Master Thesis

The determinants of cash holding: Evidence from Dutch listed firms

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Abstract

This thesis examines the firms specifics determinants of Cash holding for a sample of 495 Dutch publicly listed firms over the period 2014-2018, while controlling for year and industry effects using dummy variables. In doing so the predictions for the various firm-specific determinants, which are suggested by three theoretical models: the trade-off model, the pecking order theory and the free cash flow theory will be tested. The results suggest Leverage and Dividend payment have negative significant influences on Cash holding which is in line with the Trade-off theory and Pecking-order theory. Furthermore the variable Cashflow volatility also suggest that there is a negative relationship which goes against the Trade-off theory. Lastly the variables Bank debt, Liquid assets and Investment opportunity are insignificant which is not unheard of but it is not in line with any of the three main theories. Overall the results show the most support for the Trade-off theory and the Pecking-order theory and the Free Cashflow theory only finds support with the variable Leverage.

Keywords: Cash holdings, trade-off model, pecking-order theory, free cash flow theory, firm-specific determinants

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1 Introduction

1.1 Research background

What determines a firm's cash holding? There is no question among scholars that cash can be seen as the oxygen of a firm. Without it the firm cannot survive, since cash is needed for hiring staff, facilitating a working place and being able to purchase necessities in order to provide their product. This is why the topic is so popular among scholars to investigate. The topic is however not without discussion. This is mostly due to the controversial nature of the topic, since cash should always be available in a perfect market to fund new projects. This means that there would be no reason to hold cash. However as scholars know there is always financial frictions in the world like transaction costs and information asymmetries, which makes the story a bit more complicated.

Examples of transaction costs are the costs of raising funds. One of the predictions that is tied to external capital is that firms who have a high degree of liquid assets hold less cash, since they can convert these assets into cash at low costs (Drobetz & Grüninger, 2007). Another example is the currency exposure a firm may have when doing a transaction (Minde & Mendolia, 2018). Information asymmetries on the other hand may make it more costly to raise external funds which is why firms prefer internal funds over external funds (Myers & Majluf, 1984). Interest in information asymmetries has also reached the general public since financial assets are becoming more and more popular. People who buy financial assets do not buy them because of an intrinsic desire in the assets themselves (Smith, 2016). They are bought because of how its value to others may change. In other words for other markets information about the product is important, but for financial assets information is the product (Smith, 2016). This is why the determinants of cash holding is such a popular topic and why researchers have offered a great deal of effort to find out what those determinants are.

The first explanation of these determinants is provided by Ozkan and Ozkan (2004). They argue that firms prefer low costs when it comes to financing. They refer to the pecking order theory which states that information asymmetry between firms and their respective investors increase the costs of external financing and therefor internal financing is preferred. The second view that might explain the determinants is that agency costs such as underinvestment and asset substitution may jeopardize the firm's survival if firms do not hold cash at a certain level (Myers, 1977; Jensen and Meckling, 1976). This is also known as the trade-off theory where marginal costs and benefits are equally balanced. These arguments speak in favor of holding cash, but that being said there are also arguments that speak against holding cash. One of these argument stems from agency costs which is linked to the Free cash flow theory by Ferreira and Vilela (2004). If a firm holds too much cash the manager of the firm might be tempted to use the cash for purposes that do not align with the vision and interests of the firm (Jensen, 1986). In other words the idea that the more cash a firm has the more control and power it has over its investments is not without risk. This view is also known as the free cash flow theory.

Given the fact that there are many explanations on why firms hold cash as well as theories on whether firms should hold cash, it remains a mystery if cash holding can be explained by either precautionary reasons, optimal financial planning or managerial opportunism (Drobetz and Grüninger, 2007). As shown even the media is conflicted about whether firms prioritize the optimization of transaction costs over the costs of information asymmetries or vice versa. The practical contribution of this thesis is showing the determinants of a firm's Cash holding as well as showing that firms can use this research to improve and adjust their Cash holding policy if needed. Also following (Ferreira & Vilela, 2004; Opler et al. 1999; Ozkan & Ozkan, 2004), this thesis will use firm specific characteristics as determinants of a firm's cash holding, which can be found in the annual reports of the respective firms, which mean that anyone can verify these findings. For efficiency reasons this thesis will get its data from the Orbis data base as explained in chapter 4.

The bulk of the literature that investigates or attempt to empirically prove the aforementioned theories are mostly focused on U.S. firms (e.g. Bates et al., 2009; D'Mello et al., 2008; Han and Qui, 2007; Harford et al., 2008; Kim et al., 1998; Opler et al., 1999). In contrast there are very few studies done regarding these theories on firms in other countries (e.g. Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004; Pinkowitz and Williamson 2001). Where Ferreira and Vilela (2004) investigate publicly listed firms from EMU countries and Ozkan and Ozkan, (2004) narrow their study down on cash holding of firms in the UK. Furthermore Pinkowitz and Williamsion (2001) investigate the cash holding positions of firms in Japan and how they differ from firms in the U.S. and Germany and finally Bigelli & Sanchez-Vidal (2010) investigate cash holding in Italian private firms.

Considering the literature coverage and the vast interest in the determinants of a firm's cash holding it might be interesting to investigate the determinants of cash of Dutch publicly listed firms in the Netherlands. In fact to the best of my knowledge there is no paper that examines this. Also given the fact that the key papers of this thesis (Ferreira & Vilela, 2004; Opler et al. 1999; Ozkan & Ozkan, 2004) use firm specific characteristics of firms as determinants this thesis suggests to investigate the following question:

How do the firm specific characteristics, influence cash holding of Dutch publicly listed firms in the Netherlands?

1.2 Research objective

When Smith (2016) pointed out that information has value he also pointed out an important difference between the value of a car and the value of information. This difference is found in the fact that the value of a car can be easily verified by going to a mechanic. The value of information however is more difficult to verify. The research objective of this thesis is to find out if the firm characteristics Firm Size, Leverage, Bank debt, Cash flow, Cash flow volatility, investment opportunity and dividend payment have an impact on the firms cash holding. The reason these firm specific characteristics are being chosen is because the reliability of the information regarding these firm specific characteristics can be easily verified as Smith (2016) pointed out. Furthermore the information is accessible for everyone since it can be found in the year reports of the respective firms. The outcome of this research is the results of a Pooled OLS regression, Cross-sectional regression using means and Fixed- and Random effects model. These tests will show whether Firm Size, Leverage, Bank debt, Cash flow, Cash flow volatility, investment opportunity and dividend payment have an impact on the cash holding of Dutch listed firms.

1.3 Research structure

In chapter two this proposal will briefly discuss the three theories and their projections regarding the determinants on cash and the hypothesis development. Chapter two will also show how the transaction costs model, precautionary model and Agency model can be integrated within those respective theories. Chapter three will discuss the methodology and define the variables that are being used. The fourth chapter will describe the data collection, whereas the fifth chapter will discuss the results. Finally the sixth chapter will show the conclusions that has been drawn.

2 Literature Review

In the first section of this chapter the literature concerning cash holding will be discussed. This means that cash holding will be defined. Also this thesis will go into detail about three models that constitutes a firm's cash holding which are: the transactional costs model, precautionary model and agency model. Once this is done the second section will go well into detail about three theories namely, Trade-off theory, Pecking-order theory and Free cash flow theory and how the three models are integrated within these theories and what the view of these theories are on these models. Lastly

this thesis will explain the predictions of these theories on how firm characteristics affect a firm's cash holding as well as showing what empirical results support the claims of the Trade-off theory. These firm characteristics are: Firm size, leverage, bank debt, cash flow, cash volatility, investment opportunity and dividend payment. What the hypothesis are concretely according to the three theories and the literature that explains them will be summarized in Table 1 and Table 2.

2.1 Cash Holding

There is no doubt among scholars that cash is the oxygen of every firm. Without cash the firm cannot run. The firm needs cash in order to pay for their staff, resources required to deliver their product and to invest in innovations and growth opportunities. If the firm cannot do this then it will be forced to declare bankruptcy and cease to exist. The synonyms that are given by the literature for cash holding are, cash, marketable securities or cash equivalents (Opler et al., 1999). With cash equivalents the literature refers to current assets that can be converted into cash and have therefor a high degree of liquidity. These assets can be U.S. treasury bills, certificates of deposits, banker's acceptance and other money market instruments. What characterizes these securities is that they have a low risk low return profile (Ferreira and Vilela, 2004; Opler et al., 1999; Ozkan and Ozkan, 2004). If the markets were frictionless and the risks would be equally spread, firms would have no reason to hold cash since they could always access external financing sources. In the real world the markets are never frictionless and the literature is to this day puzzled about the reasons why firms hold cash (Drobetz and Grüninger, 2007; Harris & Raviv, 2017; La Rocca et al., 2018).

There are several different models that make predictions about why firms hold cash. The most dominant one is the transaction costs model. This model was first introduced by Keynes (1936) who suggested that firms hold cash to save on transaction costs of selling illiquid assets, converting them into cash, or using capital markets to raise funds to secure resources to meet payments due. The transaction costs of external funds has been widely mentioned in the literature (Damodaran, 2008; Ferreira and Vilela, 2004; Opler et al. 1999; Ozkan and Ozkan, 2004). Another example of transaction costs was pointed out by Damodaran (2008). In his paper he points out that the fact that a firm has to make transactions is a cost in itself. In other words the more transactions a firm has to make the more cash the firm has to hold to make those transactions. Fast food restaurants and retail businesses, which can be classified as cash oriented businesses, will hold more cash than credit oriented businesses like banks (Damodaran, 2008).

The second model that is being introduced is the precautionary model. According to Harris and Raviv (2017) the precautionary model states that firms "Accumulate cash to avoid passing up profitable investments in case of a shortfall of internal cash flow coupled with excessive cost of raising cash when it is needed" (p, 142). This means that if the firm decides to pass on investments in the short-run in order to build up cash, then those costs are more than offset by the insurance of valuable projects in the long-term. This is especially true with firms that exist in very volatile economies (Damodaran, 2008) and in economies that experience a recession. In times of recession it is more costly to exchange cash into liquidity. The opportunity costs of investments is also lower in times of recession which makes it even more attractive to hold cash. This in contrast when the economy is performing well (Custodia et al., 2005). The final reason to hold cash is simply because it is a rational thing to do and it can be used as a strategic weapon. In these cases firms claim that they hold cash for opportunities, however at that time those opportunities whether created by signs or actions are not clear at that moment (Damodaran, 2008).

The third model is the agency model. The decision what to spend money on falls on the managers. This means that it is crucial that the managers interests align with the interests of the firm. When firms have excessive cash this alignment can become in jeopardy by the managers investing in pet projects and perquisites (Bates et al., 2009; Harris & Raviv, 2017; Jensen, 1986). If this is the case then the argument that hoarding cash does not only result in passing up on valuable investments but also that the money is spent on unprofitable investment becomes much more valid.

Dittmar, Mahrt-Smith, and Servaes (2003) found evidence that country with greater agency problems hold more cash. Dittmar, Mahrt-Smith, and Servaes (2003) and Harford, Mansi and Maxwell (2008) found that found evidence that entrenched managers are more likely to build excess cash balances, but spend cash quickly. A remedy for this could be to change corporate mechanisms and adjust the contract so that this does not happen (Harris & Raviv, 2017). However Bates et al. (2009) find that there is no link between an increase in cash holding can be blamed on agency problems. This means that this remedy is unnecessary until the consensus changes.

It is necessary to say however that the first two models are the best models that explain the trade-off theory and pecking order theory. These two theories will be explained in the next section as well as the free cash flow theory.

2.2 Firm specific Determinants

2.2.1 Trade-off theory

The trade-off theory postulates that firm's seek an optimal level of cash holding by comparing the marginal costs and benefits of holding cash. By doing so, firms attempt to maximize the shareholder value (Ferreira & Vilela, 2004; Singh & Misra, 2019). Opler et al. (1999) claims that the trade-off theory can also be called the transaction costs theory, because the optimal level of holding cash is determined by the transaction costs that are related to raising funds on the capital market and also to avoid the liquidation of assets to meet obligations (Opler et al., 1999). To illustrate the transaction costs model and the trade-off between the benefits and costs of holding cash or liquid assets it is important to look at figure 1. Figure 1 shows the marginal cost of liquid asset shortage curve and the marginal cost of liquid asset (holdings). According to the transaction costs model the optimal amount of cash holding is at the point where those two curves intersect (Opler et al., 1999).

Following Ferreira and Vilela (2004) the trade-off theory also poses that firms hold cash to build a buffer in case of financial distress or economic recess' thus integrating the precautionary model. This way the firm does not make themselves vulnerable to the costs of issuing debt and the costs of liquidating assets to meet their financial obligations (Ferreira & Vilela, 2004; Opler et al., 1999). What is interesting however is that although both of the referred papers agree that this is indeed a benefit of holding cash, Ferreira and Vilela (2004) places the precautionary model under the trade-off model and Opler et al. (1999) place the precautionary model under the pecking-order theory. It is therefore important to note that this thesis will not give judgement about where the precautionary model fits best, but that this thesis will show in this chapter how the precautionary model can be integrated within the respective theories.

Finally according to Ferreira and Vilela (2004) as well as Opler et al. (1999), the Trade-off theory poses that the costs of holding cash the firm can create an optimal investment policy. If the firm is not hindered by the transaction costs as mentioned above, the firm does not suffer from opportunity costs by having to pass on investment projects with a positive net present value (NPV). However, this line of reasoning is a two edged sword. Firms can forego valuable investment projects if the transaction costs outweigh the benefits of investing, but they can also forego valuable investment projects by holding liquid assets with low return. In other words it is important to figure out when the transaction costs are larger than the opportunity costs and vice versa. These opportunity costs are also known as a liquid premium (Kim et al., 2011).

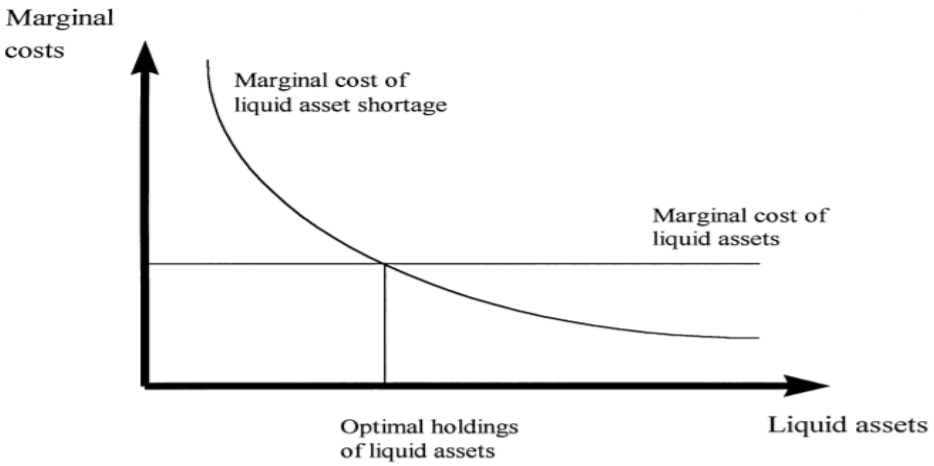

Fig. 1. Optimal holdings of liquid assets. The optimal amount of liquid assets is given by the intersection of the marginal cost of liquid assets curve and the marginal cost of liquid asset shortage curve. The marginal cost of liquid assets curve is non-decreasing while the marginal cost of liquid asset shortage curve is decreasing.

