in the U.S.. Cash flow to Total assets less cash ratio are not clearly different in the two countries, however there is more variation in the U.S. data. Furthermore, both capex. and acquisition spending as well as intangible asset ratio is in general higher in the U.S. as well as companies belong to industries with higher cash flow volatility. Companies in the U.S. are pay substantially more often dividends compared to Danish firms, as the data sample shows that U.S. firms pays dividends 2,5 more often than Danish firms. However, similar levels are found for repurchase of own stocks.

6.2 Post crisis – period (Q1 2004- 2007Q2)

For now, I have been assessing pre-crisis data to create a basis of comparison for the essential part of this study; the development in the post-crisis period.

6.2.1 Aggregate cash holding development among U.S. – listed firms

Aggregate cash ratios in the U.S. have risen after the financial crisis. As shown in figure 15, aggregate cash holdings have bounced back and exceeded the pre-crisis levels after the financial crisis.

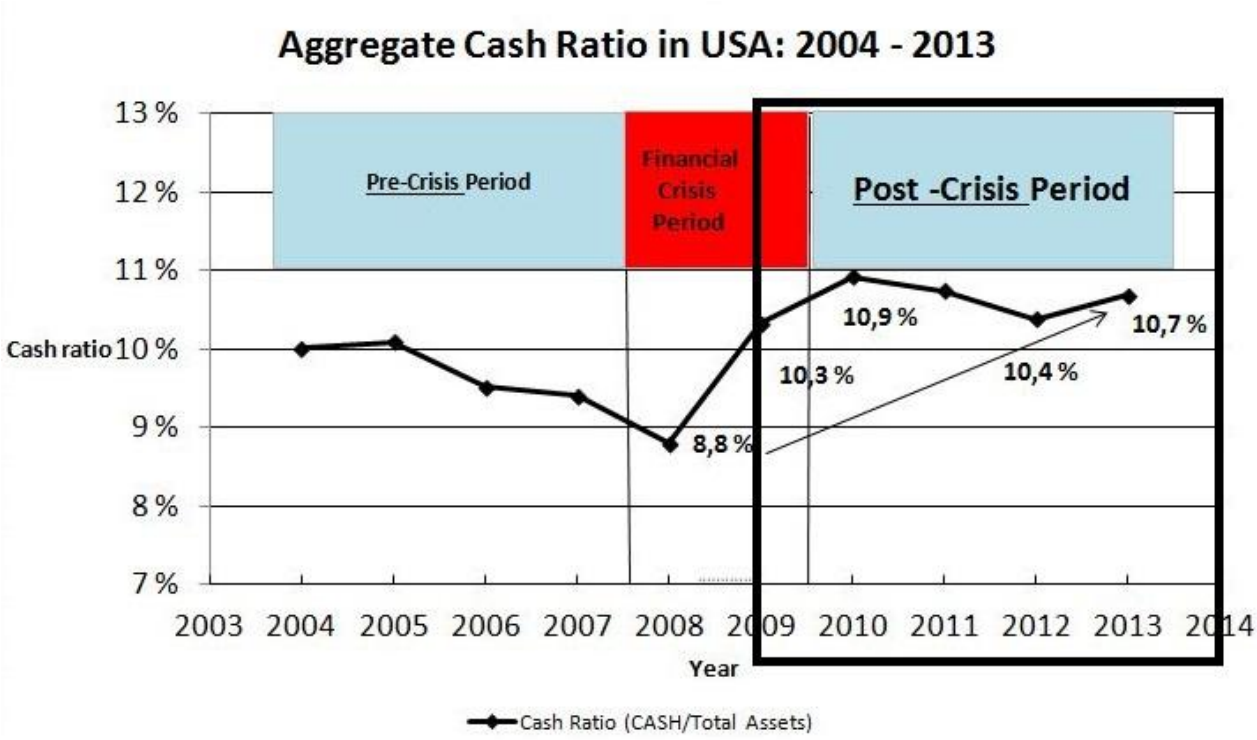


Figure 15 - *Aggregate cash ratio of all U.S. listed companies in the period of 2004 – 2013 both years included. Highlighted is the development in the post-crisis period. Source: Compustat.*

6.2.2 Aggregate cash holding development among DK – listed firms

As contrary to the development in the U.S., the aggregate development in Denmark has not gone back to its pre-crisis levels but continued to *gradually decline* in the post-crisis period.

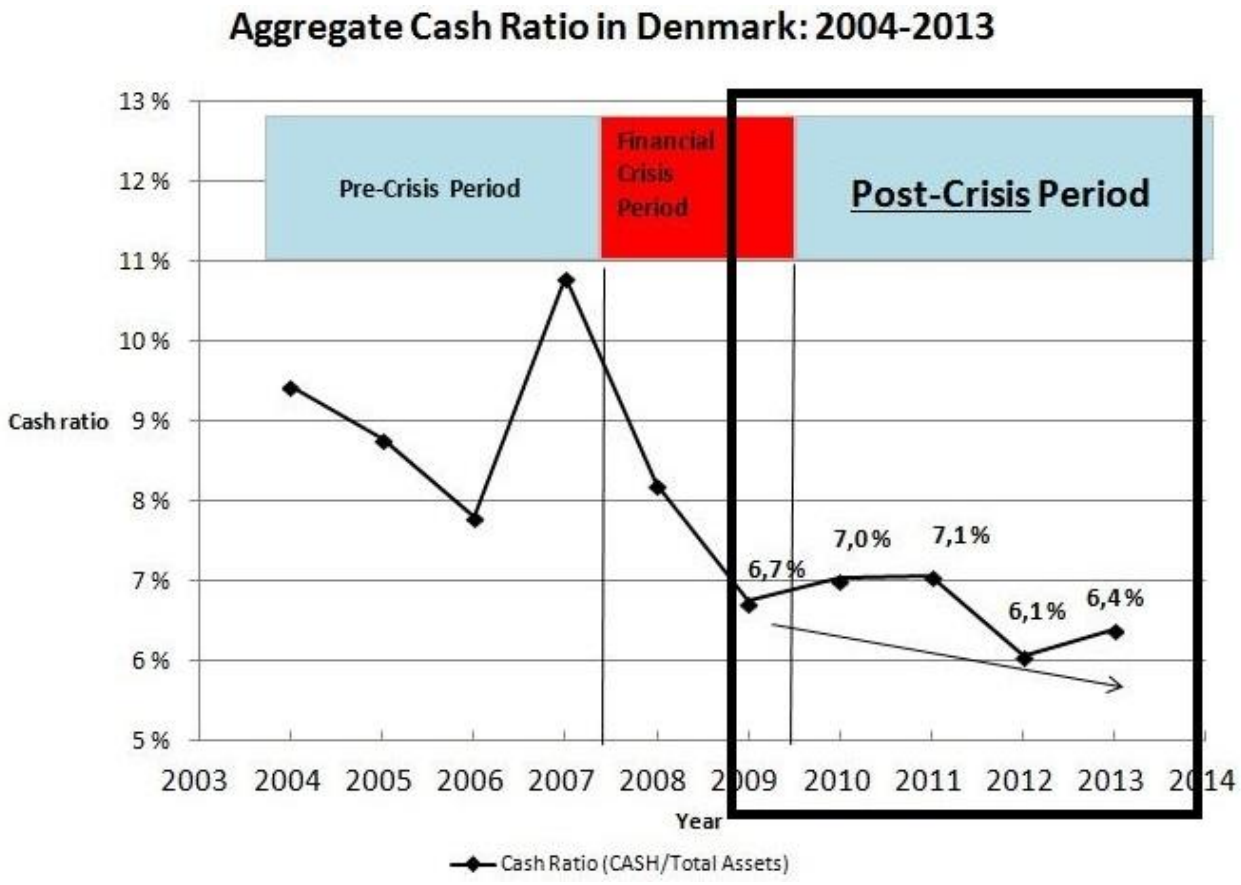


Figure 16 - *Aggregate cash ratio of all Danish listed companies in the period of 2004 – 2013 both years included. Highlighted is the development in the post-crisis period. Source: Compustat.*

6.2.3 Descripitve statistics of firm-specific variables

Much of the same firm-specific differences between the two countries before the crisis can be seen in the after crisis too. We see that the gap in cash holding levels are still very prevalent, however, as expected, the gap has increased in the CASH/TA variable compared to the pre-crisis numbers. Also, dividend payout and repurchase of own stocks have increased in both countries.

