

# Master Thesis

## The effect of the Financial Crisis on Firms Capital Structure: A Cross Industry Study



## Radboud Universiteit Nijmegen

**Abstract:** This study examines the effect of the last financial crisis on the capital structure of firms. A large sample of 1555 listed companies are analysed from 3 European countries: Germany, France and UK for the period 2008-2016. The focus is on the last financial crisis period 2008-2012, firm-level determinants and industry fixed effects. The results show that the determinants firm size, growth opportunity and tangibility have a positive relationship with leverage, measured as long-term debt divided by total assets. On the other hand, the study found that the determinants liquidity and profitability have a negative relation with capital structure. Based on the firm-level determinants in this study, the general finding is that the **pecking order theory** is the most influential capital structure theory. However, the results also show that the last financial crisis of 2008-2012 has a negative effect on leverage which is in accordance with the **trade-off theory**. Furthermore, the study found that the firm-specific determinants firm size and tangibility are more important during times of crisis. These characteristics could help firms to mitigate the negative relationship between crisis and leverage. Finally, this study found evidence that industry fixed effects have a significant influence on the capital structure decision.

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## 1. Introduction

The global financial crisis of 2008 had tremendous effects on financial markets across the globe. What started as a US crisis, spread rapidly across countries all over the world. The crisis was transmitted worldwide through financial markets, international banks and trade links, which affected many different industries (Ahn, Amiti, & Weinstein, 2011). Many businesses across the globe ended up with liquidity issues and turned insolvent. Campello et al. (2010) stated that during the financial crisis the growth opportunities for many firms were affected negatively since it became more difficult to obtain external funding. Consequently, managers paid increasingly more attention about relevant investment decisions which include the appropriate ratio of debt and equity since it is proven that the capital structure influences firm performance (Fosu, 2013; Fama & French, 1998). Moreover, the experience and possibility of unexpected financial crises like the global financial crisis in 2008 made managers more concerned about financial stability and more conservative in their financial policies. Consequently, the capital structure has become an important survival indicator (Bhamra, Kuehn, & Strebulaev, 2010).

The decision for the best mixture of capital sources in firms has been studied for a long time since the paper by Modigliani and Miller (1958). The irrelevance theory of Modigliani and Miller states that a firm's value is not influenced by its capital structure choices. The underlying reasoning of this theory is that capital markets are perfect which means that there are no taxes, no bankruptcy costs and no information asymmetry. This subsequently means that investors can get equal access to the financial markets and that debt and equity are perfect substitutes for each other. However, when the capital market is inefficient the capital structure becomes an important value determining factor (Deesomak et al., 2004). In those situations, firms must make choices in the quantity of debt and equity or a combination of both. Since the work of Modigliani and Miller (1958), several theories and extensions have emerged that could explain the capital structure decisions. The trade-off theory and the pecking order theory are considered to be the most important theories concerning the capital structure decision (Fama & French, 2002; Frank & Goyal, 2002). However, these theories have contrary thoughts about capital structure decisions. The trade-off theory states that a firm is gradually moving towards a target debt ratio. On the other side, the pecking order theory states that firms prefer internal to external financing, and debt to equity while issuing securities.

Both theories also expect a different effect of the financial crisis on capital structure. Firstly, the trade-off theory argues that the financial crisis should have a negative effect on leverage<sup>1</sup>. An important reason is that bankruptcy risk is higher during financial distress, which makes debt more expensive. This suggested relationship is supported by prior research (Graham, Leary, & Roberts, 2014; Kahle & Stulz, 2013). Secondly, according to the pecking order theory, financial crisis should have a positive effect on leverage. The underlying reason for this is that firms are less profitable which means that they have less internal funds. This suggested relationship is also supported by empirical research (Iqbal & Kume, 2014). Based on the theoretical framework and the literature review it can be concluded that it is still unclear how the financial crisis influences the capital structure. This makes it interesting to investigate this topic further.

The choice between debt and equity depends on firm-specific characteristics, however, the empirical evidence is mixed and often quite difficult to interpret (Deesomsak et al., 2004). Furthermore, there is still little understanding about the firm's financing mix of other developed markets outside the US (Rajan & Zingales, 1995). Especially when investigating the financial crisis of 2008, it is interesting to focus on countries outside the US, for example Europe. The crisis was transmitted to Europe through international financial markets, international banks and trade links (Shelburne, 2010) (Poole, 2010). European countries had been hit hard on one hand due to high debt levels of government and households and bailouts of financial institutions. Furthermore, Europe was vulnerable due to variations between the fiscal policies in different countries in the European Union and international trade imbalances. Eventually, these factors together have made the damage to the European economy even as harsh as the initial financial crisis in the US (Kenny, 2018). The focus of this study is on the last financial crisis period 2008-2012, firm-level determinants and industry fixed effect in Germany, France and UK.

This leads to the following Research Question:

**How does the last financial crisis influence firms' capital structure and its determinants within different industries in European countries?**

This paper has three main objectives. Firstly, this study investigates the firm-specific determinants of capital structure and determine whether the trade-off theory or the pecking order theory is the most influential. Secondly, it increases the understanding about how the last financial crisis affected the firms' capital structure in European developed countries. Furthermore, it investigates whether certain determinants become more important or less important during times of crisis. This can be considered as a contribution to the literature because empirical research often only investigates how

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<sup>1</sup> Leverage can be explained as the ratio of a company's long-term debt to the total value of their assets.

the capital structure ratio is affected by the crisis without looking at the firm-specific determinants. Finally, this study will investigate whether industry fixed effects have a significant effect on the capital structure decision.

A large sample of 1555 listed companies will be analysed from 3 European countries: Germany, France and UK for the period 2008-2016. The focus is on the last financial crisis period 2008-2012, firm-level determinants and industry fixed effects. To make sure the data set contains enough companies per industry, multiple countries are considered in this research. Country-specific differences are beyond the scope of this research and will not be discussed. The standard firm-specific characteristics of leverage like firm size, growth opportunity, liquidity, non-debt tax shield, profitability and tangibility will be analysed. Besides that, a crisis dummy is incorporated to investigate the role of the financial crisis on the firm-specific determinants. Thereafter, different industries are considered to investigate whether industry fixed effects are an important determinant.

Because the world has witnessed several global financial crises and will most likely face similar events in the future, this research increases the knowledge about how crises periods in the future would potentially affect firms' capital structure in different industries when the economy is disrupted. Therefore, this research should be of interest for stakeholders, not only from a managerial point of view but also for potential investors and creditors. The interest for the various groups lay in the importance of the capital structure decision. Managers could use this knowledge to make capital structure decisions while it could help investors to for example adjust their portfolio during periods of financial crisis.

The remainder of this paper is organized as follows. Section 2 will explain the phenomenon capital structure, discuss the most important theories considering capital structure, explain the causes and effects of the global financial crisis and develop the hypotheses. Section 3 describes the dataset, the variables, the empirical strategy and the descriptive statistics. Results from the regressions are evaluated in section 4, while the robustness checks are provided in section 5. Section 6 provides the conclusion, discussion points, limitations of this study and suggestions for future research. Finally, in the last parts of this paper the literature references and the appendices are included.

## 2. Theoretical Framework

The purpose of this theoretical framework is to explain what capital structure is and review the most influential capital structure theories that have been developed in the finance literature.

### 2.1 The Capital Structure of firms

Firms can acquire money for investments from different financial resources. Which form of resources a firm will choose depends on their preferences. Two sides of financial resources can be compared with both their own costs and benefits. At one side there is internal capital, which includes the retained earnings and the depreciation of a firm. This can be labelled as sources *within* a firm. Retained earnings are the earnings after dividend payments, which means that it is fully available for future investments. In this way firms use their profits as capital for investments. On the other hand, there's external financing which is based on acquiring new money from *outside* the firm. These resources could be generated by the sale of financial claims which could be either equity or debt (Hillier et al., 2014).

Internal financing is considered to be less expensive compared to external financing because it does not include transaction costs, nor does it include taxes associated with dividend payments. Furthermore, there are no control procedures needed regarding creditworthiness, it is considered to be more flexible and it gives more freedom to the owner because there's no influence of third parties. On the other hand, there are some disadvantages regarding volume limitations compared with external financing. Besides this, internal financing is not tax-deductible and there is no increase in capital (Hubbard, Kashap, & Whited, 1995). Overall, external financing is considered to be more costly. Firms can construct countless combinations of debt and equity. However, their attempt is to find the particular combination, the optimal capital structure, that maximizes its overall market value (Abor, 2005).

The theories that will be discussed, all tried to provide a clarification for the firms' capital structure decision. The introduction already mentioned that findings about this topic are dubious. This section will explain these theories and their differences regarding the capital structure decision. First the capital structure will be explained, thereafter the irrelevance theory of Modigliani and Miller (1958) will be reviewed, followed by two major theories that emerged as a reaction on Modigliani and Miller.

### 2.1.1 Modigliani and Miller theorem

The irrelevance theory of Modigliani and Miller states that a firm's value is not influenced by its capital structure choices. The underlying reasoning of this theory is that capital markets are perfect which means that there are no taxes, no bankruptcy costs and no information asymmetry. This means that investors are able to get equal access to the financial markets and thus to the same leverage in the market. Eventually, Modigliani and Miller had two findings: The value of the firm is independent of its capital structure and therefore, debt and equity are perfect substitutes for each other. And the cost of equity for a leveraged firm is equal to the cost of equity for an unleveraged firm plus an added premium for financial risk. In this case, with an increase in leverage the total firm risk is constant, and no extra value is created (Modigliani & Miller, 1958). However, later Modigliani and Miller (1963) introduced taxes into their model which showed that an increase in leverage is positively influencing firm performance due to the tax shield. But this model predicts 100% debt financing due to substantial corporate tax benefits which is not realistic.

Since the work of Modigliani and Miller (1958) several theories and extensions have emerged that could explain the capital structure decisions. These theories relax the unrealistic assumptions of the capital structure irrelevance principle. In section 2.1.2 and 2.1.3, two theories will be discussed which are considered to be the most influential: The Trade-off theory and The Pecking Order theory (Fama & French, 2002; Frank & Goyal, 2002). Furthermore, these theories have contrary thoughts about capital structure decisions. The trade-off theory states that a firm is gradually moving towards a target debt ratio. On the other side, the pecking order theory states that firms prefer internal to external financing, and debt to equity while issuing securities. In the pecking order theory, a firm has no well-defined target ratio (Myers, 1984). These different thoughts make it possible to test which theory is the best predictor of capital structure decisions.

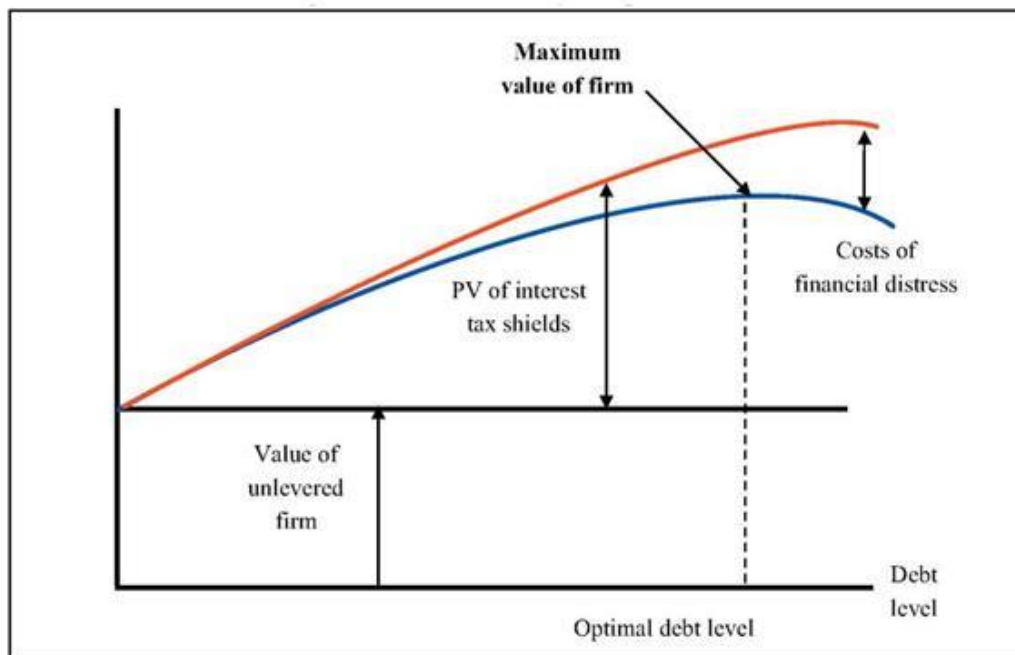
### 2.1.2 Trade-off theory

The market imperfections that are addressed in this theory are the taxation of firm's profits and the existence of bankruptcy penalties (Kraus & Litzenberger, 1973). According to the trade-off theory of capital structure there is an advantage to financing with debt, which is the benefit of using debt as tax shield. On the other hand, there is a commitment for upcoming cash outflow due to the required future interest payments on debt. Besides, there are some costs of financing with debt which are the bankruptcy costs or the financial distress costs.

