

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
School of Business
Finance

Walteri Waljus

**DETERMINANTS OF CASH HOLDINGS IN FINNISH INDUSTRIAL
SECTOR: MEASURING THE IMPACT OF FINANCIAL CRISIS 2007-
2010**

Supervisor/Examiner: D.Sc. (Bus. Adm.) Sheraz Ahmed

Examiner: Professor Minna Martikainen

ABSTRACT

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This thesis studies cash and short term investments to net assets ratio of Finnish industrial companies during financial crisis, and how different firm specific and macro economical variables affect cash and short term investments.

The data consists of quarter level interim reports. Regression analysis was used to find out the effects of different variables. Regression models were formed based on previous studies on cash holdings. It was found that firms studied held more cash during financial crisis than before it. Cash and short-term investments acted as substitute of net working capital. Leverage had a positive and significant relationship to cash and short term investment ratio. It was also found out that firms have a target cash and short term investments ratio.

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Tämä tutkielma tarkastelee miten suomalaisten teollisuusyritysten kassavarat ja lyhytaikaiset sijoitukset suhteessa nettotaseeseen (varat vähennettynä kassavaroilla ja lyhytaikaisilla sijoituksilla) ovat muuttuneet talouskriisin aikana. Ja miten eri yrityskohtaiset sekä makrotalousluvut vaikuttavat kassavarojen ja lyhytaikaisten sijoitusten määrään.

Tämä tutkielma koostuu yritysten osavuosikatsauksista. Regressiomallit muodostettiin aikaisempien tutkimusten pohjalta. Tutkimuksessa havaittiin, että yritykset pitävät suhteessa enemmän kassavaroja ja lyhytaikaisia sijoituksia taantuman aikana kuin ennen sitä. Kassavarat toimivat selkeästi substituuttina nettokäyttöpääomalle. Velkaantumisasteella oli positiivinen ja merkitsevä vaikutus kassavaroihin. Tulosten perusteella yrityksillä on tavoite suhde kassavaroille ja lyhytaikaisille sijoituksille suhteessa nettotaseeseen.

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1. Introduction

1.1. Background and motivation

Cash management is one of the most important supportive functions in a corporation, however it was long ignored in financial research by academics as well as by professionals. (Weston and Copeland, 1992; Kytönen 2004, Miller 1983) One of the modern cash management's main responsibilities is short-term financing activities and during the financial crisis management of these has become more important than ever before. In this study we are interested especially in cash and marketable securities holdings, factors that have affected them during the financial crisis and in finding if there is a target cash balance into which cash managers try to adjust their cash holdings.

Optimal cash balance levels have been researched based on monetary theory, which has been studied, for example, by Baumol (1952), Miller and Orr (1966) and Melzer (1963). Whereas the financial theoretic approach is interested in determinants of firms cash holdings and its impact on performance, leverage and shareholder value, these have been studied, for example, by Sartoris and Hill (1983), Morris (1983), Schwetzler and Reimund (2004), Mikkelsen and Partch (2003), Jensen (1986), Opler et al. (1999) and Dittmar et al. (2003). However there are only a few research how a crisis has affected cash holdings for example Elkinawy and Stater (2007), Alvarez et al. (2010) and Lee and Song (2007).

Motivation to this study is from the subprime crisis that began from declining US real estates' prices in 2007. The crisis has had an enormous impact on capital markets, business environment and trust between different market participants. Even though financial crisis didn't affect much the Finnish financial sector, it sure did for the economy as a whole.

The gross domestic product of Finland fell 8.0 per cent in 2009 compared to 2008 and exports fell 20.3 per cent during the same time period. The sales of Finnish industry corporations are highly depended on foreign demand, which makes them interesting group to analyze. 25 largest export firms represent roughly a half of the total exports of Finland and also ten largest export firms represent about third of total export. From those ten companies this analysis covers 6 and all are included in the 25 largest export companies. (Tilastokeskus, Talouselämä)

The research by the Confederation of Finnish Industries in 2008 showed that the financial crisis didn't affect the financing of Finnish large companies very much, the credit terms had come stricter and price of debt had risen. Changes in collateral requirements were only problem to small enterprises. Similar study in 2009 showed that the credit margins of the new and also old debts' were even doubled in some cases and at least one and half a time larger. (Confederation of Finnish Industries 2008 and 2009)

1.2. Objectives

In this thesis we are going to research how the current financial crisis has impacted short-term debt and cash and marketable securities holdings of Finnish industry corporations. It is also interesting to see if there is target cash and short-term investments holding ratio that corporate cash managers try to meet also during the financial crisis.

- What determinants explain the changes in amount of cash and cash equivalents to net assets ratios of Finnish basic industry's corporations?
- Is there a target cash and short-term investment holding ratio that corporate cash managers try to meet?

- How the amount of short-term debt ratios and cash and marketable securities ratios has changed during the financial crisis?

Regression analysis is used to find out the effects of the determinants. First order autoregressive model is used for determining the possible target cash balance behavior. The variables are formulated by using capital market variables such as interest and exchange rates, and corporate level variables are formulated by using interim financial statements on quarterly level from 2002 to the first quarter of 2010.

1.3. Structure of the thesis

First overall look to cash management is given. In second part the research of the cash management and cash holdings are presented from the monetary theoretic and the financial theoretic point of view. Third section describes the used data and the variables used. Fourth section discusses the results obtained from the models. Section five concludes the analysis.

1.4. Cash management and cash holdings

Cash management was relatively little researched and practiced until the short-term interest rates rose, i.e. higher costs for keeping cash in basic bank account, during the 1970s. The rise in cost of capital has motivated academics to research cash holdings, optimal cash balances and cash management processes. (Weston & Copeland, 1992, p.761)

Cash management is not only about managing the excess cash, cash owed to company and forecasting company's cash position. Figure 1 shows the areas of modern cash management. The people responsible for cash management are usually concerned with short-term financing activities, collecting cash, managing cash disbursements, transferring

funds and improving cash flow. One of the most important aspects is to forecast the cash outflows, since then company may make money market investments with sufficient maturities. Other related tasks are payment systems and taking care of the relationships to banks. As Foster Back (1997, 9-10) suggests that it is very hard to draw a line how much a certain size company should use resources in cash management, it is more about the type of the company and in what kind of business it is involved.

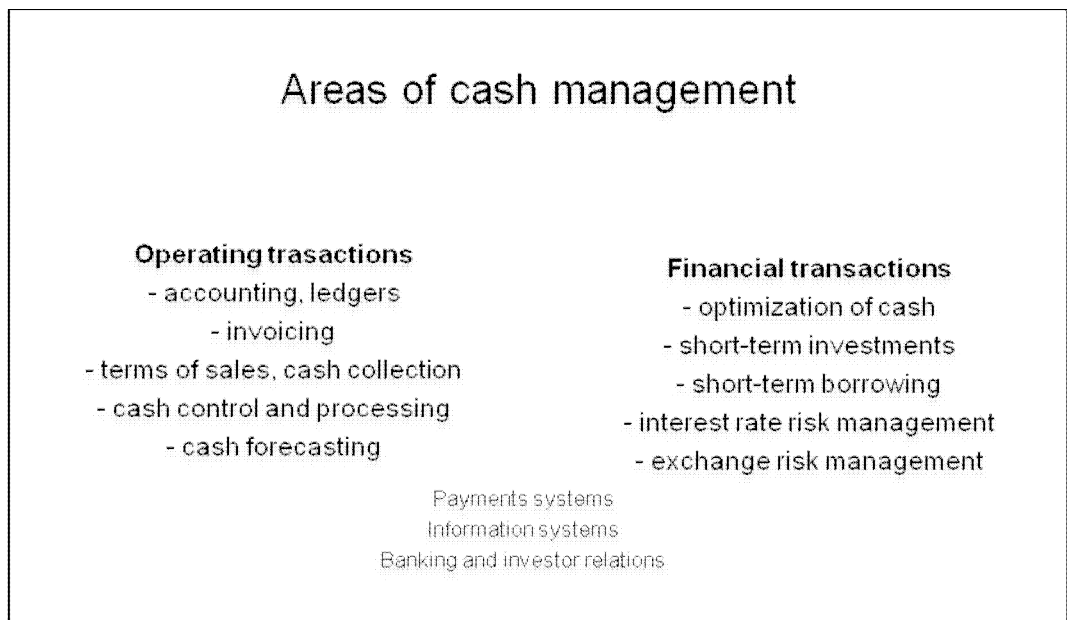


Figure 1 Areas of cash management (Kytönen, 2004)

The primary tasks of finance departments, evaluating inefficiencies and poor processes, is getting very complex, since businesses have a large amount of different products, services and markets and the amounts are only growing larger. (Ashby & Bayly, 2008) Nowadays cash managers may choose, from high number of different investment and cash management products, the products that suit his company's needs. The making of the needed transactions has become very easy thanks to the modern Internet-banking. Efficient cash management may save company significant amounts of money e.g. by reducing borrowing, reducing length

of collection period, forecasting cash flows and making short-term investments with idle cash.

According to a questionnaire by GT News (GT News, 2009) treasurer is owner of the cash management processes in 82.6 per cent of the firms examined. 32.7 per cent of respondents said that greatest potential for improving cash management is sales and receivables process, followed by cash flow forecasting. As cash concentration techniques zero and target balance pooling were mostly used, other important method was inter-company netting. 70.3 per cent of respondents allocate surplus cash to bank deposits, but allocation to money market funds in future was up from 4.2 per cent to 43.9 per cent. This is close to the future surplus cash allocation of 50.5 per cent. Bank deposits were used because of the ease of decision, current economic uncertainty, company policy and limited credit risk.

1.4.1. Cash management research

Theoretical part of this thesis is linked to the classification of cash management research shown in Figure 2. Cash management research is classified into four trends, which are monetary theory, financial theory, operations research and cash management practices research. In this study we are going to present the theoretical framework from monetary and financial theory point of view.

Disciplines of cash management

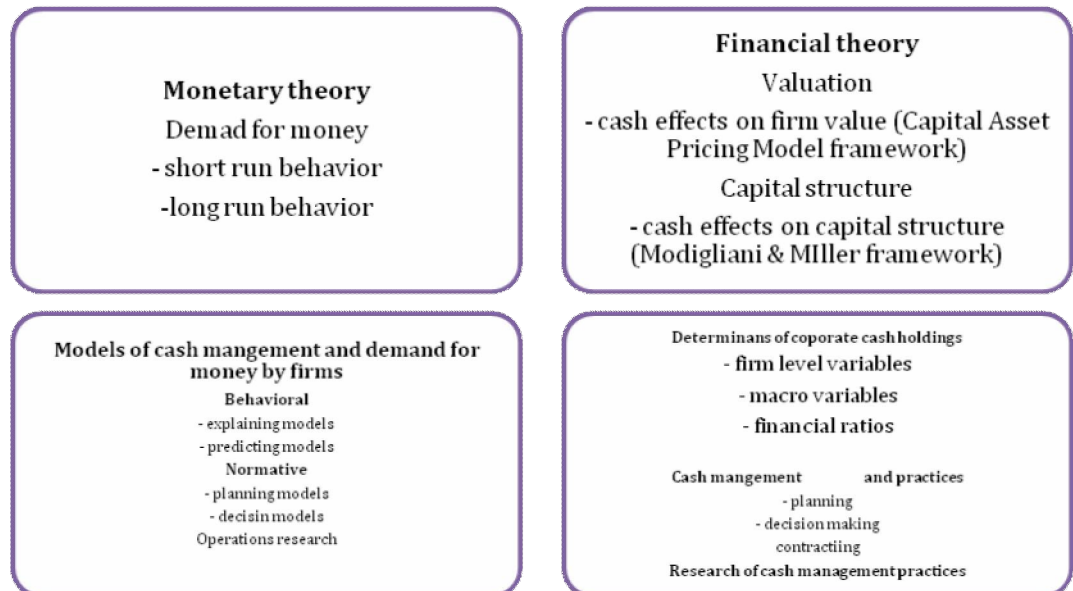


Figure 2 Theoretical research on cash management (Kytönen, 2004)

Monetary theory examines the questions regarding to demand for money by firms. Many models have been created in order to explain the demand for money by firms, for example from inventory theoretic approach Baumol (1952) Miller and Orr (1966) and Attanasio et. al (2002) and wealth theoretic approach Melzer (1963). There is no clear evidence that economies of scale exist in cash management, but most studies suggest that there are economies of scale in cash management. Economies of scale in cash holdings and cash management have been researched by Melzer (1963), De Alessi (1966), Vogel and Maddala (1967), Nadiri (1969), Ungar and Zilberfarb (1980), Natke (2001) and Bover and Watson (2004).

Financial theory is interested in the relationship between cash and other short-term investments to firms' capital structure and value. Even though Modigliani and Miller (1958) theoretically proved that capital structure has no effect in value of a firm, in a real world with efficient cash management firm may reduce costs of cash holding, optimize capital structure and

create shareholder value over time. Cash management's impact on shareholder value has been researched by Sartoris and Hill (1983) and Morris (1983). The impact of cash holdings to profitability has been researched by Schwetzler and Reimund (2004), Mikkelson and Partch (2003), Elkinawy & Stater (2007). and Oler and Picconi (2007). Jensen (1986), Opler et al. (1999) and Dittmar et al. (2003) have studied the strategic reasons for cash holdings.

1.4.2. Cash

Cash is sometimes called nonearning asset. It is needed for everyday transactions such as wages, material purchases and so on. In this study as cash is regarded the Cash & Short-Term Investments line from interim balance sheets. This amount includes physical notes and coins, money in bank accounts and short-term deposits and investments that can be quickly liquidated, in other words money that is easily accessible. It is not the inventory, properties nor accounts receivable, they might be transferred into cash at some point of time, but they are not instantly available.

2. Theoretical framework

2.1. Monetary theoretic approach to cash management

Monetary theorists have been trying to describe the mechanism of demand for money by firms, because it differs from the behavior of other economic agents. They have been building models to forecast the demand for money by trying to find stability between the quantity of money and its determinants. Monetary theorists describe the behavior of cash management operations through narrow definition of cash management, where cash management consists of the purchasing or selling of financial securities or borrowing or repaying capital. (Kytönen, 2004)

2.1.1. Inventory theoretic approach to cash management

A lot of theories have been written in order to explain the cash holdings and cash management of companies. Most of the theories are also considered with the cash management from point of view where the managing of the company's cash position and managing of the company's physical inventory are seen as a similar process. The base of the inventory theoretic approach is from Baumol (1952) who was the first to mix inventory managements "lot" thinking to the cash holdings. There are two basic monetary theoretic transaction models, which are widely accepted in financial literature. The Baumol inventory models are deterministic where as the Miller-Orr inventory model is stochastic; both models are in accordance with the theory of the firm.

