Determinants of capital structure:
Evidence from the German market

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This paper investigates the determinants of capital structure of German companies by analyzing the capital structure theories. After running an OLS regression based on the data of listed companies, results show that firm size and tangibility have a significant positive effect on capital structure decisions as it was assumed by pecking order theory and trade-off theory. Other determinants did not show a significant influence on the capital structure decision.

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1. INTRODUCTION

Every company has to decide how they want to finance their operations. There are various ways on how to accomplish an effective capital structure, and there are also a lot of factors that can influence this decision. In the existing literature is already written a lot about capital structure and its different theories. Those theories explain the relationship between different determinants in relation to the way of financing. For instance, the pecking order theory by Myers and Maluf (1984) implicit that firms like to use internal sources rather than external sources. Due to asymmetries in information between managers and investors the use of internal sources is more favored than debt and equity. Those firms consider equity financing as last option since the use of debt can generate savings from taxes. In contrast to that the trade-off theory (Kraus & Litzenberger, 1973) suggests that using of debt has its cost and its benefits. According to this theory debt provide tax savings but on the other hand bankruptcy cost can be very costly. Companies can find an optimal debt-equity ratio based on internal and external characteristics. Next to that there are other capital structure theories, as for instance agency theory that discusses information asymmetry and interest conflicts, or the Modigliani and Miller propositions that represent the basis of all capital structure theories.

There are already a many studies that deal with the question about capital structure and the influence of specific factors. Most of the existing literature is based on US economy. Due to differences in traditions or financial environments, results of can differ in their validity from studies about German companies. On the other hand there is also research done about the German market. The studies of Rajan and Zingales (1995) and Antoniou, Guney and Paudyal (2002) deal with capital structure decisions of European economies and include Germany. But after the financial crisis of 2008-2010 there was not much added to the literature body. Therefore this study can add relevant knowledge, since the changing environment after the crisis can lead to the assumption that also the capital structure decision has changed. More research need to be done to make valid and significant statements.

In addition to that, de Jong, et al. (2008) showed that determinants of capital structure can differ among countries and cannot be generalized. Their results suggest to conduct a research for a particular country to find meaningful results. Therefore the goal of this thesis is to find evidence for the validity of the theories in the German market. The underlying research question is formulated as follows: What are the firm specific determinants of capital structure of German companies?

This study grounds its results on theoretical and empirical findings. All results are based on the underlying data of 286 selected German companies and the dominating capital structure theories; the pecking order theory and trade-off theory. At the one hand the results go in line with these theories by showing significant influences on the capital structure decision, whereas there also insignificant results that can be referred to only one of the theories.

The paper is divided into various sections. The first part of the paper is the literature review. Hereby the existing literature including the great capital structure theories are analyzed and synthesized. Also the involved firm specific factors that have influence on the capital structure decision are described and explained. The second part of the paper defines the hypothesis that need to be tested later. In the next section the methodology is taken nearer into account. This includes the type of method, the underlying dataset as well as the description of the variables. The fourth section of the paper presents a discussion about the results and analysis including the confirmation or rejection of the hypothesis. The last part of this study gives a conclusion and suggestions for further research.

2. LITERATURE REVIEW

In the following section the existent literature of capital structure will be critically analyzed. Much is already written about the choice of capital structure and the determinants that lead to it. Later in this section the financial theories and its origin will be closer considered.

First of all the existent literature about capital structure will be analyzed. Early research about this complex topic by Rajan and Zingales (1995) searched for evidence in the G7 countries. While most of the research was based on only US firms before, they analyzed also other advanced economies with differences in environment or traditions. By analyzing data from these countries they came to the result that the leverage among the G7 countries is relatively similar. Furthermore they observed the determinants of capital structure and recognized that for instance tangibility always had a positive effect on leverage, while profitability was negative correlated. Next to that also size was found to have a positive correlation with leverage except for German companies. These results will be seized later in this study again.