As Modigliani and Miller (1963) recognize firms can benefit from leverage due to the interest deductibility of pre-tax income, which means that interest expenses reduce the taxable income which insists a positive impact on firm value. On the other hand, the trade-off theory recognizes the

negative effects of leverage on firm performance. Debt financing is namely associated with a commitment for upcoming cash outflow in the form of required future interest payments on debt. These payments negatively influence firm's liquidity and financial performance, which increases the financial risk in terms of bankruptcy and insolvency (Kraus & Litzenberger, 1973; Brealey, Myers, & Allen, 2008).

**Figure 1: The Trade-Off Theory**



Cornett and Travlos (1989) argue that every firm should move towards an optimal capital structure by increasing or decreasing their level of debt to create a balance between the debt benefits of tax savings and the debt costs of higher risk for financial distress. This can be summarized graphically with Figure 1 (Ebrary, 2015). The starting point is the value of a firm financed only by equity which is illustrated with the black horizontal line. The present value of tax shields is then added to form the red line. It initially increases as the firm borrows more, until additional borrowing increases the probability of financial distress rapidly. When the cost of financial distress increases, the marginal benefits of the debt shield will decrease because with lower income, lower amount of taxes have to be shielded. This is the reason why the red line is not a straight line. The cost of financial distress is assumed to increase with the debt level. The cost of financial distress is illustrated in the diagram as the difference between the red and blue curve. Thus, the blue curve shows firm value as a function of the debt level. Moreover, as the graph suggest an optimal debt policy exists which maximized firm value. As a conclusion, the trade-off theory shows that it is profitable to borrow until the moment the marginal costs of bankruptcy do offset the marginal benefits of the debt shield. (Modigliani & Miller, 1958).



### 2.1.3 Pecking order theory

Myers and Majluf (1984) developed a competitive theory to the trade-off theory, named the pecking order theory. This theory suggests that firms prefer internally generated funds rather than using external funds. It explains that firms utilize internal funds first, then issue non-risky debt, risky debt issuance and as the last resort issue equity capital.

There are several features that explain this order. In the most common way the pecking-order theory can be motivated by information asymmetry and adverse selection developed by Myers and Majluf (1984). Asymmetric information can affect capital structures of firms by limiting access to outside finance. When the problem arises of information asymmetry, it holds that the larger the information asymmetry between managers and investors, the higher the cost of capital. Adverse selection refers to the situation where investors could end up buying overvalued stocks and lose money due to the presence of information asymmetry. This information asymmetry usually occurs due to the fact that managers and owners have more information about the firm than outside investors (Akerlof, 1970). The insiders of a firm know for example the true value of a firm's assets and growth opportunities. For outside investors it is much harder to gain this information.

Because investors do not have all the information about a firm they can use signals to value a company: when a firm for example sells equity, potential investors interpret this as a signal that the equity is overvalued which makes it simultaneously riskier. Furthermore, when managers behave opportunistic and do not maximize firm value, investors face the risk of investing in overvalued stock. Due to this possibility of adverse selection, investors will ask for higher premia to protect themselves and cover the potential risk, which makes external financing more expensive. Therefore, firms prefer internal financing (Myers, 1984).

However, when firms do not have enough internal funds and are forced to finance their operations with external funds they prefer debt over equity according to the theory. One reason for this preference is that equity is considered riskier than debt for investors for several reasons. Firstly, because debt has a regular payment schedule which leads to more certainty for investors. Secondly, debtors get paid off earlier in the event of a bankruptcy and thirdly, debt often comes with more protection, such as collateral and guarantees which decreases the risk. The issuing of equity becomes more expensive for companies due to the higher risk for investors.

Another reason for the preference for debt over equity is the fact that debt is less sensitive to information asymmetry. The reason that debt is less information sensitive is due to the fixed payment of interest that is required for debt. Based on these payments and the duration, investors could indicate the price-sensitivity of their bonds and predict their value (Dang, Gorton, & Holmstrom, 2010). This eventually helps to mitigate adverse selection. According to the pecking

order theory firms choose to finance by means of equity at the time when the debt capacity is reached (Lemmer & Zender, 2010).

Other reasons that could explain why the pecking order theory recognizes equity financing as a last resort are that equity issuance signals to outsiders that the company has lack of capital, which could have a negative effect on its stock price. Another reason is that equity issuance could signal a lack of confidence in the board that may feel the share price is overvalued. An issue of equity would therefore lead to a drop-in share price (Adair & Adaskou, 2015). As a conclusion: according to the pecking order theory firms should prefer internal financing over external financing, and debt over equity until the debt capacity is reached.

## 2.2 The Global Financial Crisis

This section will explain in more detail what causes the financial crisis, how it spread all over the globe and how it affected firms in general and their capital structures.

### 2.2.1 Causes of the Global Financial Crisis

Events in the period of 2001-2005 are important to understand how the financial crisis in the US started. In 2001, when the tech bubble came to an end, there was a long period of low interest rates, low unemployment, low inflation and sustainable economic growth. The low interest rates in combination with reduced underwriting standards for mortgages led to the issuance of loans, also called subprime mortgages, to people and companies who had a higher default probability and therefore a higher risk. Due to the competitive environment banks did not want to calculate the extra risk. US banks even started to create an own market to earn premiums by trading mortgage backed securities to other banks and investors all over the world. And because of the historically low default rate of mortgages, the demand for these new financial products was very high among investors. When the maximum capacity of prime mortgage takers was reached banks were not able anymore to stimulate the demand of prime mortgages. Simultaneously, banks started to issue more and more subprime mortgages to risky borrowers with for example no proof of income or employment. Americans started to borrow more and more money for housing which they eventually could not afford. The housing bubble was created, which was especially very dangerous in combination with the deregulated housing market. The US government believed that the housing market had to be completely deregulated and because it would manage itself. This simultaneously cut down their power and possibility to intervene in case of need for action. Because of the steady housing market developments till then, the US government failed to identify the risk of mortgage backed securities (Thakor, 2015).

This especially became a problem when the Federal Reserve increased the interest rates in August 2007 to stabilize inflation. Many borrowers experienced problems regarding the payments of their loans and because their houses were used as collateral the prices of houses declined. Therefore, banks suffered with a liquidity lack because it became uncertain whether they received their issued loans. Eventually, banks became entirely dependent on support of central banks and third parties (Fosberg, 2012).

Rating agencies, the lack of transparency and the relative new financial products were other important factors that causes the crisis. Because the subprime mortgages and mortgage backed securities were relatively new to the financial market it was hard for buyers to determine their risks. Besides these MBS, financial institutions created Collateralized debt obligations (CDO's). These CDO's were structured financial products that pools together cash flow-generating assets like mortgages,

bonds and loans that serve as collateral. These were resold to investors. Because of the difficulty to determine the risk of these products, banks were depending on rating agencies. However, when these rating agencies were too careful to give favourable ratings to the CDO, financial institutions are triggered to choose for other rating agencies. Therefore, these agencies were tended to give too high ratings even when the products actually were very risky. Managers were aware of the information asymmetry and banks incorporated increasing amount of sub-prime mortgages in the financial products. Furthermore, financial institutions used accounting methods to hide their true investments in mortgage-backed securities (MBS) from investors and clients (Fosberg, 2012).

Due to information asymmetry and a decline in trust, the willingness of parties to lend money to each other became less which ultimately lead to a decline in liquidity. At the end of 2007 the main rating agency downgraded the credit ratings and CDO's suddenly had no value anymore. After the devaluations of MBS and CDOs, financial institutions could no longer hide their investments from the public. This led to an extreme decline in the US stock market because these losses were not anticipated and the demand for MBS dropped further which created a downward spiral for the US financial sector. This led to the bankruptcy of the largest investment banks in US. The bankruptcy of Lehman Brothers in September 2008 could be considered as the start of the global financial crisis. Because this research is focussed on European countries it is important to know how the financial crisis spread from the US to Europe. Section 2.2.2 will explain and describe this process.

### **2.2.2 How the Financial Crisis spread from the US to Europe**

There are different reasons that explain how the financial crisis spread from the US to Europe. One of the main reason was the fact that many banks in Europe bought collateralised US debt. The global MBS market was huge and unregulated. Many of the subprime mortgages were bundled into CDO's and sold onto financial institutions in Europe. When the defaults of these CDO's rose, European banks lost a lot of money. Another reason was the international banking system which is linked to each other. During the recession, banks started to lose money and simultaneously became reluctant to lend to each other due to uncertainty and a lack of trust. Information asymmetry caused the inter-bank credit market to dry up. It even affected countries in Europe which didn't have any exposure to subprime lending (Poole, 2010). Furthermore, global trade played a role in the contagion process: due to the recession in the US, their amount of imports decreased which led to a decline in exports for many European countries. The trade of European emerging economies was impacted more severely by the crisis than the trade for other regions in the world. For over one half of these economies, the exports and their GDP declined by more than 50% (Shelburne, 2010).

During 2008 and 2009, Europe tried to stabilize their banking system. At this point the sovereign debt markets were not in turmoil yet. However, in late 2009 numerous European countries reported large

budget deficits. Due to the fear for more losses, the banking sector started to devalue sovereign bonds. When more and more countries reported losses and Greece eventually violated the EU fiscal rules a fund for bailing out countries was created by the EU and IMF. First, Greece and Ireland and later Portugal were put out of the bond market in respectively 2010 and 2011 and bailed out by mostly EU funding. The EU was forced to direct stricter budget deficit guidelines for other member states. This led to insufficient margin for many countries to invest and smooth out the effects of the recession (Lane, 2012).

The euro zone was in crisis, with bailouts of debt-laden members and the euro that tended to collapse. But in July 2012, the ECB president Draghi came with the following announcement: 'Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough'. Traders reacted immediately, and the euro strengthened against the dollar and leading European stocks jumped over 2%. After the announcement, the ECB prevailed its Outright Monetary Transactions (OMT) programme and later the Quantitative Easing (QE) programme. The OMT is a plan for unlimited purchases, under certain conditions, of bonds issued by struggling euro nations. The QE is an expansionary monetary policy whereby the central banks buys predetermined amounts of government bonds or other financial assets in order to stimulate the economy and increase liquidity (Bernanke, 2015). Considering slow political progress on solving the eurozone crisis, Draghi's statement has been considered as a key turning point in the fortunes of the eurozone (Baldwin & Giavazzi, 2015).

### **2.2.3 The effect of Financial Crisis on Capital Structure.**

From existing theory and empirical studies, it is clear that a financial crisis may impact the capital structure through different channels and in different ways (Demirguc-Kunt et al., 2015). Campello et al., (2010) state that during financial crisis the growth opportunities for many firms were affected negatively since it became more difficult to obtain external funding. Consequently, managers paid increasingly more attention about relevant investment decisions which include the appropriate ratio of debt and equity since it is proven that the capital structure influences firm performance (Fosu, 2013; Fama & French, 1998). Kahle and Stulz (2013) argue that the global financial crisis of 2008 caused a supply shock in the equity markets which made it costly for firms to raise additional equity. Furthermore, a lower demand for consumption and a higher uncertainty about economic recovery led to a decline in demand for products and services. This results in a decrease in debt and an increase in cash holdings due to postponement of investments. Also, Graham et al., (2014) argue that during crisis investment opportunities are rare which simultaneously lead to less need for external capital.