Firm specific variables - post crisis (Q3 2009 - Q4 2013)

	DK				US			
VARIABLES	25% Quartile	Median	75% Quartile	Std. dev.	25% Quartile	Median	75% Quartile	Std. dev.
CASH_TA	0,021	0,049	0,169	0,203	0,050	0,139	0,336	0,250
CASH_NETASSETS	0,024	0,056	0,219	3,464	0,052	0,160	0,500	18,995
Growth_ MarketBook	0,665	1,251	2,981	2,765	0,863	1,701	3,285	3,330
Size_LogTA	5,351	6,635	8,077	2,214	3,613	5,657	7,457	2,899
Leverage_ TLTA	0,358	0,519	0,670	0,381	0,293	0,498	0,726	8,290
Debt structure_CLTL	0,491	0,684	0,829	0,250	0,310	0,588	0,877	0,307
CashFlow_NetAssets	0,000	0,019	0,040	3,086	-0,012	0,025	0,047	11,698
Capex_NetAssets	0,003	0,013	0,034	0,150	0,006	0,019	0,047	0,524
AcqusitionSpend_NetAssets	0,000	0,000	0,005	0,062	0,000	0,000	0,009	0,506
Liquidity_NWC -CA_NetAssets	0,000	0,120	0,289	2,890	-0,162	0,005	0,161	5,894
IntangibleAssets_NetAssets	0,023	0,105	0,251	0,216	0,000	0,093	0,346	0,243
Industry Vol Score.	0,083	0,083	0,583	0,291	0,249	0,500	0,800	0,191
	Sum of dummies	% of total obs.			Sum of dummies	% of total obs.		
DividendDummy	229	13 %			18107	21 %		
Repurchasedummy	462	25 %			23804	27 %		
Total # of observations:	1818				86702			

Figure 17 - *Overview of statistics on firm specific variables in Denmark and the U.S . Source: Compustat.*

Furthermore, there are no very significant and noteworthy changes that really derivates from the descriptive analysis in the pre-crisis section. Again, there is a higher levels of both repurchase of own stocks and dividends which can be reflect the stronger shareholder rights in the U.S.

6.3 Conclusion descriptive analysis

Based on the descriptive analysis two this can be said: there has been a contrary development in holdings and there are clearly firm-specific differences in the two countries. However, the firm-specific differences have only marginally changed going from the pre-crisis period to the post-crisis period. This includes capex. and acquisition spending in the U.S., which one could expect had effected the cash development in the U.S. to some extent. Therefore, it is hard to point out possible explanations based on the firm-specific statistics on why cash holding development has differed in the two home markets. This amplifies the need for further investigation on the true dynamics behind holdings as discussed in chapter 2.

7 Methodology

Again, the purpose of this thesis is to examine and compare the impacts of determinants on corporate cash holdings among U.S. and Danish listed firms before and after the financial crisis. In order to create the best basis for such comparison analysis, I am aiming to develop, and then apply, a similar statistical model for both countries in both periods.

In the following sections, the final model will be built up, step by step. Along with explanation of the modeling procedure, essential aspects of the premises of the model will be outlined too.

7.1. Pooled regression

The following model aims to estimate the impact of constructed cash determinants on corporate cash holdings among all listed firm in Denmark and U.S. before and after the crisis:

$$CASH\_NetAssets_t = \beta_0 + \beta_1 GROWTH\_OPPORTt + \beta_2 ASSET\_SPEC_t + \beta_3 SIZE + \beta_4 CASHFLOW_t + \beta_5 LIQUIDITY + \beta_6 TOTAL\_LEVERAGEt + \beta_7 DEBTSTRUCTURE_t + \beta_8 CAPEX\_SPEND_t + \beta_9 ACQ\_SPEND_t + \beta_{10} INDUSTRY\_VOL + \beta_{11} DIVIDEND\_DUM_t + \beta_{12} REPURCH\_DUM_t + \mu_t + \varepsilon$$

As the requested dataset from the Compustat database takes a time series form, it would be possible to conduct a pooled ordinary least square (OLS) regression. However, a pooled regression would assume that there is no heterogeneity in the cross section and no heterogeneity in the time dimension. This would not be a suitable as I do expect cash holdings levels to differ for individual firms. Likewise, I also expect the time dimension to influence on the cash holding level given the empirical findings, e.g. cash levels are higher in 2013 than 2009 in the U.S.. To conclude, the datasets need to be transformed so that both the time dimension as well as the individual firm is taken into consideration.

7.2 Panel data

As concluded above, to create the best basis for testing the impact of cash determinants, both time and the individual dimension should be included. Such datasets are formed in so-called panel data, also called cross sectional time series. As the name implies, these data sets contains individual observations each identified with a unique time dimension. Table 18 exemplifies of how panel data form looks like:

Company	**Date/Quarter**	**Cash Ratio**	**Capex**	**Size**	**Dividend**	**Etc.**
1 (Novo)	30/06-10	0,13	0	1000	Y (1)	-----
1 (Novo)	30/09-10	0,1	500	1050	Y (1)	------
2 (APMM)	30/06-10	0,2	300	500	N (0)	------
2 (APMM)	30/09-10	0,22	400	450	N (0)	-------
Etc.	------	----------	------	--------	------	-------

Figure 18 – *Example of panel data structure*

As I am dealing quarterly data for all U.S. and DK listed firms, my datasets gets really big when using panel data. For example, the U.S. post-crisis dataset contains more than 9700 firms with quarterly data in the period of Q2 2009 – Q4 2013, which sums up more than 87000 observations. However, because of a large sample size that varies over two dimensions, the parameter estimates based on panel data are usually more *exact* than smaller data sets with "only" time series data or cross-sectional data. A general regression model for panel data can be expressed as:

$$Y_{i,t} = \alpha + \beta * x_{i,t} + \mu_{i,t}$$

Where Y expresses the dependent variable, α is the intercept, β is the parameter estimate and u is the residuals. The "i" and the "t" is the individual and time dimension, respectively, which are expressed in vertical vectors seen in the figure. To the original model, the "i" will be added.

There are many advantages of using panel data. Most importantly, as each individual firm is taken into account in panel data, it is easier to distinguish between spurious state dependence and true state dependence. (Gujarati et. al., 2003) The individual dynamics are now identified which

easier allows for identification of true state dependence. Secondly, the effects of an omitted variable bias are reduced with panel data. This bias arises when the included explanatory variables in a model is correlated with an excluded variable.

