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Leverage in Pharma

Determinants of Capital Structure

Authors:

Carl Becht

Atle Nilsson

Samuel Ögren Brunsberg

Supervisor:

Anamaria Cociorva

Abstract

Title: Leverage in Pharma

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Authors: Carl Becht, Atle Nilsson and Samuel Ögren Brunsberg

Advisor: Anamaria Cociorva

Key words: Pharmaceutical Industry, Capital Structure, Pecking Order Theory, Trade-off Theory, Corporate Social Responsibility

Purpose: To test established theories on capital structure determinants for the pharmaceutical industry and to discern the determinants of capital structure of this industry.

Methodology: A quantitative study is conducted using a deductive approach to statistically describe the nature of the global pharmaceutical industry's capital structure.

Theoretical perspective: The theoretical framework of this study consists of the trade-off theory and the pecking order theory. The study presents previous research on capital structure determinants for the pharmaceutical industry and companies in general. The theoretical foundation of the dependent and explanatory variables used in the study is also presented.

Empirical foundation: The sample consists of 209 global pharmaceutical companies from high-income OECD countries. The data was collected from Datastream and covers the time period of 2011 to 2016.

Conclusions: The statistically significant determinants of the capital structure for global pharmaceutical companies are dividends, profitability, size and corporate social responsibility. Dividends and profitability are negatively correlated with debt while size and corporate social responsibility are positively correlated. The trade-off theory is a better predictor for global pharmaceutical companies' capital structure determinants, with three significant results compared to the pecking order's one correct prediction.

Sammanfattning

Titel: Leverage in Pharma

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Författare: Carl Becht, Atle Nilsson och Samuel Ögren Brunsberg

Handledare: Anamaria Cociorva

Nyckelord: Läkemedelsindustrin, Kapitalstruktur, Pecking order-teorin, Trade-off teorin, Företags samhällsansvar

Syfte: Att testa etablerade kapitalstrukturteorier för läkemedelsindustrin och att urskilja de bestämmande faktorerna för kapitalstrukturen i branschen.

Metod: En kvantitativ studie genomförs med en deduktiv ansats för att statistiskt beskriva läkemedelsindustrins kapitalstruktur.

Teoretiskt perspektiv: Det teoretiska ramverket för studien består av trade-off teorin och pecking order-teorin. Studien framför tidigare forskning om kapitalstrukturens bestämmande faktorer för både läkemedelsindustrin och företag som helhet. Det teoretiska underlaget för den beroende och de förklarande variablerna presenteras.

Empiriskt underlag: Urvalet består av 209 globala läkemedelsföretag från höginkomst OECD-länder. Data samlades in från Datastream och täcker perioden från 2011 till 2016.

Slutsats: De statistiskt signifikanta bestämmande faktorerna för kapitalstrukturen för globala läkemedelsföretag består av utdelningar, lönsamhet, företags storlek och företags samhällsansvar. Utdelningar och lönsamhet är negativt korrelerad med skuldsättningsgrad medan företags storlek och företags samhällsansvar är positivt korrelerade. Trade-off teorin är bättre på att förutse de bestämmande faktorerna för de globala läkemedelsföretagens kapitalstrukturer med tre signifikanta resultat jämfört med pecking order som förutser ett korrekt resultat.

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1. Introduction

The background of capital structure theory and the pharmaceutical industry is presented. This is followed by a discussion about the problems uniting these two fields, leading to the purpose of this study and the research questions the authors answer. Then, the limitations and the scope of the study is presented, followed by a presentation of the outline of the paper.

1.1 Background

A company's choice of capital structure is one of the most important decisions that the management of a company has to make (Berk & DeMarzo, 2017) and it is also a topic within academic corporate finance that has been debated heavily for over 70 years (Walter, 1989). Generally speaking, the cost of capital is higher for equity than for debt but this is offset by the fact that increasing the leverage increases the risk, thereby making the equity holders expect a higher return to compensate for this (Berk & DeMarzo, 2017).

The foundation of modern theory of capital structure consists of Miller and Modigliani's (1958) theory suggesting that, in a perfect market, the choice of capital structure does not affect the value of a company. This theory has later been revised by the authors themselves (Miller & Modigliani, 1958) and to a certain extent replaced by other theories such as the trade-off theory (Kraus & Litzenberger, 1973) and the pecking order theory (Myers & Majluf, 1984). The former theory shows that there are tax benefits and bankruptcy costs to debt, while the latter claims that there is no perfect mix of capital but rather that the sources of financing are chosen in a certain pecking order.

Building on these theories, the authors have noted that the cost of capital for a company is hard to define when the yields from assets are uncertain (Miller & Modigliani, 1958). This could be considered particularly relevant for pharmaceutical companies who make assumptions about their assets, ranging from projected sales curves to study costs and risk assessments.

It is not just the importance of intangible assets that set the pharmaceutical industry apart from other industries. Due to the risks associated with developing drugs, diversification is critical as a risk mitigation tactic (Bogdan & Villiger, 2010). The risk mitigation and the effect on the capital structure is, however, dependent on what type of diversification the company is engaged in (La Rocca, La Rocca, Gerace & Smark, 2009). This can be shown by the example of Valeant, who went from a debt to total asset ratio of around 45 percent in 2010 to a ratio of around 15 percent seven years later in 2017 (Valeant Pharmaceutical International, Inc., 2018), while pursuing a merger and acquisitions strategy that greatly diversified their product portfolio (Alsumidaie, 2014). This did not stop the eventual downfall of Valeant, which lost over 90 percent of the stock's value in just a year between 2015 and 2016 (Bloomberg, 2018). This example raises the question, not only of how different kinds of diversification affect risk, but also the influence that diversification and risk have on leverage in the pharmaceutical industry.

1.2 Problem Discussion

Global Pharmaceutical companies' costs and business models differ from regular companies. When developing a pharmaceutical drug, companies go through an extensive development process in order to take the product to the market, consisting of many obstacles along the way.

Moreover, intangible assets such as patents are synonymous with value generation for these companies. This raises the question if, the determinants of capital structure are the same for these companies as they are for other companies.

As shown by Baranes (2017), since 2002 American pharmaceutical companies have increased their ratio of intangible assets to productive capital and cash. According to Baranes this implies that pharmaceutical companies rely more heavily on rent-generating assets, rather than their productive capacity, to generate profits. In his article, Baranes shows that this has created a situation where the companies seek to "extract value, rather than create it" (Baranes, 2017, p.9).

During the same period, the financial leverage of pharmaceutical companies has also increased (Baranes, 2017), raising the question of how intangible assets affect the choice of capital structure. According to Long and Malitz (1983), an increase in intangible assets should lead to a decrease in debt capacity as it is harder for outsiders to judge the soundness of the investments, thereby creating a larger information asymmetry. Long and Malitz's theory has been confirmed by more recent empirical studies (Bolek & Lyroudi, 2015; Hall, 1992). A study by Graham, Leary and Roberts (2016), documenting an increase of the financial leverage for the unregulated sectors of American corporations, did not find that an explanation could be found in intangible assets, as these had in fact increased during the same period. A similar phenomenon seems to be at play in the pharmaceutical industry on a global level.

Previous studies have found that a firm's size, capital intensity, liquidity, cash flow coverage ratio and operating leverage are some of the determinants of capital structure for pharmaceutical companies (Bodla & Kaur, 2015; Sheluntcova, 2014; Zambuto, Billitteri & Nigro, 2011). Much of the research that the authors have been able to find has either been about companies in general, and not specifically the pharmaceutical industry, or about markets in specific regions. Therefore, the results are not necessarily valid for the global pharmaceutical market. Also, the previous research has not focused on industry-specific factors, such as intangible assets, diversification and corporate social responsibility, leaving an informational void that could explain, to a large degree, the choice of capital structure for the industry.

1.3 Purpose

The purpose of this study is to test established theories on capital structure determinants for the pharmaceutical industry and to discern the determinants of capital structure of this industry. This is done by obtaining empirical results from a regression analysis.

1.4 Research questions

- *What are the capital structure determinants for pharmaceutical companies?*
- *Which of the established capital structure theories applies best to the pharmaceutical companies?*

1.5 Limitations and scope

There are several kinds of debt, such as long-term debt, short term debt and convertible debt. An approach similar to, for example, that used by Titman and Wessels (1988), with six different dependent variables would render this paper more complex. Moreover, such a procedure with six

different dependent variables would be difficult considering (1) different theories are applied; (2) each dependent variable requires several econometrics tests, for instance in regard to normality and heteroscedasticity; and (3) inappropriate given the extent of this paper.

Another limitation is that tax shields as an explanatory variable has not been included. Titman and Wessels (1988) suggest that proxy variables such as depreciation over total assets do not fully describe the non-debt tax shield (Titman & Wessels, 1988). As this study examines debt in several different companies, and tax systems varies widely between countries (UHY International, n.d.), Moreover, the pecking order does not provide an explanation for this variable, making it unsuitable for theory comparisons.

Only settled and stable companies are creditworthy and can raise debt. Smaller and younger pharmaceutical companies are not eligible for debt as the risks from pharmaceutical projects are deemed too high. Additionally, private companies often lack the possibility of raising debt in the pharmaceutical industry and are consequently completely equity financed (Bogdan & Villiger, 2010). This has entailed a focus on listed and large pharmaceutical companies in developed countries.

1.6 Outline

Theoretical framework: The main theories of capital structure are presented, previous empirical research, regarding capital structure in general and for pharmaceutical companies, is discussed and the explanatory variables used in this study are described.

Methodology: The scientific approach of the study is discussed and followed by a discussion of the motivations for the decisions made in general, throughout the chapter. This includes motivations for the choice of theories and the sample selection. It also includes a discussion about the reliability and validity of the regression and how this has been tested.

Results: This chapter displays and discusses the results of the statistical test in the regressions diagnostics and presents the final regressional output of the study.

Analysis: The results are analyzed according to the theoretical framework and compared to previous research. The special case of the pharmaceutical industry is also discussed, with possible industry-related explanations.

Concluding remarks: The research questions are answered in the conclusion. A broader discussion of the importance of the findings is held, the authors' reflections on the study are presented and topics for further research is suggested.

2. Theoretical framework

This chapter starts out with discussing the three main theories trying to explain capital structure decisions. Previous empirical research is then presented, both for companies in general and studies focusing specifically on the capital structure determinants of pharmaceutical companies. Lastly, the dependent variable is presented along with industry-specific explanatory variables and previously used explanatory variables also used in this study.

2.1 Capital structure theories

The first modern theory explaining capital structure was created by Miller and Modigliani over 60 years ago (Harris & Raviv, 1991). According to Miller and Modigliani's two propositions, the market value of a company is derived from the cash flows that will be generated independently of the capital structure; the cost of capital for levered equity increases when the debt ratio increases (Berk & DeMarzo, 2017). However, this theory assumes that there is a perfect market with, for example, no transaction costs and no taxes, while also assuming a firm's finance decisions do not reveal new information to the market.