Weston and Copeland (1992, p787) suggest that the inventory theoretic models' performance depends not only on how well they represent the reality, but also how well the parameters and probabilities are estimated.

For example the cost per transaction is hard to estimate, because it depends on the amount of work the person responsible for the transaction has to do in order to be able to execute the transaction. The models should be used only as guides, because the treasurer may know something that is not implied in the model.

2.1.1.1. Baumol-model

The model created by Baumol (1952) is based on the assumption that cash is an inventory like commodity, which is held up because it can be given out at some convenient moment. The firm is supposed to act rationally thus it holds a cash balance which minimizes the costs of holding cash, the forfeited interest income. It is also assumed that the firm is on average growing and it is a net user of cash. The optimal size of the cash transfer:

$$C^* = \sqrt{\frac{2bT}{i}}, \quad (1)$$

where C^* is the optimal size of the cash transfer, T is the total cash usage for the involved time period, b is the cost of the transaction in the purchase or sale of marketable securities, i is the applicable interest rate on marketable securities. The average cash balance for the period will thus be

$$\frac{C^*}{2}, \quad (2)$$

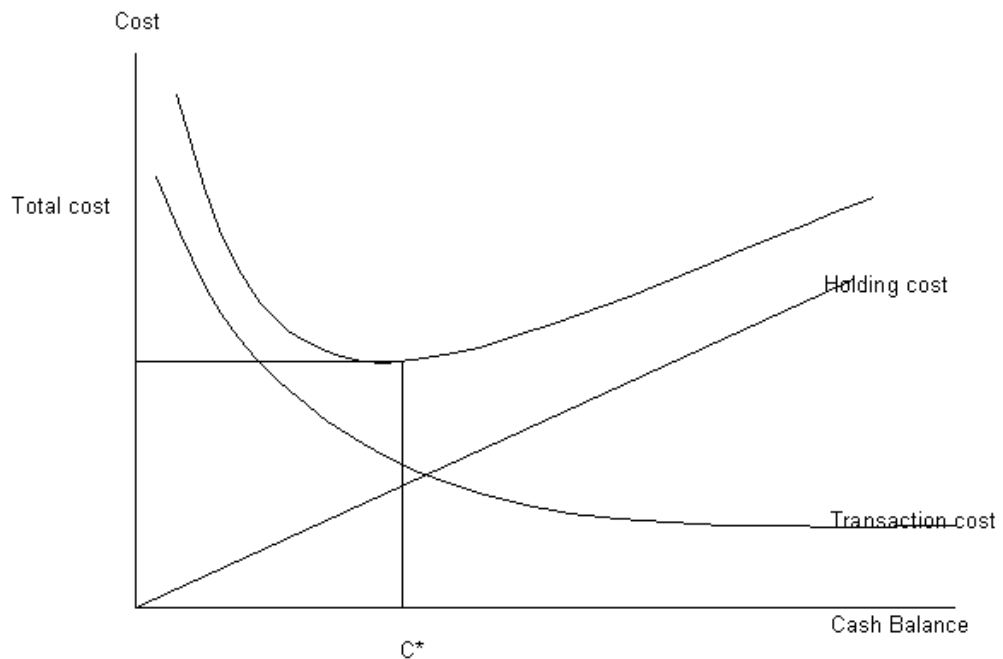


Figure 3 The Total cost per year for maintaining cash balances

In figure 1 shows the cash balance C^* that minimizes the total costs of holding cash. Holding costs increase linearly as the average cash balance $i\left(\frac{C^*}{2}\right)$ increases, the interest rate i is assumed to stay constant over time.

The transaction costs $b\left(\frac{T}{C^*}\right)$ decrease when cash balance increases assuming that the wanted balance stays constant, meaning that less transactions are needed to maintain the wanted balance.

It should be noted that nowadays, when Internet banking has made the making of deposits/withdrawals between different accounts or investments very easy, the b could be zero if the firm uses only interest paying savings accounts. Thus if the firm uses only savings accounts the total cost for the year would be only the interest rate difference between savings account interest and the return from marketable securities or the interest earned from fixed term deposit. Leaving out the expense of the amount of trades made during the time period. Of course we can calculate the expense for

the work that the person responsible needs to make these transactions and estimate the expense of Internet banking which is rather easy.

Baumol (1952) admits that the model is oversimplified because of the assumptions of rationality and static nature of cash disbursements. Also the interest rate is assumed constant, which is the case only by fixed term deposits, and the “broker fee” is constant or linearly impacted by the amount invested in marketable securities. But he suggests that the “broker fee” assumption is usually satisfied in practice. Usually there is a minimum fee, after which the fee increases in relation with the invested amount. The model neglects the Keynesian precautionary and speculative demand for cash. This is because the model needs a perfect world, where future transactions are perfectly forecasted and they occur in a steady stream, which is not the case in real world.

2.1.1.2. Miller-Orr model

The Miller-Orr model (1966) expanded the completely deterministic Baumol model by taking account the stochastic nature of cash expenditures and receipts. They assume that cash flows behave “as if they were generated by stationary random walk”. Meaning that cash flows are random in both size and direction, and they form a normal distribution when the number of observation periods increase.

The model is designed to determine the time and size of transfers from cash account to investment account; the process is illustrated in Figure. The *upper limit* h , is triggered at time t_1 , causing the cash manager to purchases marketable securities thus reducing the cash balance by $(h - z)$ dollars, to the *return point* z . After every transaction that leads to surpass the upper limit the cash balance is returned back to the return point. The cash balance follows random walk until it reaches the *lower limit* r (also referred as minimum balance point) at time t_2 , now marketable securities are sold with $r-z$ dollars, in order to return the cash balance back to the

return point. (Miller and Orr, 1966. Weston and Copeland, 1992, p785-788)

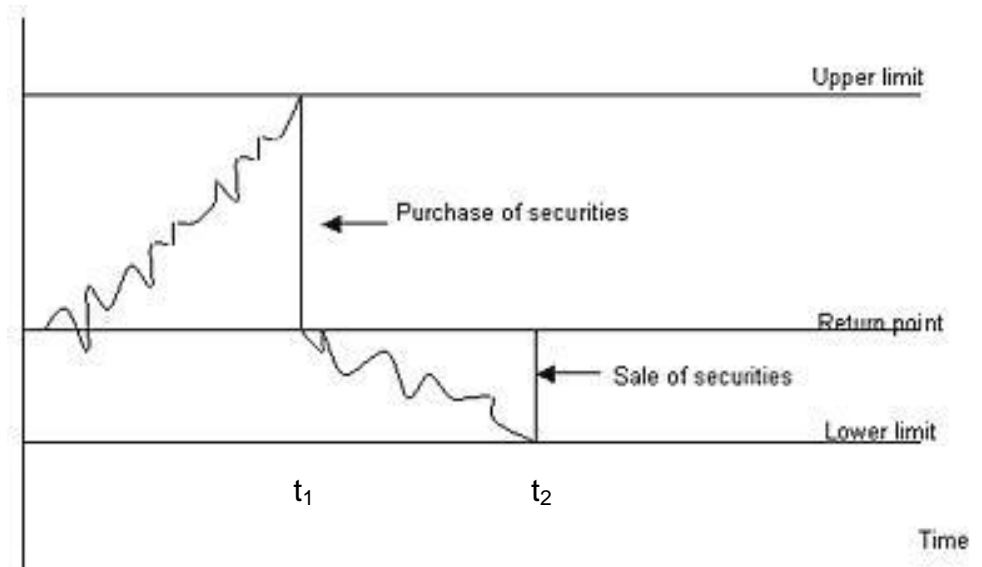


Figure 4. Miller-Orr Cash Management Model

The t is defined as $1/t$ representing some small fraction of a working day such as $1/8$ or the number of cash transactions per day. It is supposed that at any hour the cash balance will either increase by m dollars with probability p or decrease by m dollars with probability of $q=1-p$. Basically Miller and Orr supposed a special symmetric or zero-drift case where $p=q=0.5$. In such a case the upper limit will always be three times greater than the return point. The lower limit is assumed to be given, for example a minimum balance deposit required by a bank. The upper limit and return point are computed so that they minimize the cost function. The Miller-Orr cost function can be stated as follows: (Miller and Orr, 1966. Weston and Copeland, 1992, p785-788)

$$E(c) = bE(N)/T + iE(m) \quad (5)$$

Where $E(N)$ is the expected number of transfers between cash and the investment portfolio during the planning period; b is the cost per transfer; T

is the number of days in the planning period; $E(m)$ is the expected average daily cash balance and i is the daily rate of interest earned on investment. $E(c)$ can be minimized by choosing of the variables h and z . The solution as derived by Miller and Orr

$$z^* = \sqrt[3]{\left(\frac{3b\sigma^2}{4i}\right)} \quad (6)$$

Where σ^2 is the variance of the daily changes in the cash balance.

Miller and Orr have also tested their model to one industrial company by applying it to nine months of daily cash balances and purchases and sales of short-term securities. The model was found to produce 40 percent lower daily cash balances (\$160 000 for the model and \$275 000 for the treasurer) than those made by the treasurer. The treasurer needed 112 transactions to be able to match the \$275 000 average daily balance, the model would have made the same with only 80 transactions. The transaction costs were determined by assuming the transaction costs until the model gave the same number of transactions than the treasurer had really made. (Weston and Copeland, 1992, p.787)

Attanasio et al. (2002) measured in their model the transaction costs with the time costs. The model is an extension to the Baumol-Tobin model. The treasurer responsible for the cash balance needs time to make transactions and that money is a way to save on transaction time. The treasurer chooses optimal money balances in order to trade off the time cost of transactions against the cost of holding money instead of an interest-bearing asset yielding a nominal return of per period. The treasurer chooses money to minimize sum of the cost of transaction time and the forgone interest, subject to a transaction technology. The equation

by Attanasio reduces to Miller-Orr solution, if $\gamma = 0$ and $\beta = 2$. (Attanasio et al., 2002)

2.1.1.3. Critic to the models

In his study Deallanbach (1974) surveyed top financial management of 20 medium and large companies, he also compared two models. He found that cash management optimization models do not offer any improvements compared to the basic rule of thumbs used by treasurers as long as fixed transactions costs are below \$50. Only if fixed transactions costs are well above \$10 to \$40 the models become attractive to very large companies. Also if the standard deviation of daily cash flows is very large the savings from models are small. The models do not provide any economical significance from small or medium size firms and limited returns to big firms. He suggests that inventory control models for products work, because it may cover thousands of products. But for cash management there is only one product to control, the cash. Also Morris (1983) suggests that the models created for determining optimal cash balance haven't been able to maximize the firm value and they only consider the expected cost aspect, thus taking no account of the risk effect of the risk on the value of the firm.

2.1.2. Wealth theoretic approach to cash management

In addition to the inventory theoretic and production theoretic approach also wealth theoretic approach to cash management is widely accepted in financial literature. Melzer has used this approach in his study in 1963, he estimated that the amount of money held by companies is a function of the market rate of interest and wealth. (Kytönen, 2004)

Meltzer defined wealth as the firm's total assets. He argued that the amount of money held is subject to a wealth constraint as well as being

dependent upon the yield of a variety of alternative assets. Melzer also used sales as a proxy for the firm's wealth. Sales proxy was derived from capital/labor ratio, intensity of capital used and the internal rate of return. The variables were assumed to be constant for all firms in the same industry. Wealth theoretic approach has been used, for example, by De Alessi (1966), Nadiri (1969) and Ungar and Zilberfarb (1980).

2.1.3. Motives for holding cash

In a perfect world the best alternative for a firm is to hold no cash at all, since then it could maximize the interest incomes because cash holdings do not earn interest or referring Keynes (2006) "There is no necessity to hold idle cash to bridge over intervals if it can be obtained without difficulty at the moment when it is actually required." But in the real world the amount of cash holdings is a mix between different needs and requirements. In this section the motives of holding cash are discussed mainly from the Keynesian point of view. Also we investigate the determinants for holding cash, why firms hold cash and we take a look at the costs of holding cash.

2.1.3.1. Keynesian motives for holding cash

One of the most important and most influential economic books is indisputably J. M. Keynes' "The General Theory of Employment, Interest and Money" which was first published in 1936. In chapter 15 "The psychological and business incentives to liquidity" he describes three different motives for holding cash: the transactions-motive (which is further classified as the income-motive and business-motive), the precautionary-motive and the speculative-motive. (Keynes, 2006, p. 176-190)

The transactions-motive

The transactions-motive is about the need of cash for the current business cash inflows and outflows. As mentioned before, the transactions-motive is further classified as the income-motive and business-motive. The motives differ from each other almost only by the fact that the income-motive deals with individual level and the business-motive with the enterprise level. In this study we are going to need only the business-motive. Keynes describes the business-motive for holding cash as the need to bridge the time period between the generated business costs and the claim of the sale-proceeds. Thus the better the company can predict its cash inflows and disbursements the weaker the transactions motive will be. (Keynes, 2006, p. 176-190)

The precautionary-motive

The precautionary-motive states that the motive for holding cash lays in the possibility to cover the extraordinary expenses or to make profitable investments/purchases, which were not noticed earlier. For example a company owning a lot of cars or trucks needs a larger amount of precautionary cash holdings in order to be able to replace, for example, a broken truck. The more volatile the business operations are the more precautionary cash the company needs and thus there is a stronger motive for holding cash. (Keynes, 2006, p. 176-190)

In their study Han and Qiu (2007) modeled the precautionary motive for a firm's cash holdings and analyzed the interaction of financial constraints, cash holdings and cash flow volatility. They found that financially constrained firm increases its cash holdings in response to an increase in cash flow volatility. There was no systematical relationship between cash holdings and cash flow volatility for financially unconstrained firm. Lee and Song (2007) received similar results in their study about East Asian firms' cash holdings before and after the Asian financial crisis. They found that

increase in cash holdings is related to firms' cash flow sensitivity of cash and that after the crisis firms held more cash than before the crisis in order to better manage their risk.