7.3 Model specifications

To make a panel data model as robust as possible one should determine whether fixed effects or random effects should apply to the model. If a fixed effects specification is applied it can to capture the effect of variables that do not vary over time. Fixed effects can also reduce endogeneity problems, i.e. when regressors are correlated with the residuals. More accurately, a fixed effect model is decomposing the error term that is correlated with the regressors into two pieces; leaving a new error term uncorrelated with the regressors. For cross sectional fixed effects, this new error term can be expressed:

$$\mu_{i,t} = \mu_i + v_{i,t}$$

Where $v_{i,t}$ is the new error term that can vary over time and entities and u_i is the individual effect.

The same can be done with the times series dimension to capture the effects that are influencing the dependent variable $Y_{i,t}$ over time but are constant for all entities. Fixed effects for the cross section and time series can be combined if proven necessary.

To determine whether fixed effects specification should apply to the model I do the Hausman specification test, also called a redundancy test. The Hausman test null hypothesis for cross sectional data states that the efficient random effects estimator is the same as the ones estimated by the consistent fixed effects estimator. If the Hausman test is significant (P-value lower than 5%) fixed effect should be used. Initial tests[7] for various samples indicated that the hypothesis can be rejected, indicating that the intercept is allowed to vary among individual observations. Same test is conducted for time-fixed effects, where the null hypothesis cannot be rejected; hence the intercept cannot change over time, only on individual observations.

[7] See appendix 2 for test-statistics and p-values

In conclusion, only cross sectional fixed effects specification will be applied to the model.

7.4 Ordinary least squares

So far I have determined that the model estimation should be based on panel data and that cross sectional fixed effect specification should apply to it. It would therefore be possible to estimate the model with a general data OLS regression. However, OLS estimation would not be suitable for this model as some of its strict assumption would be violated.

The first assumption to be violated is autocorrelation. The error term in an OLS model should not be correlated with lagged error terms, i.e. the correlation of $u_{i,t}$ and $u_{i,t}$ should be 0. As shown in the empirical study section there are trends in of the data which most likely indicate that autocorrelation is present. Initial correlation tests and Durbin Watson test statistics results also prove this assumption is violated with an OLS regression.

The second assumption that is violated is endogeneity. There different potential sources of endogeneity present in this model. The first one is reverse causality. For example, an increase in market-to-book ratio (proxy for growth opportunities) is likely to increase the cash ratio, but I cannot rule out that an increase in cash ratio might cause higher the market-to-book ratio.

Second potential source is omitted variables, which occurs when determinants of the dependent variable, i.e. an explanatory variable where the coefficient is not 0, is left out of the model. Given the complexity of determinants of cash holdings, I cannot rule out that a valid causal factor have been left out from the model. Fortunately, the panel data is reducing the omitted variable bias in the model. Finally, potential measurement errors are the third source of endogeneity.

In conclusion, a more suitable estimation model than OLS should be applied.

7.5 Unit root testing

In determining the best estimation model, the question whether corporate cash holdings are assumed to be mean reverting or not of will now be addressed, as this have implications in structuring a regression model.

Overall, empirical studies have found that firms typically aim at a target of cash holding (Opler et. al. 1999). In other words it corporate cash holdings tend to be mean reverting, i.e. holdings tend to move to the average holding level over time. From a static trade-off theory perspective this makes sense as it implies that an optimal level, or "normal" level, of corporate cash holding do exists.

Mean reversion can be tested though a stationary test developed by Dickey Fuller. The DF test can be estimated based by regressing the first difference of a variable on its lagged variable with drift (1) without drift (2) and finally with drift and a deterministic trend. (3), given the characteristics of the time series. The null hypothesis is that the time series is non-stationary and the critical values of the t- statistics follows the tau-statistics. A DF-test would be interesting for my research; however given the short time period of my samples (Q1 2004 - Q2 2007 and Q3 2009- Q4 2013) a stationary test would not be entirely valid, as it would be hard conclude something based on such a short time frame. A stationary test should be conducted for time series with longer time period to be able to conclude if whether the dependent variable is mean reverting or not. So given my short time series sample and the clear empirical evidence that cash holdings is mean reverting, a stationary test will not be conducted, and holdings are assumed to be mean reverting.

7.5.1 Inclusion of lagged variable

As cash holdings are assumed to be mean reverting, a lagged variable of the dependent variable is included in the model. This is to investigate the previous period's holding level on the current period's holding level. Therefore from now on, $\beta_1 CASH\_NetAssets_{t-1}$, will be included in the previous mentioned model. Having a lagged dependent in the model causes the need for a dynamic model. OLS is not the best approach in dynamic estimation, but rather the so-called general method of moments (Arrelando et. al., 1991).

7.6 Generalized Method of Moments (GMM)

Studies have shown that applying the general method of moments (GMM) on dynamic panel data, i.e. inclusion of a vector with a lagged dependent variable, resulted in consistent and efficient parameters (Hansen 1982). The GMM is also taking into account the autocorrelation and endogeneity problem with OLS which I addressed in 7.4. To complement this, Arrelano and Bond (1991) stated that the model should be transformed into first differences to remove the individual firm-specific effects in the model, and that first difference value of the dependent and independent variables can be used as valid instruments. They also introduced the Sargan test statistics (J-statistics) that can determine the strength of these instrument variables in the model.

To summarize, the GMM estimation uses first differences values as which can minimize autocorrelation problem as well as the endogenity problem. When differencing the original model I get the following expression:

$$(CASH\_NetAssets_t - \beta_1 CASH\_NetAssets\ t\text{-}1) = (\beta_0 - \beta_0) + (\beta_1 CASH\_NetAssetsi_{\ it\text{-}1} - \beta_1 CASH\_NetAssets_{\ it\text{-}2}) (\beta_2 GROWTH\_OPPORT_{it} - \beta_2 GROWTH\_OPPORT_{it\text{-}1}) + (\beta_3 ASSET\_SPEC_{it} - \beta_3 ASSET\_SPEC_{t\text{-}1}) + (\beta_4 SIZE_{it} - \beta_4 SIZE_{it\text{-}1}) + (\beta_5 CASHFLOW_t - \beta_5 CASHFLOW_{t\text{-}1}) + (\beta_6 Liquidity_{it} - \beta_6 Liquidity_{it\text{-}1}) + (\beta_7 TOTAL\_LEVERAGE_{it} - \beta_7 TOTAL\_LEVERAGE_{it\text{-}1}) + (\beta_8 DEBTSTRUCTURE_{it} - \beta_8 DEBTSTRUCTURE_{it\text{-}1}) + (\beta_9 CAPEX\_SPEND_{it} - \beta_9 CAPEX\_SPENDi_{t\text{-}1}) + (\beta_{10} ACQ\_SPEND_{it} - \beta_{10} ACQ\_SPEND_{it\text{-}1}) + \beta_{11} INDUSTRY\_VOLSCORE + (\beta_{12} DIVIDEND\_DUM_{it} - \beta_{12} DIVIDEND\_DUM_{it\text{-}1}) + (\beta_{13} REPURCH\_DUM_t - \beta_{13} REPURCH\_DUM_{t\text{-}1}) + (\mu_{it} - \mu_{it}) + \varepsilon$$

Reducing this, yields the following:

$$\Delta CASH\_NetAssets_t = \beta_1 \Delta\ CASH\_NetAssets_{t\text{-}1} + \beta_2 \Delta GROWTH\_OPPORT_t + \beta_3 \Delta ASSET\_SPEC_t + \beta_4 \Delta SIZE + \beta_5 \Delta CASHFLOW_t + \beta_6 \Delta Liquidity + \beta_7 \Delta TOTAL\_LEVERAGEt + \beta_8 \Delta DEBTSTRUCTURE_t + \beta_9 \Delta CAPEX\_SPEND_t + \beta_{10} \Delta ACQ\_SPEND_t + \beta_{11} INDUSTRY\_VOLSCORE + \beta_{12} \Delta DIVIDEND\_DUM_t + \beta_{13} \Delta REPURCH\_DUM_t + \varepsilon$$

The first difference parameters now express changes instead of levels, i.e. an increase of market-to-book from 1 to 1,1 in a manufacturing firm is now equal to an increase from 4 to 4,4 in a tech firm. By doing this, we eliminate the individual firm (and industry) specific effects in the model.