The theory is hard to disprove as there are many factors driving debt and company value but since there does exist empirical evidence showing a relationship between leverage and several variables, it does not seem to be describing how the actual financial decisions are made and the model is simply not realistic (Brealey, Myers & Allen, 2011; Frank & Goyal, 2008). To mitigate this, the trade-off theory, built upon Miller and Modigliani's theory, has been introduced, which adds considerations of tax benefits and financial distress costs. The same year, the pecking order theory was proposed, which provides a completely different explanation of capital structure choices and tries to replace the two previous theories.

2.1.1 The trade-off theory

The trade-off theory suggests that decisions about the debt to equity ratio are a trade-off between the benefits of interest tax shields and the costs of potential bankruptcy. According to the trade-off theory, "the total value of a levered firm equals the value of the firm without leverage plus the present value of the tax savings from debt, less the present value of financial distress costs" (Berk & DeMarzo, 2017, p.594). This means that companies have an incentive to increase debt as they receive tax benefits from debt. However, if they add too much leverage, the risk of bankruptcy is increased (Brealey, Myers & Allen, 2011). However, according to Frank and Goyal (2009), it is a well-known fact that tax effects are relatively hard to clearly identify, while adding that they matter to some extent.

One assumption is that the marginal benefit of additional debt declines in accordance with the debt level. There is a theoretically optimal leverage ratio, also known as the target leverage ratio, where the benefits of the tax advantages are just slightly higher than the costs of possible financial distress, as displayed in the figure.

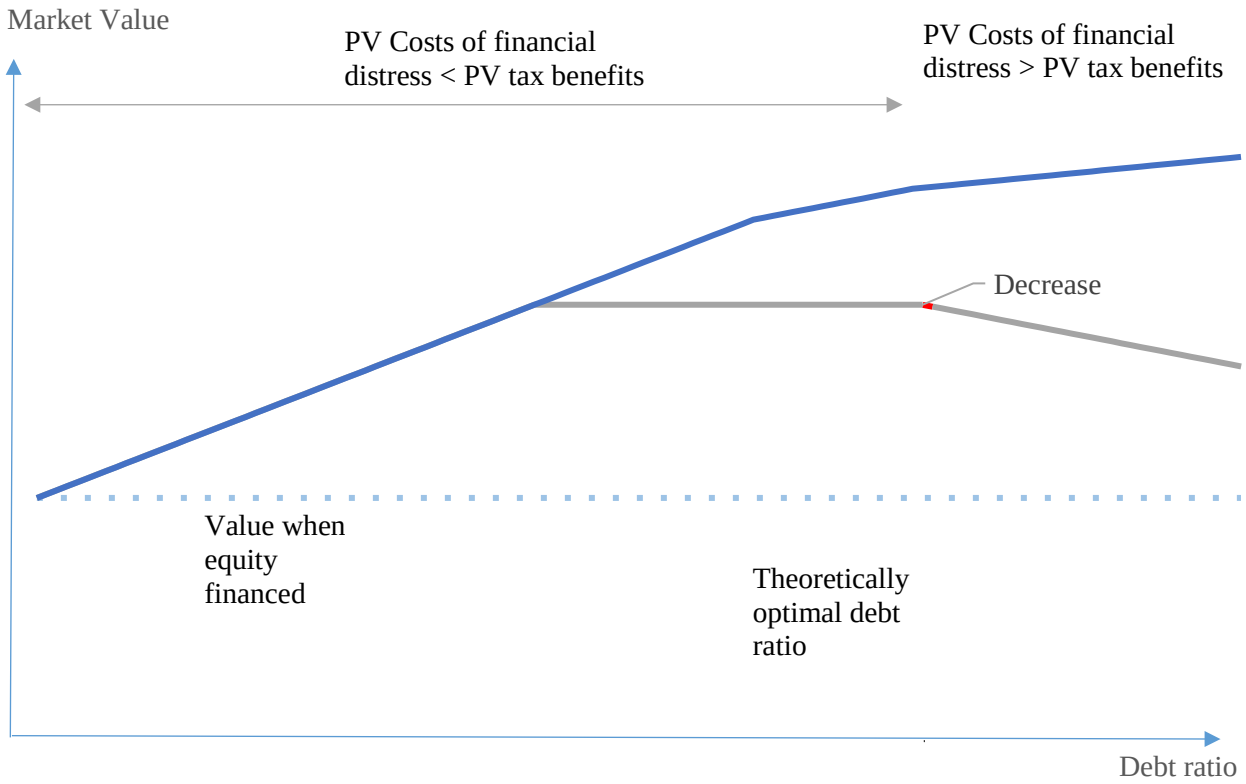


Figure 1: Optimal debt ratio according to trade-off theory (Brealey, Myers and Allen, 1984).

There are three main variables deciding the present value of financial distress costs: (1) the probability of distress; (2) the size of the costs, if the company were to fall into financial distress; and (3) the relevant discount rate to use for the costs (Berk & DeMarzo, 2017).

The probability of distress depends on the company's ability to meet its debt obligations. This probability decreases the higher the debt ratio of the company is and the higher the volatility of the company's asset valuations and cash flows are. The size of the costs depends on direct costs of bankruptcy, such as legal and administrative costs and indirect costs of financial distress, such as loss of customers, suppliers and employees. These costs also vary between industries, due to how they are structured. The discount rate depends on the company's market risk.

Some empirical findings do confirm the theory while others contradict it. The theory successfully predicts that high-tech growth companies, with large proportions of risky and intangible assets, do not have much debt, while companies in sectors such as the airline industry can be highly leveraged, since their assets are tangible and generally safe (Brealey, Myers & Allen, 2011). Another major failing of the theory is that the most profitable companies actually have lower debt ratios, despite the theory's prediction that these companies would borrow more, since they have a higher debt servicing capacity and more taxable income in need of being shielded (Brealey, Myers & Allen, 2011). This is a conundrum that the pecking order theory solves.

2.1.2 The pecking order theory

A more recent and less idealistic theory that has been proposed is the pecking order theory. The pecking order suggests that the choice of capital structure is not dependent on a certain target mix of debt and equity as the trade-off theory does. Instead, the sources of capital are graded relative to each other and when the preferred choice of capital is depleted, the second-best choice is used and so on (Brealey, Myers & Allen, 2011).

Evidence from Brealey, Myers and Allen (2011) imply that companies prefer to raise capital from operational earnings, followed by debt and ultimately new equity issues. Issuing debt is preferable to equity when the information asymmetry between stock holders and the company firm is high. If managers are better informed than investors then, assuming both parties are rational, companies will prefer to issue debt.

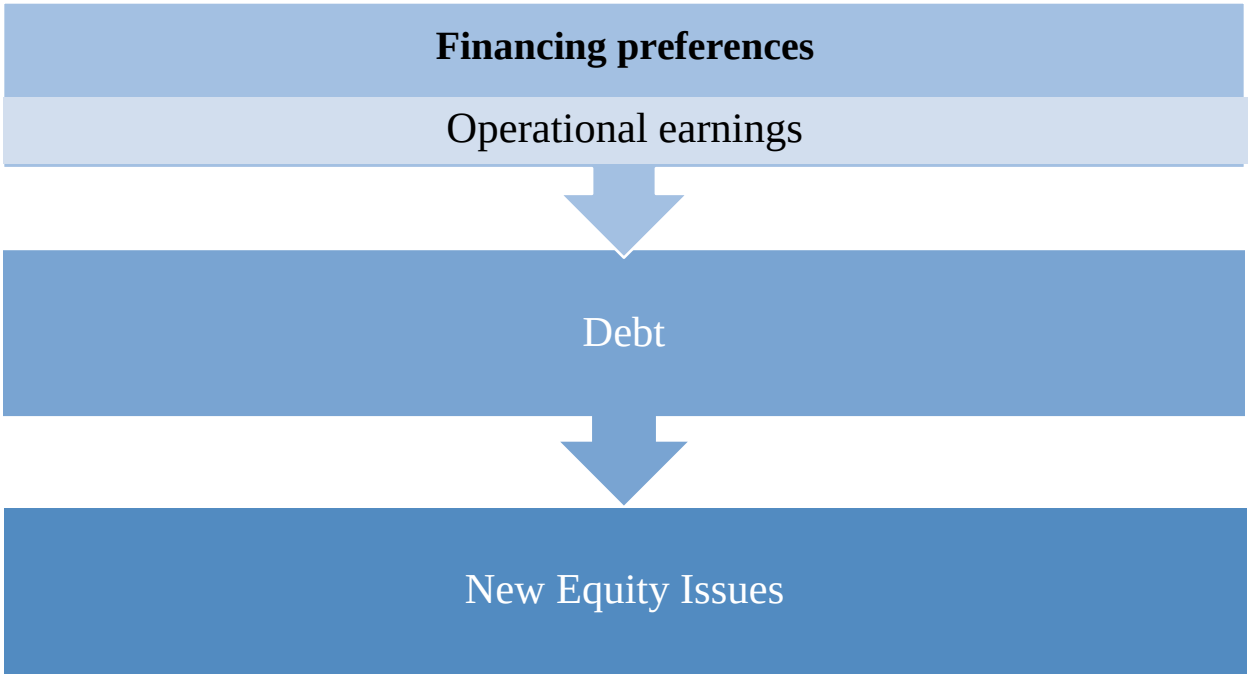


Figure 2: Financing preferences according to the pecking order theory (Brealey, Myers & Allen, 2011).

The main points of the pecking order according to Brealey, Myers & Allen (2011) are (1) firms prefer internal finance; (2) they adapt their target dividend payout ratios to their investment opportunities; (3) rigid dividend policies and fluctuations in earnings and investments may result in the generated cash flow exceeding the capital expenditures occasionally, and (4) If external finance is required, firms issue the safest security first. That is, they start with operational earnings, then debt, then equity as a last resort (Brealey, Myers & Allen, 2011).

Information asymmetry is a crucial part of the theory, as financing aims to mitigate problems created by differences in information between company managers and outside investors (Myers, 2003). According to Myers and Majluf (1984), in theory, the management of a company knows more about the value of the company than the investors do, which results in information asymmetry. In regard to pharmaceutical companies, managers are generally considered to know

more about the products under development, their likelihood of success and marketing prospects (Aboody & Lev, 2000).

Information asymmetry can result in adverse selection costs. For example, when a company issues equity, investors will demand a discount if there is information asymmetry present and they consequently are unable to accurately determining the value of the equity they would buy (Bharath, Pasquariella & Wu, 2006).