Another study by Antoniou, Guney and Paudyal (2002) conducted a research about capital structure in France, Germany and the UK. Here also the different traditions and financial environments served as motivation to search for evidence about determinants of capital structure. They have found several correlations for the different countries. They results showed that the determinants are country specific. For instance, the relationship between profitability and leverage showed to be for significant positive France and UK and not significant for German companies. Firm size was always found to have a positive influence on the leverage of a company. In contrast to that tangibility was found to have different assertions concerning leverage. In France the correlation was insignificant, in Germany significant positive and negative in the UK. Based on these findings the environment of a company plays also an important role by determining the optimal debt equity ratio.

In addition to that also Jong, Kabir and Nguyen (2008) found that capital structure can be influenced by many factors. Their study was based on companies of 42 different countries, equally divided between developing and developed countries. They found that there is a direct effect on leverage by country specific factors and that there is an indirect effect of country specific factors on firms specific factors. Similar results were found by Deesomsak, Paudyal and Pescetto (2004) in their study about Asian-Pacific region including data from four countries. Also Hall, Hutchinson and Michaelas (2004) confirmed this findings in their studies about SME's and capital structure in various countries. Due to the influence of country specific factors and to avoid complications with those factors as for instance legal enforcement, the financial system or GDP growth rate, this thesis will focus only on German companies.

2.1 Financial theories:

In this section the most significant capital structure theories will be considered. These theories build the framework of this study and are also the foundation of the later tested hypothesis. First we will have a closer look on the Modigliani and Miller propositions, followed by the analysis of the trade-off theory and the pecking order theory. These theories will build the theoretical framework of this paper.

2.1.1 Modigliani and Miller propositions:

The underlying capital structure theories are grounded in the work of Modigliani and Miller in 1958. Based on their findings they postulated the M&M propositions. According to the irrelevance proposition, the capital structure of a firm should not matter under perfect market conditions. But this propositions do not take into account real world factors as for instance taxes, bankruptcy costs or transaction costs and are therefore not applicable on real markets.

Subsequently different authors complement to the work of Modigliani and Miller and postulated their own theories of capital structure. First versions of the trade-off theory grew out of the Modigliani and Miller theorem. While there were corporate taxes and bankruptcy costs added to the original theory, it showed that there were benefits of debt in case off tax shield savings.

2.1.2 Trade off theory:

In 1973 Kraus and Litzenberger published their version of the trade-off theory which focuses on the financial benefits and costs of debt. The trade-off theory assumes that there is an optimal leverage ratio that companies should reach by using the right amount of debt. By using debt the company can profit from tax savings, but on the other hand bankruptcy costs can have a negative influence. Therefore companies should strive for the optimal balance between debt and equity.

2.1.3 Pecking Order Theory:

The pecking order theory is often seen as counterpart to trade off theory. This theory was first introduced by Myers and Maluf in 1984 and postulates that asymmetric information increase the cost of financing. Furthermore it states that financing comes from three sources, namely internal funds, debt and equity. Companies prefer to finance their investment by using internal funds as for instance their retained earnings. As second source they should use debt, and lastly they should raise the more risky equity. Raising equity should be the last possibility, because that would mean to issue new shares and hence bring new ownership into the firm.

This preference order is caused by the information asymmetry between internal and external parties. Managers have better insights about the companies risk and value. While issuing debt, managers show confidence about an investments profitability and that stock prices are undervalued. Issuing equity has an inverse impact.

2.1.4 Agency Theory:

The Agency Theory suggests that interests of managers and shareholders are not perfectly aligned (Jensen and Meckling, 1976). Because of the information asymmetry, problems between the various stakeholders can occur. Mangers often have better insights and more information about the firms' performance than shareholders have. The difference in interest can result in costs. These are called agency costs and include for instance monitoring costs. The main aspect of the agency theory, namely the information asymmetry between shareholders and managers, goes in line with the assumptions of the trade-off theory. Therefore also the predictions of the different determinants are aligned.