Again, almost all of the variables that I have constructed have some kind of firm or industry characteristics, (f.x. pharmaceutical companies tend to have a lower leverage than manufacturing

firms) and having a model that measures changes instead of *levels* enables us to estimate determinates in *one* model rather than per industry by industry.

6.6.1 Validity of instruments and autocorrelation

When using the constructed first difference model, the validity of the instruments used in the model by performing the Arrelano et. at., (1991)'s Sargans test, also called the J-statistics. The null hypothesis states that all of the instrument variables as a group are exogenous. This would then indicate that they are strong instruments while a rejection of the null hypothesis would indicate weak instruments are included among the variables.

Applying the GMM and having transformed the model to a first difference model, I expect the autocorrelation problem to be minimized. However, I still test for autocorrelation in the error term. First order autocorrelation (correlation between $u_{i,t}$ and $u_{i,t-1}$) can be detected by conducting a Durbin Watson test. The test statistics can be expressed as: DW = 2*(1-ρ). No autocorrelation would yield a test statistics value around 2, while values going towards 0 and 4 would indicate positive and negative autocorrelation, respectively.

7.7 Robustness test

To check for robustness can be done in many ways. One way is that the variables can be replaced with proxy variables to ensure that its original variable is valid while holding the other variables constant. As an example, one could replace the intangible assets ratio variable with R&D-costs to revenue variable as they both express the degree of asset specificity. This can be done both for both dependent and independent variables. However, given the high number of variables and the very high number of observations in each of them, finding a proxy for each of them would be very time consuming. Therefore, other approaches have been considered.

Another test for robustness is to do a natural logarithm transformation of the dependent variables cash ratio.

This approach is used in the literature on American firms (Opler et. al. 1999) and on French firms (Saddour, 2006). The articles argue for that the dependent variable should be natural logarithm of cash ratio as a consequence that cash ratios is said to be mean reverting. Applying this approach, I use the natural logarithm of cash ratio as the dependent variable whilst using the same variables as the original model, but in level form. I get the following:

$$Log(CASH\_NetAssets_t) = \beta_0 + \beta_1 GROWTH\_OPPORT_{it} + \beta_2 ASSET\_SPEC_{it} + \beta_3 SIZE_{it} + \beta_4 CASHFLOW_{it} + \beta_5 Liquidity_{it} + \beta_6 TOTAL\_LEVERAGE_{it} + \beta_7 DEBTSTRUCTURE_{it} + \beta_8 CAPEX\_SPEND_{it} + \beta_9 ACQ\_SPEND_{it} + \beta_{10} INDUSTRY\_VOL + \beta_{11} DIVIDEND\_DUM_{it} + \beta_{12} REPURCH\_DUM_{it} + \mu_t + \varepsilon$$

This model will probably have some autocorrelation problems as is it not been first differenced; however by applying cross sectional fixed effects , this problem can be reduced.

8 Results

In the following pages are the results of my panel data analysis where I aim to answer the overall main research question of this thesis. As derived in the methodology section, the two statistical models have applied to investigate the dynamics behind corporate cash holdings. Again, the section is divided into a pre-crisis analysis (1) and a post-crisis analysis (2) with a concluding comparable analysis and discussion (3). As the primary focus is to investigate dynamics in the post-crisis period, more weight has been put on part 2 and 3.

8.1 Pre-crisis period

The main of purpose of analyzing the dynamics of cash holdings in the pre-crisis period, is to test them against the mentioned hypotheses AND to *create a basis for comparison* for the post-crisis period.

PRE-CRISIS REGRESSIONS

	DENMARK		US	
	MAIN TEST	**ROBUST TEST**	**MAIN TEST**	**ROBUST TEST**
Dependent Variable	diff(CASH_NETASSETS) *(First difference data)*	LOG(CASH_NETASSETS) *(Original data)*	diff(CASH_NETASSETS) *(First difference data)*	LOG(CASH_NETASSETS) *(Original data)*
Independent variables	**Estimates**	**Estimates**	**Estimates**	**Estimates**
Intercept	-0,9723	-2,974 ***	0,6570	-3,3361 **
	((1,1862))	((0,3417))	((0,8359))	((1,7415))
Growth_ MarketBook	0,8596 ***	0,0357 ***	0,0001	0,0000
	((0,3033))	((0,011))	((0,00006))	((0,000146))
Size_LogTA	1,62607 ***	-0,0284	3,6300 ***	-0,3041 **
	((5,0321))	((0,0321))	((0,7981))	((0,1466))
Leverage_ TLTA	0,632 ***	-0,4635 **	-0,0377 *	-2,7049 ***
	((0,0609))	((0,2348))	((0,0588))	((0,062))
Debt structure_CLTL	0,4257 ***	0,534 ***	1,7300 *	2,4600 **
	((0,0728))	((0,2131))	((1,9315)	((1,1559))
CashFlow_NetAssets	0,0672	2,0577 ***	0,0456 ***	0,5274 ***
	((0,1422))	((0,6751))	((0,0134))	((0,0271))
Capex_NetAssets	-0,093	0,5826	8,9000 ***	3,0955 *
	((0,1339))	((0,8802))	((1,6454))	((1,92))
AcqusitionSpend_NetAssets	-0,15 *	0,1079	-4,2004 *	0,4317
	((0,55))	((1,39))	((2,7915))	((1,1511))
Liquidity_NWC -CA_NetAssets	0,874 ***	1,0679 ***	-0,0550 ***	-1,9870 ***
	((0,0342))	((0,0797))	((0,0050))	((0,1565))
IntangibleAssets_NetAssets	0,5508 ***	-0,4139	-5,5053 *	-0,0806
	((0,1612))	((0,4156))	((3,1128))	((1,3115))
Industry Vol Score.	0,5632	0,0472	-1,4317	0,9160
	((3,25))	((0,2038))	((1,0859))	((1,5615))
DividendDummy	-3,5315 *	-0,2637 *	-0,2598	-0,4826
	((1,97))	((0,1498))	((1,0612))	((0,7712))
Repurchasedummy	2,88	0,1599	0,2672	0,5262
	((2,42))	((0,1259))	((0,6878))	((0,8589))
diff2(CASH_NETASSETS)	0,1348 ***		0,4279 ***	
	((0,0131))		((0,000882))	
# of periods:	18	18	18	18
# of firms/cross sections:	101	101	9732	9732
# obs:	1050	1050	73666	73666
R-square	0,77	0,4	0,81	0,04
DW-statistics:	1,92	2,12	1,99	2,00
Prob for J-stat:	0,31	0,25	0,16	0,05***

Figure 19 - *Regression results from pre-crisis period data in Denmark and U.S., respectively. Note: (i) numbers in double brackets are the standard error of estimates, (ii) *,**,*** indicates the significance level on 10%, 5% and 1%, respectively. (iii) DW-statistics indicates the test for autocorrelation in the error terms and finally (v) the probability for J-statistics indicates whether the instruments are weak or not. Source: Output regression model*

8.1.2 Pre-crisis regression results

In figure 19 are the full results of the panel data regression for the pre-crisis period among all the publicly listed firms in Denmark and U.S. Overall, the some appears to be no autocorrelation in the error terms as the DW statistics is around 2 in all of the models. Meanwhile the J-statistics shows that the instrumental variables seems to be valid in all models, except for the U.S. robustness test where the J-stat is significant (=0,05). Most importantly, however, the two first difference models appear be statistically sound estimation models.