Now that this thesis has explained what the Trade-off theory implicates it is important to show what the theory predicts regarding the firm specific characteristics. Below a review can be found about which firm specific characteristics are important according to the Trade-off theory and more importantly the empirical support for this theory. Based on the predictions of the Trade-off theory and the empirical results this thesis will produce its on hypotheses

Size

The effect size can have according to the transactional costs model was introduced by Miller and Orr (1966) who argues that large firms can benefit from economies of scale when managing their cash. This has been confirmed by Faulkender (2002); and Bover and Watson (2005) who show that larger firms tend to hold less cash, which is stemmed from more financial innovation. This is because larger firms can take up more financial innovation which reduces the sales elasticity and therefor reduces the demand for money. Thus larger firms hold less cash than smaller firms.

In another study Ferreira and Vilela (2004) found no correlation between the fees of borrowing and the size of a loan. This indicates that fees like this are fixed amounts and shows empirically that smaller firms are encouraged to hold more cash than larger firms since issuing external funds is more expensive for them. Rajan and Zingales (1995) add to this argument by finding empirical evidence that large firms have easier access to external financing because they are more diversified. This means that larger firms have more unrelated businesses to make money from. This in turn leads to a lower costs of capital and therefor larger firms tend to hold less cash. Kim et al. (1998) added on this argument by finding empirical evidence that large firms have less borrowing constraints than small firms which means that they hold less cash. In more recent literature Singh and Misra (2019) found that size is negatively related to cash holding for Indian agricultural enterprises. Kwan and Lau (2020) found a negative relationship between size and cash holding in both hospitality firms and non-hospitality firms.

Leverage

Regarding the effect of leverage on cash it is safe to say that there is not much consensus within the literature. Ferreira and Vilela (2004) show that firms with higher leverage hold less cash because they have more access to external finance. Ozkan and Ozkan (2004) show that firms with higher leverage ratio hold less cash because they want to minimize the opportunity costs of holding cash. The counter argument is however that firms with higher leverage are more at risk of financial distress and bankruptcy, which will lead to firms holding more cash to minimize said risks. However Ferreira and Vilela (2004) found no evidence that this is the case. The same goes for Kwan and Lau (2020) who

found a negative relationship between leverage and cash holding in both hospitality firms and non-hospitality firms.

Bank debt

Regarding the relationship between bank debt and a firm's cash holding it is important to note that firms prefer bank debt over other types of leverage. This is because banks mitigate information asymmetry, agency problems and are more skilled and more committed to evaluate a firm's credit score and monitor their financial policies (Ferreira and Vilela, 2004). According to Krivogorsky et al. (2011) this is why firms are more inclined to go to banks for external finance instead of using other types of external debt. Furthermore Ozkan and Ozkan (2004) provide empirical evidence that banks can minimize the information costs thus optimizing the value of the firm. In other words if the banks offer a loan to a firm it means that there is positive information about that firm. As a result if a firm has bank debt it means that the probability of financial distress decreases, which in turn also helps in optimizing the cash holding of the firm which is the main goal of the trade-off theory.

On a side-note it is worth mentioning that it could also be argued that bank debt should be placed purely under the Free cash flow theory because of the reduction of agency costs banks seem to provide. However given the fact that the Free Cash Flow theory puts more emphasis on agency costs does not mean that the agency model cannot be integrated in the trade-off theory. As mentioned above the trade-off theory aims to optimize a firms cash holding by comparing marginal costs and benefits of holding cash. It could be argued that this includes comparing the benefits of holding cash with the agency costs.

Given all these differences between bank debt and other leverage and the fact that the literature (Ferreira & Vilela, 2004; Ozkan & Ozkan 2004) treats bank debt as a different variable this thesis will treat bank debt as a separate and unique variable as well. The difference in preference between bank debt and leverage and the general differences, however does not mean that there is a different expectation for the relationship between bank debt and cash compared to leverage and cash. Just like with leverage a high bank debt ratio means that firms have easier access to bank debt which means that they will hold less cash as empirically shown by Ferreira and Vilela (2004) and Pinkowitz and Williamson (2001) who found evidence for this negative relationship.

Cash flow

According to Kim et al. (1998) cash flow can be seen as a substitute for Cash, because it is seen as a ready source of income. Furthermore according to the empirical results of Kim et al. (1998) an increase in cash flow means an increase in investment in liquid assets which includes Cash. This means that it seems safe to assume that there is a negative relationship between cash flow and cash holding. However the empirical evidence of Ozkan and Ozkan (2004) presented mixed results regarding this relationship. In their cross-sectional regression they indeed found a negative relationship between cash flow and cash holding. However in their dynamic panel estimation results they found a positive relationship between cash flow and cash holding. The empirical results of Ferreira and Vilela (2004) also proved that there is a negative relationship between cash flow and cash holding, since firms with large cash flow have much cash coming and thus do not need to hold much cash. However their results do not support this. In more recent literature the empirical evidence of Kwan and Lau (2020) presented mixed results as well regarding the relationship between cash flow and cash holding. In their full sample there is a positive relationship between cash flow and cash holding. However in the hospitality firm sample the relationship becomes negative and insignificant, where the non-hospitality sample is again positive and strongly significant.

Cash flow volatility

Regarding cash flow volatility the empirical results of Ferreira and Vilela (2004) show that firms with more volatile cash flows face a higher probability of experiencing cash shortages due to unexpected cash flow deterioration. This cash flow deterioration means that firms are forced to transform liquid assets into cash or to issue external capital which increases transaction costs. Thus, cash flow

uncertainty should be positively related with cash holding. Ozkan and Ozkan (2004) report similar results and thus the trade-off model states that there is positive relation between cash holding and cash flow volatility.

Non cash Liquid assets
When scholars talk about liquid assets, they talk about assets that can be easily converted into cash with low transaction costs. This includes account receivables and inventory, or networking capital minus cash. Given that they are a substitute on cash the bulk of the literature (Bigelli & Sanchez-Vidal, 2012; Ferreira & Vilela, 2004; Ozkan & Ozkan, 2004; Opler et al., 1999) predict and presented empirical results that there is a negative relationship between liquid assets and cash holding. In fact, firms seem to hold more liquid assets in case firms cash holding position becomes too low to invest in new projects.

Investment opportunity
When it comes to cash flow, leverage and liquid assets the argument for either holding cash or not having to hold cash was always in part linked to opportunity costs and forgoing investment opportunities. It is therefore safe to assume that the more investment opportunities a firm has the more cash it wants to hold in order to minimize the opportunity costs regarding investments (Kim et al., 2011; Opler et al., 1999; Ozkan and Ozkan, 2004). This is especially true for firms whose value depend on growth opportunities and who want to save on costs of external financing. This is because these firms tend to be more susceptible to external shocks and financial distress (Kim et al., 2011). On top of that Ferreira and Vilela (2004) argue that firms with a lot of growth opportunities have higher bankruptcy costs because when the firm goes bankrupt the investment projects with a positive NPV disappear. Empirical results are provided by Opler et al. (1999) and Ozkan and Ozkan (2004) who found empirical evidence that Investment opportunities are positively related to Cash holding.

Dividend payments
When it comes to the relationship between dividend payments and cash holding the literature gives a mixed view. On one hand Ferreira and Vilela (2004) found evidence that firms who claim that firms that pay dividend can easily raise funds by decreasing dividend payouts. However this goes against the conventional wisdom that decreasing dividends is a bad signal towards possible investors. If a firm decreases dividend then investors may think that the firm faces financial distress. When Brav et al. (2005) investigated the payout policy in the 21st century they presented empirical results that CEOs would rather turn to external finance than decrease their dividend payout. Even in recent literature Kwan and Lau (2020) found mixed results regarding dividends and cash in hospitality and non-hospitality firms. With hospitality firms the results were positive and significant however with the non-hospitality firms the results were negative and non-significant except for the OLS pooled regression test where the result was negative and significant (Kwan & Lau, 2020). This means that there is still no consensus on the relationship between dividend payments and cash holding.

2.2.2 Pecking order theory
Where the trade-off theory wants to find the optimal balance between the benefits of access to external financial sources and the risk of financial distress, the pecking order theory has different priorities. The pecking-order theory was first designed by Myers and Majluf (1984) and it poses that information asymmetries between the firm and its shareholders make external financing costly. This is why firms prefer to use internal financing sources to finance investment projects. Should internal financing sources prove insufficient then firms turn to external financing sources i.e. bank debt and bonds. If that proves to be insufficient as well then firms will issue new equity. This is highly unpopular with shareholders since it shows that firm managers have information the shareholders do not. As a result the share value will decrease (Myers & Majluf, 1984). Opler et al., (1999) and

Bigelli and Sanchez-Vidal (2010) refer to pecking order theory as the finance hierarchy theory since it does not assume an optimal level. The only optimal thing as far as the firm is concerned is to be able to finance investment projects with internal finance sources. Now of course it is worth mentioning that cash is not the internal source but that there are also cash equivalents and liquid assets that are very easy to convert into cash. Chapter 3 will show the specific definition of this variable and how it will be measured. However that does not mean that firm characteristics do not impact cash according to the pecking order theory. Below there is a review of the effect of firm characteristics on a firm's cash holding and how it relates to the pecking order theory following Ferreira and Vilela (2004) .

Size
When it comes to the relationship between a firm's size and a firm's cash holding the literature is very clear that there is a positive relationship. This is because larger firms are more successful and therefor better able to hold more cash after controlling for investment (Ferreira & Vilela, 2004; Weidemann, 2018).

Cash flow
When a firm's cash flow increases it ability to hold cash also increases. This gives the firm more opportunity to hold more cash after controlling for capital expenditures and paying of debt (D'mello et al., 2008). Ferreira and Vilela (2004) also claim that operations go well if the cash flow increases, since firms can rely more on internal financial sources. This is why the finance hierarchy theory poses that there is a positive relationship between cash flow and cash holding.

Investment opportunity
As mentioned before Myers and Majluf (1984) argue that internal financial sources is the best way to finance investment projects. This means that it is logically to assume that firms with a lot of investment opportunity and who's value depend highly on growth opportunities hold more cash. This claim is supported by several scholars (Ferreira & Vilela, 2004; Ozkan and Ozkan, 2004; Weidemann, 2018). This prediction aligns with the trade-off model, but for different reasons since the trade-off model reasons from the transaction costs model and the pecking-order theory reasons from the precautionary model.

Leverage
Since issuing debt is the second best option after internal financial sources according to the finance hierarchy theory it is safe to assume that there is a negative relation between leverage and holding cash. This is especially the case when the level of investment exceeds the level of retained earnings (Ferreira & Vilela, 2004). Thus from the perspective of the pecking-order theory there is a negative relationship between leverage and cash holding.

Bank debt
Regarding the relationship between bank debt and cash it is worth mentioning that the pecking order theory and the trade-off theory have once again similar expectations but for different reasons. Banks are known for being effective in reducing problems associated with information asymmetries and agency conflicts (Ozkan & Ozkan, 2004). This is mostly because of their strong ability to monitor a firm when a loan is given, which is why a loan is received as a positive sign. This positive sign leads in turn to a decrease in costs of external financing which reduces the precautionary model for holding cash. This is where the pecking order theory differs from the trade-off theory since the trade-off theory argues from the transaction costs model even though they both expect a negative relationship between cash holding and leverage.

2.2.3 Free cash flow theory

The Free cash flow theory as it was named by Ferreira and Vilela (2004) shares the view with the pecking order theory that firms do not pursue an optimal level of cash flow, but instead give preference to internal financial sources. However where the pecking order theory claims that firms should hold as much cash as possible without creating too much opportunity costs, the Free cash flow theory is less liberal when it comes to holding cash. This is because the free cash flow theory also integrates the agency model for holding cash in their theory and the pecking order theory is more focused on the precautionary model. Jensen (1986) argues that even though holding cash increases the shareholder value and the power of making investment decisions, this increase of power is not free of charge. The agency model suggests that if the power of making investment decisions becomes too great, the manager may be tempted to make investments that do not align with the firm's interests. Shareholders do not appreciate this since it can have a detrimental effect on the value of the firm. So despite the benefits of holding cash for the managers of the firm, and the firm itself since it decreases opportunity costs and transaction costs, it may in the end still decrease the value of the firm (Jensen, 1986). This is why Jensen (1986) argues that having leverage might increase the value of the firm since it decreases agency costs. Below is an overview on how the Free cash flow theory views the effect of the firm specific characteristics on Cash holding as well as the empirical results of the literature that proves these views.

Firm size

According to the Free cash flow theory larger firms have more shareholders and cash and have therefor a superior managerial discretion (Ferreira & Vilela, 2004). Furthermore Opler et al. (1999) found evidence that larger firms are less likely to fall prey to hostile takeovers, since it takes more resources to takeover a larger target. Also because managers tend to have more discretionary power they have more political influence when it comes to determining investment policies, which leads to a greater amount of cash as proven by Ferreira & Vilela (2004). This is why the free cash flow theory posits that larger firms hold more cash.

Leverage

Ferreira and Vilela (2004) show that firms who are more leveraged hold less cash due to the monitoring roles of the lenders and that decrease the discretion of the managers. This is why firms who have more leverage hold less cash.

Bank debt

Like leverage, having more bank debt increases the monitoring role of banks which as a result decreases the discretion of the managers as proven by Pinkowitz & Williamson, (2001). This is on a side note the only determinant where the trade-off theory, pecking order theory and free cash flow theory agree that there is a negative relationship between bank debt and cash holding.

Investment opportunity

The relationship between investment opportunity and cash holding seems a bit illogical. On one hand the literature found evidence that firms with very few investment opportunities hold more cash so that they can finance investment projects even if they have a negative NPV (Drobetz and Grüninger, 2007; Ferreira and Vilela, 2004). This suggests that there is a positive relationship between investment opportunities and cash holding. However because firms with low growth opportunities invest in projects with a negative NPV the firm faces shareholder value destruction. This is why the literature predicts a negative relationship between cash holding and investment opportunities.

2.2.4 Tax-based explanation

Another factor that has an influence on a firm's cash holding position, which is not included in the regression test due to lack of data is the tax-based explanation. In their article Foley et al. (2007) test the hypothesis that the size of the firm's cash holding is, to a certain extent a consequence of the tax incentives faced by US multinational companies. The US taxes the foreign operations of domestic firms and grants tax credits for foreign income taxes paid abroad. They claim that the US and many other countries tax the foreign income of their firms. This amount is the same as the difference between foreign income taxes paid and tax payments that would be due if foreign earnings were taxed at the US rate. However apparently these taxes can be deferred until earnings are repatriated and as a result the forecast of these tax burdens give the incentives for holding cash if the investment opportunities abroad are slim (Foley et al., 2007). In addition Foley et al. (2007) also make a distinction between foreign cash holding and domestic cash holding and that they test whether foreign cash holding also impacts the domestic cash holding.

When investigating if firms indeed hold cash as a result by taxes triggered by repatriations they found four main results. First If the tax costs when repatriating earnings increase firms will hold more cash. Second repatriation tax burdens induce firms to hold more cash abroad. On a side-note the tests do indeed show an increase in foreign cash holding as a result of an increase in repatriation tax burden. However there seems to be no correlation between the increase in foreign cash holding and an increase in domestic cash holding. It must also be said that the literature spends very little attention to the distinction in the location of where the cash is being held. Almeida et al. (2014) argue that if the literature would make this distinction more often the conclusions of the literature could be altered in two ways. First the different macroeconomic and political condition of the countries could affect the safety degree of the cash being held. Second the cash could be held in places with less opportunity costs and more costs that are not up for negotiation if the firm wants to bring the cash to regions that with better investment opportunities.