However, all corporate investments create information asymmetries. The extent of information asymmetry associated with R&D is larger than that associated with tangible assets and financial investments because of the relative uniqueness of R&D. For instance, a clinical trial for a certain drug is a unique event not shared with any other pharmaceutical companies (Aboody & Lev, 2000). Naturally, a firm is likely to promote information asymmetry or secrecy because if information is provided to outside investors, it may be expose company secrets to competitors (Bhattacharya & Ritter, 1983).

The asymmetric information can also be a result of the investors' limited ability to comprehend the valuation of the pharmaceutical company. Because of the relatively complicated process of R&D and product development, it is difficult for investors to understand the value of the firm's R&D, and therefore the company value (Aboody & Lev, 2000).

Investors may also be overwhelmed by the large amount of R&D information, so that selecting relevant information can become exhaustive. As a result, some investors may overestimate the long-term benefit of R&D due to the wide coverage of the successes of certain drugs in combination with systematic marketing efforts, while the development failures are less pronounced (Efrata, 2008).

2.2 Previous empirical research

2.2.1 Companies in general

2.2.1.1 The Determinants of Capital Structure Choice - Titman and Wessels

In the past, a lot of research has been conducted on the determinants of capital structure. One of the most cited sources is Titman and Wessels' (1988) article in The Journal of Finance. The authors of this paper perceived it to be highly relevant, despite it being published in 1988, since it is both theoretical and empirical. Titman and Wessel (1988) say that they extend the range of determinants of capital structure, by examining theories empirically.

In their study, they conducted a regression panel data analysis between 1974 and 1982. According to Titman and Wessels (1988) there are many factors that affect the capital structure, including asset structure, profitability and growth. They obtained a number of coefficients for the explanatory variables, either positive or negative, reflecting the relationship with the debt ratio.

Change in explanatory variable	Debt Change
Increased collateral assets...	Increased debt.
Increased Profitability...	Decreased debt.
Increased growth opportunities...	Decreased debt.
Increased uniqueness...	Possibly decreased debt.
Firms manufacturing machines and equipment...	Possibly less debt.
Increased volatility...	Increased debt.
Increased firm size...	Increased debt.
Increase in non-debt tax shields...	Decreased debt.

Table 1: Summary of parameter change and theoretical debt change according to Titman and Wessels (1988).

2.2.1.2 The Theory of Capital Structure - Harris and Raviv

Harris and Raviv (1991) gathered the theoretical and empirical research in this field up to that publication date and did not perform any empirical research on their own. They showed that the previous research had found that fixed assets are positively correlated with debt and research and development are negatively correlated with debt. Most studies also showed that profitability and size is negatively correlated with debt. The authors summarized the empirical findings for determinants of capital structure in a table, which is the main inspiration for conducting a summary of previous research, in terms of coefficient signs, for this paper (see appendix I).

2.2.1.3 Effect of diversification on capital structure – La Rocca et al.

Diversification has been an important topic in management for 60 years (La Rocca et al., 2009). Due to the co-insurance effect, firms with diversified business interest are able to increase their leverage (Kim & McConnel, 1977). The co-insurance effect is simply the realization that operating risk is reduced when a company is diversified, as the correlation between different cash flows is lower than for a specialized business. This enables the company to increase their leverage as the risk of default is decreased (Lewellen, 1971). Others argue that diversified companies should have a higher debt ratio since diversification, combined with a low debt ratio, increases the risk for overinvestments (Li & Li, 1996). Both arguments lead to the conclusion that diversification should be positively correlated with debt.

There are, however, two different types of diversification: related and unrelated (La Rocca et al., 2009). Related diversification refers to operational synergies based on sharing skills connected to tangible and intangible assets while unrelated diversification refers to financial synergies, such as benefitting from an internal labor market, internal capital market, reduce risk and acquire tax benefits.

The paper of La Rocca et al. (2009) concludes that diversification does affect capital structure choices but adds that diversified companies should not be viewed as homogeneous. What

financial decisions companies will make, depend on whether the diversification is related or unrelated and how diverse their product mix is. The study found, similarly to previous studies, that companies with diverse product mixes are more likely to have higher debt ratios. However, the findings also show that it is important to differentiate between the scope of diversification and differences between related and unrelated diversification, as companies with related diversification have less leverage than firms that are specialized, while companies with unrelated diversification have more leverage. These findings indicate that companies engaged in unrelated business ventures increases their leverage to benefit from tax deductions and co-insurance effects.

2.2.2 Pharmaceutical companies

2.2.2.1 Determinants of Capital Structure – A study of selected Pharma Companies

Bodla and Kaur's (2015) paper is one of few that have examined capital structure determinants for listed pharmaceutical companies. The study revolves around listed Indian pharmaceutical companies in the time period 1999 to 2013. Even though India is an emerging market, according to the International Monetary Fund (2015), the study is interesting as the authors perceive the average company size in the sample to be high, from their perspective, as well as including only listed companies. The paper is deemed relevant, based on these two characteristics.

The study reports that several explanatory variables have an effect on the capital structure on a significant level, including size.

2.2.2.2 Capital Structure of Private Pharmaceutical Companies in Russia – M. Sheluntcova

Sheluntcova´s (2014) study is interesting as it relates to the same industry the authors of this study are researching, along with the same theoretical framework based on pecking order and trade-off theory. Sheluntcova (2014) showed that assets' structure, firm's size, profitability and short-term liquidity are negatively correlated to debt to total assets ratio for private Russian pharmaceutical companies. The sample consisted of 144 companies that were examined from 2006 to 2011 (Sheluntcova, 2014).

However, caution should be used when drawing general conclusions since the study analyzed companies that are privately owned, in an emerging market with mostly smaller pharmaceutical companies. For instance, companies from emerging markets use less debt in general than companies from developed countries (Glen & Singh, 2004). Sheluntcova's (2014) study was also conducted during the global financial crisis, which made the companies more risk-averse than they had been previously. This paper limits that problem by selecting a time period after the crisis. The findings are interesting as the size of the firm influences the capital structure on a significant level. The size of the firm is negatively related to the leverage ratio, and the author concludes that the result is consistent with the pecking order theory. Furthermore, the author concluded that the higher the profitability, the less leverage. This is also in line with the pecking order theory.

2.2.2.3 Capital structure decisions in the biopharmaceutical industry

Zambuto, Billitteri and Nigro (2011) discuss the capital structure problem but explain the drivers of capital structure decision for the listed biotechnology industry in the OECD country Italy. One

of the most relevant findings of the study is that the variable profitability is negatively correlated to debt, which is consistent with the pecking order theory and previous research (Brealey, Myers & Allen, 2011). The study also showed that there was a positive correlation between firm size and leverage. As the study relates to biotechnology companies, it is interesting to see that the results are similar to the pharma specific papers, suggesting less sector-specific differences.

2.2.3 Summary of previous research

According to Frank and Goyal (2009), advocates of the trade-off and the pecking order theories frequently refer to empirical evidence to support their theory, such as Harris and Raviv (1991) or Titman and Wessels (1988). Frank and Goyal (2009) assess that these two papers disagree over facts in regard to which explanatory variables have explained leverage on a significant level in the past, which is considered an empirical problem.

Consequently, a research study specific to this paper was deemed necessary in order to provide the reader a picture over relevant research that has been conducted in the past (see appendix I). The coefficient sign is of particular importance in capital structure determinant papers, as it shows the relation between debt ratio and an explanatory variable. From extracting the significant coefficients, it is noted that no explanatory variable related to this paper shows 50 percent positive coefficients and 50 percent negative coefficients, as displayed in appendix I. Thus, there exists skewness to some direction.

2.3 Dependent variable

The dependent variable used to describe the capital structure is total debt in relation to total capital. The book value of total assets is used rather than the market value. Titman and Wessels (1988) speculate that market value data is preferable but note that because of the high cross correlation between the market value and the book value, it does not make a significant difference. Moreover, calculating unlevered betas and unlevered volatilities requires accurate-measurements of the market value of the firm's debt ratio, complicated by the fact that it evolves over time as well as the existence of the tax gain to leverage. The potential for spurious correlation arises if the impact of leverage and taxes is not completely purged from these volatility estimates.

The general book debt to capital ratio for pharmaceutical companies is around 41 percent today, which is low compared to the average for all industries of 63 percent (Damodaran, 2018). This is a characteristic that the pharmaceutical industry has in common with other industries with a lot of R&D, resulting in higher volatility in cash flows (Asquith & Weiss, 2016).

2.4 Explanatory variables

2.4.1 Industry-specific explanatory variables

Apart from the variables used in prior research, a few new additional explanatory variables have been added regarding diversification, asset structure and ESG, which are deemed relevant for pharmaceutical companies.

2.4.1.1 Diversification

According to Biotechnology Innovation Organization (2016), only 9.6 percent of all pharmaceutical projects in the first clinical phase go all the way to the market. Either the outcome is a complete success, or a complete failure (Bogdan & Villiger, 2010). Diversification in the form of additional pharmaceutical products can greatly lower the aggregated risk of failure. Bogdan and Villager (2010) conclude that diversification not only reduces the downside risk of complete failure, but also makes the outcome more predictable. The authors assess that the diversification between projects leads to a reduced risk profile for the company. Similar to Bogdan and Villiger (2010), using a scenario comparison with the success rate mentioned above of 9.6 percent for pharmaceutical products, the positive benefit of diversification can be easily illustrated.

Number of pharmaceutical products	Risk of failure for all pharmaceutical products
1	(1-0.096)^1=0.904
2	(1-0.096)^2=0.817
3	(1-0.96)^3=0.739

Table 2: By increasing number of pharmaceutical projects from one to three, the company can reduce the risk of total pharmaceutical failure with 16.5 percentage points (0.904-0.739).

In this paper, diversification regarding products and geographical sales in relation to total sales are studied. On a sales level, once a pharmaceutical drug is successfully ready for market launch, sales is generated for around ten years until the patent protection expires. When it expires, market competitors will create generic copies of the drug, which reduces the sales volume and profit (Brealey, Myers & Allen, 2011).

As diversification increases the stability of cash flows, this will decrease the risk of financial distress (Kim & McConnel, 1977). It is therefore the authors conclusion that the trade-off theory predicts a positive correlation between diversification and leverage. Since the pecking order assumes that financing with retained earnings is preferred to debt financing, the increased stability of cash flows will decrease the risk of having to turn to debt and it can therefore be expected that the pecking order predicts a negative correlation between diversification and leverage.

As La Rocca et al. (2009) concluded, companies with diverse product sales are likelier to have higher debt ratios. A low ratio between the largest product segment sales and total sales would indicate that they are well diversified with many revenue streams, while a larger ratio would indicate that they are less diversified with fewer revenue streams. The proxy measurement is therefore lack of diversification, when compared to the debt ratio.