Most of the estimated results are supported by the robustness test, indicating that the first difference data is consistent by the original data models, which again indicates sound results.

The results show that there are differences in the estimated coefficients both between the two countries, as well as some derivations from the pre-crisis hypotheses which were based on the meta-analysis.

To highlight the *key take away* from this regression analysis, following table presents the significant signs of the estimated beta coefficients of each of the variable. For the variables that are showing contradictory signs (significant) in the main model and the robustness check have been marked with “vague”.

Pre-crisis coefficients

Variables	DK	US	Hypotheses
Growth_ MarketBook	+	Not sign.	+
Size_LogTA	vague	vague	-
Leverage_ TLTA	vague	-	-
Debt structure_CLTL	+	+	+
CashFlow_NetAssets	+	+	+
Capex_NetAssets	Not sign.	+	-
AcqusitionSpend_NetAssets	-	-	-
Liquidity_NWC -CA_NetAssets	+	-	-
IntangibleAssets_NetAssets	+	-	+
Industry Vol Score.	Not sign.	Not sign.	+
DividendDummy	-	Not sign.	-
Repurchasedummy	Not sign.	Not sign.	-
diff2(CASH_NETASSETS)	+	+	+

Figure 20 – *This figure shows the significant signs of the estimated beta coefficients on the proxy variables applied in the model. The term "vague" is applied when then main model and the robustness test are showing significant, but contrary signs. Source: Output regression model.*

Given the clear findings in the meta-analysis it is a bit surprising that the traditional determinants growth opportunities, size and leverage are partly showing vague results. One cannot rule out that short time horizon in this data sample (3,5 years) slightly short to create more consistent results for these variables.. Also worth nothing is that the, the proxy variable for asset specificity is estimated to be *negatively* related to cash holdings among U.S. firms. Interestingly this does goes against the hypothesis of higher degree of asset uniqueness as a proxy of information asymmetry, leading to higher cash holdings. Beside this, most of the other estimated coefficients are supporting the pre-crisis hypotheses.

8.1.3 Conclusion pre-crisis panel data regression

The estimated results themselves are showing that there are some country specific differences as well as some derivation from the set up pre-crisis hypotheses. Interestingly, the traditional determinants like growth opportunities, size and leverage are showing weak or vague results, contrary to clear findings in the meta-analysis. The models appear to be statistically sound and are in general showing robust results, creating a solid basis of comparison for the post-crisis regression model.

8.2 Post-crisis period

As I have investigated the determinants for the time period before the crisis, I am now ready to move on to the main regression analysis for this study, the post-crisis period.

The main purpose for the panel data regression study is to investigate the dynamics behind cash holding in the post-crisis period as well as the changes compared to the pre-crisis period. Again, the implications of these findings will be discussed subsequently. In the following table are the estimated results of the beta coefficients.

POST-CRISIS REGRESSIONS				
DENMARK			**US**	
	MAIN TEST	**ROBUSTNESS TEST**	**MAIN TEST**	**ROBUSTNESS TEST**
Dependent Variable	diff(CASH_NETASSETS) *(First difference data)*	LOG(CASH_NETASSETS) *(Original data)*	diff(CASH_NETASSETS) *(First difference data)*	LOG(CASH_NETASSETS) *(Original data)*
Independent Variables	**Estimates**	**Estimates**	**Estimates**	**Estimates**
Intercept	1,5027	**-1,6774** ***	-0,8433	-3,1714 ***
	((2,3858))	((1,2354))	((1,0441))	((0,0353))
Growth_ MarketBook	0,0469	**0,0016** **	6,44E-05	2,06E-05
	((0,0391))	((0,0006)	((0,001027))	((0,00002))
Size_LogTA	-4,0598 *	**0,0031**	1,2703 *	0,0194 ***
	((5,98))	((0,009057))	((1,0332))	((0,00288))
Leverage_ TLTA	1,8782 ***	**1,9964** ***	-0,0464 ***	-0,0052 ***
	((6,1566))	((0,0518))	((0,0171))	((0,00039))
Debt structure_CLTL	6,85444 ***	**0,7407** ***	10,65 ***	1,7093 ***
	((13,6238))	((0,0768))	((2,5174))	((0,024))
CashFlow_NetAssets	-2,7903 ***	**-0,2921** ***	0,3931 ***	0,0122 **
	((1,31))	((0,0134))	((0,0241))	((0,000581))
Capex_NetAssets	-3,26438 **	**-0,0572**	-1,0038 *	0,0699 **
	((14,4007))	((0,1121))	((0,6804))	((0,0117))
AcqusitionSpend_NetAssets	-5,93008 *	**-0,6412**	-0,0657	-0,0406 **
	((64,1025))	((0,5353))	((0,7047))	((0,012))
Liquidity_NWC -CA_NetAssets	8,84338 ***	**1,1234** ***	-0,0822 ***	-0,00166 **
	((1,48))	((0,00764))	((0,004594))	((0,00013))
IntangibleAssets_NetAssets	5,8787 ***	**0,6008** ***	-7,6765 *	-0,6815 *
	((18,9053))	((0,0853))	((4,2909))	((0,0268))
Industry Vol Score.	-2,4651	**0,0168**	1,3629 *	0,9694 **
	((5,71))	((0,0648))	((1,3619))	((0,0334))
DividendDummy	2,67	**0,0039**	0,2632	-0,4737
	((3,39))	((0,0404))	((1,2912))	((0,0158))
Repurchasedummy	-0,6008	**0,0405**	1,2074 *	0,1184 **
	((5,0408))	((0,0489))	((0,821))	((0,0163))
diff2(CASH_NETASSETS)	0,0867 ***		0,8626 ***	
	((0,006354))		((0,001247))	
# of periods: (Q3-2009-Q4 2013)	18	18	18	18
# of firms/cross sections:	107	107	9733	9733
# obs:	1818	1818	86652	86652
R-square	0,968	0,967	0,886	0,149
DW-statistics:	1,97	2,00	2,00	2,00
Prob for J-stat:	0,23	0,27	0,18	0,08*

Figure 21 - *Regression results from post-crisis period data in Denmark and U.S., respectively. Note: (i) numbers in double brackets are the standard error of estimates, (ii) *,**,*** indicates the significance level on 10%, 5% and 1%, respectively. (iii) DW-statistics indicates the test for autocorrelation in the error terms and finally (v) the probability for J-statistics indicates whether the instruments are weak or not. Source: Output regression model*