During crisis, when there is more uncertainty and more risk, especially long-term debt became less attractive because the premiums that lenders are asking for increase strongly. Uncertainty causes business prospects to become less clear and therefore incentives to shorten the maturity of debt increases despite of the high roll-over costs associated with short-term debt. Demirguc-Kunt et al., (2015) found evidence that new issuance of long-term debt declines, and any new debt issues would have shorter maturities.

Demirguc-Kunt et al., (2015) conducted a panel data research, covering 77,000 firms across 79 countries, and found that during financial crisis firm leverage and debt maturity declined in both advanced and developing countries. Truong & Nguyen (2016) investigated the effects of financial crisis on capital structure of listed firms in Vietnam. They used a panel of 265 firms listed on HNX and HOSE for the period of 2006-2013. They found no evidence that the leverage of Vietnamese listed firms significantly change during the crisis periods. Furthermore, Balsari and Krikulak (2008) found that the 1994 financial crisis in the Turkish economy had a negative impact on the leverage ratio in Turkish countries. Finally, Pattani and Vera (2011) and Akbar et al., (2013) both found a negative relationship during the financial crisis (2007-2009) because UK firms held more cash and issued more equity.

## 2.3 Development of Hypotheses

In this section the hypotheses will be discussed that contribute to the reciprocation of the main question of this study. Part 2.3.1 will discuss the hypotheses regarding the determinants of capital structure, part 2.3.2 will include the hypotheses about the effect of the financial crisis on capital structure. Finally, part 2.3.3 contains hypotheses about the effect of industry fixed effects. An overview of the hypothesis is given in table A1<sup>2</sup>.

### 2.3.1 Determinants of Capital Structure

The theoretical framework and prior research finds inconsistent evidence on the effect of specific determinants on firms' capital structure. Based on the literature review the following determinants are chosen: profitability, firm size, tangibility, growth opportunities, liquidity and non-debt tax shield (Akdal et al., 2011; Deesomak et al., 2004; Harrison et al., 2014; Iqbal et al., 2014; Truong et al., 2016). These determinants show in most empirical studies a significant relationship. Empirical research often used the industry leverage median as an independent variable. However, this research investigates industry differences by including industry fixed effects. Furthermore, separate regressions per industry will be performed. Therefore, the industry leverage median is excluded in

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<sup>2</sup> The 'A' in table A1 means that this table can be found in the appendix.

this research. Other determinants like inflation and tax are also excluded because these show in most cases a non-significant relationship.

### **Profitability**

According to the theories discussed earlier the determinant profitability is subject to contradicting predictions. The trade-off theory stated that firms should use debt until the bankruptcy costs become too high. In profitable firms the costs of debt will be lower because of a lower bankruptcy risk. Furthermore, profitable firms have higher needs to shield their income for corporate tax benefits. This indicates that profitability has a positive impact on leverage. Also, Williamson (1988) expected a positive relationship because debt is used as a discipline tool to prevent managers from building empires and instead pay out profits.

On the other hand, the pecking order theory argues that profitable firms rather use retained earnings as investment funds and only use external funds if it is necessary due to information asymmetry and signalling effects. Because profitable firms are likely to have more internal funds, profitability is expected to have a negative effect on leverage (Myers & Majluf, 1984). Because of these contradicting predictions, the hypothesis for the determinant profitability will be based on prior research. Most empirical research found a negative relationship between profitability and leverage which supports the pecking order theory (Harrison & Widjaja, 2014; Rajan & Zingales, 1995; Akdal & Sinan, 2011).

*H1: Profitability is negatively related to leverage*

### **Firm Size**

Degryse et al., (2012) argue that firm size could act as an inverse proxy of bankruptcy costs. This is the case because larger firms are often more diversified and therefore have a more stable cash flow. Less earnings volatility leads to a reduction in the indirect bankruptcy costs. According to the trade-off theory more debt can be issued when the bankruptcy costs are low. Therefore, firms size should be positively correlated with leverage. According to the pecking order theory, Fama and Jensen (1983) argue that larger firms tend to provide more information to lenders than smaller firms. Due to this fact, information asymmetries are less harsh for larger firms. The need for higher returns by lenders will be reduced which leads to lower cost of debt. Furthermore, Deesomak et al., (2004) argue that larger firms have besides lower agency costs and less volatile cashflows also easier access to the credit market and require more debt to fully benefit from the tax shield. Therefore, firm size is expected to have a positive relationship with leverage.

*H2: Firm Size is positively related to leverage*

**Tangibility**

Tangibility is defined as the ratio of fixed assets to total assets. Fixed assets are long-term tangible assets that a firm owns and uses in its operations to generate income. Furthermore, tangible assets are not expected to be consumed or converted into cash within a year (Hillier et al., 2014). Multiple theories of capital structure have suggested the relationship between tangibility and leverage in a company. Rajan & Zingales (1995) argue that tangible assets could serve as collateral, which reduces adverse selection problems. This has a diminishing effect on the risk of the lender suffering the agency costs of debt. In other words, the risk of the lender is shifted to the borrower. Subsequently, lenders are more willing to supply loans when the tangibility ratio is higher. This leads, in accordance with the pecking order theory, to a lower cost of debt and higher leverage.

Furthermore, Rajan & Zingales (1995) argue that tangibility also influences the costs of financial distress. In periods of economic downturn, when firms are more likely to face financial distress, firms can sell their tangible assets to pay their short-term commitments and prevent bankruptcy. Therefore, a higher portion of fixed assets on the balance sheet will lead to lower bankruptcy risk and following the trade-off theory to a lower cost of debt. Both arguments indicate a positive relationship between tangibility and leverage.

*H3: Tangibility is positively related to leverage*

**Growth Opportunity**

There are several arguments to give about the relationship between growth opportunities and leverage. Firstly, some arguments will be discussed that indicate a negative relationship between growth opportunities and leverage and thereafter some arguments will be given that support a positive relationship.

According to Deesomak et al., (2004) higher growth opportunities provide incentives to take more risk by accepting more risky projects which could lead to suboptimal investments. If firms behave riskier, agency conflicts arise, and debt holders will ask for higher returns which increases the cost of debt. Following the trade-off theory higher cost of debt will lead to less leverage and more equity or internal financing. Furthermore, they argue that high growth firms do not want to be committed to debt servicing because this could lead to unavailability of internal recourses when appealing investment opportunities appear. According to this argument leverage would be negatively correlated with growth opportunities. De Jong et al., (2008) agrees regarding this relationship, but with another argument. He argues that firms with high growth opportunities prefer to finance their investments with equity instead of debt. This is because firms with high growth opportunities often are overvalued and have a market-to-book value above 1. Overvalued firms prefer to issue new



shares since the firm would gain a higher price for a new issue of share relative to the book value (Harrison & Widjaja, 2014).

On the other hand, there are some arguments that indicate a positive relationship between growth opportunities and leverage. (Awan, Ishaq Bhatti, Raza Ali, & Azeem Qureshi, 2010) argue that owners of firms may view available growth opportunities as unsustainable and risky and therefore intend to pass on that higher risk to the creditors. This is also called risk shifting which could occur when information asymmetry is present. The argument for risk shifting relates to the argument of Deesomak et al., (2004) discussed above and assumes that firms prefer to issue debt despite of the fact that creditors will ask for higher returns because of the risky project. Furthermore, the existing of growth opportunities could lead to higher leverage because firms need the extra funds to finance the growth opportunities. According to the pecking order theory, as mentioned before, firms prefer in this situation debt before equity which causes a positive relationship between growth opportunity and leverage. Because both a positive as a negative relationship is possible, the hypothesis is based on empirical research which gives more support for the trade-off theory.

*H4: Growth opportunity is negatively related to leverage*

#### **Liquidity**

Also, for the relation between liquidity and leverage are several opposite arguments given by theories and empirical research. The relationship between liquidity and firm's leverage can be predicted using the pecking order theory. Accumulated cash and other liquid assets serve as internal sources of funds and will be preferred in comparison with external funds as debt and equity (De Jong, Kabir, & Nguyen, 2008). This argument indicates a negative relationship between liquidity and leverage.

On the other hand, a positive relationship can be expected. Williamson (1988) argued that high liquid firms should finance its operations with debt. The reason behind this is that such firms are easier to liquidate in case of bankruptcy which protects bondholders since they get paid off earlier in case of bankruptcy. This relates to the precautionary motive of liquidity. Anderson (2002) found that firms with high liquidity levels issued more debt. If such firms are not able to repay its current liabilities, they have enough liquid assets that can cover the arrears.

*H5: Liquidity is negatively related to leverage*

#### **Non-Debt Tax Shields**

Non-Debt tax shields are items, apart from interest expenses, that contribute to a decrease in tax payments. An important item of non-debt tax shields is the tax deduction for depreciation (Bauer, 2004). In this case non-debt tax shield will be defined as the ratio of depreciation to total assets.

According to the trade-off theory the most important reason to issue debt instead of equity are the corporate tax savings that come along with using debt. However, firms could use non-debt tax shields such as depreciation to reduce corporate tax. In this way, non-debt tax shields act as a substitution for the use of debt to save taxes (Deesomak et al., 2004). Therefore, non-debt tax shields are expected to have an inverse relationship with leverage.

*H6: non-debt tax shield is negatively related to leverage*

The table below shows the expected relationship between every determinant on capital structure and which theory supports the expected relationship. In some cases where the empirical findings differ from the expectations from the Trade-off and Pecking Order Theory, the \* & \*\* give explanations for the deviating findings.

**Table 1 – Relationship between firm specific determinants and capital structure**

Determinant	Trade-Off	Pecking Order	Empirical Findings	Expectation
Profitability	+	-	+/-	-
Firm Size	+	+	+	+
Tangibility	+	+	+	+
Growth Opportunity	-	+	+*/-	-
Liquidity		-	+**/-	-
Non-Debt Tax Shields	-		-	-

\* Empirical research found a positive relationship due to the risk shifting principle

\*\* Empirical research found a positive relationship due to the precautionary motive

### 2.3.2 Effect of the Financial Crisis on firms Capital Structure

Based on the theoretical framework, it can be concluded that the effect of financial crisis on capital structure is ambiguous. Based on the theories two opposite expectations will be discussed: the trade-off theory argues that the financial crisis should have a negative effect on leverage because the bankruptcy risk is higher during financial distress, which makes debt more expensive. On the other hand, according to the pecking order theory, financial crisis should have a positive on leverage. According to this theory profitable firms use less debt because they have greater internal cash flow, which means they need less debt (Hillier et al., 2014). However, during financial crisis, firms are in general less profitable which lead to less internal cashflows and therefore an increase in the use of external capital. Finally, because debt is preferred over equity according to this theory, the financial crisis should have a positive effect on leverage. However, it can also be argued that during recession, less investment opportunities are present which leads to less need for money.

Because the discussed theories have ambiguous expectations about the relationship between financial crisis and leverage it is hard to formulate a hypothesis. However, based on empirical research, related to the financial crisis, there is more evidence for the trade-off theory. Especially regarding to long-term debt because it became less attractive due to the increased premiums and the uncertainty that causes incentives to decrease leverage levels and shorten the maturity of debt. More evidence for the trade-off theory means that every firm should have an own optimal capital structure which means that the capital structure is likely to be different between industries. Besides differences between capital structure also the effect of the financial crisis is, due to differences in external financial dependence between firms, likely to be different for different industries. Section 2.3.3 will give some more insight in industry differences between capital structure.