The strengths of the precautionary- and transactions-motive

According to Keynes (2006, p. 176-190) the strengths of the transactions-motive and precautionary-motive, which share the same basics, partly depend on the cheapness and the reliability of methods when cash is obtained. Thus there is no need to hold large cash reserves, if the company can easily obtain cash when it is actually required. But the strength of these two motives is impacted by the possibility of running out of cash. If there was a situation where the company could very easily obtain cash with no borrowing costs, the optimal situation would be to hold no cash at all, and when a need for cash occurs it could sell the needed amount of marketable securities or borrow from bank etc. to cover the need. Nowadays many companies rely to use reserve-borrowing capacity rather than use cash for speculative purposes. (Brigham and Houston, 2004, p. 689)

The strength of the motives depends also on the company's relative cost of holding cash. The motive for holding a certain amount of cash weakens when the relative cost of cash increases, for example because of incapability to purchase a profitable asset. The motive strengthens for example, if the deposit account pays interest or bank chargers are avoided by cash holdings, thus lowering the relative costs. (Keynes, 2006, p. 176-190)

The speculative-motive

Keynes (2006, p.176-190) treats the speculative-motive as a choice between cash and bonds. The cash holdings have an opportunity cost, which is the forfeited interest payments that would be received from bonds

or deposits. Cash holdings have also a rate of return, which is usually zero, or close to it. If the investor believes that the interest rates are going to fall in the future, thus inducing increase in bond prices, he will buy bonds, thus decreasing his cash holdings, and vice versa. The demand for money is affected by the current nominal interest rates and the future interest rates. Rising interest rate also means higher opportunity cost for holding cash. But many companies are not able to take an advantage of securities investments because of the lack of required knowledge or interest.

Nadiri (1969) researched the US manufacturing sector from 1948 to 1960 and found that long-term interest rate and changes in interest rates were significant determinants of real cash balances, thus there was evidence of speculative motive in holding real cash balances.

2.1.3.2. Other motives for holding cash

Weston and Copeland (1992, p. 768) have suggested two more motives for holding cash. The first “Future Needs” is somewhat a mixture of precautionary and speculative motives. They propose that company’s cash holdings may rise to very large amount on a temporary basis, when the cash is needed to meet some specific future need. The other is “Compensating Balance Requirements”, which refers to the checking account balances that banks may require and the minimum amount that the firm agrees to maintain on them. This is an assurance for bank that they may loan on a longer basis, thus it is rather an institutional reason than motive for holding cash. They also recognize other reasons as follows:

- One very important reason to hold cash is the ability to take advantage from trade discounts. For example if the terms of sale is 2/10, net 30, which means 2 percent discount if the bill is paid within 10 days, or full payment

within 30 days. The annual effective interest rate for such a discount is 45 percent, which is significantly higher than the cost of capital from other sources.

- Having good current and acid test ratio, thus showing a strong credit standing for suppliers, banks, investors and customers.
- Ability to take advantage of favorable business opportunities, such as special cash offers or acquisitions.
- Ability to meet emergency situations such as strikes, fires or marketing campaigns of competitors.

Opler et al (1999) also presented motivations for holding cash in their study:

- By holding cash frequent short-term borrowing costs can be reduced
- Firms with low or no reserve borrowing capacity hold an enhanced amount of cash
- Internal cash generation capability or external borrowing capacity is insufficient
- The presence of entrenched management can be seen as low market-to-book ratios and higher levels of cash
- Firms with similar investment expenses but higher future investment opportunities tend to hold more cash than other firms

2.1.4. Determinants of firms' cash holdings?

In the models developed for cash management, the main determinant for corporate cash holding was thought to be transaction costs and firms with higher marginal cost of cash shortfalls were expected to hold more cash.

In this study we are more interested in firm and macro level determinants of firms cash holdings.

Recently researchers have also shown evidence that capital market development (Ferreira and Vilela, 2004) and shareholder protection (Ferreira and Vileta, 2004, Dittmar et al., 2003) are very important determinants for corporate cash holdings. In this study shareholder protection and capital market development are not very relevant since Finland has relatively high shareholder protection and capital market development is high.

In their study Opler et al. (1999) found that:

- large firms hold smaller amounts of cash, relative to their size
- firms with better growth opportunities hold higher levels of cash
- non-regulated firms hold lower levels of cash than risk regulated firms
- net working capital and cash holdings were negatively correlated, indicating that a positive net working capital is a close cash substitute
- there was a negative relationship between leverage and cash holdings
- insider ownership had a direct impact on the cash holdings of the firm
- company cash holdings and firm volatility were positively correlated
- low level of cash holdings are related to higher bond rating
- there is no evidence that derivatives are seen as cash substitutes

2.1.4.1. Asymmetric information

Asymmetric information between firms and investor make the external financing costly. Outsiders don't want to purchase overpriced securities and they discount them appropriately. Because outsider know less than

the firm's management they are very likely to underprice the security with the information received from the management. The outsiders may want to discount the security so that management decides not to sell the security and reduces or cancels the investment. (Opler, et al., 1999)

Ozkan and Ozkan (2002) report about study conducted by Myers and Majluf where they suggest that in a case of asymmetric information firms tend to prefer internal financing to information sensitive external financing. They also argue that the problem with asymmetric information is more severe for firms with high growth options. Firms with higher growth opportunities are supposed to have higher bankrupt probability. Ozkan and Ozkan (2002) suggest that growth opportunities are intangible of nature and in a financial distress and bankruptcy its value falls drastically. Thus the firms with higher growth opportunities have a motive to avoid financial distress and bankruptcy.

Elkinavy and Stater (2007) have researched the cash holdings of firms in Mexico and Brazil during Latin American Financial Crisis. They found that in Mexico the cash holdings declined during the crisis compared to the holdings before the crisis, but in Brazil the cash holdings stayed constant. They suggest that this is because in Brazil high agency costs and lower liquidity are roughly equal and offset the crisis, but in Mexico lower access to liquidity holds the cash holdings lower than they would be if there would be greater agency costs. In Mexico firm size had a positive effect on cash holdings and during the crisis the effect increased.

2.1.4.2. Ownership and cash holdings

Ozkan and Ozkan (2002) identifies three potential ownership structures which may impact firms' cash holdings; Managerial Ownership, Large Ownership or block ownership and Identity of Ultimate Controllers.

Managerial ownership. According to Ozkan and Ozkan (2002) previous research states that one potential conflict between managers and outside shareholders arises when management owns less than 100 percent of the residual cash flow rights. This creates agency costs that are borne by original shareholders. Jensen (1986) believes that large cash reserves serve mainly managers' interests, thus making the free cash flow a serious potential of conflicts. Shareholders may want that free cash flows are returned to them, but managers' may make inefficient investments or consume perquisites. Ozkan and Ozkan (2002) state that previous literature has developed to support the idea that managerial ownership may make the financial interest of management parallel to those of original shareholders. The firm performance improves through managerial ownership because as the managers are owners too, it is also their advantage to maximize to firm value. But via the managerial ownership the managers become more capable of shirking and the use of perquisite may outweigh the loss from reduced firm value. However there has been no sufficient research on how the managerial ownership impacts firms' cash holdings.

Large ownership or block ownership. Agency problem between managers and shareholders could be efficiently controlled, by monitoring the firms' management to ensure that they work in the interest of the shareholders. But for a small shareholder the costs of controlling and monitoring may outweigh the advantage received from it. The benefit received from controlling the managers is received only in proportion to their shareholding. Thus the controlling is more worthwhile since they already "own" more of the cash flows, also the free riding problem involved in controlling and monitoring are reduced. Thus large shareholder reduces the agency costs between management and shareholders, which leads to a lower cost of capital for external financing and less need for holding large cash balances. Large shareholders may also have nearly full control of the firm. Large shareholder may have the incentive and opportunity to increase the amount of cash under their control and with high cash

balances the controlling shareholders are also less willing to give up their control, thus suggesting that there is a positive relationship between large shareholders and cash holdings. (Ozkan and Ozkan, 2002)

Identity of ultimate controllers. The nature of monitoring of the managers may depend on the identity of the controlling shareholder. For example family owners are more likely to directly involve to managements controlling than financial institution. This leads to higher agency costs between management and outside shareholders, because the family owners may set up the monitoring inefficiently or not able to keep it at reasonable level for a longer time frame. Thus family controlled firms would hold more cash and marketable securities than otherwise controlled firms. But if the managerial owners set up monitoring, it would be more cost-effective and thus lower the agency costs otherwise related to higher managerial ownership. (Ozkan and Ozkan, 2002)

2.1.4.3. Pecking order theory

Pecking order hypothesis describes the order in which the firms wish to finance its activities. Pecking order theory is mainly a behavioral explanation of why some companies finance their operations as they do. It has also its rational arguments such as signaling and asymmetric information. (Van Horne, 2001, p. 298.) Meyers (1984) divides the financial pecking order as follows:

1. Internal financing is preferred for investments, because then firm doesn't need to give any information to outsiders. There are no flotation costs when retained earnings are used. But when the cash flows aren't enough to fund all desirable investment opportunities or "sticky" dividend payments, then is time to raise capital from outside. Thus cash is held to fund these needs.

2. Straight debt is preferred, because it also has almost none flotation costs. The issuance of debt may also work as a positive signal to investors; the management believes that the stock is undervalued and either debt is overvalued or valued fairly by the market. (Van Horne, 2001, p.298)
3. Preferred stock is next and it has some same features as of debt. It has no voting right, but it has priority to over common stock in the payment of dividends and liquidation.
4. Hybrid securities, for example convertible bonds.
5. The last is to issue straight equity. Equity financing has the highest flotation costs and may also act as a negative signal, because it may be assumed that firm didn't receive any other financing. According to pecking order hypothesis the issuance of straight equity is seen as a last resort.

2.1.4.4. Leverage and cash holdings

Debt is often seen as a substitute for cash. But leverage has also its limits, rationally thought firm should hold more cash when its leverage rises, since it needs larger amounts of money to interest and redemption payments. High leverage leads also to higher cost of additional debt, because the possibility of financial distress and bankruptcy rises. Li (2008) suggests that higher deviations from company's optimal cash balance leads to increase in leverage, increasing net borrowing costs and decreases return on net operating assets.

Guney et al. (2007) suggests that the relationship of leverage and cash holdings could be non-linear. Leverage of firm can be thought as a proxy for their ability to issue debt, thus meaning a negative relation between leverage and cash holdings. If firm raises too much debt it is more likely

that it will experience financial distress or even possibility of bankruptcy. But if leverage increases firms are likely to hold more cash in order to minimize risk of financial distress and possibility of bankruptcy. Thus meaning a positive relationship between cash holdings and leverage at high levels of leverage. They also found that country-specific and firm-specific characteristics play an important role in determining the relationship between leverage and cash holdings of a firm.

The costs of financial distress are important factor determining firms' liquidity and leverage policies. When the costs of financial distress are high the firm may hold more of its assets in a more liquid form or be careful with additional debt. John (1993) suggests that the liquidity ratio has a positive relationship with the financial distress proxies (firms Tobin's Q, R&D and advertising expenditures, an index of asset specificity and an index of the probability bankruptcy). The liquidity ratio is negatively related to sources of alternative liquidity such as intermediate cash flows, debt financing, length of cash conversion cycle and the collateral value of assets. These findings were strongly consistent with hypothesized relationships between corporate liquidity and financial distress costs (increase the liquid proportion of assets to lower costs of financial distress), and corporate leverage and financial distress costs (reducing debt to lower costs of financial distress). Kim et al. (1998) found a positive and significant relationship between liquidity and future economic conditions. Thus firms with higher probability of financial distress have lower levels of liquidity due to problems meeting their payments.

2.1.5. How much do firms hold cash?

During economic downturn short-term borrowing may be difficult, customers pay late and suppliers demand faster payments and then the cash is the king. Cash is needed for operations, interest payments, redemptions and possible dividends, keeping the company running. But

how much cash is enough? For that question there seems to be no clear answer. In the EMU area companies average cash and cash equivalents to assets ratio has been 15%, 18% in the US and worldwide round 9%. But there are large differences between countries, depending on the shareholder protection and development of capital markets. (Ferreire and Vilela, 2004; Dittmar 2003; Opler et al. 1999; Schwetzler and Reimund 2004)

Ferreira and Vilela (2004) investigated determinants of corporate cash holdings in EMU countries. As data they used publicly traded firms from EMU countries from 1987 to 2000. They found that EMU corporations held on average 15% of their book value of assets in cash or cash equivalents. Highest ratio was in Italy 21.9%, lowest in Portugal 5.1%. They found that the amount cash held by firms was positively affected by the investment opportunities and negatively affected by leverage and the amount of liquid asset substitutes. There was also a negative relationship between cash holdings and company size, which provided support to trade-off theory and contradict the pecking order theory. Firms in countries with high investment protection hold more cash and the capital market development is negatively related with cash holdings, which supports the precautionary motive.

Dittmar et al. (2003) studied over 11 000 companies in 45 countries from 1998. They found that companies held cash or cash equivalents were almost 9% of total assets and slightly above 9% of the market value of equity. Their results indicate that corporate governance is very important determinant of cash levels. The companies in poor shareholder protection countries hold 25% more cash than in higher shareholder protection countries. The difference increases to 70% when compared with capital market development. They also found that developed debt markets were positively related to cash holdings. Large firms and profitable firms hold more cash than other. Firms with higher net working capital hold less cash, because working capital is easy to convert into cash. Their study got

similar results to study conducted by Opler et al. (1999) and Ferreira and Vilela (2004). Schwetzler and Reimund (2004) studied German public corporations and found that there was mean corporate cash holding of 5.93%.

Opler et al. (1999) researched cash and marketable securities holdings among publicly traded US firm (financial firms were excluded) from 1971 to 1994. The mean cash/marketable securities to assets ratio was 18.03%. They found that firms with strong growth opportunities and firms with risky business activities tend to hold more cash than other firms. Firms with better access to the capital market hold less cash and there was a negative relationship between cash holdings and firm size. They suggest that firms hold liquid assets to be able to make investments when cash flow is too low relative to investment or funds from other sources are too expensive. Interestingly acquisitions were positively related to excess cash also disbursements to shareholders increased with excess cash. They found that precautionary motive is major determinant of cash holdings; the managers tend to hold excess cash in order to be able to survive from bad times.