Again, it appears that the models are statistically sound as there appears to be have no serial autocorrelation (DW=2) and J-stats are all insignificant on 90% level. Again, for simplicity reasons, the key findings from the regression are presented in figure 22, where the changes from the pre-crisis are shadowed:

Post-crisis coefficients

(Grey shadow= *changed* compared to pre-crisis)

Variables	DK	US	Hypotheses
Growth_ MarketBook	+	Not sign.	?
Size_LogTA	-	+	-
Leverage_ TLTA	+	-	?
Debt structure_CLTL	+	+	+
CashFlow_NetAssets	-	+	+
Capex_NetAssets	-	-	?
AcqusitionSpend_NetAssets	-	-	?
Liquidity_NWC -CA_NetAssets	+	-	-
IntangibleAssets_NetAssets	+	-	+
Industry Vol Score.	Not sign.	+	+
DividendDummy	Not sign.	Not sign.	+
Repurchasedummy	Not sign.	+	+
diff2(CASH_NETASSETS)	+	+	+

Figure 22 – *The figure shows the significant signs of the estimated beta coefficients on the cash holding proxy variables applied in the post-crisis regression. A grey shadowed area implies that the sign of the variable has changed compared to the pre-crisis period. Source: Output regression model*

8.2.1 Post-crisis regression results and interpretation

Cash flow

A very important finding for this study is the contrary post-crisis sign on how cash flows effects cash holdings. Cash flow, measured as EBITDA/Total assets less cash, has positively contributed to cash holdings in the U.S., which is in accordance with the hypothesis and pecking order. Furthermore, it can also be interpreted as companies taking precautionary action; firms want to protect themselves against future cash shortage or high costs to raise capital to meet future investment needs by accumulating operational cash flows. In contrast, the negative and significant impact cash flow had on Danish firms' holdings is line with the static tradeoff proposition, which predicts that firms with cash flows does not need hold cash as the future cash flows can finance projects. This factor can be one of contributing causes for the contrary development.

Cash flow volatility

Another important change in the cash holding dynamics is the positive impact cash flow volatility appears to have on U.S. firms. Form having an insignificant impact before the crisis, the post-crisis regressions shows that industry cash flow volatility now has affects cash holdings positively, which is line with trade-off theory. The beta estimate is significant on 10% and 5% respectively, which indicates robust results. It is very likely precautionary motives among the U.S. firms are causing this change. Possibly because of the financial crisis and the severe volatility that found place in both operating cash flows, stock prices and the general uncertainty that took place in the economy. Interestingly, among Danish firms neither regression indicated that the industry volatility played had any significant impact on cash holdings. This is a noteworthy distinction between the two countries, which can also contribute to the contrary cash holdings development between the two countries.

Size

From showing vague results in the pre-crisis period, size shows interestingly mixed, but significant results for the post-crisis period. For Denmark, the negative relationship is in line with static trade-off theory and the meta-analysis. This implies that larger firms have relatively easier and cheaper to access to external funds. For U.S.-firms, however, the significant positive relationship implies two things. First, the positive sign is in line with pecking order hypothesis that larger companies have been more successful in the past by accumulating more retained earnings, i.e. cash, than smaller companies. Second, the positive relationship could indicate agency problems between managers and shareholders, possibly due to empire building behavior, as managers want to maximize assets under control and not pay back dividends or that manager want to increase financial flexibility without being subject to capital markets.

Leverage

Interestingly for Danish firms, leverage has gone from negative to positive impact on cash holdings. The positive post-crisis relationship is consistent with the view that higher debt levels leads companies to hold more cash to compensate for higher probability for financial distress. This might indicate some precautionary motives among the Danish firms in the after crisis period. One the other hand, leverage affected holdings in U.S. negatively both before and after the crisis, however by a small margin. Given the severe credit crunch during the crisis, this finding was a little bit surprising for the U.S. sample. However, the negative relatedness can be interpreted in line with static trade-off theory (substitution of cash) or pecking order (spends cash first, then issue debt).

Dividends and repurchase of common stocks

In general, the dividend and repurchase dummies show insignificant results, both before and after the crisis, except for the repurchase dummy for among the U.S. firms after the crisis. This noteworthy finding shows that repurchasing of own common stocks is positively effecting cash holdings. This suggests that firms would like to avoid situations where repurchasing of own shares would not be possible, which again can be interpreted as another precautionary motive for

holding cash among the U.S. firms and possibly also reflecting the stronger shareholder rights in the U.S.

Debt structure

Just as in accordance with hypotheses, the portion of short term debt has an overwhelmingly positive relationship with cash holdings in both countries. What is worth noticing is that the impact the debt structure had on cash holding was substantially larger in the post-crisis, according to the regressions. This could be interpreted as a reaction to the severe credit crunch during the crisis, where refinancing or extension of credit lines could be impossible. Hence precautionary motives could explain some of these dynamics, i.e. protection against refinancing risk.

Growth Opportunities

Interestingly and contrary to the meta-analysis, the variable growth opportunities showed mixed results. In Denmark, the regressions support the hypothesis, however only weakly supported in the post-crisis period. In U.S., on the other hand, the proxy variable market-to-book shows clearly insignificant values (and coefficients close to 0) in both time periods, which indicate the low impact of growth opportunities on cash holdings. I.e. the cost of cash shortage does not seem to be affected by the level of growth opportunities in the U.S. Also, changing the proxy variable to Tobin's Q, *does not* change anything, supporting the U.S. findings.

Capex. and acquisition spending

Firms in both countries show that capex. and acquisition spending negatively affects holdings in the post-crisis period, which is in line with pecking order theory. However, what is interesting is that this is a change from a positive impact on cash holdings before the crisis, which supported the static trade-off prediction. This change is a bit surprising as one could possibly expect that firms with large capex and spending reluctant to issue new capital to fund investments and compensate with cash hold. However, the results for these variables are not robust, so one should be careful to draw a definite conclusion on the effect of capex. and acquisitions spending.

Liquidity

The results show interestingly clearly contrary but significant signs on the level of NWC. The negative coefficient among U.S. firms are in accordance with the trade-off prediction as higher levels of NWC can be seen as a substitute for cash, and cash holdings would therefore fall if NWC increases. On the other side, it is surprising that this is not the case among Danish firms. With very significant and robust results higher levels of NWC is positively effecting cash holding. This goes clearly against the meta-analysis and thus the hypothesis.

Intangible assets

Another dynamic behind cash holding that differs between the two countries is the uniqueness of assets, measured as the level of intangible assets in the firm. As mentioned in the literature reviews, the level of intangible assets can be seen as a proxy for information asymmetry. All results are significant and robust, but the effects are positive related in Denmark meanwhile it is negatively related in U.S., however only on 10 % significance level. The positive relationship is consistent with Opler's transaction cost model as more uniqueness would indicate higher liquidation costs if funds are needed. However, the negative relationship among the U.S. firms might indicate that intangible assets might not be the best proxy variable for information asymmetry as this finding goes against the very consistent findings on this field. Perhaps if R&D expenses were applied as a proxy instead, it would yield results consistent with the literature.