3. HYPOTHESIS:

In the following section the hypothesis are according to the explained theories established and described. Due to the fact that the theories in some cases differ in the assertion about the effects of the firm specific factors, there will be made a distinction. Therefore all hypothesis labeled with an "a" belong to the

directions of the pecking order theory and all hypothesis marked with a "b" belong to the trade-off theory.

3.1 Firm size:

The size of a firm is determined by its total assets. The more assets a company has the larger is its size. Trade-off theory and pecking order theory differ in their hypothesis about the effect on capital structure.

According to the pecking order theory there should be a negative effect of firm size on leverage. Rajan and Zingales (1995) argue that size also can reduce the amount of debt used by a company. Since larger firms tend to have more complex organizations which can increase information asymmetry costs. Therefore it is more complicated for a company to finance their operations by external funds.

H1a: Firm size is negatively correlated to leverage.

According to the trade-off theory firm size has a positive relationship to leverage. Since large companies have more diverse activities there is less risk for bankruptcy. This allows the company have higher levels of debt (Frank and Goval, 2009; Desomsaak et al., 2004; Titman and Wessels, 1988). Furthermore larger firms often have more stable cash flows that allows them to acquire higher levels of debt (Jong et al., 2008).

H1b: Firm size is positively correlated to leverage.

3.2 Profitability:

The firm specific factor profitability is measured by the operating revenue divided by total assets. Profitability describes the company's ability to generate earnings in contrast to its expenses. The grand financial theories differ in this case. While according to the pecking order theory there is a negative correlation between profitability and leverage, the trade-off theory postulates a positive correlation.

The pecking order theory by Myers and Maluf (1984) assumes that companies tend to use internal financing first. Only if the internal resources as for instance the profits are exhausted the company will use debt for financing its operations. Therefore a higher degree of profitability will reduce the need for external financing. According to that there is a negative effect of profitability on leverage.

H2a: Profitability has a negative effect on leverage.

In contrast to that the trade-off theory postulates a positive influence of profitability on leverage. Kraus and Litzenberger (1973) argue that there are tax benefits of debt. While a company has higher revenues it has to pay as well more taxes. By using more debt instead of equity the company can profit from tax deductible interest of debt. Therefore a company with high profitability should have a larger part of debt in their capital structure (Frank and Goyal, 2009).

H2b: Profitability has a positive effect on leverage.

3.3 Tangibility:

Tangibility is the degree of tangible assets, as for instance machinery or buildings that are incorporated by a company. According to both pecking order theory and trade-off theory, tangibility has a positive effect on leverage. While having a higher degree of tangibility there is less risk for lenders, less risk of financial distress and less bankruptcy cost (Rajan and Zingales, 1995). The high degree of tangible assets guarantees creditors to recover its funds in case of financial distress. Therefore it allows a company to issue more debt resulting in higher degree of leverage.

H3a+b: Tangibility has a positive effect on leverage.

3.4 Liquidity:

Liquidity is defined as the ability of a firm to convert its assets quickly into cash. According to the logical assumptions of the pecking order theory liquidity has a negative effect on leverage. Pecking order theory suggests that firms prefer to use internal sources first followed by debt and equity. Companies with high liquidity will use those liquid assets to finance their operations before they use external financing. Earlier research also has found that there is a significant correlation between liquidity and leverage, whereby most of the results apply on advanced economies (Jong et al., 2008).

H4a: Liquidity has a negative effect on leverage.

3.5 Growth:

Growth can be defined as the book value of the total assets less the book value of equity plus the market value of equity divided by the book value of total assets (Deesomsak et al. 2004). Furthermore growing companies are characterized by profitable reinvestment opportunities. In relation to capital structure growth has shown to have a negative effect on leverage. Firms with high growth opportunities tend to invest in more risky projects. This increases the cost of borrowing and thus growth firms tend to use internal financing before issuing debt. This is in a line with pecking theory that suggests to use internal financing before external financing. Furthermore the trade-off theory predicts a negative relationship to growth rate because growing firms could have higher financial distress costs (Fama and French, 2002). Frank and Goyal (2009) also argue that high market-to-book ratio should reduce leverage.