La Rocca et al. (2009) mentioned geographical diversification as a suggestion for further research. Another explanatory variable regarding geographical diversification is therefore included in the paper, measured as foreign sales as a percentage of total sales. The idea is that if foreign sales make up for a larger portion of the total sales than domestic sales, the company has diversified revenue streams.

Choice of variable	Value range	Effect on leverage, according to trade-off theory*	Effect on leverage, according to pecking order theory*
Largest product segment sales to total sales	$0 \leq x \leq 1$	(-)	(+)
Foreign sales to total sales	$0 \leq x \leq 1$	(+)	(-)

*: The authors' conclusions.

2.4.1.2 ESG - Corporate social responsibility

Corporate social responsibility (CSR) is becoming an increasingly important dimension in the corporate landscape (Salton & Jones, 2015). For pharmaceuticals there are a variety of global issues, including ethics of clinical trials in developing countries, misleading drug marketing, access to medicines and combining profitability with patient safety (Reprisk, 2016). Global pharmaceutical companies engage in CSR activities, including donations, differential pricing for resource poor countries and health issue awareness campaigns (Droppert & Bennet, 2015).

One of the widely recognized measures to proxy CSR is the Environmental, Social, and Governance (ESG) score (Han, Kim & Yu, 2016). The database Asset4 from Thomson Reuters (n.d.) provides this information based on 250 performance indicators and 750 individual data points, suggesting enough variation to be different across companies and therefore relevant as a proxy variable. A total ESG score was deemed as an appropriate measurement of ESG, where a high score indicates good ESG practices while a lower one indicates worse practices. The ESG score is not available for all companies which results in substantially fewer observations, but in return contributes a value-adding variable for the paper.

Yang, He, Zhu and Li (2017) argue that because corporate social responsibility is viewed as incremental information for stakeholders, especially creditors, information transparency can mitigate the information asymmetric between managements and creditors. The inclusion of CSR improves the transparency of nonfinancial statements (Menz, 2010), thus directly reducing information asymmetry between firms and creditors.

According to the pecking order theory, when information asymmetries are lowered, the risk of adverse selection costs decreases, and the company will have less motives to finance their investments with debt (Harris & Raviv, 1991). The findings of Yang et al. (2017) therefore lead the authors of this paper to the conclusion that, according to the pecking order theory, there should be a negative correlation between CSR and the debt ratio.
Other studies have shown that there is a negative correlation between bankruptcy risks and CSR (Ahn & Park, 2016; Al-Hadi, Chatterjee, Yaftian, Taylor & Hasan, 2017; Chang, Yan & Chou, 2013). Orlitzky, Schmidt and Rynes (2003) also showed in a meta-analysis of 52 studies with a total of 33 878 observations that there is a positive correlation between profitability and CSR.

Since then, others have found similar results (Mánescu, 2010), even though the results seem to differ from industry to industry (Baron, Harjoto & Jo, 2011).

One should be careful in assuming a particular order of causality however, as the causality might be the reverse. For example, if companies in financial distress cut down on non-core expenses such as CSR first, struggling companies will have a low ESG score because of their financial issues. They will therefore not have financial issues due to their ESG score, indicating a potential causality problem.

As shown by Attig, Ghoul and Guedhami (2013) however, the credit ratings of firms seem to support the conclusion that CSR is related to financial health, as firms with high social performance routinely are rewarded higher ratings than firms with lower social performance, increasing their capacity to increase debt. Because of this, the authors of this paper have drawn the conclusion that, according to the trade-off theory, there should be a positive relation between CSR and debt. This is because a lessened risk of bankruptcy would lower the potential financial distress costs, which in turn would enable the company to borrow more to maximize the benefits from tax shields (Myers & Majluf, 1988).

Choice of variable	Value range	Effect on leverage, according to trade-off theory*	Effect on leverage, according to pecking order theory*
ESG score	$0 \leq x \leq 1$	(+)	(-)

*: Conclusions from the theories and empirical findings.

2.4.1.3 Intangible assets

The amount of tangible assets has been an explanatory variable in several capital structure papers, however, intangible assets have been noted less frequently. Among intangible assets there is a variety of different items, including intellectual property, goodwill and development costs. Intellectual property in particular, such as patents, represents the major source of value for the pharmaceutical industry (Bogdan & Villiger, 2010).

Furthermore, Loumioti (2012) reports that lenders accept intangible assets as collateral because they have found innovative ways of leveraging, financing, and valuing them. Using intangible property as collateral has become increasingly more common, which was a lending practice unheard of only a few years ago (Kim, 2016).

However, valuing the balance sheet item patents in the pharmaceutical industry is difficult, seeing as it occurs in an early stage for these companies. Companies do not even know if the patent will be used or not. Patent valuation is therefore subject to a high degree of uncertainty (Bogdan & Villiger, 2010). Previous research suggests a wide range of issues limits the applicability of patent-backed securitizations (Fishman, 2003; Throckmorton, 2004; Watanabe, 2004).

According to Odasso and Ughetto (2011), there are a wide variety of factors influencing the success of a pharmaceutical patent-backed securitization, including factors related to the patent, the drug development and the market potential. In line with previous research they conclude that PBS are (1) complex instruments of financial engineering with high structuring costs; and (2) associated with valuation difficulties as there is no generally accepted methodologies for the valuation of Intellectual property.

Since intangible assets are riskier and associated with assumptions and therefore lose most of their value in case of liquidation, the trade-off theory suggests that intangible assets are negatively correlated with debt (Myers, 2001). On the other hand, the pecking order suggests a positive correlation between intangible assets and debt ratio. Intangible assets are associated with more information asymmetry than tangible assets (Alves & Martins, 2014), and according to the pecking order theory, more information asymmetry causes adverse selection costs. This means that investors will demand a discount when buying equity in the company, increasing the attractiveness of debt.

Lim, Macias and Moeller (2014) provide a different explain to why intangible assets are correlated positively with debt. They argue that intangible assets can generate cash and therefore are well-suited to support debt increases. They noted in their work on intangible assets as a capital structure determinant that the assets were positively correlated with debt. Intangible assets had the strongest effect on leverage in technology firms and in firms with low tangible asset intensity, which might suggest pharmaceutical companies.

Choice of variable	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
Intangible assets to total assets	$0 \leq x \leq 1$	-	+

2.4.2 Previously significant explanatory variables

Studies have been conducted in the past with the same research question, namely to identify capital structure determinants. Some have been general in character while others have been industry-specific or country-specific. The industry-specific research papers have incorporated variables proven to be significant in previous papers from researchers within the capital structure area. In similar fashion, explanatory variables have been used in accordance with capital structure theory, in addition to the aforementioned added variables with connection to the pharmaceutical industry.

2.4.2.1 Dividend

If a firm pays out larger dividends, the probability of financial distress will increase, which will then lower the optimal debt level. The trade-off theory predicts a negative relation between dividend and debt (Frank & Goyal, 2003).

According to pecking order theory, firms prefer debt when retained earnings are insufficient (Brealey, Myers & Allen, 2011). Seeing as dividend payments are a reduction of the earnings in the company, it will therefore increase the need for debt financing. According to Bhaduri (2002), dividends could also have a positive signal value for the financial health of the company. Therefore, a positive correlation is to be expected between dividends and debt according to the pecking order theory as well.

From a pharma perspective, if the company does not have growth opportunities or if they believe they have enough cash, they can afford to pay out dividends or buy back shares. However, these two measures usually signal that the company lacks alternative growth investments (Bogdan & Villager, 2010). Larger profitable pharmaceutical companies can, however, use retained earnings to finance operations while paying out dividends, which still makes the theories relevant for pharmaceutical companies.

Choice of variable	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
Dividend Pay out ratio	$0 \leq x < \infty$	-	+

2.4.2.2 Growth

According to Titman and Wessels (1988) high R&D is synonymous with growth opportunities. This is particularly true for the pharmaceutical industry - companies have to invest heavily in research in order to take the drug to the market. The R&D cost of bringing a new drug to market has been estimated to 800 million USD (Brealey, Myers & Allen, 2011). R&D expenditures to sales is used as a proxy for measuring R&D intensity (Bah & Dumontier, 2001).

Different theories give different explanations for why this ratio is important in determining the capital structure of companies. The trade-off theory predicts that growth companies can be expected to borrow less, due to the risk of financial distress costs (Brealey, Myers & Allen, 2010), as the loss of market value during financial problems are greater for growth companies (Myers, 1977). The pecking order theory however, predicts that companies with more investments will, if profitability is fixed, accumulate more debt, as the internal funds will be constant, while the expenditures will be higher (Frank & Goyal, 2008).

Choice of variables	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
R&D to sales	$0 \leq x < \infty$	-	+

2.4.2.3 Liquidity

The pecking order theory suggests that firms with high liquidity will borrow less (Myers, 1984). Thus, a negative relationship between liquidity and leverage is expected. On the other hand,

Degryse, De Goeij and Kappert (2009) observe that the higher the liquidity of the company, the higher the chance to raise debt since creditors assume that their potential bankruptcy costs are low. Because of this, they conclude that the trade-off theory predicts a positive correlation between liquidity and debt. Other researchers, such as Jensen (1986), also suggest that companies possessing higher liquidity, in the form of current assets, also have more leverage.

Cash in a pharmaceutical company might not be worth the same as in the owners' own hands, since it might be invested in projects and investments that the investor finds unattractive. For these reasons the cash of a company is often only accounted for in a valuation with a certain discount (Bogdan & Villiger, 2010). This obviously could affect the choice between equity and debt, if public capital markets have lower preference for liquidity when it is possessed by more investment-heavy industries. One commonly used proxy variable for liquidity is current ratio.

Choice of variable	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
Current Ratio	$0 \leq x < \infty$	+	-

2.4.2.4 Profitability

Profitability measures for the firm, such as return on assets, are employed in several of the earlier cross-sectional studies. Results show that these profitability variables have been found to be strongly negatively related to leverage (Friend & Lang, 1998).

Kester (1986) mentions, in kind with Friend and Lang (1998), that profitability has been found to be a significant determinant of capital structure. In their own empirical paper, they defined profitability as something that influences the ability to service debt and funding of projects. Consequently, they chose an EBITDA variable divided by the total assets as their proxy which returns a return on assets ratio.

According to the pecking order theory, there is a negative relation between profitability and debt (Myers, 1984). This is because a profitable firm has cheaper ways of raising capital than to issue debt, and they will only use debt when they cannot use retained earnings. Given the supposition that companies generally make enough investments to keep up with the growth of the rest of the industry, the investment rates in the industry will converge (Brealey, Myers & Allen, 2011). As dividend rates are slow to change, the less profitable companies will be forced to increase their financial leverage.