This leads to the following hypotheses:

*H7: The Financial crisis is negatively related to Leverage.*

*H8: The relationship between determinants variables and leverage change in crisis periods*

### 2.3.3 Industry Differences in Capital Structure

This section will discuss if specific industry characteristics could influence the leverage ratio of firms. Degryse et al., (2012) stated that the trade-off theory argues that firms tend towards an optimal leverage ratio, which could differ across industries. On the other hand, the pecking order theory does not give a clear prediction about industry fixed effects. Bowen et al., (1982) found empirical evidence for cross-industry differences in financial leverage. Their study indicates consistent significant differences in the level of financial leverage among industries. They also found that firms within industries tend to move towards the industry mean and therefore have more similar leverage ratios. Jong et al., (2006) explained that a firm's industry might serve as a reference point regarding capital structure decisions. Firstly, this research tests if the capital structure indeed differs between the particular industries:

*H9: The capital structure of firms differs significantly between industries*

The significant differences could be explained by unobservable factors that are correlated within an industry. Guney et al., (2011) showed that companies operating in the same industry have many similarities and operate in the same environment. Because of this fact, they face similar challenges, competition, risks, technology, profitability and regulations. Frank and Goyal (2009) provide for example significant differences in capital structure based on investments in fixed assets. They argue that industries that need to make huge investments in fixed assets also face high fixed costs which often lead to a higher level of leverage. Furthermore, Titman and Wessels suggested that firms manufacturing machines and equipment are more likely to be the ones that specialize in specific products and services. These firms will find liquidation costly and therefore use fewer debts Yang et al., (2010). Furthermore, Bello et al., (2009) argued that market characteristics such as the level of competition, extent of product differentiation, strength and number of buyers and sellers and ease of entry to the market is different in any industry and could also influence capital structure decisions. Balakrishnan and Fox (1993) investigated the importance of unique characteristics of firms in explain the variance in capital structure. They find that 11% of the capital structure is explained by inter-industry effects. The analysis above, based on empirical research, led to the following hypothesis:

*H10: The firm specific coefficients are not equal across all industries*

Besides the fact that industry fixed effects cause different capital structures, researchers also argued that industries are suffered differently by financial crises. Moore and Mirzaei (2016) found that externally financially dependent industries have suffered significantly from a decrease in growth during the crisis. Industries that are less dependent on external funds maintained more often their growth. Frank and Goyal (2009) show that industries that need make huge investments in fixed

assets also face high fixed costs and are therefore more dependent on external financing. Table A8 shows descriptive statistics per industry. According to that table, the industry mining has the highest ratio of tangibility (0.66). This could indicate that mining suffers the most from a financial crisis where external funds are scarce and expensive. However, the table also shows that mining has the lowest leverage ratio. This is remarkable and indicates that tangibility is not the only factor that influences the amount of leverage. On the other hand, manufacturing has from, the industries with more than 100 companies, the lowest ratio of tangibility which could indicate that it suffers the least during a financial crisis. However, this is also quite remarkable because manufacturing is considered to be capital intensive, while mining is considered to be labour intensive (Bratveit, Moen, & Mashalla, 2003). Capital intensive industries are considered to be more dependent on large investments with external finance. This leads to contrary expectations regarding the effect of the financial crisis on different industries based on table A8.

However, especially small-scale coal mining is generally labour-intensive and due to developments in machinery and technology the industry Mining is more capital intensive nowadays. Furthermore, our industry classification quite broad, the sector mining includes many different mining related industries which could cause the remarkable statistics. However, because of the analysis above, differences between industries regarding the effect of financial crisis can be expected. Therefore, the following hypothesis is formulated.

*H11: The effect of crisis on leverage differs significantly between industries*

### 3. Data

This section will discuss the dataset and the time-period that will be used in this research. Furthermore, it will elaborate the proxies for the variables and their operationalizations and the descriptive statistics. Finally, it will explain the empirical strategy of this research.

#### 3.1 Dataset

The data consists of yearly observations of variables on nonfinancial listed firms in the most important and most developed countries from Europe: Germany, France and United Kingdom. The countries are selected based on the Global 500 annual ranking of world's largest corporations (CNN Money, 2012). Based on the list of the largest European companies these countries are most common. To make sure the data set contains enough companies per industry multiple countries are considered in this research. However, country-specific differences are beyond the scope of this research and will not be discussed. All the data will be retrieved from Bureau van Dijk Orbis Database. This database contains financial and business information on about 200 million companies worldwide, based on annual reports. The data coverage contains the last 10 years. However, unfortunately the data of 2017 is not fully up-to-date which makes it not possible to include it in the research. Therefore, this study contains the time-period 2008-2016.

The distribution of industries is based on the US Standard Industrial Classification (SIC). Orbis provides US SIC codes for each firm in the sample. In this study the focus is on the 2-digit level. This hierarchy provides 10 industries to help investors monitor broad industry trends. However, financial firms are excluded due to regulations like the banks' minimum capital requirements and the fact that they have different financial statements, which could affect the research. It would make it difficult to compare it with other industries and draw general conclusions (Frank & Goyal, 2009). An overview of the remaining 9 industries with their corresponding SIC codes is listed in Table A2.

In order to capture the effects of the financial crisis the research period will include a crisis period (2008-2012) which is in line with previous research (Harrison & Widjaja, 2014) and a non-crisis period which will include most recent data (2013 – 2016). The period 2008-2012 is chosen as crisis period because this period is likely to be affected by the global financial crisis and the European debt crisis. As discussed before in this study, Draghi's statement in 2012 has been considered as a key turning point in the eurozone crisis. However, empirical studies also used other periods to capture the financial crisis period. To test whether the chosen period is indeed the crisis period with the most influence on capital structure a comparison is made with other possible crisis periods: 2008-2013 and 2008-2014. The test agrees that the period 2008-2012 indicates to highest correlation with leverage. This test is listed in Table A3.

## 3.2 Variables

### 3.2.1 Dependent Variable

The dependent variable in this study is capital structure, which is also called leverage in empirical studies. There are several ways to define and measure leverage. In this study the following operationalization for the proxy leverage will be used: long term debt divided by the book value of total assets. This is consistent with empirical studies. (De Jong et al., 2008; Iqbal & Kume, 2014; Harrison & Widjaja, 2014). An important reason to choose for long term debt in stead of total debt is the fact that the latter includes both long term and short term debt. Short-term debt consists largely of trade credit and De Jong et al., (2008) stated that trade credit is influenced by completely different determinants. Besides this, empirical research found that determinants of leverage have an opposite relationship considering long term debt and short term debt. An example to explain the difference is the matching principle. This theory states that firms should finance their short term assets with short term liabilities and their long term assets with long term liabilities (Fosberg, 2017). According to this theory, the determinant tangibility should have a positive effect on long term debt and a negative effect on short term debt. Also during crisis, which is already discussed, the maturity rate of leverage is tend to decrease which could cause opposite effects cause by financial crisis regarding long term- and short term debt. Therefore, the examination of total debt ratio is likely to generate results which are difficult to interpret. Based on this analysis, long term debt is chosen as the dependent variable.

### 3.2.2 Firm Specific Determinants and Crisis

The choice for the firm-specific determinants of leverage that will be used in this study is already discussed and based on prior research. This section will explain the operationalizations of the proxies. PROFITABILITY is defined as the earnings before interest and taxes (EBIT) over the book value of total assets. EBIT is also known as the operating income which is the revenue minus the costs of goods sold, labour costs and other day-to-day expenses. FIRM SIZE is defined as the natural logarithm of the book value of total assets. TANGIBILITY is defined as the fixed assets over the book value of total assets. Fixed assets are long-term tangible assets that a firm owns and uses in its operations to generate income. Furthermore, tangible assets are not expected to be consumed or converted into cash within a year (Hillier et al., 2014). GROWTH OPPORTUNITY is defined as the change in total assets, which is calculated as the total assets in t-1 minus total assets of the current year divide by the total assets in t-1. LIQUIDITY is defined as the ratio of current assets divided by current liabilities. Current assets and current liabilities are expected to be consumed and repaid within a year. NON-DEBT TAX SHIELD<sup>3</sup> is defined as the depreciation divided by the book value of total assets. Finally, the CRISIS variable is included as a dummy variable in which the dummy equal 1 for the crisis period (2008-2012) and 0 for the non-crisis period (2013-2016). In Table 2 an overview

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<sup>3</sup> NDTS instead of non-debt tax shield will be used in the remaining parts.

is given about the proxies, their operationalizations and the empirical research the operationalizations are based on.

**Table 2 – Proxies and their operationalizations**

<b>Variable</b>	<b>Measurement</b>	<b>Reference</b>
Profitability	EBIT to book value of total assets	(Deesomak, Paudyal, & Pescetto, 2004)
Firm Size	Log of total assets	(Truong & Nguyen, 2016)
Tangibility	Fixed assets to book value of total assets	(Akdal & Sinan, 2011); (Harrison & Widjaja, 2014); (Rajan & Zingales, 1995)
Growth Opportunity	Change in total assets	(Truong & Nguyen, 2016); (Harrison & Widjaja, 2014)
Liquidity	Ratio of total current assets to total current liabilities	(Akdal & Sinan, 2011) (Harrison & Widjaja, 2014) (Harrison & Widjaja, 2014)
NDTS	Depreciation to book value of total assets	(Deesomak, Paudyal, & Pescetto, 2004)
Crisis Dummy	1 = crisis period (2008-2012); 0 = post-crisis period (2013-2016).	



### 3.3 Descriptive statistics

Table A4 shows the descriptive statistics for all variables that are used to run the regressions for the firm level determinants. Remarkable are the differences between the minimum and maximum values and the standard deviations for all the variables apart from firm size and tangibility. The standard deviation quantifies the amount of variation of a set of data. These high values indicate that the data points are spread out over a wide range of values which is possibly caused by outliers. For example, the maximum liquidity ratio of 305.4286, the maximum value of NDTs of 52.55319 and the maximum leverage ratio of 3129 are very unlikely and could therefore be considered as spurious outliers. Because the dataset contains many outliers it is likely that the results from the regressions are unreliable. To deal with this problem the winsorization approach is used in this study. This approach is a widely used approach to deal with outliers (Hall, 2012). This approach winsorizes the minimum and maximum tail at the 1% level. This means that the values above the 99<sup>th</sup> percentile and below the 1<sup>st</sup> percentile are replaced with the values of the concerned percentiles. The descriptive statistics for all variables after the winsorization approach are shown in table 3.

**Table 3 – Summary statistics after winsorize approach (1% at each tail)**

	count	mean	sd	min	max
e_id	13995	778	448.9058	1	1555
i_id	13995	4.587138	2.193747	1	9
year	13995	2012	2.582081	2008	2016
firmsize	13977	18.71124	2.660823	6.907755	26.73877
growth	12400	.0887912	.3088654	-.4606575	1.448749
liquidity	13626	2.389493	2.847021	.2602926	16.26282
LTD	13977	.1995123	.181739	0	.7226172
NDTS	13635	.0469686	.0492982	0	.262963
profitabil-y	13968	-.0152932	.2338013	-1.074246	.277372
tangibility	13977	.5011958	.2480763	0	1
crisis	13995	.5555556	.4969217	0	1

As the table above indicates, the difference between the minimum and maximum values and the standard deviations decreased significantly. This indicates that the winsorization dealt with the problematic outliers. The 'count-column' shows the amount of observations per variable. The differences in observations between the variables is caused by missing values. However, the dataset is still considered as strongly balanced because of the low amount of missing values. Because of this, it can be concluded that the missing values would not cause unreliable results. The determinant 'growth' has less observations because it is calculated with the following formula:  $((\text{Total assets } t - \text{Total assets } t-1) / \text{Total assets } t-1)$ . Because the used database goes back till 2008 there are no values for asset growth in 2008.

Because this research contains multiple independent variables there could be a problem of multicollinearity. Multicollinearity refers to a situation where a number of independent variables in a multiple regression model are closely correlated to one another. This could lead to misleading results when attempting to predict how well an individual independent variable influences the dependent variable. To test whether multicollinearity is a problem in this research, a correlation matrix and a formal VIF- test is used. The correlation among all variables are gathered in table A5. According to the theory, a correlation above 80% is considered as problematic. The correlation matrix in table A5 indicates that our data does not contain a multicollinearity problem. The highest correlation between independent variables, which is between firm size and long-term debt, has a value of 0.3635 which is not a problem. Furthermore, the formal VIF-test which is displayed in table 4. The mean VIF-value is 1.15 and all the individual VIF-values are below 4, therefore, there can be concluded that multicollinearity will not affect the results in this research (O'Brien, 2007).