Third, they found that affiliates that cause high tax costs when repatriating earnings hold higher levels of cash than other affiliates of the same firm. They did not find that multinationals have a tax incentive to retain earnings in the form of cash in branches located abroad. In contrast they found that incorporated affiliates in lower tax jurisdictions have higher cash holding, whereas affiliates that are organized as branches hold lower levels of cash (Foley et al., 2007). Finally, they found that firms with a high level of domestic leverage and are below investment grade are less likely to defer taxes associated with repatriations by holding cash abroad (Foley et al., 2007). In response to these results it must be noted however that when Pinkowitz et al. (2013) investigated whether cash holding have become abnormally high following the Financial Crisis of 2008–2009, they found contradictory results. They document that compared to the benchmarks of 1990 the U.S. firms increased their cash holding more significantly more than foreign firms. However they did not find a drastic increase during the financial crisis and argue that the increase in cash holding that did happen was not because of the tax repatriation. This is because the amount of cash holding did not increase with the multinationals they investigated after the Homeland Investment Act of 2004, even with the large repatriation that was reported.

In addition to the research of Foley et al. (2007), Hanlon et al. (2015) found that firms who hold a lot of foreign cash also acquire more foreign firms. They also found a negative relationship between tax-induced foreign cash holdings and the reaction of the market to foreign deals. To give more context, the investment activity of firms with high repatriation tax costs is seen by the market as less value enhancing than that of firms that experience low tax costs. Not everyone is pleased with this however. Cisco's Chief Executive Officer (CEO) John Chambers revealed sentiment regarding overseas cash holding. He stated " We leave the money over there, I create jobs overseas, I acquire companies overseas, I build plants overseas, and I badly want to bring that money back" (Chambers, 2011). This sentiment leads to the research of De Simone et al. (2019) who investigated if an anticipated reduction in future repatriation taxes affects the amount of cash U.S. multinationals hold

overseas. They found that the expected benefits of a repatriation tax reduction are positively related with accelerated accumulations of global cash holdings, once Congress proposed legislation. Additional tests examining domestic and foreign corporations, voluntary disclosures of foreign cash, and corporate payout behavior support the conclusion that observed increases in excess global cash are driven by changes in foreign cash.

2.3 Hypotheses Development

In the previous section this thesis addressed how firm specific characteristics affect a firm's cash holding according to the trade-off theory, pecking order theory and free cash flow theory. With some of these firm specific characteristics it has become quite clear that the three theories do not see eye to eye in how they relate to the cash holding of firms. In order to give a clear picture how the three theories see the relationship between the firm specific characteristics and cash holding and how they differ from each other, the variables and their predictions will be summarized in table 1.

Table 1: Model predictions

Firm specifics	Trade off Theory	Pecking order theory	Free cash flow
Size	-	+	+
Leverage	-/+	-	-
Bank debt	-/+	-	-
Cash flow	-/+	+	n.a.
Cash flow volatility	+	n.a.	n.a.
Liquid assets	-	n.a.	n.a.
Investment opportunity	+	+	-
Dividend Payment	-	n.a.	n.a.

In Table 1 the relationship with the firm specific characteristics and the three theories are being shown. A + sign means that there is a positive relationship between the variable and cash holding according the theory. A – sign means that there is a negative relationship between the variable and cash holding according to the respective theory and +/- means that the theory is conflicted about this variable. Lastly, in the case the respective theory does not make a specific prediction about the relationship, the respective firm specific is denoted as "n.a.".

Table 2: Author empirical results

Firm specifics	Opler et al. (1999)	Ozkan and Ozkan (2004)	Ferreira and Vilela (2004)	Harford et al. (2014)	Drobetz and Grüninger (2007)	Dittmar et al. (2003)	Harford et al. (2008)
Size	-	n.s.	-	+	-	-	n.s.
Leverage	-	-	-	-	-	-	-
Bank debt	n.a.	-	-	n.a.	n.a.	n.a.	n.a.
Cash flow	+	+	+	n.a.	+	+	+
Cash flow volatility	+	n.s.	-	n.a.	+	n.a.	+
Liquid assets	-	-	-	n.a.	-	n.a.	-
Investment opportunity	+	+	+	+	n.s.	+/-	n.s.
Dividend payment	-	n.s.	n.s.	-	+	-	-

In table 2 the relationship between the firms specific characteristics and cash holding according to the empirical literature are being displayed. A "+" sign means that there is a positive relationship between the variable and cash according to the respective paper and a "–" sign means that there is a negative relationship. The abbreviations n.a. and n.s. mean that the variable was respectively either not tested or that it was tested but that the researchers did not find a significant relationship.

Where table 1 shows the predictions according to the respective model, table 2 shows what results key papers have found empirically regarding the relationship between the firm specific characteristics and cash holding.
When analyzing the empirical results from top to bottom, then it is clear that the consensus in the literature is that size has a negative relationship with cash holding with the exception of Harford et al. (2014) who find a positive relationship. The negative relationship between size and cash holding is in support of the trade-off theory who poses that firms benefit from economies of scale and thus hold less cash. However both the pecking order theory and the free cashflow theory predict a positive relationship between firm size and cash holding. The pecking order theory predicts a positive relationship because of the precautionary model and the costs related to information asymmetries. Regarding firm size the pecking order theory poses that larger firms are generally more successful and are more successful, thus they are able to hold more cash. The free cash flow theory believes that larger firms hold more cash because of managerial discretion. However since this thesis aims to provide evidence regarding the relationship between firm size and cash holding, it is logical to base the hypothesis on evidence as well. Therefor this thesis states that:

Hypothesis 1: Firm size has a negative effect on a firm's cash holding.

When it comes to leverage the all the empirical evidence suggests that there is a negative relationship between leverage and cash holding. Furthermore the theoretical models are in this case in line with the empirical results, although the trade-off model is still a little bit ambiguous when it comes to leverage. This is because the trade-off model poses on one hand that firms should hold more cash with leverage because of the risk of bankruptcy. While on the other hand firms do not have to hold much cash because they seem to have easy access to leverage which means lower costs of financing. The pecking order theory or financing hierarchy theory poses that leverage is the second best option when it comes to obtaining financial sources and prefers internal financing sources. Lastly the free cash flow theory argues that leverage would function as a repressive measurement against the agency problems firms face when holding cash. Thus the free cash flow theory predicts a negative relationship between leverage and cash holding. Taking both the empirical evidence and the theoretical predictions in regard this thesis states that:

Hypothesis 2: Leverage has a negative effect on a firm's cash holding.

When it comes to bank debt both table 1 and table 2 show a very clear picture. Even though bank debt is not very expansively examined the empirical studies do show that there is a negative relationship between bank debt and cash holding. The theoretical models also show a clear negative relationship between bank debt and cash although the trade-off model shows an ambiguous view. The trade-off model suggests that banks offer financial knowledge and strategic planning, thus reducing the financing costs. The pecking order theory and free cash flow theory refer to the monitoring side of banks which helps reducing the costs of information asymmetry and agency problems respectively. The consensus between the empirical studies and the theoretical models lead to the hypothesis that:

Hypothesis 3: Bank debt has a negative effect on a firm's cash holding.

The empirical studies show with Harford et al. (2014) as exception that there is a positive relationship between cash flow and cash holding. The theoretical theories however are not as in agreement as the empirical studies are. The trade-off model posits that cash flow can act as a substitute for cash holding which results in a negative relationship between cash flow and cash. The pecking order theory posits that cash flow is an internal financing sources which helps the firm to build up there cash holding. The free cash flow theory has no prediction what so ever regarding cash flow. As stated

previously this thesis will follow the empirical consensus when forming an hypothesis. Thus this thesis predicts that:

Hypothesis 4: Cash flow has a positive effect on a firm's cash holding.
When it comes to cash flow volatility table 1 shows that only the trade-off model makes a prediction regarding this firm specific characteristic. Firms who have high cash flow volatility are at higher risk of facing financial distress as shown by Ozkan and Ozkan (2004). Furthermore the empirical studies in table 2 show a clear consensus on the positive relationship between cash flow volatility and cash holding. This is why this thesis predicts:

Hypothesis 5: Cash flow volatility has a positive effect on a firm's cash holding.

Similar to cash flow volatility, the trade-off model is the only one that makes a prediction regarding the relationship between liquid assets and cash holding. The trade-off model states that liquid assets can be easily converted into cash with low transaction costs. This means that firms with a lot of liquid assets do not have to hold cash since they have easy access to cash because of these internal funds. The fact that the pecking order theory does not make a prediction about this can be considered strange. Since the pecking order theory prefers internal financial sources over external financial sources, it would not be surprising if the pecking order theory would predict a positive relationship between liquid assets and cash holding. However taking the empirical studies of table 2 in regard it is safe to assume that the relationship between liquid assets and cash holding will be negative. Thus this thesis predicts that:

Hypothesis 6: Liquid assets has a negative effect on a firm's cash holding.

When it comes to investment opportunity the trade-off model clearly states that there is a positive relationship with cash holding. The trade-off model poses that more investment opportunities will also mean an increase in transaction costs. Thus firms with a lot of investment opportunities will hold more cash. The pecking order theory prefers internal funds over external funds when it comes to financing new projects and thus also the pecking order theory predicts a positive relationship. The free cash flow theory however predicts a negative relationship due to the agency costs that is associated with a lot of investment opportunities. Managers tend to hold more cash when there are less investment opportunities, because they want to exert their discretionary power even if it means investing in projects with a negative NPV. However since the empirical studies in table 2 clearly predict a positive relationship between investment opportunity and cash holding this thesis predicts that:

Hypothesis 7: Investment opportunities has a positive effect on a firm's cash holding.

The only theoretical model that makes a prediction about the relationship between dividend payments and cash holding is the trade-off theory. The consensus within the trade-off theory predicts a negative relationship between dividend payments and cash holding even though the argument could be made for a positive relationship as shown by the literature review. The pecking-order theory and free cash flow theory make no predictions regarding the relationship between dividend payouts and cash holding. Looking at the empirical studies in table 2 the consensus is clearly that there is a negative relationship between dividend payouts and cash holding with only Drobetz and Grüninger (2007) as an exception with a positive relationship. Since the trade-off theory and the consensus of the empirical studies both predict a negative relationship, this thesis states that:

Hypothesis 8: Dividend payment has a negative effect on a firm's cash holding.

These hypotheses will be tested with four different regression tests, which will be explained in the next chapter.

3 Research Methods

This chapter will describe how the three research methods work and how they will be applied in this thesis. The methods that will be explained are the Pooled OLS-Model, Fixed/Random-Effects-Model, and the cross section regression using means. In addition this chapter will explain why it is justified to use these models for this dataset. However, before this thesis will do that, it is necessary to address the type of data and what advantages and disadvantages this data has. This means that the first section will go into the concept of panel data and the second section will go into the regression analyses.

3.1 Panel Data

Panel Data thanks its name to the fact that it comprises a cross-sectional, as well as a time-series dimension. Since the data is collected from various firms (units) over multiple periods, it is also referred to as longitudinal data. The cross-sectional dimension is represented by a series of observations made at a particular time across multiple variables. The time-series events are represented by observing one variable over the course of a time interval. In table 3 the advantages and disadvantages are being shown. These advantages and disadvantages come from the studies of Mátyás and Sevestre (2008) , Verbeek (2008) and Wooldridge (2002).

Table 3: Advantages and Disadvantages of panel data

Advantages	**Disadvantages**
1 Using panel data the researcher automatically increase the number of observations, which increases your degrees of freedom, explanatory variables and efficiency	1 This kind of data make it difficult to assume that observations are independent. Hence this may complicate the analysis
2 Panel datasets allow to control for individual heterogeneity. The regression estimates can be biased if these individual specific effects are not controlled for.	2 This kind of data is known for missing observations due to e.g. merger or bankruptcies. This leads to the adjustments of standard analysis.
3 Panel datasets are more suited for studying complex dynamic behavioral models.	3 The problems of multicollinearity and autocorrelation that exists in cross sections and time-series respectively need to be addressed in the panel data.
4 Panel data can better detect measurements that cannot be detected in pure time-series or pure cross-sectional methods.	
5 When studying large units, panel data can minimize the bias	

3.2 Regression Analysis

When dealing with panel data, the majority of the literature (Ferreira and Vilela 2004; Opler et al. 1999; Pinkowitz and Williamson 2001; Subramaniam et al. 2011) recommends using a certain set of regression tests in order to estimate the effect of the independent variables on the dependent variable in a reliable way. The methods that are recommended are:

- The pooled OLS-Model
- The Fixed/Random-effects-Model (FEM)
- Cross-sectional regression using means

Regarding the FEM and the REM regression tests it is worth mentioning that through running a test by Hausmann (1978), it can be identified which test is more suitable for the data of this thesis. In other words this thesis will not use both tests but will choose between them. Furthermore it must be noted that this thesis uses multiple regression tests to increase the reliability of the relationship results. As mentioned before, using panel data is not without disadvantages and challenges. It is therefore of crucial importance to minimize the risks regarding reliability.

In the light of reliability it is important to note that the variable Bank debt will be dropped in some of the models of all the regression tests. The reason for this is because the sample size will drop drastically if Bank debt is included as shown in chapter 4. Since bank debt is an important firm characteristic it is important to include it as a separate variable. However the reliability of the tests increases when the sample size increases. Therefor the models of the tests will show the results when bank is included and excluded. The year dummy variables and the industry variables will also be included and excluded to see how it affects the relationship between the independent variables and the dependent variables. In the following sections this thesis will discuss for every test their purpose, advantages and disadvantages.

3.2.1 Pooled OLS regression

The pooled OLS regression (POLS) is also called pooled time-series cross sectional regression. In this regression all the cross-section data are pooled into one large cross-section data. This is also called panel data and the standard OLS regression is used to estimate this pooled data. At the same time the POLS regression disregards the heterogeneity between the units as well as the time variant effects of the data (Wooldridge, 2013). One advantage of the POLS regression is that it can be used to increase sample size by pooling observations from different time periods. This is incredibly helpful if the original sample is relatively small but the researcher sill wants to include many explanatory variables in the equation. Thus the researcher can increase their degrees of freedom, which in turn increases the accuracy and consistency of the estimation of the regression results. There are of course many other advantages and disadvantages when it comes to POLS, and the rest of them are presented in appendix 1.

That being said the disregard of heterogeneity would result in the data becoming inconsistent and biased when the heterogeneity is present (Wooldridge, 2013). This means that in order to control for the fact that this thesis extracts data from different time periods, this thesis will follow Ferreira and Vilela (2004) and include dummy variables for the different years. In other words for the years 2014 to 2018 this thesis will use dummy variables where “1” means that the respective observation was made and “0” means that the observation was not made. By using 2014 as the base year it is possible to use different intercepts for time period, thus countering the heterogeneity problem. As control variable this thesis will use the indicator of “Financial distress” which is also known as the Z-score as Kim et al. (1998) and Drobetz and Grüninger (2007) label it. This control variable will be defined in section 3.3.3. however the logic is that the higher the Z-score of a firm is, the lower the likelihood that the firm will face financial distress. Section 3.3.3. will also justify why this is the only control variable this thesis will use besides the year and dummy variables.