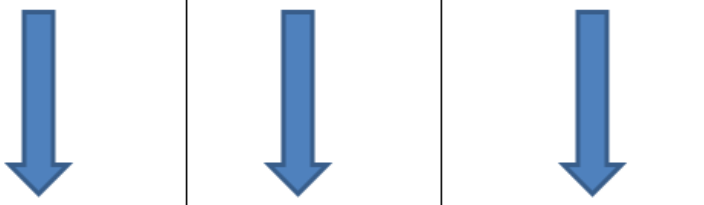
8.2.2 Summary and theoretical propositions

Based the significant and robust findings in post-crisis period, which have been interpreted one by one, I am now able to summarize which theoretical proposition each of the variables is in line with. This is important to understand the general dynamics behind holdings in each of the countries, as well as to create a basis for *further discussion and explanations for the contrary development in the two countries.*

As shown in table 23 three main conclusions can be drawn; first, trade of theory is dominant among DK-firms. Second, pecking order theory is dominant among U.S.-firms and finally third precautionary motives are dominant among U.S. firms.

Findings and Propositions

Variables	Static trade-off		Pecking Order		Precautionary motives	
	DK	US	DK	US	DK	US
Growth_ MarketBook	X					
Size_LogTA	X			X		X
Leverage_ TLTA	X			X	X	
Debt_structure_CLTL						
CashFlow_NetAssets	X			X		X
Capex_NetAssets			X	X		
AcqusitionSpend_NetAssets			X	X		
Liquidity_NWC -CA_NetAssets		X				
IntangibleAssets_NetAssets	X					
Industry Vol Score.		X				X
DividendDummy						
Repurchasedummy						X
diff2(CASH_NETASSETS)						
Total	**5**	2	2	**5**	1	**4**



TRADE-OFF IS DOMINANT AMONG DK-FIRMS

PECKING ORDER IS DOMINANT AMONG US-FIRMS

PRECAUTIONARY MOTIVES DOMINANT AMONG U.S.-FIRMS

Figure 23 - *The table shows which of the theoretical propositions that is dominant for each country. By classifying the findings on each of the variables in the post-crisis regression, the dominant theoretical proposition can be determined. Source: Findings and discussion in 8.2.1.*

In broader terms, how do these findings explain, and relate to, the contrary cash holding development between the two countries? In the following paragraphs, the implications and further analysis of this question will be addressed.

8.3 Implications on cash holding development

In the following paragraphs, each of the three findings from 8.2 will be analyzed and discussed.

1. **Precautionary motives dominant among U.S. firms**

Starting with a very important finding that can help explain the contrary development between the two countries is the apparent and overwhelmingly dominant precautionary motives for holding cash among US firms. In general terms, this can suggest that U.S. firms tend to hold an extra buffer to protect themselves against unforeseen situations compared to Danish firms.

This notion is also supported by Gao et. al., (2014), that also conclude that U.S. firms hold large holdings for precautionary reasons. However, the paper concludes that these precautionary decisions to hold on cash more dominant due to systematic and macroeconomic reasons, than the firm-specific reasons. Again, this amplifies the prevalence of precautionary reasons for holding cash that contributes to higher holdings among US-firms.

These large holdings due to precautionary motives might inflict *conflict of interest for shareholders* as they rather would see their money invested, or that the cash is paid back to them so they can invest in other securities. Interrelated to this aspect, which is also potentially inflicted by large precautionary holdings, are the agency costs of managerial discretion. Particularity risk aversion, but also the desire for greater financial flexibility and "empire-building behavior" might also be other sources of agency costs that occur due to the precautionary holdings. As an equity investor in US, these are potential problems one should be aware of.

On the other hand, creditors and banks are clearly benefitting from cash heavy firms as it reduces the firm's liquidity risk and thereby risk of bankruptcy. One could also interpret this as managers catering towards banks at the expense of shareholders.

2. Pecking order prediction dominant among U.S.-firms

The second main finding is that the dynamics among the U.S.-firms can better be predicted by the financial hierarchy model, and not the static trade-off model. One of the important explanations this is that cash flow is positive related to cash holdings in the U.S., contrary to Denmark. This again might be explained by the weaker creditor protection in the U.S. Therefore, all else equal, U.S.-firms are therefore generally more dependent on internally generated funds than DK firms, where creditor rights are stronger. This could also be a contributing cause to the difference in holding levels between the two countries.

What is also worth noting is that among U.S.-firm the dynamics have changed from trade-off theory prediction *before* crisis, to the financial hierarchy model prediction *after* the crisis, amplifying how the crisis has changed the holding dynamics.

3. Static trade-off prediction among Danish firms

The third and final main finding is that dynamics supported by trade-off theory is more dominant in determining cash levels among the Danish firms. In other words, the factors influencing the cost of cash shortage and/or the opportunity cost of holding cash appears to be of most importance.

As addressed in the literature review, the interest earned on cash holdings is one of the components affecting the opportunity cost of cash. In a very low interest environment, the opportunity cost increases, holding cost of cash shortage equal. By using liquid government bonds, American and Danish ones respectively, as proxy for risk free rates[8], Danish rates have generally been lower in the post-crisis period. All else equal, this might be one of the contributing factors to the lower cash holdings in Denmark compared to U.S.

The trade-off theory prediction was also dominant before the crisis in predicting the cash holding level among Danish firms.

[8] See Appendix 3 for government bond yields for both countries.

8.4 Cash holdings – put in perspective

Going forward, what can be said about prediction of cash holding levels, given this study? That is obviously a very hard and complex question with no clear answer. Because, as this thesis has shown, there are a wide range of factors that are influencing holding levels, including factors that have not been researched in this study. What can be expected, however, is that many dynamics can change its impact on holding given the circumstances and context the firms are operating in, i.e. some determinants are more dominant and profound in some contexts, whereas less dominant in other contexts. For example, coming out of the financial crisis precautionary motives were now proven to be dominant among U.S. firms, then they were before the crisis. So determinants cannot be said to be static, but should be addressed in a holistic perspective.

9 Conclusion

This thesis has in summary investigated how the financial crisis has impacted the dynamics behind corporate cash holdings among U.S. and Danish listed firms. Investigating this, possible explanations for the contrary after- crisis development between U.S. and DK-firms could emerge.

In the literature review trade-off theory, pecking order theory, agency problems and investor protection rights are discussed as those propositions appears to be most dominant in the literature on cash holdings.

In the descriptive analysis, the contrary development is shown; both home markets had a drop in cash holdings during the crisis, however levels in U.S. bounced quickly back and above pre-crisis levels, meanwhile DK-firms continued to drop. Nothing significant can be said based on the descriptive analysis of the pre-crisis and post-crisis firm specific variables in the two home markets including capex. and acquisition spending; therefore a panel data study are conducted.

My regressions results shows in general a slight derivation from former studies, summarized in the meta-analysis.

One of the most important finding in the panel data study is that there appears to be an overwhelmingly number of precautionary reasons to hold cash among U.S.-firms compared to

Denmark in the after crisis period. Also, it appears that the financial crisis changed the dynamics as these motives for holding cash where not apparent before the crisis. These reasons are cash flow volatility, cash flow/total assets, size and repurchase of own stock which are positively related to cash. These findings were significant on 10% level or more and can be interpreted as an important contributing cause to the large holdings among U.S.-firms. However, this can indicate conflict of interest, as one could interpret the precautionary reasons that managers are catering towards their own discretion or creditor's interest rather than shareholders' interest, and agency costs might occur.

Second, I find overwhelmingly support for pecking order prediction for holding cash among U.S.-firms. An important contributing cause for this, and possibly to the large holdings among U.S. firms too, is that cash flow/assets has a positive and significant relationship with holdings contrary to Danish firms. This can be supported by the relatively weaker creditor protection rights in the U.S., which makes U.S.-firms more dependent on internally generated funds, all else equal.