Faulkender (2002) researched cash holdings of 2800 small firms; data was obtained from 1993 National Survey of Small Business Finance. He found that firms held cash 7.1% of sales on average. He also found that smaller firms hold more cash than bigger firms, suggesting that bigger firms have better access to credit markets and thus lower marginal cost for holding cash. Financial institutions, mining and service firms held the most cash whereas retail trade, manufacturing held and wholesale trade held the least cash to sales. Firms engaged to research and development held more cash than others, but the relative cash holdings declined as the firm size increased. Also when leverage increases for smaller firms their cash holdings increase whereas larger firms with high leverage held less cash.

Steijvers and Niskanen (2009) have researched the privately owned family firms in the US. The average cash to asset ratio was 22.8%, which is significantly higher than in above studies. They found that single owner managed family firms tend to hold more cash than family firms with diverged ownership. They suggest that this is the cause of higher shareholder-manager agency costs, e.g. free riding of family members. If the control and management are separated the cash holdings increased, thus being able to use the cash to benefit the core family or invest in not-necessary projects. They found that descendant-managed family firms hold more cash than family firms that are on first generation stage and the good banking relationship was negatively related to cash holdings. The information asymmetry between bank and firm reduces with long banking relationships and thus makes borrowing easier, which then enables firm to hold less cash.

Niskanen and Niskanen (2007) observed cash equivalents to assets ratios of Finnish (Häme region) small and medium sized firms from 1994 to 1997. They found that on average Finnish micro firms held 23% cash and the relationship between firm size and cash holdings was negative. This supports the findings of Opler (1999) and Faulkender (2002). What was bit surprising was that firms with high levels of liquid assets held more cash, this suggest that liquid assets are not seen as substitutes for cash, this is against trade off theory of cash holdings. When compared to findings of Ferreira and Vilela (2004), Opler (1999) and Faulkender (2002) we can see that Finnish SMEs hold substantially larger amounts of cash than other companies in the Europe and the US. Kim et al. (1998) found that average ratio of cash plus marketable securities to assets is 8.1% during the period from 1975 to 1994 in 915 U.S. industrial firms.

2.1.6. Cost of holding cash

In perfect capital markets where there are no transaction costs, no asymmetric information nor taxation, the holding of cash has no benefits, since the capital is available to positive net present value investments. But there are also no costs for holding cash because of the lack of transaction costs, taxes, securities mispricing or agency costs. Thus the cash holding has a zero net present value. (Modigliani & Miller, 1958. Faulkender, 2002) In real world there are costs for cash holdings and these costs together with the benefits of holding cash set the optimal cash balance level.

Taxation creates costs and there is a problematic relationship between the firms' cash and marketable security holdings and investors. If the firm does not pay dividend to its investors and keeps the cash to itself, the investor may lose money, because he could have invested cash better by himself. Large companies may invest in liquid marketable securities, but the investor can invest in them too if he holds the cash. Also the earnings from cash are double taxed, first at the firm level and then at the individual level, thus destroying shareholder value compared to the situation where the investor holds the cash himself. If the investor had done the investment, he would have paid taxes only on individual level. Where as borrowing creates a tax shield, investing in marketable securities creates a tax penalty. (Faulkender, 2002)

Jensen (1986) sees a conflict between shareholders and managers' interests when a project is earning a substantially higher free cash flow than originally planned with relevant discount factor i.e. cost of capital. The problems are usually caused by the management incentives that motivate managers to grow the firm beyond the optimal size and this leads to investing in projects with negative net present value. Growth also increases managers' power via the increased investment resources under his control. Thus the excess cash holdings have a cost, which appears as below cost of capital investments or spending in organizational inefficiencies rather than as disbursements to shareholders.

Kalcheva and Lins (2007) investigated over 5000 companies in 31 countries to examine the net costs and benefits of cash holdings. Their analysis shows that outside investors discount the cash holdings so that the firm is likely to have managerial agency problems in countries where shareholder protection is poor. In such a countries investors' valued \$1 cash holding in firm as \$0.76, but if the management was the largest shareholder then the dollar was discounted to \$0.39. Also absent of strong external shareholder protection the managements' decision to retain rather than pay out dividends affects negatively firm value. Only when country-level governance was strong investors valued cash at par value, despite of poor or entrenched management. The firm-level agency problems with high cash holdings were negatively related to firm value.

2.1.7. Cash management and economies of scale

Because we are examining large companies in this study, it is interesting to take a look what research say about economies of scale in cash management. Does the large size provide more advantages in cash management? The previous studies indicate that there are economies of scale in the demand for money.

Melzer (1963) studied the cross-sectional demand for money by the firms in the USA. He strongly suggests that the cross-section demand for money by firms is a function of sales, to a first approximation linear in the logarithms and unit elastic. The results of Melzer (1963) and De Alessi (1966) suggest that money defined as currency plus demand deposits yield a meaningful demand function that is unit-elastic in wealth and is stable over time. Melzer also found that there are economies of scale and sometimes-even diseconomies of scale depending on the industry. De Alessi (1966) conducted a similar study with data from United Kingdom. His results supported the results from Melzer. He states that statistically

significant economies of scale occur in cash holdings with relative large amount of wealth.

Vogel and Maddala (1967) researched US manufacturing companies in order to find whether a model of wealth or transactions demand better explains liquid asset holdings and the existence of economies of scale in the demand for cash among others. Interestingly they got contrary result to Melzer (1963) and De Alessi (1966), suggesting that there are economies of scale in demand for money by firms. They also found that when the size of manufacturing company increases it purchases government securities, thus using government securities as substitute for cash. Vogel and Maddala (1967) found a downward trend in relative money balances to rising interest rates and financial management innovations.

Nadiri (1969) investigated the US manufacturing sector from 1948 to 1960 and found that there were substantial economies of scale in real cash balance holdings. Ungar and Zilberfarb (1980) studied different issues affecting the demand for money in the Israeli firms. Their results gave no evidence of economies of scale in the cash management, but in the inflationary environment the changes in interest rates had a significant effect on the demand for money, this was contradict to previous research where the effect of interest rates has been negligible or insignificant. Daellanbach (1974) suggests that the models used in cash management do not provide any economical significance for small or medium size firms and limited returns to big firms. Thus slightly supporting the economies of scale assumption.

Natke (2001) researched Brazilian firms over four-year period during high inflation. He found that economies of scale exist for multinational subsidiaries but not for Brazilian firms. As reasons for this he suggests that multinational subsidiaries may hold less liquid assets because they have superior knowledge in financial management and access to foreign financial markets through the parent firm or the subsidiary network, and

the multinational subsidiaries may also react differently to specific stimuli than domestic firms. He also found that interest rates have a strong and elastic relationship with liquid asset demand. Bover and Watson (2004) found that scale effects, using firm level data the unobserved determinants for the demand for money, accounted for around half of the differences in firms' cash holdings in Spain. The differences were correlated with sales and were not explained by industry dummies. The same phenomenon was true also in the UK and the US.

2.2. Financial theoretic approach to cash management

Despite of its importance cash and liquidity management as whole it has received relatively little research conducted by academics or professionals. The research has been interested in the relationship between capital structure and firm value, and research of financial policymaking has been interested in capital structure and dividend policy. Liquid assets are an important piece of firm's total assets and these may be financed with short-term debt with relatively high cost of capital. Efficient cash management is as important as other financial policy variables when creating shareholder value. Cash management can be linked to financial theory by adding it to the financial theory models such as capital assets pricing model (CAPM) or the Modigliani-Miller model (M&M). Then cash managements' importance is considered in imperfect markets. The addition of cash balances to these models showed the importance of liquid assets for the value of firm, this could be seen as the systematic risk component, and for the optimal capital structure, which is related to the liquidity slack concept. (Kytönen, 2004)

The financial theory considers reasons for cash balances, in addition to the monetary theoretic reasons, closely to the strategic decisions that are related with the speculative motive for holding money by Keynes. Especially liquidity slack has received attention from academics and they

argue that it has an important effect on firm value and capital structure. Where the financial theory of valuation considers the trade-off between risk and return, the inventory theoretic models focus only on the expected cost. (Kytönen, 2004, Miller, 1983)

2.2.1. Cash balances and the value of the firm

As mentioned before, in theoretical finance the working capital management and especially cash management and liquidity management have received only a little attention over time, even though issues of working capital management (cash, marketable securities, receivables, payables, inventories etc.) issues are the most encountered problem for financial managers. Also the impact of liquidity balances has been widely ignored in researches, because it has never been incorporated into the mainstream financial theory that emphasizes with maximization of the value of a firm. (Morris, 1983)

From cash holdings impact on valuation point of view the CAPM, which is popularly used for determine theoretically appropriate required rate of return of an assets, is useless without modifications. The basic problems of CAPM are structured in assumptions that leave cash balances irrelevant. For example, in a single-period CAPM the value of the firm is determined as if the firm was liquidated at the end of one period and the proceeds are distributed to shareholders. The earnings of the firm are all realized at the liquidation date and when all earnings occur at the terminal date, there is no reason for the firm to hold any cash balances, thus they are unnecessary and irrelevant to the value of the firm. Also the assumption of investors' unrestricted access to lending and borrowing at the risk-free rate, with perfect and frictionless markets, makes the cash balances unnecessary. (Morris, 1983)

Morris (1983) included cash balances to the CAPM, which assumptions were modified to allow cash balances to be considered. He suggests that a firm that holds too little cash, the cost of cash management will have higher expected value and due its uncertainty they may increase the firms' systematic risk. Increasing the cash balance may decrease the uncertainty, but at the expense of unproductive investment. Varying both initial cash balances and cash management policy the systematic risk could be reduced. He also found that the initial cash balance should be expanded to the point where the marginal value of the costs of cash management is equal to the value of the return of the funds invested in productive capital assets.

Sartoris and Hill (1983) studied cash flow cycle and changes in cash management policies. They amended short-run cash inflows and outflows into the net present value model, and found that changes in cash management policies have an effect in value of the firm.

Schwetzler and Reimund (2004) studied German public corporations. The idea was to analyze how cash holdings impact the value of the company's real assets. They found that deviations from the industry median cash to sales ratio have a significant effect, both positive and negative, upon excess value of the firm. Suggesting that lower than median cash to sales ratios yield lower excess value and positive deviation has a positive impact. The excess value of corporation was calculated as market value of the firm minus value of corporate cash holdings or market value of equity plus net debt and using the valuation algorithm of Berger/Ofek.

2.2.2. Cash holdings and performance of the firm

Schwetzler and Reimund (2004) found also that high corporate cash holdings are driven away from improving the operating business at the expense of operating performance. Jose et al. (1996) examined the

relationship between profitability measures and management of liquidity needs for a large cross-section of firms over a twenty-year period. They suggest strongly that more aggressive liquidity management (i.e. lower cash conversion cycle) is associated with higher profitability. This was the case for several industries such as Service, Retail/Wholesale and Manufacturing, and the relationship was not driven by firm size.

Mikkelsen and Partch (2003) analyzed firms that had large cash holding policy between 1986 and 1991. They selected firms that maintained a ratio of cash and marketable securities to assets excess of 0.25 at the end of each fiscal year during the period. They found that during the five years examined firms with large cash holdings had greater median operating performance than the performance of firm matched by size and industry and greater than or comparable to the performance of firms matched by propensity to retain high cash reserves. They also found that firms with high cash levels grow faster, undertake higher levels of investment and have higher ratios of market-to-book value of assets.

Oler and Picconi (2007) investigated if future abnormal returns and operating performance are based on a firm's deviation from its optimal cash level. They found that cash balances that are below the optimal level are associated with poor future returns, but the firms do not exhibit lower operating performance in the future. They suggest that when firm holds large amounts of excess cash, firms are more likely to make bad investment decisions, which decrease future performance. Young firms seemed to have negative future returns when they held excess cash, but the excess cash was held to reduce the need for costly external financing and it increased their chance to survive.

Li (2008) extended the model of Opler et al. (1999) and found that higher deviations, both positive and negative, from the optimal cash balance were associated with lower return on assets, but the effect of negative deviation is stronger than the effect of positive deviation. Interesting was also that

that the marginal effect on future return on assets increases as the size of the deviation increases.

2.2.3. Financial and liquidity slack

Financial slack and liquidity slack are similar but distinct. Financial slack is the excess of firm liquidity next cycle's needs for operations, debt payments and payments to preferred shareholders. Liquidity refers to any asset that can be converted to cash or cash equivalents during the current operating cycle relative to the expected cash disbursement over the same period. (Bruchey, 2000, p. 2)

Jensen (1986) refers to liquidity slack, as free cash flow in excess of that is required to fund all projects that have positive net present value when discounted at relevant cost of capital. He suggests that in order to prevent the excess cash to be invested in low-return projects or wasted, the excess cash should be paid out as dividends or share repurchases. Or reduce the possibility to increase the excess cash by issuing debt. Debt can be a substitute for dividends, when exchanged in shares managers promise shareholders to pay out future cash flows in a way that is not achieved by just increasing dividends.

Liquidity slack can be thought to be similar to definition of excess cash by Opler et al. (1999). They defined the excess cash as the amount of cash held by a firm excess of the amount predicted by their model. The model included variables such as firm size, financial leverage, cash flow, cash flow riskiness and financial distress costs.

2.3. The impact of the SEPA on cash management

Even though the Euro was introduced in 1999 and in 2002 many EU countries were using same currency, the low-value euro payments were handled and processed differently in different countries. The fees for cross-border payments in the EU had always been high compared to

domestic payments. Thus European regulation on cross-border payments in euro (Regulation 2560/2001) was created, one of the main content, among others, is that payment fees could no longer be higher for cross-border euro payments within the EU than for corresponding domestic euro payments. The European banking industry responded to the regulation in 2002 by creating European Payments Council, its mission is to coordinate and to be the decision-making body for payments issues and Single European Payments Area (SEPA) was launched at the same time. (www.ecb.europa.eu)

Automation, centralization and reduced costs are the most important benefits of SEPA from the cash management point of view. Corporates may reduce number of the accounts, get full benefit from electronic invoicing and make faster transfers across Europe. Corporates having subsidiaries around Europe may have one collection account per subsidiary and one centralized account from which payments are made, except salary payments, which cannot be paid from corporate account. Other possibility is to have only one account for collections and one for payments for in the euro area. Reducing accounts releases capital, managing payables comes easier and also cuts banking costs. Making payments to different countries becomes easier and cheaper. The handling of incoming and outgoing payments is easier because they are sent in same format. E-invoicing reduces manual processing, mistakes, use of paper and postage fees, same time it also creates possibility to forecast cash flows more accurately on the corporate level. The most benefit firms with high payment volumes and institutions and governments. (www.euromoney.com; www.pohjola.fi; Skinner, 2008)

According to GT News (2009) many of the companies had not considered the impact of SEPA. Most respondents believe that they will have fewer accounts in future. Finnish respondents believe that the SEPA has no impact to their operations or it was not considered yet at all.