The trade-off theory on the other hand predicts a positive relation between profitability and debt. According to Frank and Goyal (2009), a profitable firm can expect lower costs of financial distress and value tax shields higher than less profitable firms. This means that profitable firms have more debt.

Choice of variable	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
EBITDA to Total Assets (ROA)	$-\infty < x < \infty$	+	-

2.4.2.6 Risk

A firm's optimal debt level is described as a decreasing function of the volatility in earnings (Titman & Wessels, 1988). If the risk measurement variable increases, whether it is volatility in earnings or sales, then the optimal debt level should decrease. Friend and Lang (1988) used standard deviation of earnings before taxes as a proxy for risk. They deemed it was a better measure of management's non-diversifiable risk than the, at the time, customary beta, due to the fact that beta had been associated with spurious regressions. According to the authors, risk is assumed to have a negative impact on leverage. Simply put, they conclude that a risky firm borrows less. Moreover, they obtained significant statistical results for this explanatory variable on leverage. According to the pecking order theory, there is a negative relation between risk and debt (Schoubben & Van Hulle, 2004).

Risk could also be related to cost of financial distress. According to the trade-off theory, firms noting a higher risk of financial distress tend to borrow less than firms with a lower risk (Oolderink, 2013), suggesting a negative relation between debt and risk. That means that the pecking order theory and the trade-off theory are in agreement in terms of coefficient sign, which is unusual.

Using the standard deviation of earnings over a larger number of years than three could have given a more accurate measure of the risk. The low number may have been caused by the few years used. On the other hand, using more past years reduces the relevance as it is further from the present situation.

Choice of variable	Value range	Correlation with leverage, according to trade-off theory	Correlation with leverage, according to pecking order theory
Standard deviation of earnings, three years average	$0 \leq x < \infty$	-	-

2.4.2.7 Size

Leverage ratios have been suggested to be related to company size. The bankruptcy costs increase as a percentage of firm value when the firm value decreases, therefore large firms tend to be more diversified with less bankruptcy risk. Shortly put, large firms should have more leverage (Titman & Wessels, 1988). The notion that firm size is positively correlated with debt has been shown to hold true in other studies as well, such as Kester´s (1986).

The relation between size and debt, predicted by the pecking order theory, is that bigger size means lower debt. Larger firms are usually older, and older firms usually have lower debt, since they have had a longer time to save up earnings (Frank & Goyal, 2009).

The trade-off theory however, predicts that larger firms have higher debt than smaller firms (Frank & Goyal, 2009). This is because large firms have a lower risk and a better reputation, thus making it easier to increase the debt levels.

The natural logarithm of sales has been included frequently in similar capital structure papers in the past, especially in regard to pharmaceutical companies, where both Sheluntcova (2014) and Zambuto, Billitteri and Nigro (2011) obtained significant results for this measurement variable. Using the same proxy variable increases the comparability between the results, and it should be noted that alternative proxy variables, such as total assets, have yielded similar results in the past, due to a high correlation with total sales. Furthermore, according to Pandit (2015), it is conventional to measure the size based on revenue in dollars for pharmaceutical companies.

Choice of variable	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
Ln(Sales)	$0 \leq x \leq 1$	+	-

2.4.2.8 Tangibility

In capital structure theory it is argued that the type of assets affects the capital structure choice (Titman & Wessels, 1988). Issuing debt secured by assets with known values decreases the asymmetrical information between shareholders on one side, and company managers on the other. According to Titman and Wessels (1988), companies with assets that can be used as collateral may be expected to issue more debt to take advantage of the fact that there are less costs associated with the information asymmetry.

According to the pecking order theory, companies with a low ratio of tangible assets will suffer more from information asymmetries, since tangible assets are easier for outsiders to value. Due to this, they are expected to accumulate more debt over time. Therefore, the theory predicts a negative correlation between tangible assets and leverage (Harris & Raviv, 1991). This is due to the fact that companies with relatively small amounts of tangible assets, compared to firm value, suffer more from information asymmetries. For these companies, the problem of information asymmetry will be more prevalent and due to the adverse selection costs, they will borrow more.

Since tangible assets are safer and retain most of their value in case of liquidation, the trade-off theory predicts that tangible assets are positively correlated with debt (Myers, 2001).

Choice of variable	Value range	Effect on leverage, according to trade-off theory	Effect on leverage, according to pecking order theory
Fixed assets to total assets	$0 \leq x \leq 1$	+	-

Summary

Industry-specific variables

Proxy variable	Area	Regressional code name	Correlation, trade-off theory	Correlation, pecking order theory
Foreign sales/total sales	Diversification	GEOW	+	-
Largest product segment sales/total sales	Diversification	PRODW	-	+
ESG	CSR	ESGW	+	-
Intangible assets/total assets	Asset Structure	INTW	-	+

Previously significant explanatory variables

Payout ratio	Dividends	DIVW	-	+
R&D/sales	Growth	GROWTHW	-	+
Current ratio	Liquidity	LIQW	+	-
Operating income/total assets	Profitability	PROFITW	+	-
Standard deviation of earnings	Risk	RISKW	-	-
Natural log of sales	Size	SIZEW	+	-
Fixed assets/total assets	Tangibility	TANGW	+	-

Table 3: Summary of explanatory variables and predictions.

3. Methodology

The first part of this chapter describes the research approach used in this paper and a summary of the work process. Then, the selection of theories is explained, followed by the methods of selecting sample and time frame. After that, reliability and validity are described, including the econometric method and tests.

3.1 Scientific approach

A quantitative method was appropriate, considering the research question, which aims to statistically describe the nature of capital structure in this industry (Skärvad & Lundahl, 2016). The study follows a deductive approach, as the empirical comparison is based on existing theories. In order to understand what dependent variables to look for in addition to the theoretical framework behind them, literature reading was deemed essential. Literature included Miller and Mogliani, various works of Myers, critique against Miller and Mogliani, and papers on capital structure determinants, including various pharmaceutical papers on a global level. Additionally, a couple of books on pharmaceutical finance that were considered appropriate for the paper were researched. After studying previous research and relevant theories, the regression analysis was conducted and the results compared to what was expected and analyzed.

3.2 Choice of theories

One of the two main theories the authors have chosen as a theoretical framework is the pecking order theory. This is due to the fact that this theory has been proven, by Shyam-Sunder and Myers (1999), to show the best results at explaining the capital structure choices of large and mature companies with accessibility to public debt markets, such as the companies this study is examining. They showed that, for mature companies, the pecking order model has a much better time-series explanatory power than the trade-off model.

Initially the pecking order theory was deemed appropriate, as it incorporates information asymmetry. It was decided to include the trade-off theory, as it provides explanatory power in areas where the pecking order theory fails, while also sharing other predictions with the pecking order theory (Fama & French, 2002). As shown by Leary and Roberts (2009), even though the pecking order theory provides the strongest explanation of empirical capital structure choices, it is still relatively weak on its own and adding variables stemming from other theories such as the trade-off theory increases the accuracy of the analysis.

Miller and Modigliani's theory is mentioned, as it has been, and still is to a certain extent, the foundation of capital structure choice theory (Berk & DeMarzo, 2017). In particular, it has been the foundation for the trade-off theory and the authors found it necessary to provide at least a short summary of it, so that the reader can understand the context of the current competing theories.

The market timing theory has not been included as a separate theory as it is not a foundational theory in the field (Myers, 2003). As it focuses mainly on one variable, it does not provide a theoretical framework for analyzing the different variables affecting capital structure choices. Zwiebel's (1996) theory of managerial entrenchment was excluded as well as its variables, such as availability of good projects or age of managers, consists of data that is hard to find and goes

outside the scope of this study. By excluding this and other managerial theories, the paper follows a common procedure among studies of capital structure and a precedent set by Myers (1984).

3.3 Sample selection

de Jong, Kabir and Nguyen (2008) assess that a remarkable feature of most existing studies on international capital structure is the implicit assumption that firm-specific factors impact leverage equally in different countries (de Jong, Kabir & Nguyen, 2008). Evidence suggests that such factors as creditor right protection, bond market development, and GDP growth rate have a significant influence on capital structure. In their own study, they determined that there are country-specific factors with a sample of 42 countries, divided equally between developed and developing countries. With their study in mind, it was decided to use high-income OECD countries as basis for the sample, in hope of reducing the country-specific factors.

The Thomson Reuters index Global Pharma was used as the starting point for the sample collection process, which tracks the largest listed pharma-related companies globally. Thomson Reuters (n.d.) have over 30 years of experience from creating indices, and it is also the largest one available on Datastream in terms of number of companies. Biotechnology companies are included, as they share the same category in Datastream while also sharing a lot of characteristics. The business models for biotech companies is different but refer to smaller companies, not biopharmaceutical giants such as Amgen, Biogen and Shire. However, according to the latest edition of EvaluatePharma's (2017) World Preview, worldwide drug sales are forecasted to increase with an annual growth rate of 6.5 percent, while sales from biotechnology drugs will increase with a higher annual growth rate. Also, the biotechnology sector is considered the driver for new drug candidates while more traditional Pharma will develop, market and distribute these drugs (Allen & Jabado, n.d.). This indicates some degree of sector specific differences.

Companies in the index with a different subsector than pharmaceuticals and biotechnology such as medical technology have been manually removed as they do not conduct pharmaceutical research and is considered to be widely extremely (Medtech Europe, n.d.).

OECD countries contain a few outliers such as Turkey, Poland and Mexico, which are considered by the World Bank to be middle-income countries (World Bank Group, n.d.). For this reason, they have been removed from the sample, resulting in a smaller sample size. In return, the homogeneity of the sample has increased since all countries are considered high-income countries by The World Bank.