As a robustness check, the specific industry of the firms used in the sample will also be taken in consideration as a control variable. This is because the sample may not represent all the industry sectors in an equal way. To give an example, if the sample size consists of 200 firms, but 100 firms are in a high-tech industry the Thus the research results may be caused by the respective industry of the firms instead of the actual independent variables. In order to distinguish between the specific industry sectors of the firms, this thesis will follow Ferreira and Vilela (2004) by using the 2-digit SIC codes that are assigned to the respective firms. The industry with the SIC code 01 (Agriculture production) will be used as the base industry. Also this thesis will use dummy variables where the variable is “1” if the firm is part of a certain industry and “0”if they are not part of a certain industry. Taking the robustness check into account the POLS will look like this:

$CASH_{it} = \beta_0 + \beta_j x'_{it} + \alpha' + \delta' + \beta_1 Z\text{-}Score + \mu_{it}$ (Eq. 1)

i = 1,2, … , N; and t = 1,2, … , T; for every variable j = 1,…,k

$CASH_{it}$ = The dependent variable for firm *i* at time *t.*
Firm *i*= the respective firms
Time *t*= the respective year between the period 2014-2018
x= vector of the explanatory variables as defined in chapter 3.2
β= coefficients of the variables
α = vector of industry dummy variables
δ = vector of year dummy variables
Z-Score = control variable
μ = the error term

Wooldridge (2013) also emphasizes that the Gauβ-Markov theorem should not be violated in order to maintain the reliability of the POLS. The Gauβ-Markov theorem states that there are certain conditions the OLS estimator much meet if it aims to reach the lowest sampling variance within the class of linear unbiased estimators. These conditions are that the errors in the linear regression model are uncorrelated, have equal variance and an expectation value of zero. The reason the Gauβ-Markov theorem is mentioned in this thesis is because there are factors that cannot be observed but might explain or affect the dependent variable. These factors might include special relationships with stakeholders, special expertise's of the firms that gives them a unique position in the market and the corporate culture in general. These issues are however reflected in the error term and should not pose a threat to the reliability of the results unless the error term is correlated with both the dependent and independent variable. Furthermore the results of the POLS will be compared to other regression tests as well as the results of previous literature like Ferreira and Vilela (2004) and Opler et al. (1999).

3.2.2. Cross-sectional regression using means

In this regression test the means of variables for each firm across time is being used (Ferreira & Vilela, 2004). After calculating the mean value of each variable of each firm from 2014-2018, an OLS regression is run to estimate the parameters. Like the POLS regression, the advantages and disadvantages of the Cross-sectional regression using means will be displayed in appendix 1. By taking the average of the dependent variable and independent variables of each year this thesis reduces the sample to a single cross-section and at the same time eliminates the time-series dimension. Thus the regression equation will look like this:

$CASHi = \beta 0 + \beta j x' \, i + \alpha' + \beta_1 Z\text{-}Score + \mu i$ (Eq. 2)

Where, i = 1,2, … , N; for every variable j = 1,…,k

$CASH_i$ = The dependent variable for firm *i.*
Firm *i*= the respective firms

3.2.3 Fixed- and Random-Effects Model

When working with panel data it is safe to say that the biggest challenge researchers face is dealing with the "omitted variable problem" (Wooldridge, 2002). The two statistical linear models that are best equipped with dealing with these unobserved individual or firm specific factors (i.e. unobserved heterogeneity) are the Fixed-Effect-Model (FEM) and Random-Effects-Model (REM). When

investigating the key papers on cash holding and cash determinants, it becomes quite clear that these models are among the most applied models. These authors include Bates et al., (2009); Drobetz and Grüninger, (2007); Harford et al., (2008); Kim et al., (1998); Opler et al., (1999); Ozkan and Ozkan, (2004); Pinkowitz and Williamson, (2001). The main difference between these two models is that they have different assumptions regarding the relationship between the unobserved variables and explanatory variables. The following model is a very standard example of how a linear panel data model looks like:

$CASHit = \beta jx' it + \alpha i + \beta_1 Z\text{-}Score + \mu it$ (Eq. 3)

Where i = 1, … , N firms and t = 1, … , T periods of time, for every variable j = 1,…,k

The REM posits that the unobserved firm specific factor αi is not correlated with any of the explanatory variables $x'it.$ Which leads to the formula

$$E(\alpha i \mid xit) = 0 \text{ (Eq. 4)}$$

This strict exogeneity must also hold for the REM. Thus this will lead to the formula

$$E(\mu it \mid xit, \alpha i) = 0 \text{ (Eq. 5)}$$

To explain this in further detail. This means that the unobserved factors that may affect cash holding must be uncorrelated with any of the explanatory variables. This does not only go for the variables at one point in time but for the variables at any given time. The FEM on the other hand does allow for correlation between the unobserved factors and the explanatory variables. This leads to the equation:

$$E(\alpha i \mid xit) \neq 0 \text{ (Eq. 6)}$$

That being said the demand for strict exogeneity also goes for the FEM. Wooldridge (2013) argues that the effects of the unobserved factors are being eliminated during the time demeaning process. When applying the FEM, the time averages from the corresponding variables are being subtracted, taking into account the firm specific unobserved fixed effects. In addition this leads also to the fact that all explanatory factors become constant over time. Thus, if the key explanatory variables become time invariant, the FEM becomes inappropriate. It is why it is common practice to apply both the REM and the FEM and see if there are statistical significant differences between these two models (Wooldridge, 2013). This test was initially proposed by Hausman (1978) and has become a routine test among econometrics under the assumptions of the random effects model. The Hausman test assumes that the REM is used unless the null hypothesis ($E(\alpha i \mid xit) = 0$) is rejected. This null hypothesis is that the firm specific unobserved factors are uncorrelated with the explanatory variables. The H1 hypothesis on the other hand poses that there is a correlation. The outcome of this test will determine if either the FEM or the REM will be used. The results of the Hausman test will be shown in chapter 5.

3.3 Measurement

3.3.1 Dependent variable

The dependent variable CASH will be measured by the cash ratio. The literature gives various ways to measure this variable but the two most used are:

- The cash and cash equivalents ratio to total assets (Bates et al. 1999)(Ozkan & Ozkan, 2004)(Pinkowitz et al., 2013), which measures the portion of cash held by firms. This is by far the most traditional way of measuring CASH
- The second way of measuring CASH is the ratio of cash and cash equivalents to the net assets of the firm. The net assets are the total assets minus the cash and cash equivalents. Opler et al. (1999); Pinkowitz and Williamson (2001); Ferreira and Vilela (2004) also refer to net assets as the non-cash assets.

In this thesis only the first one will be used, since it is by far the most used way when measuring CASH.

3.3.2 Independent variables

This section will explain how the independent variables, that have been thoroughly examined in chapter 2, will be measured. The firm specific characteristics that will be used are: Size, Leverage, bank debt, cash flow, cash flow volatility, liquid assets, investment opportunity and dividend payment.

Size

The variable firm size will be measured as natural logarithm of the book value of the total assets of the firm in accordance with Opler et al. (1999); Pinkowitz and Williamson (2001); Ferreira and Vilela (2004) and Ozkan and Ozkan (2004). Using the natural logarithm of the total assets the growth factor of the firm is measured. Also using the natural logarithm will result in a decrease in difference of the size between the firms and the years.

Leverage

The method of measuring Leverage is pretty straight forward. Following Bates et al. (1999); Ozkan and Ozkan (2004) and Ferreira and Vilela (2004), this thesis will use the ratio of total debt to total assets. The total debt will be calculated as total current liabilities + total long term debt.

Bank debt

This variable will be measured as the ratio of total bank debt to total debt (total current liabilities + total long term debt). This approach follows the method of Ferreira and Vilela (2004) and Ozkan and Ozkan (2004).

Cash flow

The component cash flows will be measured as the earnings after taxes plus depreciation. The variable cash flow will be measured by using the component of cash flows divided by the total assets of the respective firm. This is also in line with Ferreira and Vilela (2004) and Ozkan and Ozkan (2004).

Cash flow volatility

Following Ozkan and Ozkan (2004) once again the variable cash flow volatility will be measured by computing the standard deviation of cash flows divided by the total of assets. The standard deviation of assets will be computed over a 5 year period. On a side note is must be mentioned that using this method for cash flow volatility is mostly suited for cross-sectional regressions, since the value would not change when applied on panel data. This is why this method will only be used in the cross-sectional regression since it uses the average over time.

Liquid assets
Since liquid assets is seen as a substitute for cash, this thesis will follow Bates et al. (1999); Opler et al. (1999) and Ozkan and Ozkan (2004) by using the ratio of net working capital (NWC) to total assets. The NWC is computed as current assets – current liabilities – total cash and cash equivalents.

Investment opportunity
Following Ozkan and Ozkan (2004) and Ferreira and Vilela (2004) this thesis will use the Market-to-Book ratio as a proxy to measure investment opportunity. The reason for this is because the balance sheet of the firms do not show intangible assets like growth opportunities. However as Ozkan and Ozkan (2004) and Ferreira and Vilela (2004) argue that, when growth opportunity increases the Market-to-Book ratio increases. Thus using the Market-to-Book ratio as a proxy for investment opportunity is justified.

The Market-to-Book ratio is computed as (book value of total assets – book value of equity + market value of equity)/book value of total assets (Ferreira & Vilela, 2004; Opler et al., 1999). The book value of total assets and book value of equity is shown in the balance sheet. The market value of equity is measured as the market cap of the firms at the end of each fiscal year.

Dividend payment
Where this thesis computed the other variables, a dummy variable will be established for dividend payment. This dummy variable will indicate whether or not the firm paid dividend in its respective year where "1" indicates that the firm did pay dividend and "0" indicates that the firm did not pay dividend.

3.3.3 Control variable

To be as thoroughly as possible this thesis will also use a control variable, beside the year and industry dummy variable, that was introduced by Kim et al. (1998) and Drobetz and Grüninger (2007). This control variable is called the Z-score which indicates whether or not a firm is likely to face financial distress. The exact calculation of the Z-score is shown in table 6 below. The logic of the Z-score is that the higher the Z-score of a firm is, the lower the likelihood that the firm will face financial distress. It must be noted though that the Z-score is merely a control variable and its effect on the firms cash holding is not a priority to measure. The reason for using this control variable is to minimize any possible confusion regarding the inference of the regression. Nevertheless since Drobetz and Grüninger (2007) argue that firms that face financial distress hold less cash it is logical to hypothesize that there is a negative relationship between the Z-score and cash holding.

It must be said that the Z-score is not the only control variable the literature used. Opler et al. (1999) also use the R&D spending of the firm to control for the higher costs firms face if it comes to liquidation. Since this is a valid point it would be logical to include R&D spending in the regression model. However Orbis does not provide any data regarding R&D costs for Dutch listed firms. The same can be said for the control variable Acquisitions that is used by Opler et al. (1999). The Acquisitions variable is to control for the fact that firms with excess cash are more likely to acquire other firms and thus acquisitions is something that this thesis could control for. However just like with R&D Orbis does not provide any data regarding the acquisitions done by Dutch listed firms. Finally Harford et al. (2008) use control variables like Leverage, Investment opportunity and Cashflow volatility when investigating the relationship between corporate governance structure and Cash holding. However in this thesis those variables are the firm specific characteristics that are used as explanatory variables, since the information of these variables can be easily verified which was the practical contribution of this thesis.

Table 6: Computing methods of the variables

Variable Name	Abbr	Formulas
Dependent variables		
Cash ratio	CASH	*Cash and cash equivalents / Total assets*
Net Cash ratio	CASH NET	*cash and cash equivalents/ (Total assets - Cash and cash equivalents)*
Independent variables		
Firm Size	SIZE	*ln(total assets)*
Leverage	LEVERAGE	*Total Debt/ Total Assets*
Bank Debt	BANK	*Bank Debt/ Total debt*
Cash flow	CF	*(Earnings after taxes + Depreciation)/ Total Assets*
Cash flow volatility	CF VOL	*Standard Deviation of Cash Flows/ Total Assets*
Liquid assets	LIQ	*(Current Assets - Current Liabilities - Cash and Cash Equivalents)/ Total Assets*
Investment opportunity	INVO	*(Book Value of Total Assets - Book Value of Equity + Market Value of Equity)/ Book value of Total Assets*
Divident payment	DIV	*"1" if firms did pay dividend, "0" if otherwise*
Inverse Z-score	1/ZSC	*1 / (3,3 * EBIT/Total Assets + 1 * Sales/ Total Assets + 1,4 *Retained Earnings / Total Assets + 0,6 * MV of Equity / BV of Total Debt)*

4 Data description

4.1 Sampling

The data collected for this thesis comes from the Bureau van Dijk Orbis database. This database has detailed information regarding publicly listed firms and private firms. This information can be numerical like stock returns, balance sheets, cash flow statements and P&L, but also more qualitative like industries and activities, legal events, studies and location. Since the main research question aims to answer how firms specific characteristics determents the cash holding of Dutch listed firms, this thesis only focuses on publicly listed firms. Also the Orbis database has more detailed, higher and more consistent information on publicly listed than private firms. Firms are required to have available accounts on a consistent level over the period of 2014-2018. The reason this that 2014 is the year right after the economic crisis that started in 2008 (NOS, 2016). Also the year 2019 was right before the outbreak of the COVID-19 pandemic, which means that the outbreak could affect a firm's cash holding as well.

The firms that are extracted from the Orbis database are Dutch publicly listed firms, which leads to an initial sample of 276 firms. To be more precise the search criteria in Orbis was, Publicly listed firms and Netherlands. Going further, this thesis will in accordance to Ferreira and Vilela (2004) exclude firms with a SIC-code between 6000-6999 since those firms are bound to certain financial requirements. In other words, the decision to hold cash might not be a free decision but pre determent by regulations. This leaves this thesis with a sample of 104 firms. The next condition involves a consistent availability on cash and cash equivalents and total assets for the entire sample period of 2014-2018. If this is not the case the firms will also be excluded from the firms and leaves this thesis with a sample of 99 firms. Next to that, it is important to note that this thesis will only use firm year observations. This means that the initial total sample size (N*t) is 495 observations. However given the fact that the Z-score will be included in every regression the actual sample size will be 392. Table 4 shows the firm year observations per variable.

Table 4: Number of observations per year

Year	Cash	Size	Lev	Bank	CF	Cfvol	Liq	Invo	Z-Score
2014	99	99	95	41	95	99	98	78	68
2015	99	99	96	34	96	99	98	84	69
2016	99	99	96	24	94	99	98	91	79
2017	99	99	97	21	96	99	98	94	86
2018	99	99	97	22	98	99	98	98	90
Total	**495**	**495**	**481**	**142**	**479**	**495**	**490**	**445**	**392**

Moreover table 5 shows the industry classification and how the sample is divided over the different classifications. This thesis uses the two digit SIC-codes to group the industries. One thing that immediately stands out is that the Manufacturing industry is the most represented and that industries like Agriculture Forestry and Fishing and Construction are only represented by one firm.