Finally, for Danish firms, I find support for static trade-off theory to predict holding levels. The variables size, leverage, capex/total assets, asset uniqueness and growth opportunities support this notion and are all significant on 10% level or more. As the trade-off model emphasizes the importance of opportunity cost of holding cash, interest rate levels are relevant. Using government bond rates as proxy for risk free rates, I find that rates in Denmark have relatively been lower than in the U.S. in the post-crisis period. Holding cost of cash shortage constant, Danish firms have therefore been holding less cash as their opportunity costs have been higher.

My findings in this thesis should, however, be interpreted as 3 out of *many* contributing causes to the contrary development. As this thesis has emphasized, the dynamics behind holdings are many and complex, and should be addressed holistically.

10 Suggestion for further research

As indicated in Gao et. al., (2014) systematic components and macroeconomic shocks, affects cash holding decisions in the U.S. more that firm-specific factors, therefore more research could be done on these components such as market risk premium, interest rates and change in policies/regulations impact on holdings.

As part of Gao et. al., (2014) point, today's extremely low interest level might have increased or changed the opportunity costs of holding cash. It would be interesting to go more in-depth on this by for example constructing a variable that measures opportunity costs for each country, in order to investigate the true impact it has in the two home markets.

Also, taxes have not been included in this study, only addressed quickly. It would be interesting to look more into the firm marginal tax rate effect on holdings, but perhaps even more interestingly to address the tax issue firms with oversea cash holdings face. Particularly U.S. tech-firms have been in the spotlight in recent years as they are reluctant to bring their large holdings back to U.S. as they would be facing higher corporate tax rates.

This study addressed both shareholder and creditor rights protection in relation to holdings, but did not include the enforcement practices in the two countries. This could have provided more on the insights on the specific country risks explain and thereby explain the different holding levels. Furthermore, corporate governance variables such as board structure, remuneration practices and ownership structure in U.S. and Denmark, as they are also important factors that could affect holding levels.

And finally, as mentioned in chapter 2, given my results among the U.S.-firms, it would be interesting to investigate the level of tolerance for uncertainty and ambiguity in the two countries. Given the finding on precautionary motives in the U.S., one could expect a culture with high uncertainty avoidance to be more prevalent there.

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Appendix

1)

S&P 500, historical chart. 1976-2015.

Source: Google Finance; https://www.google.com/finance?cid=626307

(Accessed March 2015)

2)

Hausman test statistics/Redundancy test:

Conducted among both DK and US-countries. Test statistics among US-firms:

Cross-section Chi statistics: 741,05

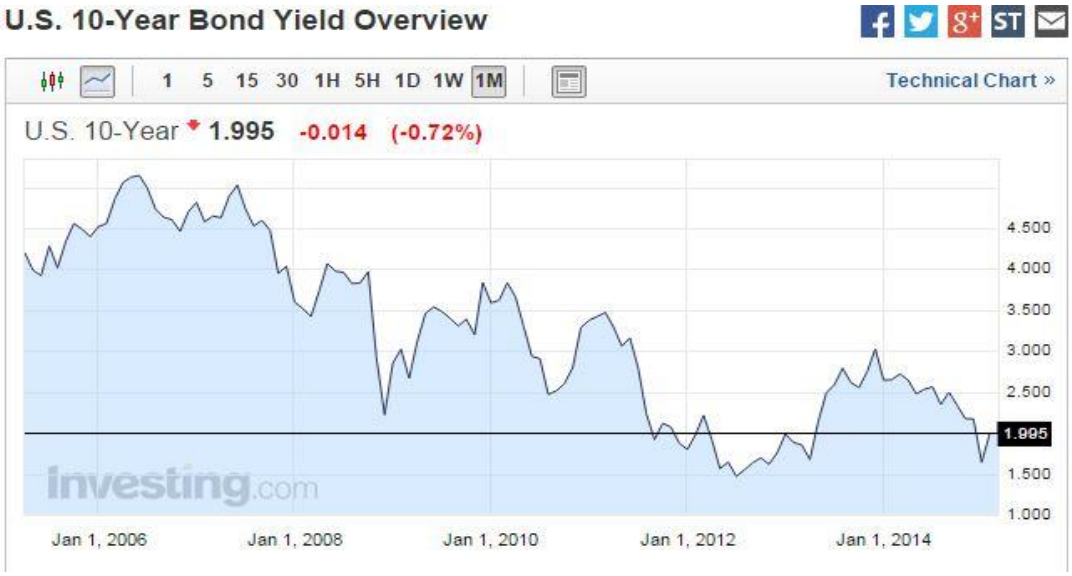
Cross section P-value: 0,00 (can be rejected)

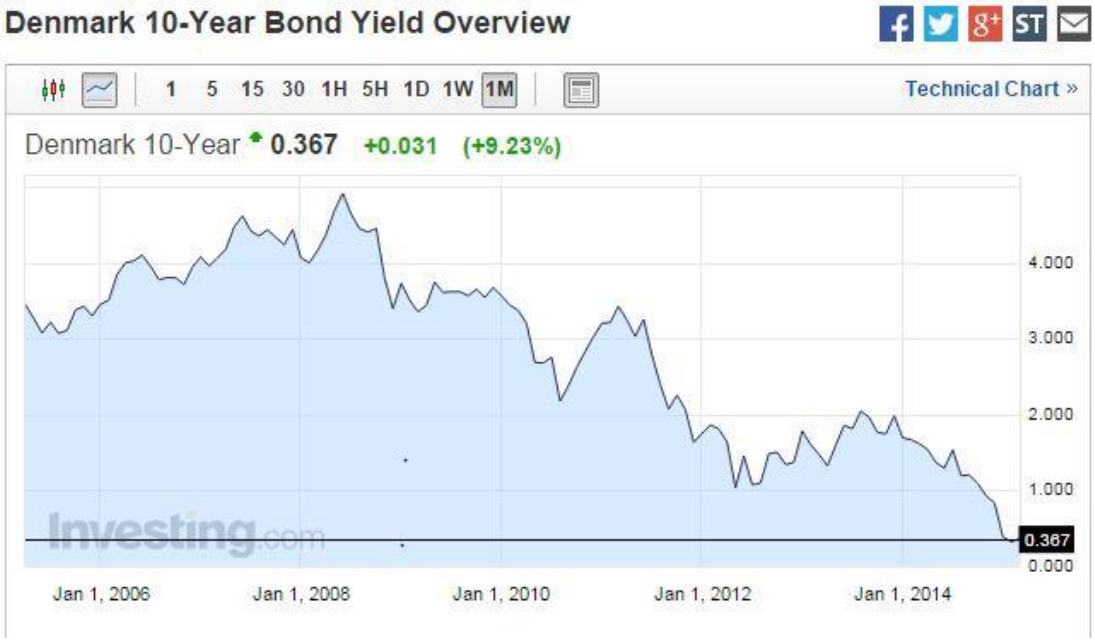
Time dimension Chi statistics: 12,53

Time dimension P-value: 0,25 (cannot be rejected)

3)

Government bond yields for U.S. & Denmark, 2006 – 2015.





Source:

http://www.investing.com/rates-bonds/u.s.-10-year-bond-yield (Accessed March 2015)

http://www.investing.com/rates-bonds/denmark-10-year-bond-yield (Accessed March 2015)