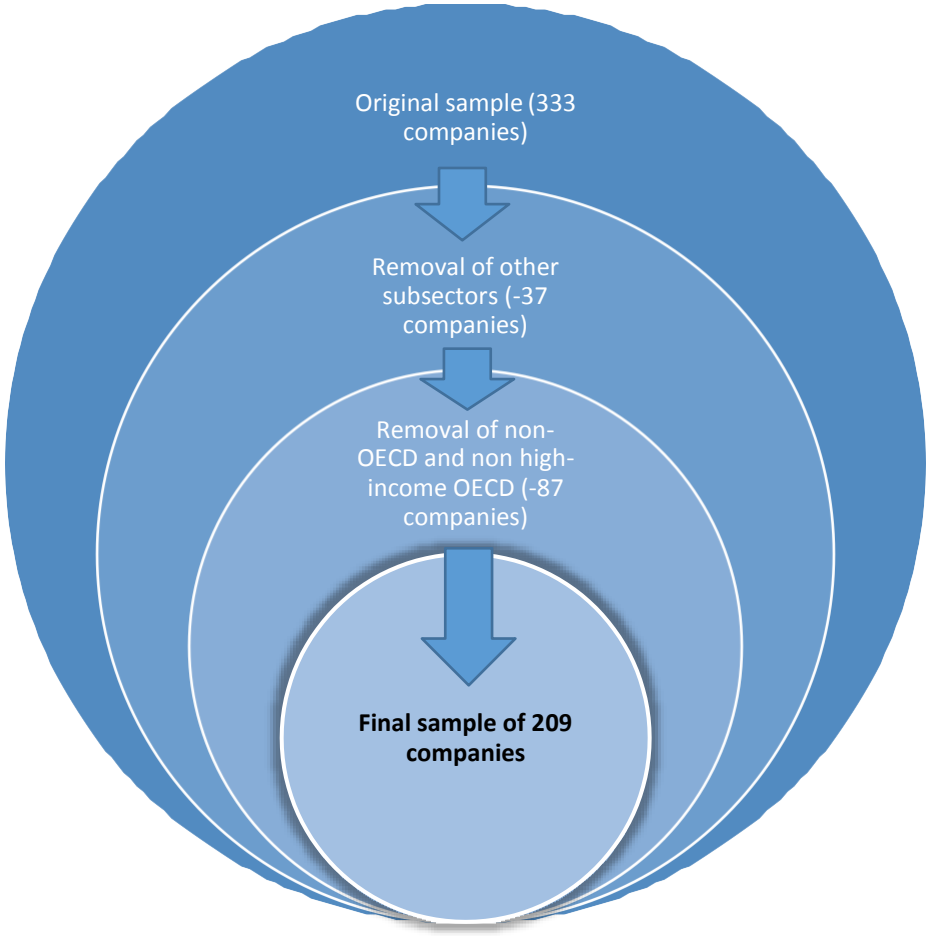


Figure 3: Sample selection process.

According to Keegan (2008), most of the pharmaceutical companies that are publicly traded have an existing track record and are substantially larger than an early-stage company in terms of revenue and asset size. Additionally, they are more diversified. This is different from smaller pharmaceutical companies, relying on new funding from shareholders and/or lenders (Bogdan & Villager, 2010). Furthermore, many smaller pharmaceutical companies have business models, in which they have no interest in taking a pharmaceutical project all the way to the market. Instead they sell the pharmaceutical project to a larger market player once it has achieved a desirable price tag or reached a certain development phase (Bogdan & Villager, 2010).

The sample in this paper is quite different from other capital structure determinant papers on pharmaceuticals with specific emerging markets as the sample base, as they revolve around smaller pharmaceutical companies with no country-specific variation. As the samples are different, it weakens the comparability of the results. On the other hand, having a unique sample of companies adds contribution value.

3.3.1 Time data

The Great Recession was a period of economic decline, related to the financial crisis of 2007-2008 and the US subprime crisis of 2007-2009 (United Nations, 2013). According to Behner,

Vallerien, Ehrhardt and Rollman (2011), the pharmaceutical sector is much less exposed to the economic crisis than others, due to its relatively inelastic demand. However, the same authors conclude that smaller players within the pharmaceutical industry, that lacked stable cash flows, experienced funding difficulties, which is relevant in the choice between debt and equity.

On a global level, the real GDP for OECD countries which is the basis for the sample declined between 2008 and 2009 (World Bank Group, n.d.). R&D expenditure in the pharmaceutical industry dropped in 2010 to a three year low of $68 billion, compared to a growth rate leading up to 2008 (Thomson Reuters, 2012), which suggests a pharma-specific consequence of the global economic downturn. Real GDP for OECD countries declined between 2008 and 2009. A time period excluding the effects of a global economic crisis was deemed appropriate in order to reduce outliers while using current data increases the relevancy of the paper.

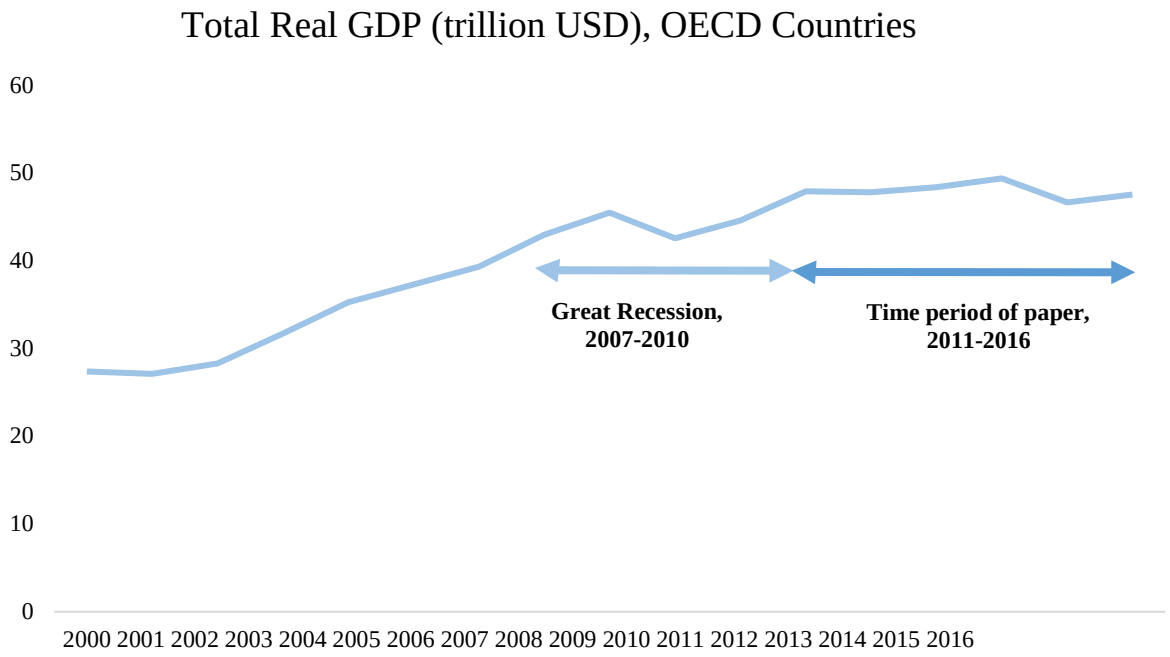


Figure 4: Total real GDP (trillion USD) for OECD countries (United Nations, 2013)

3.3.2 Country Selection

One key issue when using a sample with a global character is the existence of country-specific effects. Rajan and Zingales (1995) found that firm leverage is more similar than previously thought across some OECD countries, namely the G-7 countries United States, France, Germany, Italy, Japan, The United Kingdom and Canada. The differences that exist are not easily explained by institutional differences. The authors argue that the factors identified by previous cross-sectional studies in the United States related to leverage seem similarly related in other countries as well. Similarly, Kester (1986) found that there was no significant difference in capital structure between the US and Japan after controlling for different variables. The study results are relevant to this study as 49 percent of the sample have one of these two companies as country of domicile.

Another issue might be biases in the sample selection. Rajan and Zingales (1995) speculate that it is possible that country differences in leverage may be simply due to differences in the industry composition. This is essentially a non-factor in this research paper. Song (2004) suggests that most cross-sectional variations in the capital structure for OECD countries could be a consequence of sample bias on country level. The author mentions that most international databases usually contain more firms from the United States than other countries. Consequently, a visual representation of the sample on country level was considered appropriate which could reflect a potential country bias.

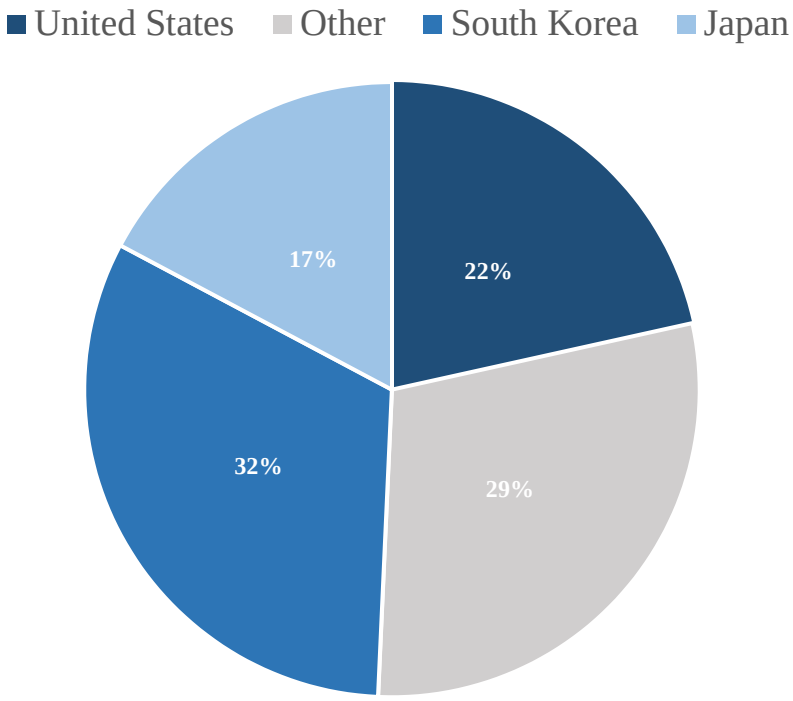


Figure 5: Country composition.

3.3.3 Outliers

In order to deal with variables that have extreme outliers, winsorization is an appropriate technique, seeing as it is common procedure (Yang et al, 2017; Lim, Macias & Moeller, 2014; Frank & Goyal, 2009). In this case, it is deemed more appropriate than trimming considering that the latter would result in a lower degree of freedom for the regression. With winsorization, the most extreme values are replaced with the most extreme value that has not been removed, in this case one percent. Seeing as there is no theoretical justification for choosing a certain winsorization threshold, a low threshold level of one percent was considered appropriate. Removing outlier observations will reduce standard errors, reduce the RSS, and therefore increase the R-squared. This is hard to combine with the idea that every data point represents useful information. Ultimately, outliers can have a serious effect on coefficient estimates which will weaken the inference of the regression model if not dealt with (Brooks, 2008).

3.4 Reliability and validity

This part will describe the concepts of reliability and validity, as well as the methods and tests used in this paper to achieve it.

3.4.1 Reliability

Reliability is the absence of random errors. According to Skärvad and Lundahl (2016), one feature of a study with high reliability is that the results do not depend on who conducts it and can therefore be replicated by others who follow the same set of procedures. In order to confirm that the result of the regression analysis would be the same regardless of program used, the same regression was conducted in both econometric programs EViews and Stata, resulting in a highly similar R-squared for the regression using the same regression estimation method.