Table 5: Industry classification

Industry	SIC-codes	N
Agriculture Forestry and Fishing	01-09	2
Mining	10-14	4
Construction	15-17	4
Manufacturing	20-39	49
Transportation	40-48	8
Wholesale trade	50-51	4
Retail Trade	52-59	6
Services	70-89	22

This table shows the classification of each firm in one firm year

5 Results

This chapter will address both the descriptive results as well as the results of the regression tests. The descriptive results will be presented in table 7 and this thesis will briefly discuss the variables and what the descriptive results indicate. The next paragraph will discuss the regression results of each method and will also compare them to each other. Finally a robustness check will be done by examining the firms from the two dominant industries from this sample. This should indicate whether the results are indeed solely driven by the independent variables or that the respective industries influence the results as well.

5.1 Univariate analysis

Table 7 shows the descriptive statistics of the entire sample period. It must be noted that this thesis winsorized the variables Cash, Bank debt, Cashflow Cash flow volatility, Liquid assets, Investment opportunity, Dividend payment and Z-score at 0,5% tail in accordance with Harford et al. (2008). After winsorizing, one thing that immediately stands out is the disparity of some of the variables. Starting with the variable Cash, the minimum is 8.21E-05 and the maximum is 0.990. This can have a significant effect on the correlation between Cash and other variables as well as influencing the regression results. However further dropping data would result in the fact that the data will no longer represent the population and thus the reality of Dutch listed firms. Looking further at differences the difference between the mean and median is 5.7% which is not much bigger than the 5% difference with Ozkan and Ozkan (2004). The difference between the mean and median of Ferreira and Vilela (2004) is 14.8-9.1= 5.7% which is the same as Ozkan and Ozkan (2004). Given the fact that neither of the authors mention that this difference is out of the ordinary, this thesis will assume the same.

However the variable Cash is not the only variable that stands out. Cashflow volatility shows a staggering disparity when looking at the minimum and maximum. Also there is a large difference in the mean and median of the variable Cashflow volatility which could definitely affect the correlation between the independent variables and affect the regression results as well. Taking this into account this thesis will transform the variables that are skewed into log variables and use robust standard errors to counter this problem, despite the fact that the regression tests themselves are already largely robust to these issues. The same goes for the variable Liquid assets which also has a large difference of 73.2% between the minimum and maximum of the variable. That being said the difference between the mean and median is only 2.2% which is larger than the 1.4% difference of Ozkan and Ozkan (2004) but this thesis does not deem it to be problematic The variable Liquid assets has a similar problem in the sense that there is a disparity of more than 100% in the minimum and maximum of the variable. However, this disparity only results in a 2.2% difference in the mean and median, thus this thesis does not expect any large effects on the correlation and regression results from this variable. Especially since Opler et al. (1999) has a 1.6% difference between the mean and median which narrows the gap even further.

In contrast to the previous variables the variables SIZE and Leverage seem pretty stable. The SIZE variable has a difference of 0.091 between the mean and median, which is slightly different from Ozkan and Ozkan (2004) which has a difference of 0.303 as well as Ferreira and Vilela (2004) which has a difference of 0.300. The fact that the difference of this thesis is smaller than that of the other studies is encouraging and makes the interpretation more reliable. However when looking at the Size of the firms in terms of their total assets a different picture emerges. In brackets the total assets of the firms are being displayed in millions and it shows a staggering difference of 7.739 million euros between the mean and median. Not only that the minimum of this variable is 98 euros and the maximum is more than 131 million euros. However given the fact that the natural logarithms are deemed reliable representatives by the bulk of the literature and the outliers were winsorized this thesis will not drop any data points. The leverage variable has a mean of 0.528 and a median of 0.505

which is a 2.3% difference. This is slightly different from the 0.7% of Ozkan and Ozkan (2004) but not as different from the 1.3% difference of Ferreira and Vilela (2004). Pinkowitz and Williamson (2001) have a close 1.36% difference between mean and median, so a 2.3% difference is not that worrying and a serious effect on the correlations and regression tests will not be expected.

Table 7: Univariate analysis

	N	Mean	Minimum	25%	Median	75%	Maximum	Std. Deviation
CASH	495	0.161	8.21E-05	0.040	0.104	0.197	0.990	0.188
SIZE	495	13.436 [€8.489]	4.589 [€9.8E05]	11.586 [€0.108]	13.527 [€0.749]	15.573 [€5.798]	18.698 [€131.901]	2.743 [€20.371]
Leverage	481	0.528	0.021	0.341	0.505	0.669	1.494	0.281
Bank debt	142	0.241	0.000	0.038	0.178	0.424	0.814	0.227
Cash Flow	479	0.056	-0.284	0.018	0.078	0.117	0.586	0.126
Cashflow volatility	495	7.609	0.010	0.287	2.126	14.241	27.735	9.285
Liquid assets	490	-0.035	-1.947	-0.132	-0.013	0.096	0.697	0.223
Investment opportunity	445	0.597	0.054	0.419	0.576	0.742	1.473	0.285
Dividend payment	495	0.380	0	0	0	1	1	0,486
Z-Score	392	0.586	-2.495	0,327	0.603	0.893	2.782	0.860

In Figure 1 the development of the cash ratio between 2014-2018 is displayed. To be more specific Figure 1 displays the mean, median, 25th percentile and 75th percentile of the cash ratio. What becomes immediately apparent is that the mean shows very little if any development within that time. The only development that stands out is the mean increase in 2014/2015 only to decrease back in 2015/2016. There is also a small decrease in the 75th percentile but the differences are not very unusual. After the financial crisis it was observed that firms were becoming way more conservative with their cash holding and started to hold more cash as a precaution after 2008 (Campello et al. 2010). Furthermore Song and Lee (2012) studied the long-term effects of the Asian crisis and they found similar results that firms become more conservative with cash holding in the face of a crisis. This may also explain why the mean of Figure 1 is largely stable, because between the year 2014-2018 there was no world-wide economic crisis that would cause firms to radically change their cash policy. The start of this stable period is shown in the study of Li and Luo (2020) who examine whether the high cash ratio and the secular increase in cash holding of U.S. firms are driven by healthcare and technology industries. In one of their figures it is clearly shown that since 2012 the mean cash ratio becomes quite stable. This means that even though the healthcare and technological industries push the increase of cash holding the overall mean remains stable.

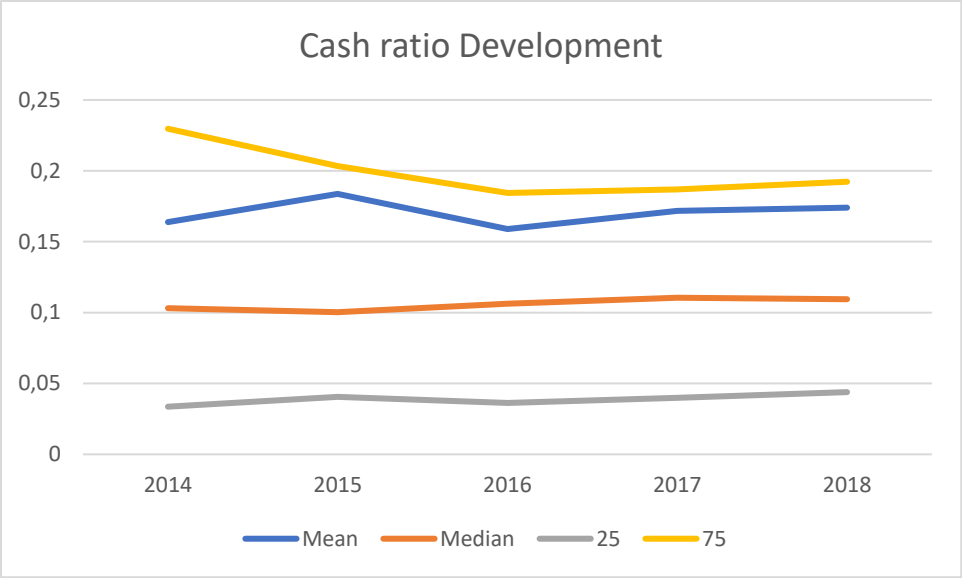

Figure 1: Cash ratio development

5.2 Regression analysis

Before this thesis will start addressing the three different regression tests, it is important to address a few other things first. The first thing that has to be verified is whether or not the data is normally distributed. This will be done for all three the tests although this section will only address the normality regarding the Pooled OLS regression. This is because this section will go more into detail on how a normality test works. The same is the case with the tests on heteroskedasticity and multicollinearity. For the Cross-sectional regression using means and the Fixed/Random effects model the results of the tests on normality, heteroskedasticity and multicollinearity will be given in their respective sections.

In SPSS there are two ways to test whether the data is normally distributed. The first way is the Shapiro-Wilk test and the second way is the Kolmogorov-Smirnov test. With the Shapiro-Wilk test it must be noted that this test will only be used if the sample size is smaller than fifty units so N<50. The Kolmogorov-Smirnov test will be used if the sample size is larger than 50 units or N>50. In this thesis the sample size is 495 units and even with bank debt included the degrees of freedom is 111 which means that the sample is still larger than 50. Therefor this thesis will look at the Kolmogorov-Smirnov test which is displayed in appendix 2. Appendix 2 shows that only Size, Leverage and Investment opportunity are normally distributed and the other variables are not normally distributed.

For testing heteroskedasticity this thesis will use the that was created by Breusch and Pagan (1979) also known as the Breusch-Pagan test. This test attempts to find out whether the variance of the errors from a regression is dependent on the values of the independent variables. If that is the case then heteroskedasticity is present. Appendix 3 shows the Anova results regarding the heteroskedasticity and the table shows quite clearly that there is heteroskedasticity. As for the multicollinearity problem a correlation matrix will be run which is shown in table 8. What stands out is the correlation between Leverage and Investment opportunity which is 0.955. Another correlation that stands out is the -0.865 correlation between Size and Cashflow volatility. Given the fact that this thesis will use the 0.8 threshold by Franke (2010), it is safe to say that there is multicollinearity. How this thesis will handle the multicollinearity problem will be discussed in section 5.2.1.

Table 8: Correlation matrix Pooled OLS regression

	Cash	SIZE	Leverage	Bank debt	cashflow	Cashflow volatility	Liquid assets	Investment opportunity	Dividend payment	Z-Score
Cash	1									
SIZE	-,338**	1								
Leverage	-,184**	-,101*	1							
Bank debt	0,024	-,327**	0,075	1						
cashflow	-,402**	,341**	-,220**	-0,054	1					
Cashflow volatility	,319**	-,865**	0,004	,254**	-,319**	1				
Liquid assets	-,160**	,108*	-,582**	0,101	,260**	-,143**	1			
Investment opportunity	-,191**	0,031	,955**	-0,044	-,190**	0,038	-,567**	1		
Dividend payment	-,239**	,361**	-,147**	-0,033	,315**	-,324**	,173**	-,120*	1	
Z-Score	-,254**	,386**	-0,041	-0,017	,214**	-,332**	0,008	-0,012	,153**	1

Finally it is important to mention that for each of the regression tests this thesis will run different models. These different models are namely the inclusion and exclusion of bank loans, time- and industry dummy variables to see what effect that has on the regression coefficients. The reason for using different models is because 72 percent of the firms of the sample size did not report any bank loans. This may affect the results and lead to an estimation bias, therefor it is necessary to see if the results differ too much. The next sections will discuss the Pooled OLS regression, Cross-sectional regression using means, Fixed- and Random effects regression in this respective order.

5.2.1. Pooled OLS regression

Since the data is not normally distributed and heavily skewed this thesis will use several log variables to control for the skewness of some of the variables (Neter et al., 1996). The rule of thumb that is being used to determine if the data is skewed is that the skewness must be higher or lower than 1 of -1 to be classified as highly skewed and higher and lower than 0,5 and -0,5 to be moderately skewed. Another rule of thumb is that the skewness cannot be larger than twice the standard error of the variable. To make sure that the skewness does not affect the results this thesis will transform the variables that have a skewness that exceeds twice the standard error of the variable into log variables. Which variables are logged are shown in table 8. Furthermore to make the test robust to the heteroskedasticity of the data this these will use robust estimations of the standard errors to control for heteroskedasticity. The coefficients of the POLS are not affected by these robust estimations. The only thing that's being affected is the error term and the t-statistics for the possibility of violating the OLS regression assumptions like normality and heterogeneity. The results of the POLS are being presented in table 9. In order to deal with the multicollinearity problem, table 9 consists of twelve models which can be divided in three categories. The first category consists of model 1 to model 4, where model 1 and 2 drop the variables SIZE and Leverage and show the results with and without bank debt. Model 3 and 4 drop the variables, Cashflow volatility and Investment opportunity and also show the results with and without Bank debt. Thus this thesis has controlled for the multicollinearity problem. Lastly model 1 to 4 exclude the year and industry dummy variables. The second category consists of model 5 to 8 which follows the same strategy as model 1 to 4. The only difference is that model 5 to 8 include year dummy variables. Lastly, the third category consists of model 9 to 12 which follows the same strategy as model 1 to 4 only now the Industry dummy variables have been included. Table 8 shows that including the variable Bank debt, the year dummy variables and industry dummy variables have great impact on the explanatory independent variables. Showing this impact is the main goal of this section. Whether these results support or don't support the hypotheses will be discussed in section 5.3 where two models will be chosen as the main model that represents this regression test.

Looking at the variable SIZE, Model 3 and 4 show a positive and significant relationship at 5% when bank debt is included and significant at 1% when bank debt is dropped. What also stands out is the fact that the coefficient becomes lower when bank debt is dropped. This does not become any

different when the year dummies are included in model 7 and 8 or when the industry dummies are included in model 11 and 12. This is not in line with H1 and it also goes against the bulk of the empirical evidence in table 2. Only Harford et al. (2014) shows a positive relationship so it is not unheard of and it also supports the Pecking-order and Free cashflow theory which state that larger firms hold more cash. The economic significance according to the Pecking-order theory is that larger firms are more successful and can thus hold more cash for investments. The Free cashflow theory makes the positive link because larger firms have more managerial discretion and fall less prey to hostile takeovers.

The variable Leverage has various results. The general pattern is that when Bank debt is being dropped the variable shows a negative and significant relationship which supports H2 and the bulk of the literature. What is also telling is that the more control variables are included the more the relationship between leverage and cash are starting to support the hypothesis. When the industry dummy variables are included the relationship remains significant even when Bank debt is included. The negative relationship shows that firms hold less cash due to the monitoring role of the lenders and because they have to pay back the debt to push of financial distress.

When looking at Cashflow the overall results show a positive and significant relationship at the 10% and 5% significance level, which is supports H4 as well as the Trade-off theory and the Pecking-order theory. What does stand out though is that this variable becomes more significant when SIZE and Leverage are taken into account. Also the year dummy variables make the relationship insignificant especially when Bank debt is included. However when the industry dummy variables are included the relationship becomes significant again. This shows that Cashflow is an important source of income when cash is needed.

Cashflow volatility shows a negative but statistically insignificant impact on cash holding, not supporting H5. Apart from Ferreira and Vilela (2004) non-of the literature in table 2 found a negative and significant relationship between Cashflow volatility and Cash holding. So even though a similar result is not unheard of it is still quite unusual. The variable Liquid assets is negative and insignificant in all of the models which means that there is no support found for H6 that there is a negative relationship between Liquid assets and Cash holding. What also stands out is that when the variable Bank debt is excluded the coefficient decreases drastically. This is quite in contrast with the effect the exclusion of Bank debt has on the other variables. Given the fact that all the empirical results of table 2 predicted a negative relationship it is quite surprising that POLS did not find any support for the hypothesis. The POLS shows various results regarding Investment opportunity. The general pattern is that when Bank debt is excluded the relationship becomes negatively significant at 1%, thus not supporting H7. This is quite in contrast with the empirical findings although Dittmar et al. (2003) did find mixed results, which means it is not quite unheard of. Furthermore the coefficient becomes more negative when Bank debt is excluded thus showing how much of an effect Bank debt has on a firm's Cash policy.