H5a+b: Growth has a negative effect on leverage.

Table 1 summarizes the above postulated hypothesis according to the respective directions of the underlying theories.

Table 1

Variable	Expected relationship	Testing theory
Size	- +	Pecking order theory Trade-off theory
Profitability	- +	Pecking order theory Trade-off theory
Tangibility	+ +	Pecking order theory Trade-off theory
Liquidity	-	Pecking order theory
Growth	- -	Pecking order theory Trade-off theory

4. METHODOLOGY:

This section of the paper will explain the methods used to investigate the relationship between the defined firm specific determinants and capital structure. A measurement for each factor will be allocated and the criteria for the underlying dataset of German companies will be explained.

4.1 Method of analysis:

To come up with grounded results a regression analysis will be conducted. A regression analysis is the common approach to deal with one dependent and multiple independent variables (Montgomery et al. 2012). In the existing literature often OLS (ordinary least square) regressions were used (Jong et al; Deesomsak, et al. 2004).

In this study the OLS regression of German companies is run as follows:

$LEV_i = \beta_{0i} + \beta_1 SIZE_i + \beta_2 PROF_i + \beta_3 TANG_i + \beta_4 LIQ_i + \beta_5 GROWTH_i + \varepsilon_i$

Where i denotes the respective company from the set of data.

LEV_i is the average financial average of the years 2010-2014.

The βs belong to the different hypotheses that need to be tested. Hereby is β_1 is the coefficient that tests H1a and H1b, β_2 is the coefficient that tests hypothesis H2a and hypothesis H2b, β_3 is the coefficient that tests hypothesis H3a and H3b, β_4 tests the hypotheses H4 and β_5 tests hypotheses H5a and H5b. Furthermore describes β_0 the constant of the formula and ε_i represents the standard error.

4.2 Variables:

The variables for the implementation of a statistical test need to be defined. In this case the dependent variable will be leverage similar to recent literature in this topic (Bennett, M. & Donnelly 1993, R.; Jong et al. 2008). As explained earlier the following determinants of capital structure will be selected as independent variables: firm size, profitability, tangibility, growth, liquidity.

Leverage (LEV): Leverage is calculated by the total liabilities and debts divided by the total equity of a firm. This is also known as the D/E ratio.

Size (SIZE): Size is calculated by the natural logarithm of total assets. (Deesomsak, et al 2004; Jong, et al. 2008)

Profitability (PROF): The Profitability is calculated by dividing operating revenue with total assets. (Deesomsak, et al. 2004; Jong, et al. 2008)

Tangibility (TANG): Tangibility is defined as the ratio between fixed assets and total assets. (Deesomsak, et al. 2004; Jong, et al. 2008)

Liquidity (LIQ): Liquidity is defined as the ratio of current assets to current liabilities. (Deesomsak, et al. 2004; Jong, et al. 2008)

Growth (GROWTH): For the growth of a firm the market-to-book ratio is used. (Booth, et al. 2001)

4.3 Data:

The data of German companies is derived from the database Orbis. While searching for German companies with data for the years 2010 to 2014 a larger number of hits was found. By applying a more detailed search with specific filters for the variables a dataset of 286 companies was created. This dataset included just firms with data for all investigated years. Companies with missing data for one of the variables were excluded from the analysis. The dataset of the 286 German companies include data for all of the following factors: current liabilities, current assets, fixed assets, operating revenue, total assets, debt-equity ratio and book value. The values for the explained variables are calculated as described in the methodology section. The companies belong to different industries, which makes this study to a general, not-industry related one. The time period of 5 years, encompassing the years 2010 to 2014 was selected to ensure that outlier values not falsify the results. Also a longer period of time allows it to gather more comprehensive data. For the calculation of the variables averages were used. Next to that these years can be seen as recovery period after the recession period of 2008-2010. The capital structure decision of companies could be affected by the financial crisis, consequently the time period of 2010-2014 was selected to gather information about possible differences. These differences will not be analyzed during this paper, but are an interesting suggestion for further research.