**Table 4 – VIF-test for multicollinearity**

Variable	VIF	1/VIF
firmsize	1.28	0.779630
profitability	1.27	0.786438
NDTS	1.18	0.849503
tangibility	1.18	0.850590
liquidity	1.11	0.900956
growth	1.06	0.940063
crisis	1.00	0.995831
Mean VIF	1.15	

Heteroskedasticity is a common problem in studies that use a dataset with a wide scale of different companies for example from different countries and industries. Heteroskedasticity occurs when the variance of error terms differs across observations. In our case this problem could be caused since some industries or firms are less effected by the financial crisis in comparison with others. Therefore, the effect of some determinants on leverage differ which causes non-constant variance. The Breusch-Pagan test is used to conclude whether heteroskedastic is present in our data. The results of the test are presented in table A5.

**Table 5 – Breusch-Pagan test for heteroskedasticity.**

```

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: firmsize growth liquidity NDTS profitability tangibility crisis

chi2(7)      = 2810.92
Prob > chi2  = 0.0000

```

The table shows that the Prob > chi2 value is 0.000, this indicates that the 'H0-Hypothesis' can be rejected and this concludes that there is some evidence of heteroskedasticity in the dataset. Robust standard errors are used to correct for heteroskedasticity.

### 3.4 Empirical Strategy

To investigate the research question and test the hypotheses an empirical regression analysis will be conducted. With this quantitative research method it is possible to determine how much of the dependent variable is explained by the independent variables. Because this study contains different entities over multiple years, a panel data research will be conducted. Because this research contains more entities than time-periods and the time-periods do not exceed 20 years, this dataset is characterized as a short and wide panel type. With panel data there are three main models that can be used: Pooled model, Fixed Effect model and Random Effects model.

This section will explain the differences between the models, which model will be used and the reasoning behind the choice. The first model is the pooled model, this model puts all observations together without making a distinction between firms, time or for example industries. However, this model only acts as a good predictor when the data is in accordance with many assumptions, which are often unrealistic. Firstly, to be able to use the pooled model, all coefficients that indicate the relationship between the dependent and independent variables should be the same. Secondly, the intercept, which indicates the starting level of their leverage ratio should be identical and thirdly, all firms should have equal variance (Baltagi, 2014). It is obvious that the data used in this research does not fulfil all these assumptions.

The second model is the fixed effects model, this model deals with individual differences over time. It captures the unique individual differences over time by adding dummies for all firms. However, the Fixed Effects model has one downside: variables that are stable over time cannot be measured. The Random Effects model allows variables in the model that are constant over time. However, the Random Effects model has also a downside: correlation between explanatory variables and the error term, renders parameter estimates of the RE model to be biased (Baltagi, 2014).

To test whether this is the case in this study a Hausman test is conducted. The results of the test can be found in table A6. The results of the Hausman test concludes that the difference in coefficients indicate a covariance between the explanatory variables and the error term. Therefore, a fixed effects model is used in this study which is often used in comparable studies (Iqbal & Kume, 2014; Frank & Goyal, 2009). However, because this study also wishes to investigate differences between industries in the effect of firm specific determinants on capital structure, it will be necessary to specify also random effects of the variables. This is because it is assumed that the effect of the firm-specific determinants varies randomly within the industries (Snijders, 2005). Furthermore, when using the fixed effects model, it becomes impossible to include the industry fixed effects per industry

as independent variables. The industry variable is stable over time and will be omitted by the fixed effects model. Therefore, for testing hypotheses 9 and 10 a random effects model is used.

The following model will be used:

$$LEVERAGE_{it} = \beta_0 + \delta CRISIS + \beta_1 PROFITABILITY_{it} + \beta_2 FIRMSIZE_{it} + \beta_3 TANGIBILITY_{it} + \beta_4 GROWTH_{it} + \beta_5 LIQUIDITY_{it} + \beta_6 NDTS_{it} + u_{it} + a_i \quad (1)$$

In this model  $i$  denotes an individual firm,  $t$  denotes the specific year and  $u_{it}$  and  $a_i$  respectively denote the time-variant and time-invariant error terms. Besides the fixed effects regression, a sample T-test will be performed to see if the crisis coefficient is statistically different from zero.

Furthermore, interaction terms will be created between the firm-specific determinants and the crisis dummy will be created to investigate if some determinants will become more important during crisis periods. This leads to the following model:

$$\begin{aligned} LEVERAGE_{it} = & \beta_0 + \delta_0 CRISIS + \beta_1 PROFITABILITY_{it} + \delta_1 (PROFITABILITY_{it} * CRISIS) \\ & + \beta_2 FIRMSIZE_{it} + \delta_2 (FIRMSIZE_{it} * CRISIS) + \beta_3 TANGIBILITY_{it} \\ & + \delta_3 (TANGIBILITY_{it} * CRISIS) + \beta_4 GROWTH_{it} + \delta_4 (GROWTH_{it} * CRISIS) \\ & + \beta_5 LIQUIDITY_{it} + \delta_5 (LIQUIDITY_{it} * CRISIS) + \beta_6 NDTS_{it} + \delta_6 (NDTS_{it} \\ & * CRISIS) + u_{it} + a_i \end{aligned} \quad (2)$$

To test the industry effects of capital structure of firms in the sample 5 dummy variables will be created that represent the 5 industries with the most firms. These 5 dummy variables will be included in the multilevel analysis with random effects. The industries that will be investigated are: business services, manufacturing, mining, transportation & public utilities and wholesale & resale trade. This study will only include industries with more than 100 firms to be sure the results are reliable and consistent. According to VanVoorhis and Morgan (2007) there is a risk that the findings are not representative for a whole industry if it includes less than 100 firms. Table A7 displays an overview of the number of firms per industry.

## 4. Results

### 4.1 The Determinants of Capital Structure

This section starts with the results from the fixed effects regression regarding the whole sample. A regression is conducted to explain how leverage is affected by the firm-specific factors that are discussed in section 3.2.2. The results are reported in Table 6. This model controls for unobservable or unknown variables which makes it possible to assess the net effect of the independent variables on the dependent variable leverage. Based on the results from the regression in table 6, the hypotheses 1 till 6 will be confirmed or rejected. The regression is based on the whole time period, which includes the crisis and non-crisis period.

**Table 6: Fixed Effects regression based on the determinants of capital structure**

Determinants of Capital Structure: Whole Period	
	(1) Leverage
firmsize	0.176*** (0.015)
growth	0.023*** (0.008)
liquidity	-0.047*** (0.016)
NDTS	0.597 (0.707)
profitability	-0.665*** (0.221)
tangibility	1.429*** (0.169)
Constant	-6.046*** (0.308)
Observations	6972
Adjusted_R2	0.239
dependent variable: Long Term Debt / Total Assets	
* p<0.1, ** p<0.05, *** p<0.01	

Table 6 shows for every determinant a coefficient. This coefficient indicates how the dependent variable leverage is affected by the concerned determinant. A positive coefficient means that an increase in the determinant leads to an increase in leverage. The stars behind the coefficient indicate if the relationship is significant in a respective 10%, 5% or 1% level. A significance level of 1% means that the relationship can be confirmed with 99% certainty.

The results indicate that 5 out of the 6 determinants have a significant relationship with leverage based on 99% certainty. FIRM SIZE shows a positive coefficient of 0.176, this means that an increase of 1 in firm size leads to an increase of 0.176 in leverage. This indicates a positive relationship which is consistent with the trade-off theory and hypothesis 1. Also, the determinant GROWTH shows a positive significant relationship with leverage. This contrasts with the trade-off theory and hypothesis H4. The trade-off theory argues that firms with high growth opportunities have more incentives to engage in risky projects which increases their costs of distress and bankruptcy risk which ultimately leads to higher cost of debt. However, some empirical research also found a positive relationship between growth opportunities and leverage. Awan et al., (2010) argue that owners of firms may view available growth opportunities as unsustainable and risky and therefore intend to pass on that higher risk to the creditors. Furthermore, the existing of growth opportunities could lead to higher leverage because firms need the extra funds to finance the growth opportunities. This is in accordance with the pecking order theory. Based on the results, hypothesis 4 is rejected.

LIQUIDITY is negatively related to leverage according to the results. This is consistent with the pecking order theory and hypothesis 5. This theory argues that firms prefer to use their internal resources first. Firms with a high liquidity ratio would therefore use less debt. PROFITABILITY also shows also a negative relationship with leverage. This contrasts with the trade-off theory and it could indicate that firms follow a certain pecking order regarding internal and external financing. Based on table 6 also hypothesis 1 can be accepted. Firms with higher profitability ratios have probably more internal resources and therefore a lower amount of leverage in their capital structure. TANGIBILITY shows the strongest relationship with leverage. It indicates that an increase of 1 in tangibility leads even to an increase of 1.4 in leverage. This is consistent with both the pecking order theory and the trade-off and hypothesis 3. The most important argument for this relationship is the role of collateral that could be fulfilled by tangible assets. More collateral leads to less bankruptcy risk, lower cost of debt and therefore a higher amount of debt. NDTS shows a positive relationship which is in contrast with the theoretical predictions. However, the relationship is not significant which makes it impossible to accept hypothesis 5 based on these results.



## 4.2 The Effect of the Financial Crisis on Capital Structure

To investigate the effect of the financial crisis on capital structure, firstly there are two separate regression conducted that are similar to the regression that is displayed in table 6. However, this time this regression is once performed based on the period 2008-2012, which indicates the crisis period and once based on the period 2013-2016, which indicates the non-crisis period. The results from both regression is compared in table 7.

**Table 7: Comparison between the Crisis and Non-Crisis Period**

Crisis vs Non-Crisis		
	(1) Crisis: 2008-2012 Leverage	(2) Non-Crisis: 2013-2016 Leverage
firmsize	0.1913*** (13.07)	0.1502*** (9.49)
growth	-0.0008 (-0.01)	0.0819 (1.55)
liquidity	-0.0689*** (-3.71)	-0.0441*** (-2.88)
NDTS	0.1463 (0.26)	0.3433 (0.75)
profitability	-0.7448*** (-4.64)	-0.4129*** (-2.65)
tangibility	1.1674*** (5.83)	0.9431*** (5.45)
Constant	-6.2343*** (-19.81)	-5.3402*** (-16.69)
R-squared	0.233	0.175
N	5450	5521

dependent variable: Long Term Debt / Total Assets

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

Table 7 shows that the direction and the significance of the coefficients are equal for both periods. Furthermore, it indicates that the determinants firm size and tangibility become more positive during the crisis period. This is in accordance with the trade-off theory and the pecking order theory. In times of crisis firm size tend to become more important. During crisis firms may become more inclined to lend to larger firms to decrease default risk (Deesomak, Paudyal, & Pescetto, 2004). Larger firms are in general more diversified and have more stable cash flows. Also, Trinh and Phuong (2016) found that during crisis periods, there is a higher chance that companies will go bankrupt.



Therefore, banks are more careful to give credit. In these cases, firm size is an important factor because of their reputation and low business risk.

Both Deesomak et al., (2004) and Harrison & Widjadja (2014) found that the positive relationship between tangibility and leverage becomes more important during crisis periods. They argue that this is the case because the prominent function of tangible assets to mitigate adverse selection problems. During the financial crisis adverse selection problems become more severe. Subsequently, lenders desire more security through qualitative tangible assets.

On the other hand, the determinants profitability and liquidity become more negative during the crisis period. This is also in accordance with the theoretical propositions and empirical research. Trinh & Puong (2016) argue that this strengthened negative relationship is caused by the inaccessibility of external debt. When firms have more internal recourses and a higher liquidity ratio they are less likely to use leverage especially in times when external funds are scarce. During these periods, managers try to avoid the use of debt to prevent their business from bankruptcy. Deesomak et al., (2004) also found a more negative relationship during crisis periods due to the inaccessibility of external debt. Furthermore, the variables NDTs and growth opportunities are both not significant.

To investigate the direct effect of the financial crisis on capital structure there are two more regressions conducted: one that includes the crisis dummy as independent variable (model (1)) and one regression that adds interaction effects that interact between the firm-specific determinants and the crisis dummy (model (2)). The results from these regressions are reported in Table 8.