3. Research data and methodology

3.1. Data and sources

The data consists from firm level financial statement data and macro economical data. We focus on Finnish industrial companies that are listed on OMX Helsinki main list, since they were most affected by the current financial crisis as foreign demand fell significantly.

In this research the data from financial statements is panel data, which combines times series data and cross section data. The financial statement data was collected from Thomson One Banker database, macro level data from Datastream database and business cycle dates were collected from National Bureau of Economic Research. If some data points were missing those were complemented from interim reports obtained from company's' Internet page, however some data was not available from those interim reports. All variables are measured quarterly in Euros from the first quarter of 2002 through first quarter of 2010. It should be noted that financial statements for 2002 and 2003 are in accordance with Finnish Accounting Standards and from 2004 onwards in accordance with International Accounting Standards.

3.2. Models and variables

The tested models and variables are based on the previous studies by e.g. Opler et al. (1999), Elkinawy & Stater (2007), Dittmar et al. (2003) and Lee & Song (2007). Models in this study are estimated using the regression analysis with straightforward ordinary least squares method and first order autoregressive model. The models are tested with the SPSS 19 program.

The linear regression model assumes that there is a linear relationship

between the dependent variable and each predictor. This relationship is described in the following formula.

$$Y_i = \alpha + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_K X_{Ki} + u_i$$

where, Y_i is the i -th observation on the dependent variable Y , X_{Ki} is the i -th observation on the independent variable X_K for $k=2, \dots, K$. α is the intercept and $\beta_2, \beta_3, \dots, \beta_K$ are the $(K-1)$ slope coefficients and u_i is the error term.

The model is linear because increasing the value of the i -th predictor by 1 unit increases the value of the dependent by β_i units. α is the intercept and it is the model-predicted value of the dependent variable when the value of every predictor is equal to 0. (Brooks 2008, 89)

Independent variable in the models is cash and short-term investments to net assets. In this study three regression models are formulated. The first model is used to determine the effects of different variables on cash and short-term investments to net assets. Into the second model we add all variables multiplied with recession dummy. In the third model as explanatory variable we use only recession dummy and finally the model four is first order autoregressive model. See appendix 1 for calculation of different variables.

We also test differences between the results of models for recession and non-recession periods by grouping the regression variables with recession dummy.

$$1^1 \quad CTA = \alpha + \beta_1 SG_{1,t} + \beta_2 PR_{2,t} + \beta_3 STA_{3,t} + \beta_4 LEV_{4,t} \\ - \quad + \beta_5 DPS_{5,t} + \beta_6 EUR_{6,t} + \beta_7 EXC_{7,t} + \beta_8 WCM_{8,t} + e_{i,t}$$

¹ α = constant, CTA = cash to assets, SG = sales growth, PR = profitability, STA = sales to assets, LEV = leverage, DPS = dividend per share, EUR = 3-month Euribor, EXC = Euro to dollar exchange rate, NWC = net working capital, e = error term

$$\begin{aligned}
& CTA = \alpha + \beta_1 SG_{1,t} + \beta_2 PR_{2,t} + \beta_3 STA_{3,t} + \beta_4 LEV_{4,t} \\
2 \quad & + \beta_5 DPS_{5,t} + \beta_6 EUR_{6,t} + \beta_7 EXC_{7,t} + \beta_8 WCM_{8,t} + \beta_9 SG * rec_{9,t} \\
& + \beta_{10} PR * rec_{10,t} + \beta_{11} STA * rec_{11,t} + \beta_{12} LEV * rec_{12,t} + \beta_{13} DPS * rec_{13,t} \\
& + \beta_{14} EUR * rec_{14,t} + \beta_{15} EXC * rec_{15,t} + \beta_{16} NWC * rec_{1,t} + e_{i,t} \\
3 \quad & CTA = \alpha + \beta_1 REC_{1,t} + e_{i,t} \\
4 \quad & \Delta CTA_t = \alpha + \beta_1 \Delta CTA_{t-1} + \varepsilon
\end{aligned}$$

In the first model as explanatory variables we use growth in sales, profitability, sales to assets, leverage, dividend per share, 3 month Euribor, Dollar/Euro exchange rate and net working capital. However the dividend per share variable acts some what similarly to the recession dummy, since it get values between zero and two, and in Finland dividends are usually paid once a year, meaning that there are three zero dividend quarters and one quarter when the dividend payment actually take place.

Model 2 has all the same variables as model 1, but it also has the very same variables multiplied with recession dummy. During recession the variable is multiplied with 1 and during pre-recession period 0, thus presenting us how the explanatory variables affect the cash and short-term investments to net assets ratio during recession.

Model 3 presents the effect of recession in cash and short-term investments to net assets ratio. Similar results obtained from this model are expected also from mean comparison of cash and short-term investments to net assets ratios before and during recession.

Model 4 is used to determine whether there is a target cash balance to which companies try adjust their cash holdings. It is estimated with first order autoregressive model for each company and for the whole sample, model is similar to the model used by Opler et. al (1999). In the model

ΔCTA_t is the change in cash and short-term investments to net assets ratio and ΔCTA_{t-1} is same variable but lagged with one time period, in this case one quarter.

Time series is auto regressive process if the current value of time series can be expressed as a linear function of the previous value of the series. First order autoregressive process is similar to random walk. If the coefficient, β_1 , of the model 4 equals one there is a random walk. If β is greater than one the process is also a random walk. If β is positive and less than one there is a positive dependence on the past and the process is stationary. If β equals zero, there is a process of order zero, i.e. white noise. If β is between minus one and zero the process depends negatively on the past. In the model ε is independent and identically distributed disturbance with zero mean. (Vandaele, 1983)

When doing a regression analysis it is also important that residuals are not autocorrelated:

$$\text{Cor}(\varepsilon_i, \varepsilon_j) = 0$$

The Durbin-Watson measure tests the autocorrelation of residuals. If the Durbin-Watson value is about 2, there is no autocorrelation. If the value is about 0 there is positive autocorrelation and if the value is about 4 there is negative autocorrelation. (Brooks 2008, 146) The Durbin-Watson values of the models are listed in appendix.

Residuals from the regression model and autoregressive model should also follow the normal distribution:

$$\varepsilon \approx N(0, \sigma^2)$$

Normality of the models' residuals is tested with Shapiro-Wilk test, because it is used for samples, which sizes vary between 3 and 2000. If in

the Shapiro-Wilk test the p-value is smaller than 0.05, then the hypothesis of normal distribution must be rejected. Because in some cases Shapiro-Wilk test may cause misleading results, we also determine normality graphically by using the Q-Q Plots. If the data is normally distributed then the data points should be close to the diagonal line in the Q-Q Plot. If the data points stray from the line in an obvious non-linear fashion then the data is not normally distributed. However if the sample is big enough the non-normality of residuals do not cause problems.

Size was removed from the final model due to high correlation with STA PR, GS, LEV and WCM, it also had low tolerance implying that most of the variance in SIZE can be explained by the other predictors. Also the variance inflation factor was over 2, which is regarded as problematic due to severe multicollinearity.

3.3. Expected signs of model 1 coefficients

Table 1 presents the expected signs of model 1 coefficients. Profitability is expected to increase the cash and short-term investments to net assets ratio, because profitability is a result of increased positive cash flow. Sales to assets is expected to increase the ratio may be either positive or negative, since increase in sales to assets may increase cash flow with a lag, but increase in sales leads also to need for more working capital decreasing the ratio through increase in assets. Sales growth is assumed to have negative relationship to the ratio, because when sales increase company needs more working capital and the real cash flow comes after receiving the payment from customer.

The coefficient of net working capital is expected to be negative, because net working capital is supposed to act as substitute for cash holdings, when net working capital increases it is paid with cash. Leverage is expected to have positive relationship, as discussed before higher

leverage increases risk of financial distress, which in turn increases cost of debt financing and covenant/collateral requirements. Dividend per share acts similarly to dummy variable and during the quarters in which the dividend is actually paid it should decrease the cash holdings.

From macro variables 3-month Euribor rate is expected to have negative relationship with the ratio, because when interest rates increase also the costs of holding cash and required return for investments increase, which should lead to more investments financed with cash if possible. Exchange rate between Euro and USD is expected to have negative relationship, because many of the raw materials and also prices of end products are in USD and if the Euro weakens against USD it should increase the cash holdings, because more Euros are needed to cover USD costs, which are not offset by USD sales.

Table 1. Expected signs of model 1 coefficients.	
Explanatory variables	Coeff.
Profitability	+
Sales to Assets	+/-
Sales Growth	-
Net Working Capital	-
Leverage	+
Dividend per Share	-
3-month Euribor	-
Exchange rate	-

4. Results

This section shows and discusses the results of this study. First sample statistics are viewed and then results of regression models are presented.

4.1. Sample statistics

Table 3a presents the number of observations, minimum, maximum, mean and standard deviation values of the financial statement variables used in this study. From the table we see that mean cash and short-term investments to net assets ratio was 4.3%, there is a huge difference between the minimum ratio of 0.41% and the maximum ratio of 31.9%, these changes reflect well the quarterly changes in cash and cash equivalents holdings among companies during the crisis. This is much lower mean than what Ferreira and Vilela (2007) found for Finnish publicly traded companies' ca. 15%, but the difference may be explained by the time frame and nature of the sample, industry sector is very capital intensive. Dittmar et al. (2003) report average cash holding of 7.6% for Finnish corporates.

The quarterly profitability was 2.7% on average and sales to assets ratio 25.33%. Interesting values are also presented for sales growth which was only 0.0545% on average, but the minimum of -42.32% and maximum of 46.01% shows well how dramatically the financial crisis hit some of the companies and how fast the recovery was. On quarterly level the standard deviation of sales growth was 14.4% also reflecting large fluctuations in sales during the time period investigated. Naturally some growth rates may reflect the accounting practices caused by large projects etc. The macro variables have also fluctuated a lot, 3-month Euribor rate has been changing during the period researched from 0.634% up to 5.277% and Euro Dollar rate has been changing between 0.8724 and 1.5812, implying

large changes in macro economy during the period and in trade environment between the Europe and the USA. The previously strong USD has become weaker and same time products and services from Euro countries have become more expensive to US customers.

Table 3a. Descriptive summary of statistics²

The table present number of observations, minimum, maximum, mean and standard deviation of each numerical value.

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Cash to Net Assets	353	0.0041	0.3190	0.0433	0.0384
Sales growth	352	-0.4232	0.4601	0.0055	0.1404
Sales to assets Profitability	359	0.1224	0.5609	0.2533	0.0757
Net working capital	335	-0.0447	0.0996	0.0274	0.0183
Leverage	353	-0.1121	0.2947	0.0796	0.0811
Dividend per Share	359	0.3017	0.7918	0.6043	0.0898
Cash to StD	363	0.0000	2.0250	0.1469	0.3490
Dollar/Euro rate	328	0.0200	10.8837	0.8196	1.4510
Euribor 3m	363	0.8724	1.5812	1.2760	0.1616
	363	0.6340	5.2770	2.8000	1.2349

Table 3b presents the means, differences in mean and statistical significance of t-tests of the selected variables before recession and during recession. T-tests were conducted to determine whether there are differences in means between in pre-recession and recession periods. The results indicate that companies hold lower proportion of their net assets in cash during the pre-recession period (3.8%) than during recession (5.8%). The 2 per cent difference is significantly lower than 3.8 per cent difference during Mexican crisis, but significantly higher than -5.1 per cent difference during Brazilian crisis (Elkinawy and Stater, 2007).

² Please see appendix 4 for company level medians and standard deviations.

Other differences observed are that companies had higher growth rates and also higher profitability during the pre-recession period. Leverage and sales to net assets did not reveal significant changes depending of the period. Interestingly the difference in mean of leverage is similar to the Elkinawy and Stater (2007) finding for differences before and during Brazilian crisis.

Table 3b. Descriptive Statistics for the data

*** (**) (*) The difference in means is significant at the 1% (5%) (10%) level.

Sample Sub Period Variables	Pre-recession (2002-2007)		Recession (2008-2010)		Crisis- Pre Crisis	
	Mean	Std. Dev.	Mean	Std. Dev	Diff. in mean	p-value
Cash to Net Assets	0.038	0.035	0.058	0.043	0.020***	.000
Sales to Assets	0.257	0.074	0.243	0.079	-0.014	.122
Sales Growth	0.019	0.134	-0.028	0.151	-0.047***	.005
Profitability	0.029	0.017	0.025	0.022	-0.004*	.070
Net Working Capital	0.078	0.080	0.083	0.085	0.005	.584
Cash to StD	0.729	1.526	1.028	1.242	0.299*	.087
Leverage	0.607	0.081	0.597	0.110	-0.011	.321
Dividend per Share	0.156	0.359	0.123	0.320	-0.033	.429
3-Month Euribor	2.911	0.857	2.504	1.881	-0.407***	.005
Dollar/Euro rate	1.214	0.138	1.442	0.084	0.015***	.000

Table 4 shows the normal distribution test results the regression variables. The Shapiro-Wilk values are below 0.05 meaning that the residuals of the variables do not follow normal distribution for the whole sample. However from Q-Q plots (Appendix 2) we can see that for some of the companies residuals are close to normal distribution.

Table 4. Summary of normality statistics

The table shows Kolmogorov-Smirnov and Shapiro-Wilk test results for normal distribution

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Cash to Net Assets	.168	308	.000	.763	308	.000
Sales to assets	.099	308	.000	.915	308	.000
Growth in sales	.104	308	.000	.970	308	.000
Profitability	.141	308	.000	.928	308	.000
Net Working capital	.058	308	.014	.988	308	.010
Cash to StD	.289	308	.000	.505	308	.000
Leverage	.069	308	.001	.978	308	.000
Dividend per Share	.419	308	.000	.519	308	.000
Euribor 3m	.147	308	.000	.942	308	.000
Dollar/Euro rate	.068	308	.002	.978	308	.000

a. Lilliefors Significance Correction

Appendix 3a presents the normality tests of the residuals of the first order autoregressive model. From the Q-Q plot we can see that the residuals are not normally distributed and also Shapiro-Wilk value is below 0.05.