5. ANALYSIS AND RESULTS:

This section of the paper includes the analysis of the underlying data and the explanation of the results. All tables and results were created by using SPSS. First of all a summary of the descriptive statistics are expressed in table 2. Hereby all values were calculated based on the description in the variables abstract. The second table presents the results of the bivariate analysis. These results show the relationships between all investigated variables of the test. The last table shows the results of the OLS regression that lead to the findings.

5.1 Descriptive Statistics:

Table 1 shows the descriptive statistics of all included variables of the 286 selected German companies. All values show positive results. The standard deviation of tangibility is relatively small, so there is high concentration around the mean of this variable. In case of leverage, growth and liquidity it is noticeable that the maximums are relatively far away from the presented mean. There are some outliers involved in the dataset. But these results also will be included in the analysis, since they could be reasoned by different industrial characteristics. The other values of the variables show reasonable results that do not need further explanation.

Table 2

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Size	286	6,67	19,48	12,76	2,38
Profitability	286	,00	3,51	1,02	,63
Tangibility	286	,02	1,00	,51	,21
Liquidity	286	,09	986,34	6,09	58,59
Growth	286	,02	12,37	1,99	1,71
Leverage	286	,00	6,77	,94	,92

5.2 Bivariate correlations (Pearson):

The next table presents the bivariate relationships between all investigated variables. The relationships are measured by the Pearson correlation. The correlations between leverage and all independent variables is described as well as the correlation between all independent variables among each other.

5.2.1 Correlation between leverage and independent variables:

The analysis of the expressed correlation table shows that leverage has a significant positive relationship with size, tangibility and liquidity. In all cases the results are significant at the 1% level, which means that the results are not correct by a chance of 1%. The positive relationship of size and leverage confirms the assumptions made based of the trade-off theory. Furthermore the positive correlation of tangibility with leverage is predicted by the assumptions of pecking order theory. Profitability shows a negative significant correlation with leverage at the 1% level. This goes in line with the predictions with the pecking order theory, whereas the trade-off theory assumes a positive relationship of profitability and leverage. The results for liquidity showed a negative relationship but without significance. Growth and leverage do not show a significant relationship.

5.2.2 Correlation between independent variables:

The correlation table shows that there is positive significant relationship between size and tangibility and a significant negative relationship between size and growth. Furthermore profitability was found have a negative correlation to tangibility. Tangibility has a positive significant correlation to tangibility at the 1% level and a positive significant correlation to growth at the 5% level. The results show that there are many strong correlated variables among the independent variables. This phenomenon is called multicollinearity and can lead to miss interpretations and make the underlying model sensitive to minor changes. Therefore the variance inflation factor were checked via SPSS and it came out that all values were below the critical value of 3. Therefore no multicollinearity has to be assumed for this study.

Table 3

Correlations

		Leverage	Size	Profitability	Tangibility	Liquidity	Growth
Leverage	Pearson Correlation	1					
Size	Pearson Correlation	,37**	1				
Profitability	Pearson Correlation	-,19**	-,09	1			
Tangibility	Pearson Correlation	,37**	,16**	-,47**	1		
Liquidity	Pearson Correlation	-,08	-,04	-,11	,01	1	
Growth	Pearson Correlation	-,05	-,17**	,05	-,12*	,03	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

5.3 Regression analysis:

In the next part the results of the linear regression are presented and analyzed. Next to that the hypothesis will be confirmed or rejected in this section. Table 3 shows the SPSS output. Based on this coefficient table significant relationships are observed.