Neither should the outcome of a research be circumstantial. Ensuring reliability is usually done by conducting the research in a standardized way. This aims to remove randomness as a factor (Skärvad & Lundahl, 2016). The data was collected from Datastream. Since it is a widely used and respected information provider, the authors believe that the data does not contain errors and that using a different source to collect data would yield a similar result. In order to avoid the impact of a single event and thereby raise the validity, a time period excluding the Great Recession was considered appropriate.

3.4.2 Validity

Validity is defined by Skärvad and Lundahl (2016) as the absence of systematic measurement errors. Having validity would mean that the method measures what it intends to measure. Several econometric tests have been performed related to several econometric practices, in order to ensure the non-existence of systematic measurement errors.

According to Hyndman (2010), regressional variations are natural when using different econometric programs, and even when using different versions of the same program. Even if EViews has been used for most tests and more importantly the final regression results, the name of the used econometric software is attached to each regression-related result to increase validity.

3.4.2.1 Panel data

Panel data consists of both time-series and cross-sectional data, which in this case is year and company variables. This increases the number of total observations and enables a lot of statistical advantages. One disadvantage with panel data is that trends and seasonal patterns may arise. The addition of period effects will create dummy variables for all time periods. This will increase the statistical inference of the explanatory variable, because trends in the data are taken into account (Wooldridge, 2012).

Data points are not always registered for some companies during specific years when dealing with uncommon company metrics, resulting in an unbalanced panel. Dealing with an unbalanced panel is similar to a balanced panel, since econometrics software makes adjustments to perform a balanced regression (Wooldridge, 2012). The main drawback is that EViews does not support a number of tests on unbalanced panel data, which has resulted in a parallel use of Stata, another econometric program.

3.4.2.2 Ordinary Least Squares

The regression analysis method of ordinary least squares (OLS) has been used. It attempts to calculate the unknown coefficients in the regression analysis. The OLS creates an equation where the dependent variable is a function of the independent variables, where the intercept and the coefficients of the dependent variables have values that minimize the residual sum squares (Wooldridge 2012).

For the OLS model to be unbiased and consistent estimates of coefficients, four assumptions need to be fulfilled (Wooldridge, 2012). These are known as the Gauss-Markov assumptions.

First OLS assumption (1): Linear in parameters

$\boldsymbol{\beta o, \beta 1\ and\ \beta k}$ are the unknown coefficients and u is an unobserved error term.

Second OLS assumption (2): Random Sampling

We have a random sample of n observations, $\{(\boldsymbol{x1, x2, \dots, xi, yi}): \boldsymbol{i = 1, 2, \dots, n}\}$ following the population model in Assumption MLR.1.

Third OLS assumption (3): No Perfect Collinearity

In the sample and therefore by estimation also in the population, none of the independent variables is constant, and there are no exact linear relationships among the independent variables.

Fourth OLS assumption (4): Zero Conditional Mean

The error u has an expected value of zero given any values of the independent variables.

$$\boldsymbol{E(u|x1, x2, \dots, xk) = 0}$$

Assumptions (1) -> (4) = Unbiasedness of OLS

The error has an expected value of zero.

$$\boldsymbol{E(\beta est) = Bi, i = 0, 1, \dots, k}$$

Assumptions (1) -> (4) = Consistency of OLS

The OLS estimator is consistent.

$$\boldsymbol{\beta est \rightarrow Bi\ as\ n \rightarrow \infty, i = 0, 1, \dots, k}$$

Woolridge (2012) Homoscedasticity is the fifth Gauss Markov assumption. Under homoscedasticity, the error term has the same variance given any values of the explanatory variables. It does not create biased or inconsistent coefficients but invalidates the OLS standard errors, rendering it an important econometric concept when performing regressions with OLS (Woolridge, 2012).

3.4.2.3 Coefficient of Determination

The coefficient of determination is R-squared since it is the most common goodness of fit statistic (Brooks, 2008). The paper contains an expressed focus on how new different variables affect the capital structure of pharmaceutical companies. However, a regression aiming to explain the capital structure as a result of only of variables relating to these new explanatory variables would likely result in a low coefficient of determination. Even if intangible assets, CSR and diversification may be capital structure determinants, they are not the only variables affecting the capital structure, as shown in previous research.

Using a regression analysis to explain a dependent variable with explanatory variables that are assumed to only explain a portion of the dependent variable, would render a low R^2 and consequently, a large error term. Because of this, the authors decided to also include explanatory variables from previous research. However, the goal of this paper is not to achieve a high R^2 at the expense of reduced empirical quality, but the authors do consider increasing it a highly relevant statistical goal for the paper, as it provides a broad indication of the fit of the model to the data (Brooks, 2008).

3.4.2.4. Test for Normality

One of the Gauss-Markov assumptions is normally distributed error terms. For panel data, it is relevant to test for non-normality in the residuals. Jarque Bera is a commonly used normality test, where the statistic has a $\chi 2$ distribution. If the residuals are normally distributed, the histogram should have a bell-shape while the Jarque Bera statistic should not be significant (Brooks, 2008).

Normality is outlined as the first test since it provides a visual representation of the residuals, making it an optimal tool for identifying statistical outliers or problems with the data. Because of this, normality has been treated more as a process, where data has been displayed before adjustments and post adjustments in order to reflect the changes that have been made to the data and therefore the normality of the residuals.

3.4.2.5 Test for Multicollinearity

When there is an exact relationship between two variables it is referred to as perfect multicollinearity. Another multicollinearity problem is near multicollinearity, which is much more likely to occur in practice. The consequence of near multicollinearity is a high R-squared. Moreover, the coefficients included in the regression will have high standard errors and will not be significant (Brooks, 2008).

Many econometricians argue that multicollinearity is more a data problem than with the model or estimation method (Brooks, 2008). Thus, testing for multicollinearity is second to normality since it is more related to the data.

Testing for multicollinearity is highly relevant for capital structure decisions, as one could have many different proxy variables that aim to measure the, which would yield a model suffering from multicollinearity. One way to deal with this is to assign only one proxy variable for a specific measurement area. For instance, regarding profitability, it has to be decided whether to

use earnings before depreciation or after depreciation as a metric of profitability, instead of including both.

Another aspect of multicollinearity is to understand the appropriateness of combining several variables from different research papers. For instance, one research paper used sales growth as a proxy for growth, while another research paper used the natural logarithm of sales as a size metric. Combining these two would result in a multicollinearity problem.

One way to avoid multicollinearity is to increase the sample, for example by using shorter intervals in the time series, e.g. using quarterly instead of yearly observations (Dougherty, 2011). However, this also has its drawbacks and may harm the quality of the regression. There may be less information available for more frequent observations, and according to Dougherty (2011) it may be less accurately measured than annual data, which results in a measurement error.

A correlation matrix is considered appropriate when testing for collinearity, providing a visual representation of multicollinearity in the model. According to Berry and Feldman (2008), multicollinearity is not a problem if no correlation between explanatory variables exceeds a certain percentage value, usually around 80 percent.

3.4.2.5 Test for Heteroscedasticity

After normality and multicollinearity, the tests after this point are more connected to the choice of estimation methods, rather than data adjustments. Heteroscedasticity is the word for when the variance of the errors in the regression analysis model are not constant (Wooldridge, 2012). A common test for heteroscedasticity is White's test for heteroscedasticity. This test function was not available for panel data. Because of this, a manual Breusch-Pagan-Godfrey test for heteroscedasticity was performed in EViews, in order to determine whether to use robust standard errors or normal OLS standard errors.

3.4.2.6 Test for Endogeneity

When the error term is correlated with an independent variable, the variable is referred to as endogenous. This is a violation of one of the Gaus-Markov assumptions, which if ignored will yield biased and inconsistent coefficients. To test for endogeneity, a Hausman test has been carried out. Rejecting the null in this test means that fixed effects should be used in order to adjust for endogenity, while not rejecting it suggests that random effects should be used (Wooldridge, 2012).

3.4.2.7 Test for Autocorrelation

When error terms are correlated across time periods, autocorrelation is said to be present. When the error terms are correlated over time, it is a case of serial autocorrelation, whereas when they are correlated cross-sectionally it is referred to as spatial autocorrelation (Brooks, 2008). The goal of performing tests for serial correlation and cross-sectional correlation respectively is to determine whether to use clustered robust standard errors instead of robust standard errors, as well as determining whether they should be serially or cross-sectionally robust. The choice of method has implications for the standard errors and therefore the regression results. It should be noted that traditional cluster-robust standard errors can only deal with only one dimension and

there is no simple and fast rule on how to deal with difficulties related to these issues (Cameron & Miller, 2015).

3.4.2.8 Test for Serial autocorrelation

A first step in testing whether the residual series from a regression model is autocorrelated is the Durbin-Watson test, which detects first order autocorrelation, AR(1). It was the first major test to be developed and popularized for autocorrelation (Dougherty, 2011).

The null hypothesis is that $p = 0$, while the Durbin Watson test statistic d is $2 - 2p$. P is assumed to have a value in the interval $-1 \leq p \leq 1$. Thus, when p is zero, the test statistic value is 2, suggesting no autocorrelation. If the test statistic value is lower than 2, positive autocorrelation is present. Consequently, values over two indicate negative autocorrelation.

3.4.2.9 Spatial autocorrelation

Autocorrelation may also be spatial in character, which means that for example regional dimensions are not captured by the model (Brooks, 2008). Baltagi, Feng and Kao (2012) suggest the Breusch-Pagan LM test when testing for cross-equation correlation. Pesaran (2004) proposes a scaled version of this LM test, suitable for heterogenous panel models. Regardless of the test outcome for heteroscedasticity, both can be used to determine whether spatial dependence exists.

The command xtcd2 in Stata is suitable as it works for unbalanced data, but with the null hypothesis that there is weak cross-sectional dependence in the regression model instead of none. According to Pesaran (2014), the null of weak cross-sectional dependence is more appropriate than the null of cross-sectional independence in the case of large panel data. Pesaran (2014) argues that weak cross-sectional error dependence does not pose serious estimation and inferential problems. In addition to this, cross-sectional dependence was tested for each variable in Stata with another test, in order to achieve a better understanding of the cross-sectional dependence on a variable level as it has choice of method has large implications for the regression results.

Summary tests		
Statistical problems	*Test*	*Result analysis*
Normality	Jarque-Bera	Determine normality or non-normality in the residuals
Multicollinearity	Correlation Matrix	Removal or change of potential variables that exceed 0.8
Heteroscedasticity	White's test	Determine homoscedastic or heteroscedastic residuals
Serial Correlation	Durbin-Watson	Determine if serial autocorrelation exists in order to optimize regression model
Spatial Correlation	Pesaran-test	Determine if spatial autocorrelation exists in order to optimize regression model

Table 4: Summary of tests.