The results from model 1 in table 8 show a negative coefficient for the crisis dummy which is significant at the 5% level. This indicates that it can be concluded with 95% probability that the financial crisis has a negative effect on leverage. This is consistent with the trade-off theory and with the theoretical proposition (hypothesis 7). The trade-off theory explains that during periods of crisis, the bankruptcy risk is higher which causes leverage to be more expensive and therefore the amount of leverage decreases. Model 2 shows that both the interaction effects with tangibility and firm size are significantly positive at the 5% level. These significant interaction effects indicate that the financial crisis has a significant influence on the relationship between tangibility and leverage and firm size and leverage. So, this concludes that the financial crisis effects the determinants of capital structure. In detail it indicates that the determinants firm size and tangibility become more important during the crisis which is in accordance with the results from table 7.

Besides the regressions, a two-sample Wilcoxon rank-sum test is conducted. This is one of the most powerful formal test to investigate if a variable significantly differs between two samples. This particular test that is reported in table 9 shows a probability of 0.0000. This means that the  $H_0$

hypothesis: ‘Leverage during crisis = Leverage during non-crisis’ can be rejected. The amount of Leverage differs significantly between both periods.

Based on Table 6, 7 & 8, it can be concluded that the financial crisis has a significantly negative effect on leverage and that the relationship between leverage and its determinants differ between crisis periods. Therefore, hypothesis 7 & hypothesis 8 are accepted.

**Table 8 – Regressions with Crisis Dummy and interaction effects**

With and Without Interaction		
	(1) Leverage	(2) Leverage
firmsize	0.1464*** (8.98)	0.1365*** (8.17)
growth	0.0713 (1.64)	0.1152** (2.06)
liquidity	-0.0606*** (-4.53)	-0.0573*** (-3.84)
NDIS	0.4301 (1.07)	0.5562 (1.23)
profitability	-0.5382*** (-4.12)	-0.5317*** (-3.46)
tangibility	1.1234*** (7.29)	1.0004*** (6.33)
crisis2008-2012	-0.0445** (-2.03)	-0.5280*** (-2.74)
firmsizecrisis		0.0199** (2.17)
growthcrisis		-0.0982 (-1.17)
liquiditycrisis		-0.0042 (-0.32)
NDIScrisis		-0.1594 (-0.29)
profitabilitycrisis		0.0027 (0.01)
tangibilitycrisis		0.2421** (2.23)
Constant	-5.3547*** (-16.34)	-5.1163*** (-15.16)
R-squared	0.205	0.207
N	10971	10971

dependent variable: Long Term Debt / Total Assets

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

Table 9 – Two-sample Wilcoxon rank-sum test

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

crisis	obs	rank sum	expected
0	5695	37158296	36248675
1	7034	43861789	44771410
combined	12729	81020085	81020085

Ho: LTD(crisis==0) = LTD(crisis==1)

z = 4.413  
 Prob > |z| = 0.0000

### 4.3 The Industry differences in Capital Structure and their determinants

To investigate industry differences in capital structure and their determinants, dummies are created to include the industries in the regressions. There are dummies created only for the industries that include more than 100 firms. Table A7 shows that this concerns the following industries: Business Services, Manufacturing, Mining, Transportation & Public Utilities and Wholesale & Resale trade. First a Random effects regression with industry fixed effects is conducted to investigate whether hypothesis 9 can be accepted. Industry fixed effects include for example market characteristics such as the level of competition, extent of product differentiation, strength and number of buyers and sellers and ease of entry to the market. Furthermore, it could include culture aspects or firms' aspects as capital or labour intensity.

The regression on the next page in table 10 includes a coefficient for all industry dummies except for one. The industry dummy without a coefficient is the reference category which is in this case the industry: 'Wholesale & Resale trade'. The coefficients of the remaining industries indicate the relationship between the industry fixed effects, of the particular industry, and leverage related to the reference category when all other determinants' coefficients are considered to be zero. Both the industries manufacturing and mining have significant coefficients: the industry manufacturing shows a positive relationship and the industry mining shows a negative relationship between the industry fixed effects. A positive relationship means in this case that the industry manufacturing has a significantly higher amount of leverage in their capital structure relative to the reference category wholesale & resale trade. On the other hand, the industry mining has a significantly lower amount of leverage in their capital structure. This is because manufacturing firms require huge amounts of equipment to produce their products and are therefore considered to be capital intensive. Mining is considered as labour intensive because the main part of the money involved in mining firms goes to the payment of workers (Bratveit, Moen, & Mashalla, 2003). The other coefficients do not indicate significant differences between capital structure in different industries.

However, the results indicate that there are significant differences between the capital structure of the industries Manufacturing, Mining and Wholesale & Resale trade, hypothesis 9 can be accepted. To test for hypotheses 10 & 11, separate regressions per industry are conducted. Firstly, regressions per industry including an industry dummy that equals 1 during the crisis period and 0 during the non-crisis period. The results of these regressions can be found in table A9. Secondly, the same regressions are carried out once for the crisis period (2008-2012) and once for the non-crisis period (2013-2016). The results from these regressions can be found in table A10.

**Table 10: Random Effects Regression with Industry Fixed Effects**

Determinants of Capital Structure: Industry Fixed Effects

	(1) Leverage
firmsize	0.161*** (0.017)
growth	0.029*** (0.008)
liquidity	-0.035** (0.016)
NDTS	0.337 (0.736)
profitability	-0.652*** (0.227)
tangibility	1.555*** (0.167)
crisis2008-2012	-0.045* (0.024)
Industry Fixed Effects:	
Business Services	-0.192 (0.119)
Manufacturing	0.200* (0.107)
Mining	-0.677*** (0.150)
Transportation & Public Utilities	0.043 (0.134)
Wholesale & Resale Trade	0.000 (.)
Constant	-5.778*** (0.347)
Observations	6304
Adjusted_R2	

dependent variable: Long Term Debt / Total Assets

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

Regarding differences between industries, three types of differences can be consulted: the presence of significant relationships, the strength of the relationships and the direction of the relationships. A different direction of relationships between determinants and leverage regarding different industries can be considered as the harshest difference because it indicates an opposite effect. The results in table A9 show that all the significant coefficients, except for liquidity, are equal considering the direction of the relationship.

Liquidity shows for both the industries manufacturing and mining a significantly negative relationship while the industry wholesale & resale trade a significantly positive relationship indicates. However, empirical research found evidence for both positive and negative directions in this relationship. Accumulated cash and other liquid assets serve as internal sources of funds and will be preferred in comparison with external funds as debt and equity (De Jong, Kabir, & Nguyen, 2008). On the other hand, Williamson (1988) argued for the precautionary motive, which indicates that high liquid firms are easier to liquidate in case of bankruptcy which protects bondholders since they have first charge on firm's assets. Therefore, the premia firms must pay for their debt is lower which could lead to a higher leverage ratio.

Furthermore, for all determinants, evidence is found regarding differences between the presence of significant relationships with leverage. For example, the determinant profitability shows for two industries a relationship with 1%-significance level, for one industry a relationship with a 5%-significance level and for one industry a relationship with a 10%-significance level. Finally, there are also some differences regarding the strength of the relationships. For the determinant tangibility, a 1% increase leads to a 0.96% increase in leverage for manufacturing firms while it leads to an increase of 2.44% for firms in the Wholesale & Resale trade.

Based on analysis above there can be concluded that there are significant differences in the relationship between leverage and its determinants regarding different industries which indicates that industry fixed effects do influence the leverage ratio of firms. Therefore, hypothesis 10 is accepted.

Table A10 shows two regressions per industry: one for the crisis period and one for the non-crisis period. It shows that the direction of the determinants differs between industries and that the effect of the crisis differs between industries. However, the most important findings are the that for every industry the coefficients of firm size and tangibility are, in most cases, significantly positive. Due to the differences in direction, significance and strength of the coefficients between crisis and non-crisis for the industries hypothesis 11 is accepted.

## 4.4 Summary of the Results

In this section an overview will be given about which hypotheses are accepted or rejected and which theory or theories are supported by the results.

**Table 11: Summary of the Results**

<b>Hypothesis:</b>	<b>Accepted/Rejected:</b>	<b>Supported by:</b>
<b>Determinants of Capital Structure</b>		
H1: Profitability is negatively related to Leverage	Accepted	Pecking Order Theory
H2: Firm Size is positively related to Leverage	Accepted	Pecking Order Theory Trade-off Theory
H3: Tangibility is positively related to Leverage	Accepted	Pecking Order Theory Trade-off Theory
H4: Growth opportunity is negatively related to leverage	Rejected	Pecking Order Theory <sup>4</sup>
H5: Liquidity is negatively related to leverage	Accepted	Pecking Order Theory
H6: Non-Debt Tax shield is negatively related to Leverage	Rejected <sup>5</sup>	
<b>Effect of financial crisis on capital structure</b>		
H7: The Financial crisis has a negative effect on Leverage	Accepted	Trade-off Theory
H8: The determinant variables of capital structure change in crisis periods	Accepted	
<b>Effect of industry fixed effects on capital structure</b>		
H9: The capital structure differs significantly between industries.	Accepted	Trade-off Theory
H10: The firm specific coefficients are not equal across all industries	Accepted	
H11: The effect of crisis on leverage differs significantly between industries	Accepted	

The results in table 11 show that for hypothesis 1 till 6, which represent the determinants of capital structure, the pecking order theory is the most influential theory. For all determinants that showed significant coefficients, the relationship is supported by the pecking order theory. Only the

<sup>4</sup> According to the hypothesis a negative relationship between growth opportunity and leverage was expected which is in accordance with the trade-off theory. However, this study finds a positive relationship which is in accordance with the pecking order theory.

<sup>5</sup> Because no significant relationship is found, the hypothesis is rejected.

relationships between firm size and leverage and tangibility and leverage were also supported by the trade-off theory. In these cases, both theories expect the same relationship.

However, when crisis becomes involved in the analyses, the results are in accordance with the trade-off theory. The trade-off theory argues that the financial crisis should have a negative effect on leverage because the bankruptcy risk is higher during financial distress, which makes debt more expensive. The results also found evidence for significant differences in the firm specific determinants between the crisis and non-crisis period (hypothesis 8). The observable pattern in the analysis considering the financial crisis was that during crisis periods the determinants firm size and tangibility become more important.

Furthermore, the evidence that is found for the differences in capital structure between industries is also supported by the trade-off theory. Degryse et al., (2012) stated that the trade-off theory argues that firms tend towards an optimal leverage ratio, which could differ across industries. On the other hand, the pecking order theory does not give a clear prediction about industry fixed effects

Finally, this study found evidence for significant differences in the firm-specific determinants between industries and that the particular industries are affected in various ways by the financial crisis. This is in accordance with empirical research. Moore and Mirzaei (2016) found that externally financially dependent industries have suffered significantly from a decrease in growth during the crisis. Industries that are less dependent on external funds maintained more often their growth. Frank and Goyal (2009) show that during crisis industries that need make huge investments in fixed assets also face high fixed costs and are therefore more dependent on external financing because internal resources are often not sufficient.

Regarding to the two important theories it can be concluded that the pecking order theory is the best explaining theory when it comes to firm-specific determinants. However, the trade-off theory supports the effect of the financial crisis and gives more explanation about the industry differences that have an influence on the capital structure decision. The next section will show the results for several performed tests to check whether the results from chapter 4 are robust.



## 5. Robustness Checks

In this study, several checks are performed to test whether the results are robust. Firstly, to test whether the results regarding the determinants of capital structure are robust, the OLS regression is conducted with the random effects model instead of the fixed effects model. Secondly, a different time period is used to test whether the results regarding the financial crisis are robust. And finally, to test whether the effects of the different industries are robust, a random effects regression is performed including the industries with less than 100 companies. These industries were omitted in the first regression. The results of the robustness checks can be found in appendix 3.