Dividend payment has overall a negative and significant relationship, although like with Investment opportunity the relationship shows less significance when Bank debt is excluded. That being said when both the year dummies and the industry dummies are being added the relationship remains negative and significant at either the 5% or the 10% level regardless of the exclusion of Bank debt thus supporting H8. The variable Bank debt on the other hand remains positive and insignificant which does not support H3 in any way. The reason Bank debt is addressed last is because its inclusion and exclusion drastically affects the results of the other variables and stands out. The reason this result is surprising is because the bulk of the literature clearly shows a negative relationship. Finally when looking at the adjusted R^2 it is clear that dropping the variable Bank debt adds a lot of explanatory value to the model. The explanatory value also increases when both the year and industry dummies are included. Finally it is alos quite telling that the adjusted R^2 is higher when the variables SIZE and Leverage are included, thus showing that firms value these variables more than Cashflow volatility and Investment opportunity when determining their Cash policy. Overall the results show generally a clear picture about the relationship between the variables and Cash holding.

Only for Hypothesis 2 and 4 did the POLS find sufficient support. For the other hypotheses there is clearly no support found.

Table 9: Pooled OLS regression results

Pooled OLS regression												
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
SIZE			0.418	0.270			0.423	0.273			0.392	0.238
			(0.017)	(0.001)			(0.022)	(0.001)			(0.025)	(0.003)
Leverage			0.418	-0.446			-0.178	-0.447			-0.449	-0.403
			(0.017)	(0.000)			(0.304)	(0.000)			(0.014)	(0.000)
Cashflow_log	0.234	0.130	0.241	0.147	0.213	0.128	0.230	0.149	0.285	0.173	0.341	0.191
	(0.093)	(0.090)	(0.080)	(0.050)	(0.151)	(0.102)	(0.120)	(0.051)	(0.039)	(0.020)	(0.012)	(0.008)
Cashflow	-0.345	-0.280			-0.354	-0.289			-0.325	-0.233		
volatility_log	(0.055)	(0.001)			(0.068)	(0.001)			(0.086)	(0.005)		
Liquid assets_log	-0.183	-0.002	-0.143	0.007	-0.190	0.003	-0.155	0.007	0.110	0,065	0.168	0.085
	(0.180)	(0.976)	(0.290)	(0.919)	(0.184)	(0.970)	(0.275)	(0.923)	(0.482)	(0.405)	(0.255)	(0.262)
Investment	-0.062	-0.396			-0.030	-0.401			-0.282	-0.347		
opportunity	(0.721)	(0.000)			(0.876)	(0.000)			(0.160)	(0.000)		
Dividend	-0.291	-0.114	-0.288	-0.122	-0.332	-0.116	-0.324	-0.120	-0.337	-0.173	-0.327	-0.170
payment	(0.028)	(0.115)	(0.027)	(0.084)	(0.024)	(0.114)	(0.025)	(0.096)	(0.015)	(0.013)	(0.012)	(0.012)
Z-Score	-0.097	0.065	-0.069	0.050	-0.140	0.065	-0.103	0.049	0.068	0.007	0.099	0.001
	(0.558)	(0.421)	(0.667)	(0.529)	(0.429)	(0.433)	(0.549)	(0.539)	(0.699)	(0.934)	(0.535)	(0.991)
Bank debt_log	0.170		-0.209		0.200		0.196		0.055		0.042	
	(0.212)		(0.191)		(0.167)		(0.170)		(0.685)		(0.741)	
Adjusted R^2	0.096	0.152	0.123	0.193	0.041	0.133	0.062	0.174	0.232	0.274	0.304	0.307
N	142	392	142	392	142	392	142	392	142	392	142	392
Year dummy	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummy	no	no	no	no	no	no	no	no	yes	yes	yes	yes

This table represents the results of several Pooled OLS regressions. For each variable the first row indicates the coefficients and the second row indicates the significance level. For this table the 5% significance threshold is being used. Finally a "yes" indicates if the dummy variables are present and "no" if they are not present.

5.2.2. Cross-sectional regression using Means

Before the results of the Cross-sectional regression using Means will be presented it is important to address the issues of normality and heteroskedasticity first. When it comes to normality this thesis is forced to use the Shapiro-Wilk test since the sample size is 49 which is lower than 50. The sample size of 49 units is due to the fact that it includes the variable bank debt as well and that reduces the sample size. Appendix 2 shows that the variables SIZE, Cashflow, Liquid assets and Z-Score are normally distributed. The rest of the variables are not normally distributed. Furthermore given the skewness of the data the variables will be transformed into log variables in order to make sure that the skewness does not affect the results. Furthermore this thesis will do once again a Breusch-Pagan test to see if there is Heteroskedasticity. Appendix 3 shows that this is not the case. This also means that applying a Wild Bootstrap is not necessary. However as Table 10 shows that the variable SIZE has multicollinearity with Cashflow, Cashflow volatility and Investment opportunity. Also the variable Investment opportunity has multicollinearity with Cashflow and Cashflow volatility. Given the fact that multicollinearity can result in an estimation bias a choice has to be made. Kim (2019) presents a few ways to deal with multicollinearity. The first way is to increase the sample size and thus decreasing the standard errors of the regression coefficients. However given the fact that this thesis already uses all the publicly listed firms that meet the conditions as described in chapter 4 it is impossible to increase the sample size within this scope (Kim, 2019). The second way to deal with multicollinearity is to combine the two variables into one variable. However if this course of action would be taken the two hypotheses have to be altered as well, since the independent effect of the variables cannot be measured. This is undesirable and therefor this way will not be used. The final solution presented by Kim (2019) is to discard one of the variables from the regression. This last option shows the most promise and this thesis will do the test with both the variable SIZE and Investment opportunity and Cashflow and Cashflow volatility dropped respectively. In other words the variables SIZE and Investment opportunity will be presented in different models than Cashflow and Cashflow volatility.

Table 10: Correlation matrix Cross-sectional regression using means

	Cash	SIZE	Leverage	Bank debt	cashflow	Cashflow volatility	Liquid assets	Investment opportunity	Dividend payment	Z-Score
Cash	1									
SIZE	-,398**	1								
Leverage	-0,130	-0,093	1							
Bank debt	0,050	-,368**	-0,049	1						
cashflow	-,388**	,913**	-0,010	-,297*	1					
Cashflow volatility	,380**	-,884**	0,136	0,264	-,837**	1				
Liquid assets	-0,170	0,097	-,610**	0,014	0,016	-0,149	1			
Investment opportunity	,355**	-,863**	0,162	,282*	-,849**	,999**	-0,161	1		
Dividend payment	-,371**	,394**	-0,130	-0,140	,356**	-,398**	,233*	-,373**	1	
Z-Score	-,351**	,492**	-0,057	-0,232	,459**	-,479**	0,007	-,466**	0,179	1

Table 11 shows the results of the Cross-sectional regression using Means (CSM) and can be divided in two categories. The first category consists of model 1 to model 4, where model 1 and 2 include the variable Bank debt and exclude the dummy variables and model 3 and 4 exclude the variable Bank debt. The second category consists of model 5 to model 8, where the Industry dummy variables are included. Like with the POLS, the main goal of this section is to discuss how the inclusion of Bank debt and Industry dummies affect the results. Model 7 & 8 will represent the Cross-sectional regression using means in section 5.3. Looking at the variable SIZE it is worth mentioning that despite the fact that the relationships are not significant there is a pattern to be seen. This pattern is that when the variable Bank debt is included the result is positive and insignificant, but when the variable Bank debt is excluded the result becomes negative insignificant. When the

industry dummy variables are included this pattern does not change. Thus the CSM did not find support for H1 which goes against the bulk of the empirical findings that there is a negative relationship between SIZE and Cash. Also this result is a lot different from the POLS which found a positive significant relationship.

The variable Leverage is insignificant in model 1 and 2 when Bank debt is included and the Industry dummy variables are excluded. However when Bank debt is dropped and especially when the Industry dummy variables are being included the relationship becomes negative and significant. The level of significance 10% in model 5 and 6, 5% in model 7 and 8 and 1% in model 3 and 4. This means that there is enough support for H2 that there is a negative relationship between Cash and Leverage. Thus also supporting the Trade-off theory, because the more access a firm has to leverage the less cash it has to hold. The Pecking-order theory and Free Cashflow theory turn it around in the sense that the more Cash it can hold the less debt it has to take on.

The variable Cashflow is negative and insignificant in every model showing no support for H4 which is different from the POLS regression which shows a positive significant relationship. This result also goes against the bulk of the literature. In fact none of the empirical findings of table 2 show a negative relationship, which means that this finding is quite striking. The same goes for Cashflow volatility which is also negative and insignificant and thus does not support H5 of this thesis. However the similarity with the POLS regression is that the POLS regression also shows a negative relationship. So even though the relationship is not significant in the CSM there is a general pattern that the relationship between Cashflow volatility and Cash is negative. According to Ferreira and Vilela (2004) is that high Cashflow volatility is associated with high cost of capital as well as high agency costs. This could explain the negative relationship between Cashflow volatility and Cash holding.

When looking at Liquid assets the results are complementary to the results of the POLS in the sense that none of the models show a significant relationship which is not in line with H6 of this thesis. More importantly none of the empirical findings of table 2 found a none significant relationship so the economic significance cannot be determined either. With Investment opportunity it is slightly different. Although there is no significant relationship which is not in support of H7, Drobetz and Grüninger (2007) did find a similar result. One explanation for the insignificant relationship Drobetz and Grüninger (2007) use is that the institutional setting of the Swiss financial system is more bank oriented. This could also be the case in the Netherlands. Another explanation could be that the Market-to-book can be a proxy for both information asymmetries and Investment opportunities. In other words these effects are not mutually exclusive and could cancel each other out empirically. However it does cast some doubts on the importance of the pecking-order theory with the liquidity planning of Dutch listed firms.

When looking at the variable Dividend payment a clear pattern becomes immediately visible. When Bank debt is included the relationship is negative and insignificant. But as soon as Bank debt is excluded from the regression the result becomes Negative and significant at the 1% and 5% level. This remains the same when the Industry dummy variables are included only then both model 7 and 8 are significant at 1%. This shows a clear support for hypothesis 8 that there is a negative relationship between Dividend payment and Cash holding. The economic significance is that Dividend payment is an easy source of internal finance when Cash is needed, thus supporting the Trade-off theory. Finally, Bank debt is negative and insignificant in all the models and thus showing no support for H3. This also goes against the empirical findings of table 2 although given the fact that most of the other empirical papers did not include Bank debt in their regression may be a sign that the relationship between Bank debt and Cash holding is still a fertile field of research. Similar to the POLS though, when Bank debt is excluded from the regression, the adjusted R^2 increases drastically. This goes for both the categories. When the Industry dummies are being added the adjusted R^2 increases as well, which is not really surprising since more variables add to the explanatory value of the model. Overall the results only show support for H2 and H8. For the other hypotheses the results have refuted them.

Table 11: Cross-sectional regression using Means results

Cross-sectional regression using Means								
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
SIZE		0.12		-0.114		0.417		-0.03
		(0.715)		(0.587)		(0.222)		(0.884)
Leverage_log	0.297	-0.211	-0.291	-0.288	-0.312	-0.359	-0236	-0.238
	(-0.184)	(0.239)	(0.007)	(0.008)	(0.097)	(0.056)	(0.028)	(0.03)
cashflow	-0.646		-0.238		-0.119		-0.241	
	(0.272)		(0.24)		(0.844)		(0.226)	
Cashflow volatility_	-0.77		-0.183		-0.285		-0.2	
	(0.185)		(0.377)		(0.626)		(0.323)	
Liquid assets	-0.162	-0.17	-0.083	-0.083	-0.091	-0.049	0.019	0.015
	(0.357)	(0.346)	(0.437)	(0.446)	(0.613)	(0.789)	(0.863)	(0.896)
Investment		0.078		-0.035		0.322		0.036
opportunity_log		(0.804)		(0.868)		(0.315)		(0.861)
Dividend payment	-0.232	-0.209	-0.281	-0.268	-0.238	-0.207	-0.29	-0.279
	(0.162)	(0.224)	(0.007)	(0.011)	(0.148)	(0.208)	(0.005)	(0.007)
Z-Score	-0.145	-0.157	-0.192	-0.167	-0.21	-0.216	-0.206	-0.185
	(0.4)	(0.372)	(0.077)	(0.128)	(0.244)	(0.224)	(0.059)	(0.094)
Bank debt_log	-0.081	-0.12			-0.053	-0.026		
	(0.604)	(0.459)			(0.739)	(0.872)		
Industry dummies	no	no	no	no	yes	yes	yes	yes
N	49	49	96	96	49	49	96	96
Adj R^2	0.03	-0.017	0.146	0.176	0.146	0.155	0.278	0.264

This table represents the results of several Cross-sectional regressions using means. For each variable the first row indicates the coefficients and the second row indicates the significance level. For this table the 5% significance threshold is being used. Finally a "yes" indicates if the dummy variables are present and "no" if they are not present.

5.2.3. Fixed- and Random-Effects Model

While the other tests were done in the statistical program Spss the Fixed- and Random-Effects model can only be done properly in Stata. As mentioned in section 3.2.3 a Hausman test must be done in order to find out whether a Fixed- or Random effects model is appropriate (Hausman, 1978) which can also only be done in Stata. Appendix 4 shows the results of the Hausman test. Given the P-value of 0.7054 the null hypothesis must be accepted and therefor the Random-Effects model is the most appropriate for this data set. However, despite the fact that the main focus will be on the Random-Effects model the results of the Fixed-Effects model will also be presented for comparison purposes. Furthermore it must be noted that given the heteroskedasticity problem, both the Fixed- and Random-Effects models will be plotted with robust standard errors. Another thing that must be taken into consideration is that Stata does an automatic test of multicollinearity and according to that test only Cashflow and Cashflow volatility have multicollinearity. This means that this thesis will deviate from the POLS test and only drop Cashflow and Cashflow volatility respectively given the fact that Stata deemed the results reliable. The results are being displayed in table 12.

Model 1 of table 11 shows the Random-Effects model without the variable Cashflow volatility due to multicollinearity reasons. The results are quite striking in the sense that none of the variables show any level of significance. This is very different from the other regression test which show some level of significance with at least a few variables. Especially the variable leverage would be expected to show at least a level of significance given the fact that with the Cross-sectional regression using means the variable was negative and significant on all the four models. Another variable that stands out is the variable Liquid assets, which has a coefficient of 16,483 which is very high. The R^2 of model 1 is 0.026 which means that only 2.6% of the phenomenon is explained by this model. That is exceptionally low. Fortunately the R^2 is not very informative since with panel data the focus lies more on the individual significance. Also since this thesis is working with panel data, it must be noted that panel data is more cross-sectional dominant. If the regression test would be more time-series dominant the R^2 would be higher. That being said given the extreme lowness of the R^2 it would be appropriate to report it. Model 2 shows the Random-Effects model without the variable Cashflow. What is interesting is that the results of the variable Cashflow of model 2 and Cashflow volatility of model 1 have the same results which hence proves the multicollinearity.