Table 5 shows the correlation matrix for the all regression variables. Pearson correlation is the most commonly used method to measure dependence between two variables. From the correlation matrix we can see that cash to net assets ratio is negatively correlated with sales growth and 3-month Euribor rate. The negative correlation between 3-month Euribor and cash to net assets may be explained by the higher required rate of return for investment when interest rates are high, thus leading to more investments, which may be financed with cash and cash equivalents.

There is very high correlation between sales to assets and profitability and net working capital, which is not a surprise since in industrials the costs are high and more sales should lead to higher profitability. The relationship

to net working capital is because of assets based production where more sales need more capital employed in production. Leverage is negatively correlated with profitability and net working capital, where the negative relationship with profitability is due to higher probability of financial distress, bankruptcy and higher cost of capital, and with net working capital the negative relationship comes from how the net working capital is calculated.

Dividend per share is positively correlated with sales to assets and sales growth, but negatively correlated with leverage. Meaning that when leverage increases dividends decrease, which is natural cause of higher financial costs, excluding a situation where dividends are paid with debt. However from accounting point of view dividends are money owned to shareholders and when they are paid it should have inverse effect, since dividends are taken from cash and cash equivalents from assets and from retained earnings from shareholders equity, if not financed with debt. Thus higher dividends should lead to higher leverage. However correlation between two variables does not implicate causality but it gives a hint of possible dependency.

Table 5 Correlation matrix of selected variables

The table presents the cross correlations between regression variables. Variables are: CTA = cash to assets, PR = profitability, STA = sales to assets, GS = sales growth, NWC = net working capital, LEV = leverage, DPS = dividend per share, EUR = 3-month Euribor, EXC = Euro Dollar exchange rate.

		CTA	PR	STA	GS	NWC	LEV	DPS	EUR
Pearson Correlation	CTA	1.000							
	PR	.007	1.000						
	STA	.161	.493	1.000					
	GS	-.047	.278	.339	1.000				
	NWC	.091	.269	.468	.025	1.000			
	LEV	.153	-.118	.265	.069	-.222	1.000		
	DPS	.098	.172	.220	.358	.103	-.132	1.000	
	EUR	-.230	.194	.193	.055	.143	-.068	.061	1.000
	EXC	.183	.033	.063	.012	.054	-.072	.102	.270

4.2. Regression results

In this section results of the regression models and first order autoregressive model are discussed. We present the coefficients values, t-stat, p-values, R-squared and adjusted R-squared values. The R-square measures how well the explanatory variables explain variations in the dependent variable (Brooks 2008, 107). Adjusted R-square takes into account the loss of degrees of freedom associated with adding extra variables. If an extra variable is added to the model and adjusted R-square rises, adding new variable is acceptable (Brooks 2008, 110).

4.2.1. Determinants of cash holdings

Table 6 presents the results for the model of determinants of cash and short-term investments to assets ratio for the whole sample. All variables except profitability and net working capital are statistically significant. 3-month Euribor and exchange rate are both statistically significant at 1% level, sales growth, leverage and dividend per share at 5% level and sales to assets at 10% level.

Profitability has a weak positive but statistically insignificant connection to the cash and short-term investments ratio, a stronger positive relationship was found by Elkinawy & Stater (2007), but the results were statistically significant. Sales to assets has a significant and positive relationship to the cash and short-term investment ratio, which was anticipated, however lagged sales to assets could have had stronger relationship because sales does not mean that the cash is received during the same quarter. Sales growth has a negative and significant connection to the cash and short-term investments to assets ratio, which is contrary to Dittmar et al. (2003). As mentioned before increase in sales does not mean an instant increase in cash, but to enable sales growth a company may have to spend more cash to generate more sales. Net working capital has a positive and

insignificant connection to the cash and short-term investments to assets ratio, which is contrary to Opler et al. (1999), Dittmar et al. (2003) and Elkinawy & Stater (2007), who all found a negative relationship. The negative relationship indicates that net working capital is used as substitute for cash.

Leverage has a positive and significant connection to the cash and short-term investments to assets ratio, meaning that when leverage increases cash holdings increase too, which is natural effect since possibility of financial distress increases too. As discussed previously leverage can have either a negative or a positive coefficient. The findings are contrary to previous studies by Opler et al. (1999), Guney et al. (2007) and Dittmar et al. (2003), who all found a negative relationship. Elkinawy & Stater (2007) found a positive, but insignificant relationship on Brazil, for other countries investigated the relationship was negative.

Table 6. Results of determinants of cash and short term investments to net assets ratio				
The table 6 presents the results for regression of the model for cash to net assets ratio determinants. Coefficients and t-stats and statistical significance are presented. Table also presents R-square and adjusted R-square values. *** (**) (*) – Coefficient estimate is significant at 1% (5%) (10%) level.				
Depended variable CTA	Whole sample			
Explanatory variables	Coeff.	t-stat	p-value	Sig.
Const.	-0.089	-3.580	0.000	***
Profitability	0.007	0.055	0.956	
Sales to Assets	0.078	1.927	0.055	*
Sales Growth	-0.039	-2.404	0.017	**
Net Working Capital	0.038	1.219	0.224	
Leverage	0.066	2.457	0.015	**
Dividend per Share	0.013	2.140	0.033	**
3-Month Euribor	-0.010	-6.091	0.000	***
Exchange rate	0.074	4.879	0.000	***
R ²	0.196			
Adjusted R ²	0.175			
Durbin Watson	0.895			
Number of observations	322			
F-stat	9.541		0.000	***

Dividend per share has a weak positive and significant connection to the cash and short-term investments to assets ratio. Previous study by Elkinawy & Stater (2007) support this finding, however their finding was not statistically significant. Guney et al. (2007) found a very weak negative relationship and Dittmar et al. (2003) and Opler et al. (1999) found a slightly negative relationship.

Both macro variables are statistically significant at 1% level. 3-month Euribor has a weak negative relationship, indicating that when interest rates rises the cash holdings fall. Rising interest rates mean higher required return for investment, leading to more investments, which may be financed from cash and short-term investments, thus it may decrease cash holdings.

Euros to USD exchange rate a positive relationship to the cash and short-term investments to assets ratio. When Euro strengthens against Dollar the cash holdings raise too, this is contrary to what could be expected, if company has lot of its sales in USD or in some other currency that is linked to USD, it is obvious that strengthening of Euro reduces its relative USD-linked incomes. The negative connection could be explained if company has its expenses in USD and incomes in Euros, which is not usually the case with Finnish companies. Most of the raw materials are priced in USD, thus the sales in USD seldom offset the costs arising from raw materials. Some part of the changes in exchange rate is determined by relative changes in interest rates, such as between 3-month Euribor and US treasury bills.

The R-square of the model is 0.196 and the adjusted R-square is 0.175. Approximately twenty percent of the variation in the dependent variable can be explained by the explanatory variables. Durbin-Watson value is 0.895 implying that the residuals are slightly autocorrelated.

Table 7 presents the results for the determinants of cash and short-term investment to assets ratio for pre-recession and recession periods. It is important to test the difference between these periods, because, for example, during recession it may be harder to raise funds, the changes in macro economical variables may increase or decrease cash flows, firms may save more of its profits compared to pre-recession period and firms may try to use less working capital.

Table 7. Results of determinants of cash to net assets ratio for pre-recession and recession period.
The table 7 presents the results for regression of the model for cash to net assets ratio determinants for pre-recession and recession periods. Coefficients and t-stats and statistical significance are presented. Table also presents R-square and adjusted R-square values.
*** (**) (*) – Coefficient estimate is significant at 1% (5%) (10%) level.

Dependent variable CTA		Pre-recession period 2002-2007			Recession period 2008-2010			
Explanatory variables	Coeff.	t-stat	p-value	Sig.	Coeff.	t-stat	p-value	Sig.
Const.	-0.082	-2.301	0.022	***	-0.130	-1.446	0.152	
Profitability	0.132	0.780	0.436		-0.211	-0.951	0.344	
Sales to Assets	0.074	1.485	0.139		0.098	1.336	0.185	
Sales Growth	-0.013	-0.636	0.526		-0.086	-2.929	0.004	***
Net working capital	0.010	0.249	0.804		0.090	1.659	0.101	
Leverage	0.067	1.788	0.075	*	0.073	1.792	0.076	*
Dividend per share	0.009	1.318	0.189		0.019	1.361	0.177	
3-month Euribor	-0.162	-2.105	0.036	***	-0.012	-4.513	0.000	***
Exchange rate	0.059	2.374	0.019	***	0.100	1.619	0.109	
R ²	0.105				0.308			
Adjusted R ²	0.071				0.246			
Durbin Watson	0.847				1.198			
Number of observations	223				99			
F-stat	3.128		0.002	***	5.006		0.000	***

The results are similar to the results for whole sample, however for both periods, many variables lost their statistical significance and surprisingly profitability seems affecting negatively cash holding during recession. For pre-recession period only leverage at 10%, 3-month Euribor at 1% and Euro Dollar exchange rate at 1% level were statistically significant. During recession statistically significant was sales growth at 1%, leverage at 10% and 3-month Euribor at 1% level.

The largest coefficient change between pre-recession and recession periods was in profitability, in which strong positive coefficient during pre-recession turned negative in recession. Implying that during pre-recession when profitability increased also cash holdings increased, but during recession decrease in profitability increased cash holdings. Other large change was in the effect of interest rate, which coefficient is significantly larger during pre-recession than during recession period, which could reflect the effect of higher interest rates to investment activity, also during recession interest rates are usually lower and investment activities are low.

Sales to assets coefficients were similar during both periods. Sales growth has only a weak negative relationship to cash and short-term investments to assets ratio during pre-recession period, but stronger negative relationship during recession, also net working capitals coefficient increased for recession period. Increase in coefficient of net working capital may be because of decrease in sales, which reduces the use of net working capital.

Leverage has larger coefficient during recession than during pre-recession period. This is according to previous discussion, where we noted that debt margins were reported to be at least one and a half time larger during recession, which means higher interest payments and banks may also require stricter covenants.

Dividend per share variable is not statistically significant, but it seems that during recession companies hold more cash during the quarter in which dividends are paid than during pre-recession period.

The R-square of the model for pre-recession is 0.105 and the adjusted R-square is 0.071, and for the recession period 0.308 and 0.246 respectively. The model explains more of the variation of dependent variable during recession than in pre-recession period. Durbin-Watson

values are 0.847 and 1.198 implying that in both models the residuals are slightly autocorrelated.

Table 8 presents the results for determinants of cash and short-term investments to net assets ratio when effects of variables are fixed with recession dummy in order to see how different variables affect the cash holdings during recession. From original variables only leverage and macro variables are statistically significant at 5 per cent level. From new variables only sales growth multiplied with recession dummy is statistically significant also at 5 per cent level.

The effects of original leverage and macro variables are similar to the results presented in table 6. Profitability has a positive relationship to cash and short-term investments to net assets ratio, which is supported by the results of Elkinawy and Stater (2007), both before and during the Mexican and Brazilian crisis. Leverage and net working capital have a positive relationship, which is contrary to the findings of Elkinawy and Stater (2007) except Mexico.

From the new variables profitability has a strong negative relationship to the dependent variable during recession, which is contrary to pooled sample of Elkinawy and Stater (2007), but similar to findings in Argentina and Mexico. Leverage and net working capital have a positive relationship to dependent variable during recession, which is similar to the findings of Elkinawy and Stater (2007).

The R-square of the model is 0.224 and the adjusted R-square is 0.183. Durbin-Watson values are 0.947 implying that the residuals are slightly autocorrelated.

Table 8. The results for determinants of cash holdings when effects of variables are fixed with recession dummy.				
The coefficients on the interaction terms represent the difference in the effect of the variable on cash holdings during the crisis and pre-crisis period. Coefficients and t-stats and statistical significance are presented. Table also presents R-square and adjusted R-square values.				
*** (**) (*) – Coefficient estimate is significant at 1% (5%) (10%) level.				
Dependent variable CTA	Whole sample			
Explanatory variables	Coeff.	t-stat	p-value	Sig.
Const.	-0.840	-2.550	0.011	**
Profitability	0.130	0.768	0.443	
Sales to Assets	0.076	1.568	0.118	
Sales Growth	-0.140	-0.703	0.482	
Net working capital	0.009	0.226	0.822	
Leverage	0.065	2.011	0.045	**
Dividend per share	0.010	1.524	0.129	
3-month Euribor	-0.007	-2.135	0.034	**
Exchange rate	0.062	2.556	0.011	**
Profitability*rec dummy	-0.322	-1.223	0.222	
Sales to Assets)*rec dummy	0.021	0.258	0.796	
Sales Growth*rec dummy	-0.064	-1.979	0.049	**
Net working capital*rec dummy	0.086	1.343	0.180	
Leverage*rec dummy	0.003	0.245	0.807	
Dividend per share*rec dummy	0.001	0.199	0.842	
3-month Euribor*rec dummy	-0.007	-0.782	0.435	
Exchange rate*rec dummy	0.009	0.603	0.547	
R ²	0.224			
Adjusted R ²	0.183			
Durbin Watson	0.947			
Number of observations	322			
F-stat	5.489		0.000	***

Table 9 presents the results of influence during recession to cash and short-term investments to net assets ratio. Explanatory variable recession dummy has a value of 0.02 indicating that during recession companies tend to hold 2 per cent more cash and short-term investments than during pre-recession period. Results are significant at 1 per cent level.

Durbin-Watson value implicates that residuals are somewhat autocorrelated. The R-square value is 0.056 and adjusted R-square is 0.053, thus the model does not have high explanatory power, which was expected, and the recession dummy explains only 5.6 per cent of the variation in dependent variable.

Table 9. The results of recessions influence to cash holdings. Coefficients and t-stats and statistical significance are presented. Table also presents R-square and adjusted R-square values. *** - Coefficient estimate is significant at 1% level.