### **Robustness Check for Determinants of Capital Structure**

To test the robustness of the results of table 6: fixed effects regression based on the determinants of capital structure, the same regression is performed again in table A11. This time a random effects model is used instead of a fixed effects model. This robustness check is besides the test for the robustness of the firm level determinants also important because for the regressions considering industries differences, the random effects model is used even though the Hausman test recommended the fixed effects model. To test whether the results are the same for both models the following regression in table A11 is conducted. The results indicate that the same determinants are significant and have the same direction regarding the coefficients. The adjusted R-squared is for both models almost identical (0.226 & 0.239). Some coefficients are stronger while others are less strong using the random effects models. Furthermore, the regression using the fixed effects model has more results that are significant at a 1% level. This could be expected because the fixed effects model was recommended by the Hausman test. However, the differences are small, and it can therefore be concluded that the results are robust.

### **Robustness Check Crisis Period**

To test the robustness of the results of tables 7 & 8 both regressions are performed again in table A12 & A13 but using a different crisis period. This time the crisis period is 2008-2013 and the non-crisis period is 2014-2016. The results from table 12 show that the strongest determinants firm size, profitability and tangibility have the same significant relationships in both table A12 and table 7. The determinant NDTs is in both regressions and both periods non-significant (crisis period 2008-2012 & 2008-2013). There are some differences regarding the determinants growth and liquidity. In table 7, the determinant growth is non-significant while table A12 a significant relationship between growth opportunities and leverage indicates. Furthermore, there are differences regarding the determinant liquidity. Table 7 shows in both periods a significant relationship between liquidity and leverage while

table A12 shows a non-significant relationship during the non-crisis period. However, when the relationships regarding liquidity and growth opportunity are significant they are also quite weak.

Table A13 includes the interactions effects with the crisis dummy and is a robustness check for table 8. The results from this table shows the same pattern as the table A12. Again, the three most important determinants show for both the regressions, with the two different crisis periods, the same significant relationships. Regarding the interactions effects, both tables show a significant and positive coefficient for the interaction between firm size and crisis and tangibility and crisis. The only remarkable difference is that table A13 show a small negative coefficient for the interaction effect between growth opportunity and crisis while table 8 shows a non-significant relationship. However, again this coefficient is small and only significant at a 10% level. Furthermore, the Adjusted R-squared for both models only show small differences. Based on the robustness checks, it can be concluded that both periods (2008-2012 & 2008-2012) could be used as crisis periods and the results regarding the financial crisis are robust.

#### **Robustness Check Industry Fixed Effects**

To test the robustness of the results of the industry fixed effects regression of table 10, the same regression is performed again in table A14. This time all industries, including the industries with less than 100 firms, are included. The results from both table A14 and table 10 are almost identical. The firm level determinants all show the same significant relationships for the determinants: firm size, growth, liquidity, profitability and tangibility. The determinants NDTs shows for both regressions a non-significant relationship. Regarding the industry fixed effects, both regressions only indicate two significant coefficients: mining and manufacturing. In both regressions the industry fixed effects of manufacturing are positive and significant at a 10% level and the industry fixed effects of mining are negative and significant at a 1% level. Based on the results in table A10 it can be concluded that the results regarding industry differences are robust.

## 6. Discussion & Conclusion

The capital structure decision of firms is still one of the most important issues in corporate finance. There are two major competing theories of capital structure that have been an important issue in several studies: the trade-off theory and the pecking-order theory. Based on these theoretical models, empirical research has identified firm-specific characteristics that have an influence on firm's leverage. This study has found more evidence about these characteristics and which of the two theories is most influential. Furthermore, evidence is found about the role of the last financial crisis on firm's leverage. Because empirical research in most cases only investigates the effect of the financial crisis on leverage ratio, this research contributes to the existing literature by investigating the effect of the financial crisis on the firm specific determinants as well. Finally, this study contributes to the literature by studying the effect of industry fixed effects on the capital structure decision of firms. A large sample of 1555 listed companies are analysed from 3 European countries: Germany, France and UK for the period 2008-2016. The focus is on the last financial crisis period 2008-2012, firm-level determinants and industry fixed effects.

The results show that firm leverage, as measured by long-term debt divided by total assets is significantly positive related to firm size and tangibility. This is in accordance with both the pecking order theory and the trade-off theory. Furthermore, the results show that firm leverage is significantly positive related to growth opportunity and significantly negative related to liquidity and profitability. These three relationships are all in accordance with the **pecking order theory** and inconsistent with the trade-off theory. NDTs shows no significant relationship in the results. Based on the firm level determinants in this study, the general finding is that the pecking order theory is the most influential capital structure theory.

However, the results also show that the last financial crisis of 2008-2012 has a negative effect on leverage. This is quite remarkable because empirical research that studied this relationship for countries in the United States found a positive relationship (Wolters, 2017; Hassan & Samour, 2015). However, this study finds a significantly negative relationship. This means that the amount of leverage in firm's capital structure is lower during times of crisis. This is in accordance with the **trade-off theory**. This theory argues that debt becomes more expensive due to higher bankruptcy risks for firms. To mitigate this negative effect firm size and tangibility become very important. This becomes clear from the results in section 4.2. It shows that the determinants tangibility and firm size become more positive during crisis. Furthermore, the interaction effects between the crisis dummy and both firm size and tangibility show significant and positive coefficients. This means that the crisis period has a positive influence on the relationship between firm size and crisis and tangibility and crisis. This

is in accordance with the theoretical propositions. In times of crisis firm size tend to become more important. During crisis firms may become more inclined to lend to larger firms to decrease default risk (Deesomak, Paudyal, & Pescetto, 2004). Larger firms are in general more diversified and have more stable cash flows. The relationship between tangibility and leverage becomes more important due to the prominent function of tangible assets to mitigate adverse selection problems. During times of financial crisis adverse selection problems are considered more severe. Subsequently, lenders desire more security through qualitative tangible assets.

Furthermore, based the results it can be concluded that there are significant differences in the relationship between leverage and its determinants regarding different industries which indicates that industry fixed effects do influence the leverage ratio of firms. The results indicate that there are significant differences between the capital structure of the industries manufacturing, mining and wholesale & resale trade. The industry manufacturing has a significantly higher amount of leverage in their capital structure relative to the reference category wholesale & resale trade. On the other hand, the industry mining has a significantly lower amount of leverage in their capital structure. This is probably the case because manufacturing firms require huge amounts of equipment to produce their products and are therefore considered to be capital intensive. Mining is considered as labour intensive. Besides this, the results show that the direction of the determinants differs between industries and that the effect of the crisis differs between industries. However, the most important findings are the that for every industry the coefficients of firm size and tangibility are, in most cases, significantly positive.

Finally, it is confirmed that the results in this study are robust for different models, different time periods for the financial crisis and different industries. Regarding to the two important theories it can be concluded that the pecking order theory is the best explaining theory when it comes to firm-specific determinants. However, the trade-off theory supports the effect of the financial crisis and gives more explanation about the industry differences that have an influence on the capital structure decision

The results in this study contribute to the literature on capital structure of firms. Firstly, it found more evidence about which capital structure theory is most influential in European countries. Because empirical research is ambiguous about which theory is most influential it is important to gather empirical evidence. The most important contribution is the evidence about the effect of the global financial crisis on the firm level determinants of capital structure. It found that firm size and tangibility are important characteristics of firms when it comes to external funding during crisis. Empirical research in most cases only investigates the effect of the financial crisis on leverage ratio. Larger firms or firms with a high tangibility ratio are less vulnerable during crisis times when external

funding becomes more difficult to obtain. Finally, it found evidence that industry fixed effects are important determinants of capital structure. Capital intensive industries are more likely to have more leverage in their capital structure. The results of this study could be of practical relevance for investors because they know that firm size and tangibility are important characteristics to survive during crisis. Furthermore, this knowledge could help managers with their financial decision making. Especially during times of crisis.

However, this study also has some limitations. Firstly, since the study focusses on the crisis- and non-crisis period data for firms in the sample it was only possible to investigate the crisis and post-crisis period because the data coverage of ORBIS is the last 10 years. So, in this case it was not possible to investigate a pre-crisis period. As suggestion for future research is to create a dataset with equal pre-crisis, crisis and post-crisis periods and investigate possible differences between these periods. Secondly, the industry classification that is used in this study is very broad. For example, the industry wholesale & resale trade includes many different organizations with different characteristics. As a result, this study is limited in the investigation of industry effects. It would be interesting for future research if a larger dataset is used. This makes it possible to divide it in more and smaller industries that includes companies that really have the same characteristics. Finally, this study did not include country differences because it would make this research to broad. A suggestion for future research is to focus on country-specific factors like investor protection, bond market development and GDP growth.

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## Appendix 1: Hypotheses and Descriptive Statistics

**Table A1: Overview Hypotheses**

<b>Determinants of Capital Structure</b>
H1: Profitability is negatively related to Leverage
H2: Firm Size is positively related to Leverage
H3: Tangibility is positively related to Leverage
H4: Growth opportunity is negatively related to leverage
H5: Liquidity is negatively related to leverage
H6: Non-Debt Tax shield is negatively related to Leverage
<b>Effect of financial crisis on capital structure</b>
H7: The Financial crisis has a negative effect on Leverage
H8: The determinant variables of capital structure change in crisis periods
<b>Effect of industry fixed effects on capital structure</b>
H9: The capital structure differs significantly between industries.
H10: The firm specific coefficients are not equal across all industries
H11: The effect of crisis on leverage differs significantly between industries

**Table A2: Industry Classification**

<b>SIC Code (2-digit level)</b>	<b>Industry Classification</b>
01-09	Agriculture, Forestry & Fishing
10-14	Mining
15-17	Construction
20-39	Manufacturing
40-49	Transportation & Public Utilities
50-59	Wholesale & Resale Trade
70-79	Business Services
80-89	Professional Services
90-97	Public Administration

**Table A3: Comparison of Crisis Periods**

<code>crisis2008-2012</code>	<code>-0.0593**</code>
<code>crisis2008-2013</code>	<code>-0.0590**</code>
<code>crisis2008-2014</code>	<code>-0.0207</code>
<code>Constant</code>	<code>-2.045***</code>

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

**Table A4: Descriptive statistics before winsorize approach**

	count	mean	sd	min	max
c_id	13995	778	448.9058	1	1555
year	13995	2012	2.582081	2008	2016
i_id	13995	4.587138	2.193747	1	9
firmsize	13977	18.71124	2.660823	6.907755	26.73877
growth	12400	.3070442	9.317519	-1	948
liquidity	13626	2.910928	8.528392	0	305.4286
LTD	13977	.5813815	27.17276	-.0242147	3129
NDTS	13635	.0675151	.6258313	-.1680578	52.55319
profitabil~y	13968	-.124866	3.374728	-252	7.064796
tangibility	13977	.5011958	.2480763	0	1
TD	13977	1.082895	29.22444	-.0014587	3255
crisis	13995	.5555556	.4969217	0	1

**Table A5: Correlation Matrix**

```
. correlate LTD firmsize growth liquidity NDTS profitability tangibility crisis
(obs=10,971)
```

	LTD	firmsize	growth	liquid~y	NDTS	profit~y	tangib~y	crisis
LTD	1.0000							
firmsize	0.3635	1.0000						
growth	-0.0455	-0.0017	1.0000					
liquidity	-0.2629	-0.2020	0.0789	1.0000				
NDTS	0.0887	-0.0723	-0.2139	-0.1152	1.0000			
profitabil~y	0.0557	0.3607	0.1406	-0.0793	-0.2943	1.0000		
tangibility	0.3140	0.2977	-0.0047	-0.2579	0.1388	0.0737	1.0000	
crisis	-0.0345	-0.0393	0.0001	0.0153	-0.0179	0.0309	-0.0068	1.0000

**Table A6: Hausman Test**

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
firmsize	.0938693	.1694431	-.0755738	.0270713
liquidity	-.0275329	-.0469698	.0194369	.0034409
NDTS	-.0273408	.5911406	-.6184814	.1823941
profitabil~y	-.6496034	-.6357041	-.0138992	.0676495
growth	.0320202	.0224852	.009535	.0022532
tangibility	1.750254	1.426425	.3238291	.0750301
crisis	-.0579952	-.0430877	-.0149075	.009343