Model 3 and 4 drops the variable Bank debt and shows the results with Cashflow and Cashflow volatility respectively. The first result that stands out is that the variable leverage is now negative and significant at the 10% percent level. This is consistent with the hypothesis of this thesis which predicts a negative relationship between Leverage and Cash holding. The other result that stands out is Liquid assets which dropped from 16.483 to -2.617. That being said the result is still not significant which is why the hypothesis that there is a negative relationship between Liquid assets and Cash holding is not being supported. The coefficients of the variables Investment opportunity and Dividend also changed from positive to negative. However like with the variable Liquid assets neither of the results are significant which means there is no support for either of the hypotheses.

When comparing the results Random-Effects model to the Fixed-Effects model there are some large contrasts to be observed within the results. In contrast to model 1 and 2 the variable SIZE is positive and significant in model 5 and 6. The variable Leverage dropped drastically in negativity and became significant at the 1% level. The variables Bank debt, Liquid assets and Investment opportunity increased had their coefficients increased in positivity drastically. Especially Liquid assets had a drastic increase in its coefficient. Also these variables became significant at the 1%, 10% and 1% respectively. The variables Cashflow and Cashflow volatility of model 5 and 6 also draw attention given the case that although their coefficients are the same, their significance level is not. This not the case in model 1 and 2 where both the coefficients and the significance level are the same.

Model 7 and 8 are a bit more in line with the results of model 3 and 4 although it must be noted that there are still differences. The variables Liquid assets and Investment opportunity show both negative coefficients and are not significant, although it must be noted that the coefficient are not as powerful in model 7 and 8 as they are in model 3 and 4. The variable Dividend payment even became positive and remained insignificant. Overall the results do not support the hypotheses of this thesis.

Table 12: Fixed-and Random-Effects Model Regressions

Fixed- and Random Effects Model Regressions								
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
	REM	REM	REM	REM	FEM	FEM	FEM	FEM
SIZE	-0.014	-0.014	-0.107	-0.107	0.844	0.844	-0.052	-0.519
	(0.908)	(0.908)	(0.247)	(0.247)	(0.044)	(0.054)	(0.629)	(0.629)
Leverage	-1.218	-1.218	-0.615	-0.615	-3.639	-3.639	-0.712	-0.712
	(0.414)	(0.414)	(0.094)	(0.094)	(0.004)	(0.008)	(0.072)	(0.072)
Bankdebt	0.030	0.030			0.175	0.175		
	(0.625)	(0.652)			(0.006)	(0.016)		
CashFlow	-0.157		-0.018		-0.251		-0.051	
	(0.146)		(0.836)		(0.040)		(0.557)	
Cashflow volatility		-0.157		-0.018		-0.251		-0.051
		(0.146)		(0.836)		(0.180)		(-0.590)
Liquid Assets	16.483	16.483	-2.617	-2.617	25.174	25.174	-0.263	-0.263
	(0.265)	(0.265)	(0.133)	(0.133)	(0.058)	(0.014)	(0.153)	(0.153)
investment opportunity	0.182	0.182	-0.170	-0.170	0.794	0.794	-0.004	-0.004
	(0.545)	(0.545)	(0.307)	(0.307)	(0.010)	(0.067)	(0.983)	(0.983)
Dividend payment	0.158	0.158	-0.004	-0.004	0.356	0.356	0.135	0.135
	(0.492)	(0.492)	(0.974)	(0.974)	(0.145)	(0.067)	(0.243)	(0.243)
Z-score	0.314	0.314	0.111	0.111	-0.604	-0.604	0.125	0.125
	(0.525)	(0.525)	(0.487)	(0.487)	(0.225)	(0.616)	(0.434)	(0.434)
_cons	-39.139	-39.139	4.528	4.528	-65.616	-65.616	0.384	0.384
	(0.230)	(0.230)	(0.304)	(0.487)	(0.036)	(0.006)	(0.410)	(0.410)
N	142	142	392	392	142	142	392	392
R^2	0.026	0.026	0.064	0.064	0.060	0.060	0.002	0.002

This table represents the robust regression results of 4 Fixed Effects Models (FEM) and 4 Random-Effects models (REM). For each explanatory variable the first row reports the regression coefficient and the significance level is displayed in parentheses in the subsequent row. The regressions are run using robust standard errors.

5.3 Comparison of Regression analyses

Now that the respective regression models have been run, this section will compare the results of these regression analysis with each other. This way the similarities and differences between the results will be discussed. To make the comparison as comprehensible as possible table 13 presents one model of each type of regression. The models that are being presented represent the main findings of this thesis. It is worth mentioning though that the models that are being used for the comparison do not include the variable Bank debt. The reason for this is because the results appear to be more reliable when Bank debt is excluded. For the POLS regression this thesis will present the models that includes both the Year- and Industry dummies. This is because it is reasonable to assume that the parameter estimates of models are more efficient and less biased since they take into account time and industry effects (Wooldridge, 2013). This is also the case for the Cross-sectional regression using means although the time effect has already been taken into account. This is also the case for the Random-Effects model, which is why this thesis will include model 3 and 4 for comparison. The reason table 13 includes two models from each of the regression tests is because of the multicollinearity between some of the variables.

Starting with the variable SIZE shows inconsistency in the results. The POLS clearly shows a positive significant relationship whereas the CSM and the REM show a negative insignificant relationship. The positive significant relationship does support the Pecking-order theory and Free cashflow theory which means that firms that are bigger hold up more Cash. What these results have in common though is that neither of them support H1 which is exactly what this thesis wanted to find out. Looking at the variables Leverage there is a clear negative and significant relationship, thus supporting H2. This also confirms the Trade-off theory which states that firms who have more access to access hold less cash. The Pecking-order theory, also predicted a negative relationship because firms that don't have the means to hold more cash are more inclined to issue more debt. Lastly the Free-cash flow theory argues that more Leverage increases the monitoring role of the lenders, thus reducing the agency risk and the amount of cash firms hold.

The variable Cashflow has inconsistent results. The POLS shows a strong positive significant relationship at the 1% level which supports H4. However both the CSM and the REM show a negative insignificant relationship. Given the fact that this thesis will derive its conclusions from the general pattern of all the tests the results are not enough to give a solid conclusion. The reason this thesis does not take one test as the leading test is because each tests has disadvantages and the tests compensate each other's disadvantages. For the variable Cashflow volatility each test shows a negative relationship where only the POLS is significant at 1%. This negative coefficient could be explained by the argument of Ferreira and Vilela (2004) that High Cashflow volatility is paired with a lot of costs of capital and that the agency costs increase as well. Overall this thesis has to conclude that there is a negative relationship with Cashflow volatility and Cash holding.

The variable Investment opportunity shows inconsistent results. The POLS shows a negative significant result at 1% significance. This is in line with the Free Cashflow theory which states that firms with low Investment opportunities invest in projects with a negative NPV just as firms with high investment opportunities do. However the difference is that for firms with low investment opportunities investing in projects with a low NPV is destructive for the firms shareholder value (Dittmar et al. 2003). The CSM and the REM show an insignificant result which could be explained by the fact that the Market-to-book ratio can be used as a proxy for both investment opportunities and that these effects can both be at work and thus cancel each other out empirically. However regardless of the reasons, the only thing that is relevant for this thesis is that the results do not support H7. When looking at Dividend payment the results show a negative significant relationship. Even though the REM is insignificant the POLS and the CSM show a clear negative relationship at the 5% and 1% level. This supports H8 as well as the Trade-off theory that firms use the reduction of Dividend payment as source of cash when they need it.

Tabel 13: Summary of regression types

Summary of regression types						
	Model 1 POLS	**Model 2 POLS**	**Model 3 CSM**	**Model 4 CSM**	**Model 5 REM**	**Model 6 REM**
SIZE		0.238		-0.03	-0.107	-0.107
		(0.003)		(0.884)	(0.247)	(0.247)
Leverage		-0.403	-0236	-0.238	-0.615	-0.615
		(0.000)	(0.028)	(0.03)	(0.094)	(0.094)
Cashflow	0.173	0.191	-0.241		-0.018	
	(0.020)	(0.008)	(0.226)		(0.836)	
Cashflow volatility	-0.233		-0.2			-0.018
	(0.005)		(0.323)			(0.836)
Liquid assets	0,065	0.085	0.019	0.015	-2.617	-2.617
	(0.405)	(0.262)	(0.863)	(0.896)	(0.133)	(0.133)
Investment opportunity	-0.347			0.036	-0.17	-0.17
	(0.000)			(0.861)	(0.307)	(0.307)
Dividend payment	-0.173	-0.170	-0.29	-0.279	-0.004	-0.004
	(0.013)	(0.012)	(0.005)	(0.007)	(0.974)	(0.974)
Z-Score	0.007	0.001	-0.206	-0.185	0.111	0.111
	(0.934)	(0.991)	(0.059)	(0.094)	(0.487)	(0.487)
Adjusted R^2	0.274	0.307	0.278	0.264	0.064	0.064
N	392	392	96	96	392	392
Year dummy	yes	yes	no	no	n.a	n.a
Industry dummy	yes	yes	yes	yes	n.a	n.a

This table shows the regression results of all three models. The dependent variable is Cash and the control variables are the Z-score, Year- and Industry variables. The rest of the variables are independent and explanatory. For each regression model the first row represents the coefficients and the second row represents the significance level. The POLS regression is represented by the model that drops the variable Bank debt and includes both the Year and Industry dummy variables. The CSM regression is represented by the model that drops the variable Bank debt and includes the Industry dummy variables. The Random-Effects model is represented by two models that drops the variable Bank debt and includes and excludes the variables Cashflow and Cashflow volatility.

Table 14 will sum up the main findings of the regression analysis, showing both the predicted relations between the explanatory variables and the dependent variables as well as the empirically determined relations. What becomes immediately clear is that the results are mostly inconclusive. For the variables SIZE, Cashflow, Cashflow volatility and Dividend payment some tests did show a significant relationship and some did not. For the variables SIZE and Dividend the significant relationships do support their respective hypotheses. However the negative significant relationships between Cashflow and Cash holding as well as Cash volatility and Cash holding do not support their respective hypotheses. The variables Bank debt, Liquid assets and Investment opportunity show no significant relationships in either of the regression tests which also means that their respective hypotheses are not supported.

Table 14 Predicted relations vs Determined relations

Variable	Predicted relations	Determined relations
SIZE	-	+/-
Leverage	-	-
Bank debt	-	N.s.
Cashflow	+	+/-
Cashflow volatility	+	-
Liquid assets	-	N.s.
Investment opportunity	+	+/-
Dividend Payment	-	-

This table shows the predicted relations of this thesis and the Determined relations though the empirical tests of this thesis. A "+" indicates a positive relationship between the explanatory variables and a "-" indicates a negative relationship. A +/- indicates that the results were inconclusive and lastly, N.s. means that the relationship was insignificant.

5.4 Robustness analysis

In order to check the robustness of this thesis, the composition of my sample will be varied based on industry indications. The purpose of this test is to see how sensitive the regression models are to changes regarding the grouping of the underlying sample. Although industry dummy variables have already been introduced a broader subgroup will be applied in this section. As table 5 shows the industry category manufacturing represents half of the sample firms and is thus the largest sector. The service sector represents around 20% of the sample firms making it the second largest sector. This is why this thesis will run separate regression models that will either only include firms from the manufacturing sector of the service sector. Table 15 presents the different regression models. It must be noted that the Cross-sectional regression using means was not used due to the fact that it would reduce the sample size too much. The same goes for the fact that Bank debt was dropped. With the sector "services" the inclusion of Bank debt would reduce the sample size to 5 units which would compromise the reliability of the test.

Looking at the results it becomes quite clear that for the "Manufacturing" industry the results are not consistent. This goes for both the POLS and the Random-Effects model which has becomes positive and insignificant. This in contrast with table 13 where the results were positve and significant with the POLS regression. For the "services" industry the results are negative and insignificant with the POLS and negative significant with the Random-Effects model. This inconsistency shows that the variable SIZE is not robust to the respective industries of the firm. Table 15 also shows different results concerning the variable Leverage. Where the variable was negative

and significant in table 13, in table 15 the variable Leverage became negative and insignificant in all the tests regarding the “manufacturing” and “services” sector. As for the variable Cashflow the robustness check shows negative and insignificant in the POLS regression of the “manufacturing” industry, but became positive and insignificant in the Random-Effects model. In the “services” industry the results remained negative and insignificant for the Random-Effects model. In the POLS however the results became negative and significant at 1%. This shows that the services sector might affect a firm’s cash holding or at least affect how the variable Cashflow is being seen.

The variable Cashflow volatility also shows inconsistent results. Where it showed a negative significant result in POLS regression of table 13 it now shows a negative insignificant results which shows that Cashflow volatility is not that important in the services sector. In the Random-Effects model the result is consistent in the sense that it is negative and insignificant. However the coefficient is more powerful in Table 15 than in table 13. What stands out however is that for the “services” industry the coefficient is really low which means that for that particular industry Cashflow volatility does not have an effect on Cash that is worth mentioning. Moving on to Liquid assets it is no surprise that the result is positive and significant for the “manufacturing” industry in both the Random-Effects model and the POLS. The reason it makes sense is because manufactures need above all else adequate Net Working Capital in order to maintain its continuity. In other words the NWC a firm needs the more Cash a firm will hold. What also stands out is the striking difference between the Random-Effects model and the POLS. The Random-Effects model is negative and significant where as the POLS regression is negative and insignificant. What is also quite striking is the difference of power of the coefficients.

With Investment opportunity the results in the “manufacturing” industry is positive and insignificant for both the Random-Effects model and the POLS regression. This is not in line with the results in table 13 given the fact that the coefficient of the Random-Effects model is positive in table 15 and negative in table 13. With the “services” industry it is the other way around in the sense that the results of the Random-Effects model is in line with the results of table 13 which is a negative insignificant relationship. However the results of the POLS is also negative and insignificant in table 15 which is not in line with the positive insignificant result of table 12.

Lastly the variable Dividend payment shows a positive insignificant result in the Random-Effects model of the “manufacturing” industry which is not in line with the Random-Effects model in table 13. The POLS regression however is negative and insignificant which is also not in line with the results of table 13 given the negative significant result. This shows that Dividend payment is not that much of a priority when it comes to determining Cash holding policy. In the “services” industry, Dividend payment plays a much more prominent role given the fact that the POLS regression is negative and significant at 1%. This is also in line with the POLS regression of table 13 only the coefficient is almost three times more powerful in table 15. In the Random-Effects model however the result is negative and insignificant which is not a surprise given the weak coefficient of table 12.

When these results are compared to the results of table 13 it becomes clear that the type of Industry does affect how the firms view the importance of these variables. That being said the fact that this is the case for two industries does not mean that it disproves the general picture of how these variables affect the Cash holding of Dutch publicly listed firms. In fact the idea that different industries prioritize different variables when determining their Cash holding policy is not a surprise at all. For example the significant relationship between Liquid assets and Cash in the “manufacturing” industry is only logical given the fact that manufacturing firms rely heavily on their NWC. Also their inventories are not so easily transformed into cash given the fact that they are quite often unique and made for a specific product. In other words it is precisely because of the fact that the specific effect of the industry has been neutralized that the general results can be considered reliable despite the changes in the subgroup.