Dependent variable CTA		Whole sample		
Explanatory variables	Coeff.	t-stat	p-value	Sig.
Const.	0.038	16.045	0.000	***
Recession dummy	0.020	4.556	0.000	***
R ²	0.056			
Adjusted R ²	0.053			
Durbin Watson	0.766			
Number of observations	353			
F-stat	20.757		0.000	***

4.2.2. Do firms have target cash levels?

As one of the hypothesis we presented that companies have a target cash balance that they try to meet. Alternatively companies could let their cash balance float freely up and down depending on the cash flow. The hypothesis of target cash balances was tested with first order autoregressive model. Appendix 2b shows the distribution of autoregressive coefficients β from this analysis for all companies.

Table 10. The results of first order autoregression. Coefficients and statistical significance are presented. *** (**) (*)- Coefficient estimate is significant at 1% (5%) (10%) level.

Company	Coeff.	p-value	Sig.
Ahlstrom	-0.450	0.016	**
Huhtamäki	-0.259	0.159	
Kemira	0.290	0.113	
M-Real	-0.098	0.601	
Outokumpu	0.020	0.915	
Rautaruukki	-0.126	0.558	
Stora Enso	-0.343	0.059	**
UPM	-0.288	0.116	
Konecranes	-0.477	0.014	**
Metso	-0.191	0.304	
Wärtsilä	-0.136	0.516	
All companies	-0.141	0.011	**
Mean	-0.187		
Median	-0.191		

Table 10 presents the results of first order autoregression, the median coefficient for the companies is negative (-.191), also mean is negative (-.187), indicating that the cash balances are mean reverting. Thus there are systematic factors that steer the companies not to let their cash balance increase too high nor decrease too low. For the whole sample the coefficient is -.141 and is statistically significant at 5% level. The results are similar to Opler et al. (1999). However Opler et al. (1999) used yearly data compared to the quarterly data used in this study, which is supposed to give us more reasonable results, since cash managers don't adjust the balances just once a year, the balances are adjusted more frequently depending on the manager.

From appendix 3 it is easily noticeable that from first quarter of 2002 until third quarter of 2008 the cash and short-term investments to net assets ratios were between 3 and 5 per cent and rose sharply from the third quarter of 2008 onwards. From the pattern of the line it is also visible how the cash and short-term investments to net assets ratio of previous quarter almost always returns back to three per cent if it has increased too much. This finding strengthens the results of autoregressive model.

However from the third quarter of 2008 onwards it seems that there is a new level for cash holdings round six per cent of net assets, which is close to the results, two per cent addition to the cash holdings during recession, received from regression analysis of model 3. The recession officially began during December 2007, thus there seems to be a three quarter lag, from the beginning of the official recession to the actual impact on cash holdings. The difference in pre-recession and recession period cash holdings was also presented in the results of t-tests in table 3b and from regression analysis results presented in table 9.

4.2.3. Group level analysis

In this section we divided the companies in two sub-groups, forest industry companies and other companies, in order to find if there are differences in

determinants of cash holdings between these two groups. In the forest group we have Stora Enso, M-Real and UPM. Stora Enso and UPM are among the ten largest forest industry companies in the world and M-Real, as part of the Metsäliitto, is one of the leading forest companies in Europe.

Table 11a present the results of the influence of recession to cash holdings among these groups. The forest companies cash and short-term investments to net assets ratio is more affected by the changes in leverage and net working capital than in the other group. From the forest group net working capital, leverage and macro variables are all statistically significant at 1 per cent level. In the other group statistically significant are sales growth, net working capital, leverage and dividend per share at 10 per cent level, and macro variables at 1 per cent level.

In forest group net working capital has a strong negative relationship to the cash and short-term investments to net asset ratio, indicating that it is used as substitute for cash. Leverage has a strong positive relationship to cash holdings, whereas sales growth has no effect at all. For the other group the net working capital and leverage has both weak positive relationships to cash holdings and sales growth has a weak negative relationship. The difference in the strengths in leverage and net working capital coefficients between these two groups is surprisingly large. One reason for the large difference in the net working capital may be that forest companies do sell fewer services and most of the sales is selling products, such as pulp and paper, compared to other group, but this can only explain a fairly small amount of the difference. There is a similar difference in the strength of leverage coefficient.

Profitability and dividend per share have almost same positive coefficients in both groups, but they are not statistically significant, except the dividend per share in the other group.

In both group macro variables have similar relationships to cash holdings, exchange rate affects more forest companies than other companies, but interest rates treats both groups similarly, having a very weak negative relationship. Sales growth has no impact in forest group's cash holdings, and it has only a little negative impact on the other group's cash holdings.

The R-square for Forest group is 0.523 and adjusted R-square is 0.476, and for the other group 0.137 and 0.106 respectively. This large difference in explanatory power between the groups is explained by the similarity of the forest companies, which all compete in same markets, make almost same products, face similar risks and use same raw materials. Where as the other group's companies have different products and services to each other, from ship engines to composites. For both groups the residuals are somewhat autocorrelated.

Table 11a. The results for influence of recession to cash holdings. Coefficients and t-stats and statistical significance are presented. Table also presents R-square and adjusted R-square values. *** (***) (*)- Coefficient estimate is significant at 1% (5%) (10%) level.								
Dependent variable	CTA	Forest companies			Other companies			
Explanatory variables	Coeff.	t-stat	p-value	Sig.	Coeff.	t-stat	p-value	Sig.
Const.	-0.219	5.744	0.000	***	-0.053	1.707	0.089	*
Profitability	0.084	0.493	0.624		0.087	0.508	0.612	
Sales to Assets	0.035	0.249	0.804		0.007	0.126	0.900	
Sales Growth	0.000	0.003	0.998		-0.032	1.741	0.083	*
Net Working Capital	-0.275	3.445	0.001	***	0.064	1.751	0.081	*
Leverage	0.230	4.440	0.000	***	0.060	1.847	0.066	*
Dividend per Share	0.011	0.857	0.394		0.013	1.934	0.054	*
3-month Euribor	-0.007	2.827	0.006	***	-0.009	4.176	0.000	***
Exchange rate	0.110	6.035	0.000	***	0.060	3.073	0.002	***
R ²	0.523				0.137			
Adjusted R ²	0.476				0.106			
Durbin Watson	1.267				0.857			
Number of observations	91				231			
F-stat	11.225		0.000	***	4.405		0.000	***

Table 11b presents the differences in means between forest group and other group. We find that all means are different and statistically significant, only sales growth and dividend per share are statistically significant at 10 per cent level, others are significant at 1 per cent level.

The means of variables of forest group are all smaller than in the other group. The largest difference between the means of the cash to short-term debt, indicating that companies in the other group have better short-term liquidity than forest companies. Forest companies held also 1.8 per cent less cash than other companies. Forest companies also had lower sales to assets which means that forest industry is more capital intensive compared to other group. Overall the sales of forest companies decreased compared to other companies, which sales increased on average, but forest companies had higher profitability. Forest companies had also less net working capital, leverage and lower dividend per share than other companies. As discussed before cash and net working capital may be substitutes, but in this case other companies held more cash than forest companies and also more working capital.

Table 11b. Difference in means Forest and other group						
*** (**) (*) The difference in means is significant at the 1% (5%) (10%) level.						
Sample	Forest		Other		Forest - other	
	Mean	Std. Dev.	Mean	Std. Dev	Diff. in mean	p-value
Cash to Net Assets	0.03	0.031	0.049	0.04	-0.018***	.000
Sales to Assets	0.186	0.025	0.279	0.073	-0.093***	.000
Sales Growth	-0.015	0.065	0.013	0.159	-0.028*	.100
Profitability	0.022	0.016	0.03	0.019	-0.007***	.001
Net Working Capital	0.057	0.037	0.088	0.091	-0.031***	.001
Cash to Short-term Debt	0.426	0.343	0.968	1.667	-0.542***	.002
Leverage	0.58	0.066	0.613	0.096	-0.034***	.001
Dividend per Share	0.092	0.212	0.167	0.386	-0.075*	.068

4.2.4. Company level analysis Rautaruukki Corp.

Rautaruukki is one of the leading suppliers of metal-based components, systems and integrated systems to the construction and mechanical engineering industries. The company has a wide selection of metal products and services, operations in 27 countries and employs currently 11,700 people. Net sales in 2009 were approximately EUR 2.0 billion. (www.rautaruukki.com, a)

Table 12 presents the annual key figures for Rautaruukki. From the table we can see that the net sales fell significantly in 2009. The exports of Finnish industries fell 20.3 per cent in 2009 compared to 2008, this shock is clearly visible from net sales of Rautaruukki. A drop of 49.4 per cent in net sales from 2008 to 2009 makes Rautaruukki one of the worst hit companies in the Finnish market. Reason for the huge decrease were recession's impact on Rautaruukki's customer industries and weakened demand in the construction and engineering solutions business and in the steel business. All these resulted lower sales volumes and selling prices. (Tilastokeskus, www.rautaruukki.com, b)

Table 12. Annual key figures for Rautaruukki

		2009	2008	2007	2006	2005	2004	2003	2002
Income statement figures									
Net sales	€m	1,950	3,851	3,876	3,682	3,654	3,564	2,953	2,884
<i>Growth</i>	%	-49.4	-0.6	5.3	0.8	2.5	20.7	2.4	-1
Operating profit	€m	-323	568	637	529	618	493	128	6
<i>% of net sales</i>	%	-16.6	14.7	16.4	14.4	16.9	13.8	4.3	0.2
Result before income tax	€m	-359	548	621	635	612	443	70	-46
Result for the period	€m	-275	406	458	501	455	330	53	-35
Balance sheet and cash flow statement figures									
Balance sheet total	€m	2,532	2,983	2,835	3,019	2,723	2,712	2,403	2,561
Cash flow from operating activities	€m	182	382	417	396	652	386	265	152
Cash flow before financing activities	€m	30	169	271	536	519	268	176	23
Financial indicators									
Return on capital employed	%	-14.2	25.6	29.8	31.4	32.8	26.0	7.1	0.6
Return on equity	%	-15.9	20.7	24.2	30.0	34.4	33.8	6.5	-4.3
Cash to Net Assets	%	11.7	9.5	7.4	13.7	6.5	2.4	2.1	2.3
<i>Leverage</i>	%	39.5	33.9	30.2	39.2	44.3	56.7	65.1	68.6
Personnel on average		12,664	14,953	14,326	13,121	11,684	12,273	12,782	13,325

Table 13 reports the cash and short-term investments to net assets ratio determinants regression for Rautaruukki Corp. Unlike in the analysis for the whole industry, in this case the R-square is very high 0.854 and adjusted R-square is 0.803. Approximately eighty percent of the variation in the dependent variable can be explained by the explanatory variables, thus our model works very well for explaining the determinants of cash and short-term investments to assets ratio for Rautaruukki.

Net working capital, dividend per share, 3-month Euribor and Euro Dollar exchange rate are all statistically significant at 1 per cent level, and sales growth at 5 per cent level. In particular profitability has insignificant effect on cash and short-term investments to net assets ratio, sales to assets and leverage are both also insignificant.

Net working capital has a strong negative relationship with cash and short-term investments to net assets ratio which means that it could act as

substitute for cash. This relationship is also visible from the appendix 3b. Also sales growth has a negative relationship with cash and short-term investments to net assets ratio, this could be related also to the working capital, because growth in sales leads to increase in demand for working capital.

Dividend per share has a positive relationship indicating that when dividends are paid Rautaruukki holds significantly more cash than usually. 3-month Euribor has a positive relationship, which is surprising and contrary to all previous results in this study.

Table 13. Results for regression analysis for determinants of cash and short-term investments to net assets ratio for Rautaruukki Corp.
Coefficients and t-stats and statistical significance are presented. Table also presents R-square and adjusted R-square values. *** - Coefficient estimate is significant at 1% level.

Dependent variable CTA		Rautaruukki Corp.		
Explanatory variables	Coeff.	t-stat	p-value	Sig.
Const.	-0.132	-1.133	0.272	
Profitability	0.208	0.443	0.663	
Sales to Assets	-0.385	-1.361	0.190	
Sales Growth	-0.141	-2.541	0.021	**
Net Working Capital	-0.795	-5.405	0.000	***
Leverage	0.168	1.533	0.143	
Dividend per Share	0.058	4.985	0.000	***
3-month Euribor	0.023	3.127	0.006	***
Exchange rate	0.211	3.257	0.004	***
R ²	0.854			
Adjusted R ²	0.803			
Durbin Watson	0.895			
Number of observations	31			
F-stat	16.841		0.000	***

Euro Dollar exchange rate has a positive relationship with cash and short-term investments to net assets ratio and it is statistically significant. In 2009 Rautaruukki had 4 per cent of the net sales and 12 per cent of the costs in USD. Whereas in Euros were 57 per cent of sales and 66 per cent of costs. Also raw materials that are used to make steel are mostly priced in USD making currency risk even higher. (www.rautaruukki.com, b)

Result of the first order autoregressive model for Rautaruukki is negative, -.127, implying that the cash balance is reverting, but it has no statistical significance. Thus there is a balance into which cash managers try adjust cash holdings.

Table 14 shows the differences in means of pre-recession and recession period. We find that Rautaruukki held on average 3.1 per cent more cash and short-term investments during the recession than during the pre-recession period. Result is also statistically significant at 10 per cent level. Sales to assets ratio was also significantly different, indicating that sales decreased during recession, which is also notable from the appendix 3b. Also leverage was significantly lower during recession than during pre-recession period, this no surprise since from table 11 we can see that from year 2002 Rautaruukki has been decreasing its leverage systematically

Table 14. Descriptive Statistics for Rautaruukki Corp.						
*** (**) (*) The difference in means is significant at the 1% (5%) (10%) level.						
Sample Sub Period	Pre-recession (2002-2007)		Recession (2008-2010)		Crisis- Pre Crisis	
	Mean	Std. Dev.	Mean	Std. Dev	Diff. in mean	p-value
Cash to Net Assets	0.046	0.039	0.077	0.054	.031*	.099
Sales to Assets	0.317	0.032	0.250	0.074	-.067***	.001
Sales Growth	0.019	0.086	-0.057	0.164	-.076*	.098
Profitability	0.050	0.021	0.042	0.022	-.008	.350
Net Working Capital	0.177	0.042	0.190	0.060	.013	.531
Cash to Short-term Debt	0.870	0.791	1.452	1.012	.592	.113
Leverage	0.551	0.125	0.370	0.042	-.181***	.000
Dividend per Share	0.233	0.531	0.200	0.456	-.033	.869

5. Conclusions

In this thesis the determinants of cash holdings and existence of target cash balances of Finnish industry corporates were studied. We were especially interested in the differences between pre-recession and recession period cash holdings determinants. In addition we examined differences between the determinants of cash holdings of forest industry corporates and rest of the sample corporates. We also examined the determinants of Rautaruukki's cash holdings alone.