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(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
          = 79.83
Prob>chi2 = 0.0000
```

**Table A7: Overview of Observations and Firms per Industry**

Industry	Obs.	Percent	Firms	Percent
Agri, Forestry & Fishing	189	1.35	21	1.35
Business Services	2,943	21.03	327	21.03
Construction	351	2.51	39	2.51
Manufacturing	5,598	40.00	622	40.00
Mining	1,359	9.71	151	9.71
Professional Services	837	5.98	93	5.98
Public Administration	54	0.39	6	0.39
Transportation & Public Utilities	1,494	10.68	166	10.68
Wholesale & Resale Trade	1,170	8.36	130	8.36
Total	13,995	100.00	1555	100.00

**Table A8: Descriptive statistics per industry**

Industry	stats	LTD2	firmsize	growth	liquid-y	NDTS	profit~y	tangib~y
Agri, Forestry & Fishing	mean	.17342	18.487	-2.018	4.1416	.03115	-.03199	.58628
	sd	.18437	2.1379	1.3583	4.8552	.04253	.22306	.25743
	max	.72262	22.96	.3707	16.263	.26296	.27737	.99527
	min	0	13.376	-7.4676	.26029	0	-1.0742	0
Business Services	mean	.15937	18.041	-2.2311	1.7785	.05212	.00427	.47777
	sd	.16703	2.2537	1.3616	1.9677	.05639	.22219	.25266
	max	.72262	24.514	.3707	16.263	.26296	.27737	1
	min	0	10.309	-12.865	.26029	0	-1.0742	0
Construction	mean	.17573	20.186	-2.3447	2.1712	.02201	.04328	.40348
	sd	.15081	2.2765	1.1469	2.4002	.03251	.07613	.25912
	max	.62954	24.942	.3707	16.263	.26296	.25636	.98875
	min	0	14.962	-6.0592	.26029	0	-.34616	.001
Manufacturing	mean	.21106	18.892	-2.4348	2.4632	.04549	-.01167	.45725
	sd	.16909	2.6182	1.3308	2.5126	.03982	.23738	.21515
	max	.72262	26.739	.3707	16.263	.26296	.27737	1
	min	0	7.7783	-10.7	.26029	0	-1.0742	0
Mining	mean	.13961	18.167	-1.6374	4.2008	.051	-.13329	.66409
	sd	.17032	2.9117	1.3532	4.7717	.06908	.31052	.26054
	max	.72262	26.69	.3707	16.263	.26296	.27737	1
	min	0	9.5716	-8.5093	.26029	0	-1.0742	0
Professional Services	mean	.19673	17.769	-2.0366	2.5386	.04111	-.03999	.48331
	sd	.18982	2.3297	1.3746	2.9749	.04978	.23887	.24928
	max	.72262	22.843	.3707	16.263	.26296	.27737	.99234
	min	0	6.9078	-9.2342	.26029	0	-1.0742	0
Public Administration	mean	.22734	17.706	-2.6826	1.2358	.08454	.01059	.51275
	sd	.15444	2.0491	.83828	.44657	.0703	.16108	.25316
	max	.59815	20.558	-.65098	2.704	.26296	.27737	.92192
	min	.00159	13.881	-4.1331	.57532	.00154	-.80703	.06346
Transportation & Public Utilitie	mean	.28912	19.825	-2.5089	2.0426	.05144	.00553	.59703
	sd	.2242	2.9816	1.4008	2.8399	.04949	.18114	.24687
	max	.72262	26.364	.3707	16.263	.26296	.27737	.99782
	min	0	9.5684	-9.3655	.26029	0	-1.0742	0
Wholesale & Resale Trade	mean	.21184	19.046	-2.4961	1.5839	.04321	.03034	.48631
	sd	.17778	2.6251	1.3349	1.2774	.04104	.18232	.24892
	max	.72262	24.829	.3707	12.538	.26296	.27737	.99908
	min	0	7.0662	-9.9611	.26029	0	-1.0742	0
Total	mean	.19951	18.711	-2.3007	2.3895	.04697	-.01529	.5012
	sd	.18174	2.6608	1.3671	2.847	.0493	.2338	.24808
	max	.72262	26.739	.3707	16.263	.26296	.27737	1
	min	0	6.9078	-12.865	.26029	0	-1.0742	0

## Appendix 2: Results

**Table A9: Per Industry regressions of firm specific determinants**

Determinants in Different Industries

	(1) Business Serv.	(2) Manufacturing	(3) Mining	(4) Transp. & Publ. Utilities	(5) Wholesale & Resale
firmsize	0.1149*** (3.16)	0.1064*** (4.14)	0.2165*** (4.15)	0.2244*** (5.78)	0.0751 (1.15)
growth	0.1853*** (2.61)	0.0922 (1.19)	0.0567 (0.42)	0.0812 (0.91)	0.1125 (0.81)
liquidity	-0.0108 (-0.51)	-0.0500** (-2.32)	-0.0921*** (-3.41)	-0.0121 (-0.53)	0.1737*** (3.47)
NDTS	-0.0967 (-0.12)	-0.0911 (-0.12)	1.2260 (1.23)	1.0604 (1.14)	1.7562 (1.19)
profitability	-1.2229*** (-4.36)	-0.5245*** (-2.59)	0.3018 (0.86)	-0.5882** (-2.11)	-1.0389* (-1.76)
tangibility	1.7163*** (5.72)	0.9679*** (3.35)	0.2898 (0.69)	1.1175*** (2.91)	2.4445*** (4.15)
crisis2008-2012	-0.0784 (-1.47)	-0.0030 (-0.09)	-0.2299*** (-2.65)	-0.0706 (-1.39)	-0.1052 (-1.37)
Constant	-5.3249*** (-7.64)	-4.3378*** (-8.94)	-6.3829*** (-5.72)	-6.9439*** (-8.68)	-4.9610*** (-3.61)
R-squared	0.239	0.136	0.339	0.357	0.225
N	2331	4522	860	1205	937

dependent variable: Long Term Debt / Total Assets

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

**Table A10: Per Industry regressions of firm specific determinants: Crisis vs Non-Crisis**

Effect of Crisis in Different Industries

	(1) Bus.. NC	(2) Bus.. C	(3) Manuf. NC	(4) Manuf. C	(5) Mining NC	(6) Mining C	(7) Tra.. & ~C	(8) Tra.. & ~C	(9) Wholes & ~C	(10) Who.. C
firmsize	0.1279*** (3.58)	0.1607*** (3.75)	0.1076*** (3.79)	0.1636*** (7.43)	0.2330*** (5.20)	0.2455*** (5.35)	0.2023*** (7.27)	0.2513*** (5.39)	0.1487*** (3.17)	0.1114* (1.86)
growth	0.1627** (2.21)	0.0800 (0.75)	-0.0192 (-0.21)	0.0343 (0.40)	0.3520* (1.83)	0.0198 (0.12)	0.3557*** (3.04)	-0.5019*** (-2.78)	0.0457 (0.22)	0.1849 (0.91)
liquidity	0.0258 (1.06)	0.0164 (0.52)	-0.0930*** (-3.10)	0.0076 (0.37)	-0.0224 (-0.88)	-0.1204*** (-3.87)	-0.0108 (-0.41)	-0.0434 (-1.07)	0.1287*** (3.38)	0.1324** (2.42)
NDTS	-0.8199 (-0.91)	0.3704 (0.40)	-0.6154 (-0.66)	-0.2039 (-0.25)	3.2832*** (2.69)	-0.4654 (-0.29)	1.9972** (2.25)	0.7960 (0.37)	-0.1370 (-0.13)	1.5216 (0.57)
profitability	-1.3040*** (-4.79)	-1.2688*** (-3.57)	-0.2793 (-1.09)	-0.6784*** (-3.47)	0.8682** (2.31)	-0.1772 (-0.35)	-0.2054 (-0.67)	-0.8859** (-1.99)	-1.5036** (-2.51)	-1.3124** (-2.43)
tangibility	2.0544*** (5.91)	1.6426*** (4.42)	0.3755 (0.97)	1.3367*** (5.64)	0.5969* (1.81)	0.5900 (0.97)	1.3890*** (3.72)	0.7351 (1.03)	1.6049*** (2.88)	2.1639*** (3.19)
Constant	-5.7415*** (-8.34)	-6.2421*** (-7.26)	-3.9227*** (-7.13)	-5.7283*** (-13.12)	-7.2326*** (-7.70)	-7.1714*** (-6.36)	-6.7053*** (-11.85)	-7.2025*** (-7.62)	-5.7619*** (-5.11)	-5.5666*** (-4.05)
R-squared	0.220	0.256	0.133	0.156	0.298	0.347	0.358	0.365	0.194	0.280
N	1179	1152	2271	2251	434	426	608	597	467	470

dependent variable: Long Term Debt / Total Assets

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

## Appendix 3: Robustness Checks

**Table A11: Robustness Check Determinants of Capital Structure**

Determinants of Capital Structure: Whole Period

	(1) Leverage
firmsize	0.140*** (0.052)
growth	0.030*** (0.008)
liquidity	-0.028* (0.017)
NDTS	-0.019 (0.809)
profitability	-0.692** (0.287)
tangibility	1.738*** (0.242)
Constant	-5.476*** (1.009)
Observations	6972
r2_o	0.226

dependent variable: Long Term Debt / Total Assets

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



Table A12: Robustness Check Crisis vs Non-Crisis Period

Crisis vs Non-Crisis Robustness

	(1) crisis: 2008-2013 leverage	(2) non-crisis: 2014-2016 leverage
firmsize	0.200*** (0.015)	0.160*** (0.016)
growth	0.017* (0.010)	0.027*** (0.010)
liquidity	-0.037** (0.019)	-0.022 (0.026)
NDIS	0.596 (1.099)	0.641 (0.817)
profitability	-0.867*** (0.294)	-0.736** (0.289)
tangibility	1.419*** (0.204)	1.327*** (0.189)
Constant	-6.553*** (0.321)	-5.678*** (0.339)
Observations	4231	2741
r2_o	0.255	0.204

dependent variable: Long Term Debt / Total Assets

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

Table A13: Robustness Check Crisis With and Without Interaction Effects

With and Without Interaction Robustness

	(1) Leverage	(2) leverage
firmsize	0.169*** (0.015)	0.149*** (0.016)
growth	0.021*** (0.008)	0.039*** (0.012)
liquidity	-0.047*** (0.016)	-0.059*** (0.021)
NDTS	0.577 (0.705)	1.078 (0.780)
profitability	-0.638*** (0.220)	-0.654** (0.264)
tangibility	1.423*** (0.168)	1.297*** (0.175)
crisis2008-2013	-0.047** (0.022)	-0.831*** (0.219)
firmsizecrisis		0.031*** (0.010)
growthcrisis		-0.027* (0.015)
liquiditycrisis		0.018 (0.018)
NDTScrisis		-0.765 (0.820)
profitabilitycrisis		-0.013 (0.283)
tangibilitycrisis		0.217* (0.120)
Constant	-5.882*** (0.305)	-5.378*** (0.329)
Observations	6972	6972
r2_o	0.240	0.243

dependent variable: Long Term Debt / Total Assets

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

**Table A14: Robustness Check Industry Fixed Effects**

Determinants of Capital Structure: Industry Fixed Effects Robustness

	(1) leverage
firmsize	0.166*** (0.016)
growth	0.026*** (0.008)
liquidity	-0.042*** (0.016)
NDTS	0.585 (0.705)
profitability	-0.683*** (0.219)
tangibility	1.563*** (0.172)
Industry Fixed Effects:	
Agri_Forestry_Fishing	-0.228 (0.426)
Business_Services	-0.184 (0.119)
Construction	-0.200 (0.211)
Manufacturing	0.208* (0.107)
Mining	-0.665*** (0.151)
Professional_Services	0.018 (0.154)
Public_Administration	0.004 (0.310)
Transportation_Public_Uilities	0.041 (0.133)
Wholesale_Resale_trade	0.000 (.)
Constant	-5.913*** (0.335)
Observations	6972
r2_o	0.262

dependent variable: Long Term Debt / Total Assets

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