Table 15 Robustness check: Manufacturing and Services sector.

Dep. var	**REM**	**POLS**	**REM**	**POLS**
Cash	**Manuf.**	**Manuf.**	**Services.**	**Services.**
SIZE	0.020	1.367	-0.118	-0.317
	(0.988)	(0.496)	(0.090)	(0.802)
Leverage	-0.283	-0.689	-0.171	-0.234
	(0.528)	(0.410)	(0.566)	(0.466)
Cashflow	1.593	-1.410	-0.040	-1.937
	(0.118)	(0.421)	(0.853)	(0.010)
Cashflow volatility	-0.115	-0.044	0.003	0.03
	(0.103)	(0.769)	(0.926)	(0.734)
Liquid assets	3.552	1.709	-0.850	-0.072
	(0.000)	(0.023)	(0.007)	(0.811)
Investment opportunity	0.062	0.152	-0.370	-0.151
	(0.905)	(0.848)	(0.201)	(0.683)
Dividend payment	0.126	-0.197	-0.076	-0.327
	(0.260)	(0.138)	(0.627)	(0.001)
Z-score	-0.085	0.061	-0.312	-0.082
	(0.451)	(0.860)	(0.029)	(0.794)
R^2	0.148	0.262	0.29	0.423
N	72	89	72	89

This table represents the robustness check using a subsample from the Manufacturing and Services industry of the initial sample. For each industry a POLS and a Random-Effects Model (REM) was run. The dependent variable is Cash. For each explanatory variable the first row reports the regression coefficient and the significance level is displayed in parentheses in the subsequent row. The regressions are run using robust standard errors.

6 Conclusion & Further Research

6.1 Conclusion

The main goal of this thesis was to answer the question "How do the firm specific characteristics, influence cash holding of Dutch publicly listed firms in the Netherlands?". This thesis draws its conclusions from empirical findings using panel data from 99 Dutch publicly listed firms from the period 2014-2018. Using the Trade-off theory, Pecking-order theory and Free cashflow theory this thesis has derived several firm specific characteristics that were used to answer the main research question. These firm specific characteristics were SIZE, Leverage, Bank debt, Cashflow, Cashflow volatility, Liquid assets, Investment opportunity and Dividend payment. Using the Pooled OLS regression, Cross-sectional regression using means and the Random-Effects model this thesis examined how said firm specific characteristics influence the cash holding of Dutch publicly listed firms.

With the variable SIZE both the Pecking-order theory and the Free cashflow theory predict a positive relationship between SIZE and Cash holding. However the empirical findings of this thesis was not enough to support of this hypothesis. The results also go against the bulk of the literature that refute this hypothesis (Opler et al., 1999; D'Mello et al., 2008; Drobetz and Grüninger, 2007; Ferreira and Vilela, 2007). Looking at the negative insignificant relationship of the Cross-sectional regression using means and the Random-Effects model it can only be said that the results were overall inconclusive. The positive significant result of the POLS does show support for the Pecking-order theory that larger firms are better at holding cash. It also supports the Free cashflow theory that larger firms are more subjected to the monitoring role of the shareholders. However given the fact that this thesis draws its conclusions from the general pattern of the three tests it is not enough support for H1.

The variable Leverage on the other hand shows consistently negative significant relationships which supports the hypothesis of this thesis as well as the predictions of the Trade-off theory, Pecking-order theory and Free cashflow theory. The Trade-off theory argues that a high leverage ratio indicates that firms maintain a good relationship with their creditors. This good relationships benefits firms in the sense that they have low costs when issuing new debt if they are in need of cash. This means that firms with higher leverage hold less cash. The pecking-order theory on the other hand follows the hierarchy of financing. This means that firms will only use debt if the level of investments is larger than the level of cash. Therefor when the level of leverage increases the level of cash will decrease correspondingly. The Free cashflow theory argues that less levered firms are subjected to less monitoring. This is turn will increase managerial discretion leading to higher cash ratios.

Moving on to the variable Bank debt, this thesis predicted that there would be a negative relationship between Bank debt and Cash. From the Trade-off theory and transaction costs perspective this is because a good relationship with banks reduces the issue costs of debt. The Pecking-order theory argues that a high bank debt ratio would lessen the need for precautionary cash holdings. This is because banks are highly capable to evaluate the financial performance and credit quality of firms. Thus the restrictions to additional debt will decrease once they built a close relationship (Ferreira & Vilela, 2004). That being said judging from the empirical results from this thesis it is safe to say that the results are inconclusive. Where the POLS shows a positive insignificant relationship, the Cross-sectional regression using means however shows a strong negative insignificant relationship. The Random-Effects model on the other hand shows a positive insignificant relationship just like the POLS. This means that the empirical results show no support for the hypothesis that there is a negative relationship between Bank debt and Cash holding

The Trade-off model argues that there is a negative relationship between the variable Liquid assets and Cash. The reason is that Liquid assets like Net Working Capital are being seen as substitute for Cash and can be easily converted into Cash (Bigelli & Sanchez-Vidal, 2012; Ferreira & Vilela, 2004;

Ozkan & Ozkan, 2004; Opler et al., 1999). Thus firms with a high NWC would require less Cash. The empirical results however do not show support for this claim given the fact that the results are all insignificant in all the tests.

For the variables Cashflow and Cashflow volatility both the Trade-off and Pecking-order theory predicted a positive relationship which is supported by the bulk of the empirical findings (Opler et al., 1999; Drobetz & Grüninger and Harford et al., 2008). The reason for this is because Cashflow can be seen as a substitute for Cash (Kim et al., 1998) since an increase in Cashflow means an increase in investment. For Cashflow volatility the motivation is different since an increase in volatility also means an increase in risk of Cash shortage(Ferreira & Vilela, 2004). Thus firms with higher volatility hold more Cash. The POLS shows support for the Cashflow hypothesis given the strong positive significant relationship between Cashflow and Cash. However both the CSM and the Random-Effects model show respectively a negative insignificant relationship. The inconsistency within the results make it difficult to draw any conclusions and the recommendation is to do more research by expanding the time span and thus making the sample size larger. For Cashflow volatility it is safe to say that the empirical results refute the hypothesis of a positive relationship. Though only the POLS shows a significant relationship, the results are consistent in its negative result and are in line with both Ferreira and Vilela (2004) and Ozkan and Ozkan (2004).

The Trade-off theory, Pecking-order theory and the bulk of the literature (Ferreira & Vilela, 2004; Opler et al., 1999; Ozkan and Ozkan, 2004 and Harford et al., 2014) predict and show a positive relationship between Investment opportunity and Cash. The Trade-off theory argues that firms with high investment opportunities should hold more Cash to find the perfect balance between opportunity costs and benefits (Kim et al., 2011; Opler et al., 1999; Ozkan and Ozkan, 2004). This is especially the case if the value of the firm depends on these growth opportunities. The Pecking-order theory also worries about opportunity costs but this worry is derived from the precautionary motive. Only the Free cashflow theory predicts a negative relationship, because firms with low growth opportunities will invest in projects with a negative NPV. The empirical results of this thesis do not show support for either its hypothesis or the theories the hypothesis was derived from. Instead in line with Drobetz and Grüninger (2007) and Harford et al. (2008) this thesis found insignificant results.

The final variable that was being investigated is Dividend payment. The Trade-off theory was the only theory that has a prediction on this variable, which is that there is a negative relationship between Dividend payment and Cash holding. Overall the results support this hypothesis. The POLS regression shows a clear negative relationship as well as the Cross-sectional regression using means. This means that the more Dividend a firm pays out the less Cash a firm holds. This goes against the conventional wisdom that firms are reluctant to decrease there Dividend payment because it sends a bad signal to possible investors.

Overall the findings indicate that the Trade-off theory and the Pecking-order theory play very important parts in explaining how firm specific determinants influence a firm's Cash holding. In contrast the Free cashflow theory has very little support in the sense that there is only support with the variable Leverage. This means that agency problems do not have a big influence on the Cash holding of Dutch publicly listed firms. The robustness check proves that the initial tests were run appropriately with the Industry dummy variables given the fact that the individual industries do have a unique effect on a firm's view on Cash holding policy. Which is why, when all the industries are controlled for, this individual effect is being neutralized.

6.2 Future Research

One of the limitations of this study is that it does not include the tax-based influence on a firm's Cash holding. The reason for this is that the Tax-based empirical findings presented by Foley et al. (2007) makes a clear distinction between foreign Cash holding and domestic Cash holding and ORBIS does not have specific information about that. Also given the fact that this thesis has already used eight explanatory variables and three kinds of dummy variables, including a detailed tax-based analysis would make the study too complicated and may decrease the reliability and validity of the study. Another limitation is that for the Cross-sectional regression using means the test was still run with Cashflow and Cashflow volatility despite the fact that the correlation got past the 0.8 threshold. Nevertheless it must be taken into account that the correlations are a bivariate relationship and collinearity is multivariate. In other words this thesis made sufficient attempt to control for multicollinearity and even though the Cashflow and Cashflow volatility are in the same model the results can still be considered reliable.

For further research it may be interesting to investigate how the firm specific characteristics may affect the Cash holding of firms in different industry sectors. The robustness check of this thesis showed a strong positive relationship between Liquid assets and Cash holding in the "manufacturing" industry and a negative significant relationship in the "services" industry. This suggests that the firms of this industry have a unique perspective on the determinants of Cash holding. Studying these different perspectives may give insight in the challenges that these firms face in their respective industries. The firms in turn can use this knowledge to create their Cash holding policy in an effective way.

Another suggestion for further research would be to examine why there is a negative relationship between Dividend payment and Cash holding. The reason why this would be interesting is because the argument that firms can easily access cash by reducing dividend payments (Ferreira & Vilela, 2004) seems a bit too shallow. This is because, as mentioned in Chapter 6 that firms are reluctant to reduce dividend payment since this sends a negative signal towards possible investors. Possible research questions would be: Under what circumstances would a firm decrease its dividend payment? Where does reducing dividend payment rank in terms of internal financial sources? These questions would address this peculiar relationship between Dividend payments and Cash holding.

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Appendix 1: **Advantages and Disadvantages of the regression tests**

Method	Reference	Advantages	Disadvantages
Pooled OLS Regression	(Wooldridge, 2013)	1 Analyzes both the cross-sectional and time-series data. 2 With few units it is possible to increase sample size 3 Potential result of panel Heteroskedasticity 4 Get more precise estimators and increases the power of the test statistics 5 Includes annual dummy variables to eliminate any macroeconomic factors. 6 capturing a larger portion of variability of the data, making the parameters estimates more robust	1 Raises several issues that this statistical tests cannot address. 2 Applying to cross-sectional data requires no concern regarding autocorrelation if the data is not independent along the time dimensions. 3 When the error variance is not constant across units in the heteroskedasticity results steps must be taken to correct it. 4 This test has a heterogeneity problem where all units are affected by a shock during the same time period.
Cross-sectional regression using means	(Opler et al. 1999) (Ferreira & Vilela, 2004)	1 Eliminates the problem of serial correlation in the residuals of a time-series cross-sectional regression	1 This test excludes annual dummy variables. As a result the macroeconomic factors will not be eliminated.
Random-and Fixed effects model	(Wooldridge, 2002)	1 Best equipped with dealing with the omitted variable problem. 2 FEM is considered to be more convincing since it allows for correlation between the unobserved factors and the explanatory variables.	1 With the FEM it is the case that, if the key explanatory variable is time invariant, the fixed effects estimator is inappropriate. Therefor the Hausman test must be done to see if there are significant differences between the results of the REM and FEM

Appendix 2 **Normality test**

The null-hypothesis of the Kolmogorov-Smirnov test is that the data is normally distributed. When the significance is smaller than 0.05 the null-hypothesis will be rejected and the data will not be normally distributed. If the significance is larger than 0.05 you accept the null hypothesis that the data is normally distributed. The same goes for the Shapiro-Wilk test

Tests of Normality POLS

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CASH	,171	111	,000	,793	111	,000
SIZE	,061	111	,200*	,983	111	,185
Leverage	,070	111	,200*	,986	111	,330
Bank debt	,165	111	,000	,881	111	,000
Cash Flow	,140	111	,000	,909	111	,000
Cash flow volatility	,268	111	,000	,675	111	,000
Liquid assets	,100	111	,008	,959	111	,002
Investment opportunity	,076	111	,148	,966	111	,006
Dividend payment	,370	111	,000	,631	111	,000
Z-Score	,165	111	,000	,909	111	,000

**. This is a lower bound of the true significance.*

a. Lilliefors Significance Correction

Tests of Normality Cross-sectional regression using means						
	Kolmogorov-Smirnova			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
Cash	0,227	49	0	0,751	49	0
SIZE	0,067	49	,200*	0,983	49	0,706
Leverage	0,099	49	,200*	0,914	49	0,002
Bank debt	0,151	49	0,007	0,895	49	0
cashflow	0,059	49	,200*	0,989	49	0,919
Cashflow volatility	0,276	49	0	0,723	49	0
Liquid assets	0,066	49	,200*	0,975	49	0,392
Investment opportunity	0,309	49	0	0,711	49	0
Dividend payment	0,376	49	0	0,629	49	0
Z-Score	0,142	49	0,015	0,955	49	0,06

**. This is a lower bound of the true significance.*

a. Lilliefors Significance Correction

Appendix 3 **Heteroskedasticity test**

The null hypothesis of the Breusch-Pagan test is that there is homoskedasticity. This means that if the significance is larger than 0,05 or P>0,05 that means that the null hypothesis of homoskedasticity must be accepted. If the P value is smaller than 0,05 or P<0,05 the null hypothesis must be rejected, which means there is heteroskedasticity. Given the P-value of 0,003 the null hypothesis must be rejected, which means that the data is heteroskedastic.

Pooled OLS Breusch-Pagan test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,003	9	,000	3,005	,003[b]
	Residual	,012	101	,000		
	Total	,015	110			

a. Dependent Variable: sqres

b. Predictors: (Constant), Z-Score, Dividend payment, Bank debt, Leverage, Cash Flow, Cash flow volatility, Liquid assets, SIZE, Investment opportunity

Cross-sectional regression using means

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,148	9	,128	1,344	,247[b]
	Residual	3,700	39	,095		
	Total	4,847	48			

a. Dependent Variable: sqres

b. Predictors: (Constant), Z-Score, Liquid assets, Bank debt, Dividend payment, Investment opportunity, Leverage, Cashflow volatility, Cashflow, SIZE

Appendix 4 **Hausman test**

This table displays the output of the Hausman (1978) test. The null hypothesis states that there is no correlation between the explanatory variables and the error term and the alternative hypothesis states that there is a correlation. Since the Prob is higher than 0,05 the conclusion that the Random effects model is more appropriate must be drawn.

```
. hausman FE RE
```

	Coefficients (b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
SIZE	.8443264	-.0141601	.8584865	.3721522
Leverage	-3.63927	-1.217828	-2.421442	.8166361
log_Bankdebt	.1746755	.0301391	.1445364	.0336869
log_CAshFlow	-.2509292	-.1568711	-.0940581	.
log_liqa	25.17356	16.48327	8.690288	5.543236
log_invest~p	.7938199	.1819841	.6118357	.1752595
Dividendpa~t	.3555507	.1577231	.1978276	.
log_Zscore	-.6038105	.3135232	-.9173337	.

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =         5.48
                Prob>chi2 =       0.7054
                (V_b-V_B is not positive definite)
```