The determinants of this study were selected based on previous studies cash holding determinants Opler et al. (1999), Elkinawy & Stater (2007), Dittmar et al. (2003) and Lee & Song (2007). However the used determinants were modified to suit this study and the variables were measured on quarterly basis, which caused some missing data points during years 2002 and 2003.

Three regression models and one autoregressive model were formulated and examined. The regression models measured the determinants of cash holdings for the whole period researched and also for pre-recession and recession periods. The autoregressive model examined weather there is a target cash balance into which cash managers adjust the cash holdings.

The most significant variables to explain the cash holdings for Finnish industry corporations were Sales to Assets, Dividend per Share, Sales Growth, 3-Month Euribor rate, Euro Dollar exchange rate and Leverage. Before the recession the cash holdings were best explained by Leverage, Euro Dollar exchange rate and 3-month Euribor rate, and during recession Euro Dollar exchange rate, Leverage and Sales Growth respectively. However not many from the determinants were statistically significant.

We also found that the corporates researched held 2 per cent more cash and cash equivalents during recession than before recession. And that

especially for forest corporates and Rautaruukki Net Working Capital acted as substitute for cash. The results obtained from autoregressive model suggested that there is a target cash balance into which the cash managers adjust the cash holdings.

The results were not very consistent with previous studies. The results were mostly consistent with findings of Elkinawy & Stater (2007) on Mexican and Brazilian data. The results from the autoregressive model were consistent with Opler et al. (1999), who confirmed that the cash balances are mean reverting and there are systematic factors that steer them.

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Appendix

Appendix 1. Definition of firm characteristics

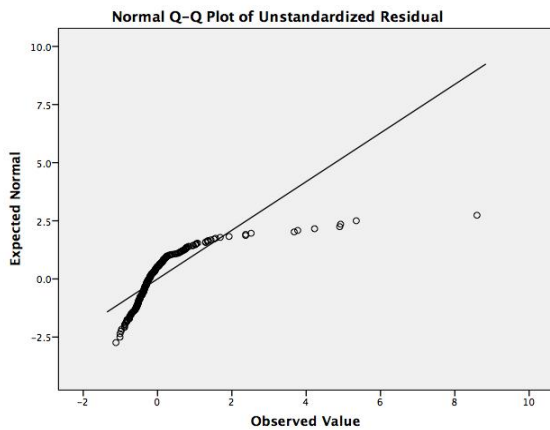
The sample consists of 11 publicly traded corporations in Finland. The source for firm financial data is Thomson One Banker and for market data Datastream. Recession dates are from National Bureau of Economic Research. All variables are calculated in Euros.

Cash holdings	$(\text{Cash \& ST investments})/(\text{Net Assets}),$ where net assets = Total assets – Cash & ST investments
Net Working Capital	$(\text{Current Assets} - \text{Cash \& ST Investments} - \text{Current liabilities})/(\text{Net Assets})$
Sales to Assets	Quarterly sales/Total Assets
Sales Growth	$(\text{Sales}_t - \text{Sales}_{t-1})/\text{Sales}_{t-1}$
Leverage	Total liabilities/Total Assets
Profitability	$(\text{Earnings before interest, taxes, depreciation \& amortization})/(\text{Net assets})$
Dividend	Dividend per share
Recession dummy	Dummy variable = 1 if NBER has concluded that there is a recession, current recession began in December 2007.
3 Month Euribor	3 Month Euribor
Exchange rate	Dollar – Euro exchange rate

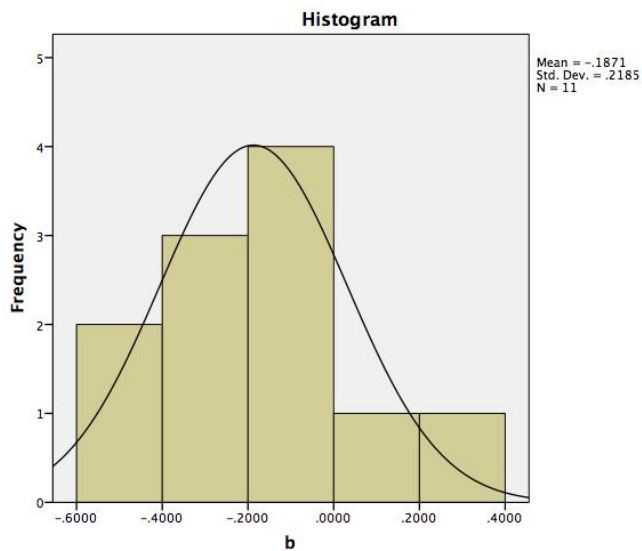
Appendix 2a

Tests of Normality

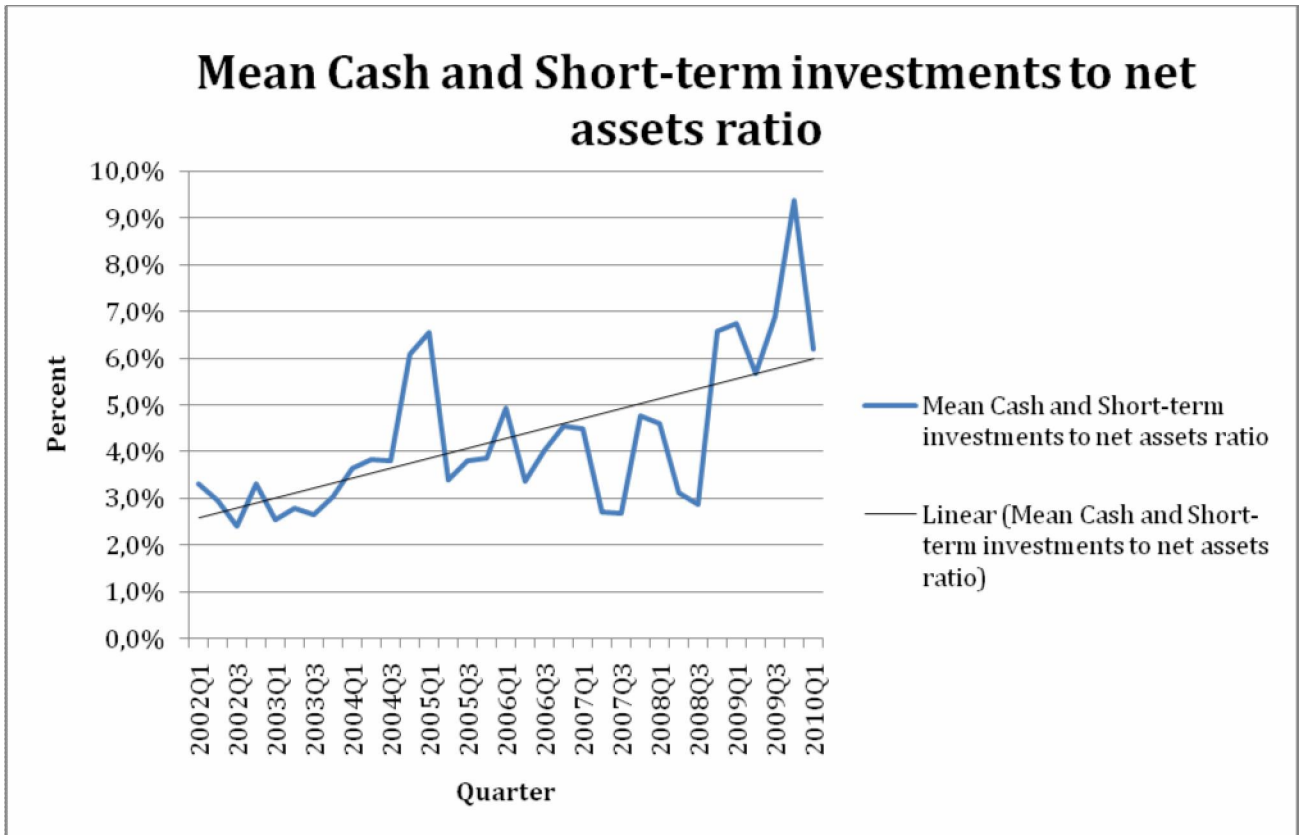
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Unstandardized Residual	.236	323	.000	.586	323	.000
Standardized Residual	.236	323	.000	.586	323	.000



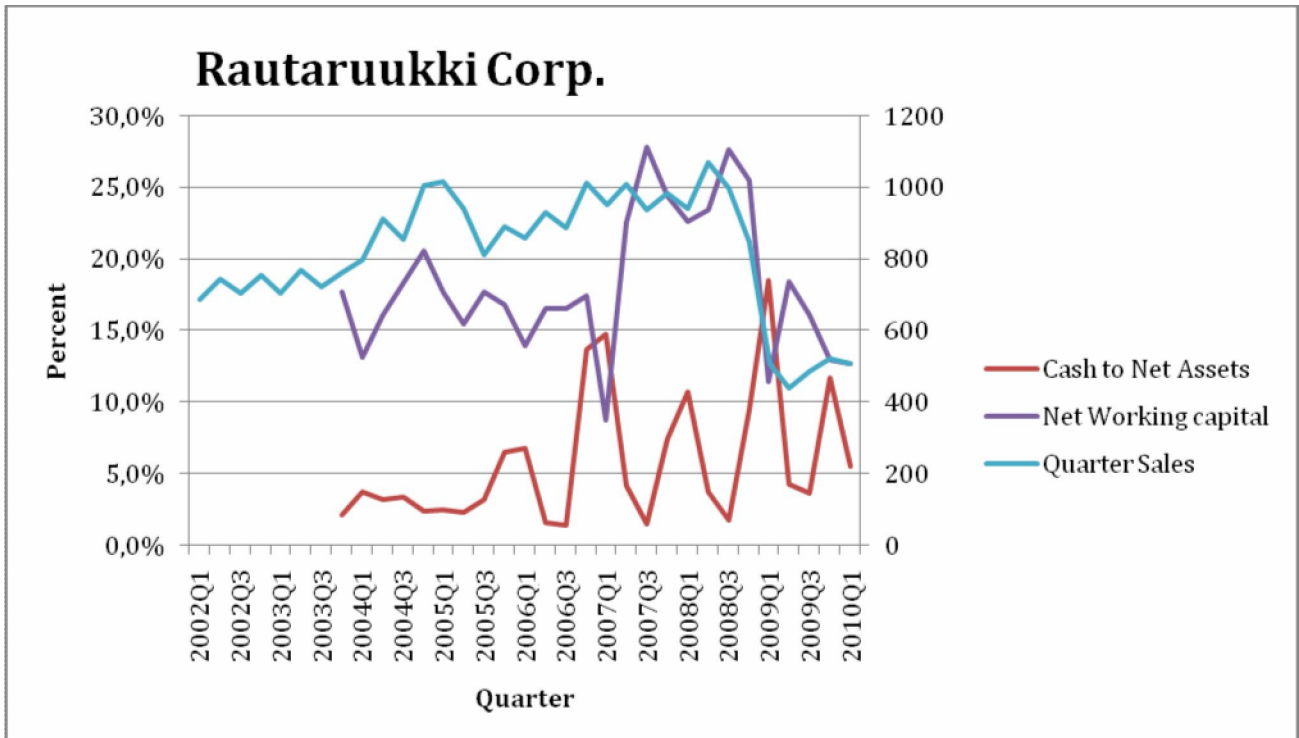
2b



Appendix 3a.



3b.



Appendix 4

Table presents the medians and standard deviations for selected company level factors for each company.

	CTA	SDV	LEV	SDV	NWC	SDV	PR	SDV
Ahlström	2.37%	1.08%	55.31%	5.32%	4.57%	4.57%	2.74%	0.71%
Huhtamäki	1.93%	1.22%	64.53%	1.66%	-1.55%	4.96%	2.17%	1.76%
Kemira	5.11%	6.25%	58.86%	3.62%	3.01%	7.15%	2.84%	1.08%
M-Real	4.36%	4.37%	66.42%	3.00%	7.29%	4.53%	1.28%	1.52%
Outokumpu	3.18%	1.72%	58.43%	9.48%	12.35%	9.07%	1.59%	2.93%
Rautaruukki	5.61%	4.60%	50.16%	13.56%	18.15%	4.84%	4.75%	2.11%
Stora Enso	2.84%	2.47%	54.30%	2.65%	5.85%	2.87%	2.88%	2.02%
UPM	1.79%	0.87%	53.24%	2.82%	4.09%	2.81%	2.49%	0.64%
Konecranes	6.53%	2.86%	68.09%	7.35%	18.61%	6.92%	3.79%	1.62%
Metso	8.31%	4.16%	70.15%	2.73%	7.89%	3.26%	2.85%	0.88%
Wärtsilä	5.96%	2.03%	65.72%	5.74%	9.73%	6.23%	2.65%	1.24%

	SG	SDV	STA	SDV	QS	SDV
Ahlström	-0.17%	5.73%	27.31%	1.65%	413.75	33.33
Huhtamäki	-0.03%	9.30%	24.71%	2.31%	547.46	42.36
Kemira	0.31%	14.23%	23.08%	3.30%	609.36	107.10
M-Real	-3.02%	6.67%	20.80%	2.33%	1241.95	343.31
Outokumpu	0.56%	18.57%	22.69%	4.79%	1390.85	397.38
Rautaruukki	-0.21%	11.63%	29.89%	5.49%	815.91	174.33
Stora Enso	-0.82%	7.02%	18.58%	1.61%	2994.08	393.51
UPM	-0.56%	5.56%	16.44%	1.24%	2389.91	217.35
Konecranes	3.75%	18.39%	42.98%	5.79%	314.83	138.36
Metso	1.59%	16.94%	27.48%	3.82%	1240.28	250.56
Wärtsilä	4.58%	25.21%	25.78%	4.34%	839.02	296.151

CTA= cash and short-term investments to assets, SDV=standard deviation, LEV = leverage, NWC = net working capital, PR = profitability, SG = sales growth, STA = sales to assets, QS = quarter sales €1000