The first hypothesis postulated that firm size can has a positive or a negative relationship on leverage. According to the trade-off theory larger firms have more diverse activities and can therefore afford larger levels of debt. The results confirm this relationship of hypothesis H1b. There is a significant positive effect of firm size on leverage in the sample of German companies at the 1% level. These results were also found by recent research about this topic. Frank and Goyal (2009) found evidence for this relationship in the American market. Also Desoomsak et al. (2008) found this correlation in their study about the Asian Pacific region. On the other hand, hypothesis H1a must be rejected. The pecking order theory suggest that firm size has a negative influence on leverage (Rajan and Zingales, 1995). The results implicit that there is no evidence to hold this hypothesis.

Profitability was found to have a negative influence on leverage based on the coefficient table. This result would confirm the predictions of the pecking order theory, but the results are not significant at the 5% level (0,63). Therefore there is no evidence to confirm hypothesis H2a. In addition to that, hypothesis H2b which expects, according to the trade-off theory, a positive influence of profitability on leverage can be rejected since the coefficient has a negative direction (-0,04). In contrast to these results other studies have found a significant negative relationship between profitability and leverage (Frank and Goyal, 2009; Rajan and Zingales, 1995; Hossain, 2014; Serghiescu, 2014).

Hypothesis 3a and 3b postulate that tangibility has a positive effect on leverage. This holds for German companies since the results show a significant positive correlation at the 1% level. Therefore the assumption of the pecking order theory and the trade-off theory can be confirmed. These results go in line with similar research. Antoniou et al. (2002) found also a positive relationship between tangibility and leverage for German companies. Frank and Goyal (2009) who investigated American companies found the same relationship. Furthermore a study about Chinese listed companies had the same correlation between tangibility and leverage (Huang and Song, 2006).

Table 4				
Coefficients				
Model		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	-1,32	,34	
	Size	,12**	,02	,32
	Profitability	-,04	,09	-,03
	Tangibility	1,32**	,26	,31
	Liquidity	-,00	,01	-,07
	Growth	,02	,03	,04
a. Dependent Variable: Leverage				
Adjusted R Square	0,27			
**. Correlation is significant at 0.01 level.				

The hypothesis H4a implicates a negative correlation of liquidity and leverage. The results show that there is negative relationship on the debt-equity ratio, but without significance. The p-value of 0,162 is outside the 5% significance level. Other studies about determinants of capital structure found a significant relationship between these variables (Jong et al, 2008; Deesomsak et al. 2009; Hossain, 2014; Serghiescu, 2014).

The last hypothesis H5a and H5b which both predict a negative relationship of growth to leverage cannot be confirmed as well. There are no significant results that would strengthen this relationship. The regression analysis shows a not significant positive relationship of the two variables. Both theories, the pecking order as well as the trade-off theory predicted a negative relationship. Recent studies have found significant as well as insignificant results about this correlation (Deesomsaak et al. 2009; Rajan and Zingales, 1995; Hossain, 2014).

6. CONCLUSION:

This paper searched for evidence of the great capital structure theories in the German market. Under this premise the determinants of capital structure were analyzed. This topic was already component of many other studies, but the specific choice of German companies was not made during the last years. The results of the study were in line with most of the existent literature. It was found that there is a significant influence of firm size and tangibility as assumed by the financial theories. Furthermore also the variables profitability, liquidity and growth were found to have an assumed effect on the capital structure choice. Since assumptions of the trade-off theory and the pecking order theory sometimes differ in the direction for the variables, some assumptions need to be rejected and some could be confirmed. But these results did not show significance to hold the hypothesis.

Further research of this field should try to focus on different industries of the German market since there are some industrial characteristics that also influence the choice of debt and equity. In addition also a specific comparison between pre- and posts-crisis data could be made to investigate whether the financial crisis has changed the choice of capital structure.

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