4. Results

First, the data is explained with expressive statistics, pre and post outlier adjustments. After that, the results from aforementioned econometrics tests are discussed, as well as the implications for the regression model. The final regression output is presented in the last part of the chapter.

Expressive Statistics

As observed from the descriptive statistics below, the data in many cases contains a few outlier values. This is normal, considering the variables for growth, liquidity, and risk are continuous variables with a value target range between zero and infinity, while profit can assume all continuous values. Moreover, growth, liquidity and profitability are all ratios, which mean that if either the nominator or the denominator is an extreme value, it will affect the entire ratio. Risk on the other hand is not a ratio, but measures volatility in earnings, with an extremely high mean.

Prior to adjustment to outliers:

	MEAN	MEDIAN	MAXIMUM	MINIMUM	OBSERVATIONS
DEBTCAP	0.24	0.20	0.99	0.00	1134
GEO	0.30	0.13	1.00	0.00	1076
PROD	0.35	0.08	1.00	0.00	787
ESG	0.61	0.70	0.98	0.02	442
INT	0.20	0.09	0.86	0.00	1174
DIV	0.22	0.13	1.00	0.00	1054
GROWTH	2.89	0.11	760.50	0.00	1113
LIQ	4.26	2.39	426.88	0.06	1169
PROFIT	0.03	0.10	2.20	-8.89	1145
RISK	19.75	0.30	6599.72	0.00	1060
SIZE	5.52	5.55	7.87	1.15	1152
TANG	0.16	0.11	0.99	0.00	900

Table 5: Descriptive statistics before adjustments of outliers.

After winsorization on the one percent level for all variables, some means became much lower due to winsorized outliers, and in accordance with the method the number of observations remained the same (see appendix II).

	MEAN	MEDIAN	MAXIMUM	MINIMUM	OBSERVATIONS	NUMBER OF WINSORIZED VALUES
DEBTCAPW	0.24	0.20	0.86	0.00	1134	5
GEOW	0.30	0.13	1.00	0.00	1076	0
PRODW	0.35	0.08	1.00	0.00	787	0
ESGW	0.61	0.70	0.97	0.02	442	3
INTW	0.20	0.09	0.83	0.00	1174	5
DIVW	0.22	0.13	0.95	0.00	1054	5
GROWTHW	1.49	0.11	115.55	0.00	1113	10
LIQW	3.87	2.39	48.36	0.39	1169	10
PROFITW	0.04	0.10	0.60	-2.08	1145	10
RISKW	1.11	0.30	19.24	0.01	1060	10
SIZEW	5.53	5.55	7.83	2.00	1152	10
TANGW	0.16	0.11	0.94	0.00	900	8

Table 6: Descriptive statistics after adjustments of outliers.

4.1 Regression diagnostics

The residuals are not standard-distributed, which is in breach of the OLS assumption of normality. Consequently, the coefficient results from the regression could be wrong. However, according to Brooks (2008), sample sizes that are sufficiently large are virtually not affected by the violation of the normality assumption. When the sample size is above 200 it is considered to be sufficiently large (Statistics Solutions, 2013), and in this case it is above that limit, rendering non-normality less of a problem.

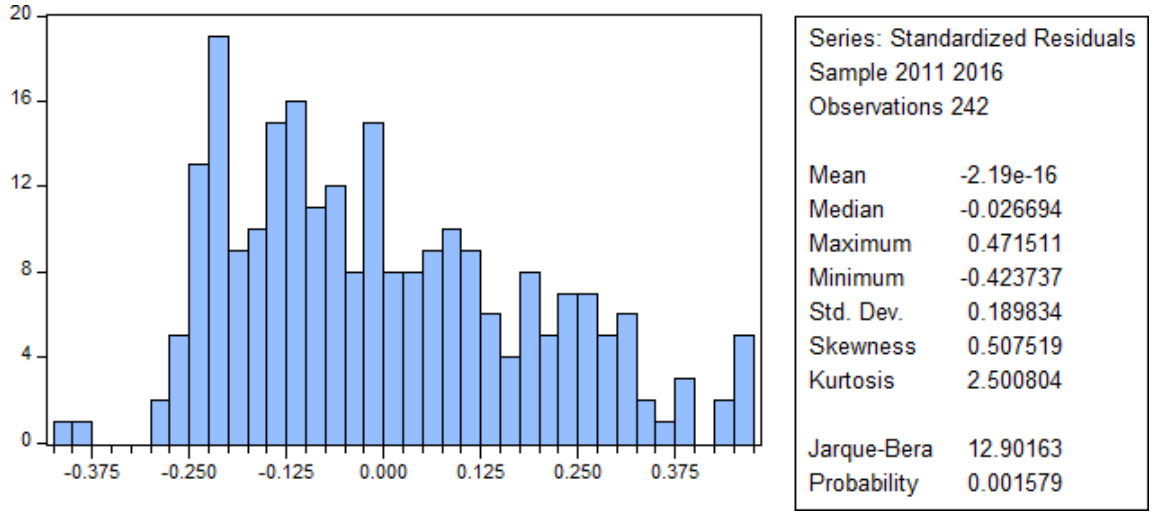


Figure 6: Standardized residuals before winsorization

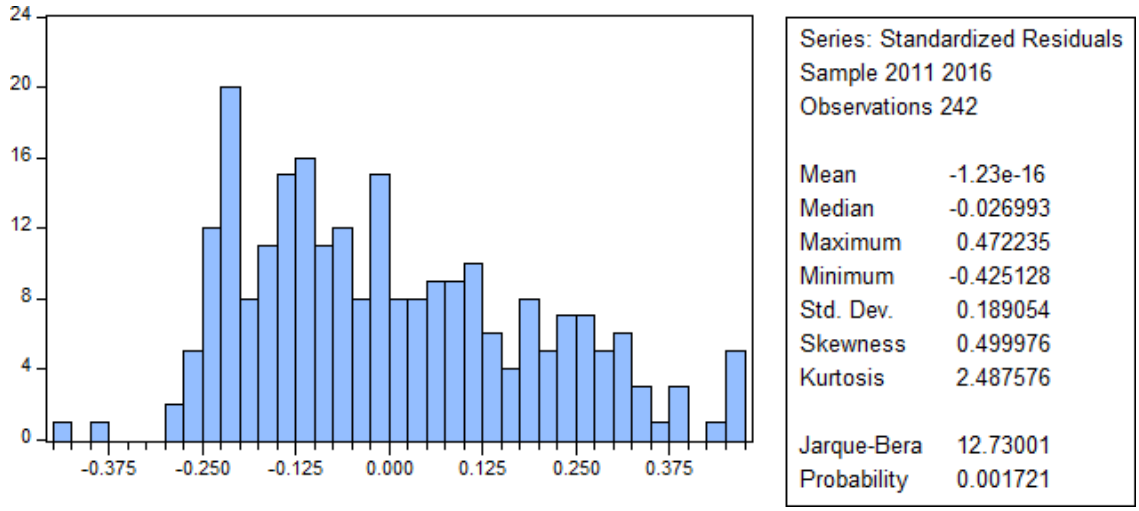


Figure 7: Standardized residuals after winsorization

Test for multicollinearity

To test for multicollinearity, a pairwise correlation matrix was created for the sample that was tested with the significance level of five percent. One takeaway is that no correlation value exceeds 80 percent which is generally considered a threshold value for multicollinearity (Berry & Feldman, 2008). Another takeaway is that the correlation values are, generally speaking, low. The 0.67 value is substantially higher than the other values in the matrix but it is still below the multicollinearity threshold and is therefore not problematic. There are few substitute values for the ESG data, and the correlation is high between them. For the variable size, other measurements of size were tested such as the natural logarithm of assets. However, assets and shares displayed a high correlation, which is consistent with previous research, where these two measurements have yielded similar results.

CORRELATION	GEOW	PRODW	INTW	DIVW	GROWTHW	LIQW	PROFITW	RISKW	SIZEW	TANGW	ESGW
GEOW	1										
PRODW	0.04	1									
INTW	0.38*	0.22*	1								
DIVW	0.38*	0.08	-0.07	1							
GROWTHW	-0.06	0.03	-0.10	-0.03	1						
LIQW	-0.27*	-0.14*	-0.22*	-0.20*	-0.02	1					
PROFITW	0.22*	0.15*	-0.24*	0.34*	-0.27*	-0.16*	1				
RISKW	-0.18*	0.00	0.14*	-0.17*	0.03	0.02	-0.25*	1			
SIZEW	**0.40***	0.16*	0.31*	**0.46***	-0.07	-0.30*	0.32*	-0.34*	1		
TANGW	-0.02	0.31*	-0.27*	0.24*	-0.13*	-0.14*	0.30*	-0.18*	0.01	1	
ESGW	0.30*	0.25*	0.18*	0.34*	0.14*	-0.24*	0.30*	-0.21*	**0.67***	0.05	1

*Table 7: Results from correlation matrix, EViews. Correlation at or above 040 is highlighted while * equals significance.*

Test for endogeneity

The p value in the Stata Hausman test was below one percent, due to a large difference between the effects for the explanatory variables (see appendix III). This means that the null hypothesis of random effects being preferable is rejected, inferring the use of fixed effects.

P-VALUE	0.0027

Test for heteroscedasticity

The p-value for the EViews White's test for heteroscedasticity was below the limit of 0.05 and the null of homoscedasticity was therefore rejected, which infers that heteroskedasticity is present, suggesting a regression model with heteroscedasticity-consistent standard errors (see appendix IV).

F STATISTIC	2.42	**P-VALUE**	0.0000

Test for Serial autocorrelation

From performing an EViews OLS regression, it was noted that the Durbin-Watson score was 1.51. This means that there is a positive serial autocorrelation in the regression, although not alarmingly high. Since the test score did not display a value of two, serial autocorrelation exists to some degree. This proposes clustered robust standard errors on period basis, i.e. White Period.

DURBIN-WATSON	1.51	**CORRELATION**	POSITIVE

Test for Spatial autocorrelation

The Stata weak cross-sectional dependence test on the regression residuals rejected the zero hypothesis that there is weak cross-sectional dependence due to a large CD-statistic, suggesting strong cross-sectional dependence in the data.

CD-STATISTIC	13.15	**P-VALUE**	0.0000

From the cross-sectional dependence test for each of the individual variables in Stata, the p-value for four of the variables were found to be close to zero due to spatial autocorrelation, rejecting the null hypothesis of no cross-sectional dependence (see appendix V). Judging by the results, especially the variables Size and ESG suffer from spatial autocorrelation with exceptionally high statistic values. This makes sense considering the companies are active in the same industry and are likely similar in terms of different characteristics such as size or different CSR activities, and how the ESG score aims to measure them. Due to several variables displaying spatial

autocorrelation, White cross-section rather than White Panel was deemed appropriate as coefficient covariance method.

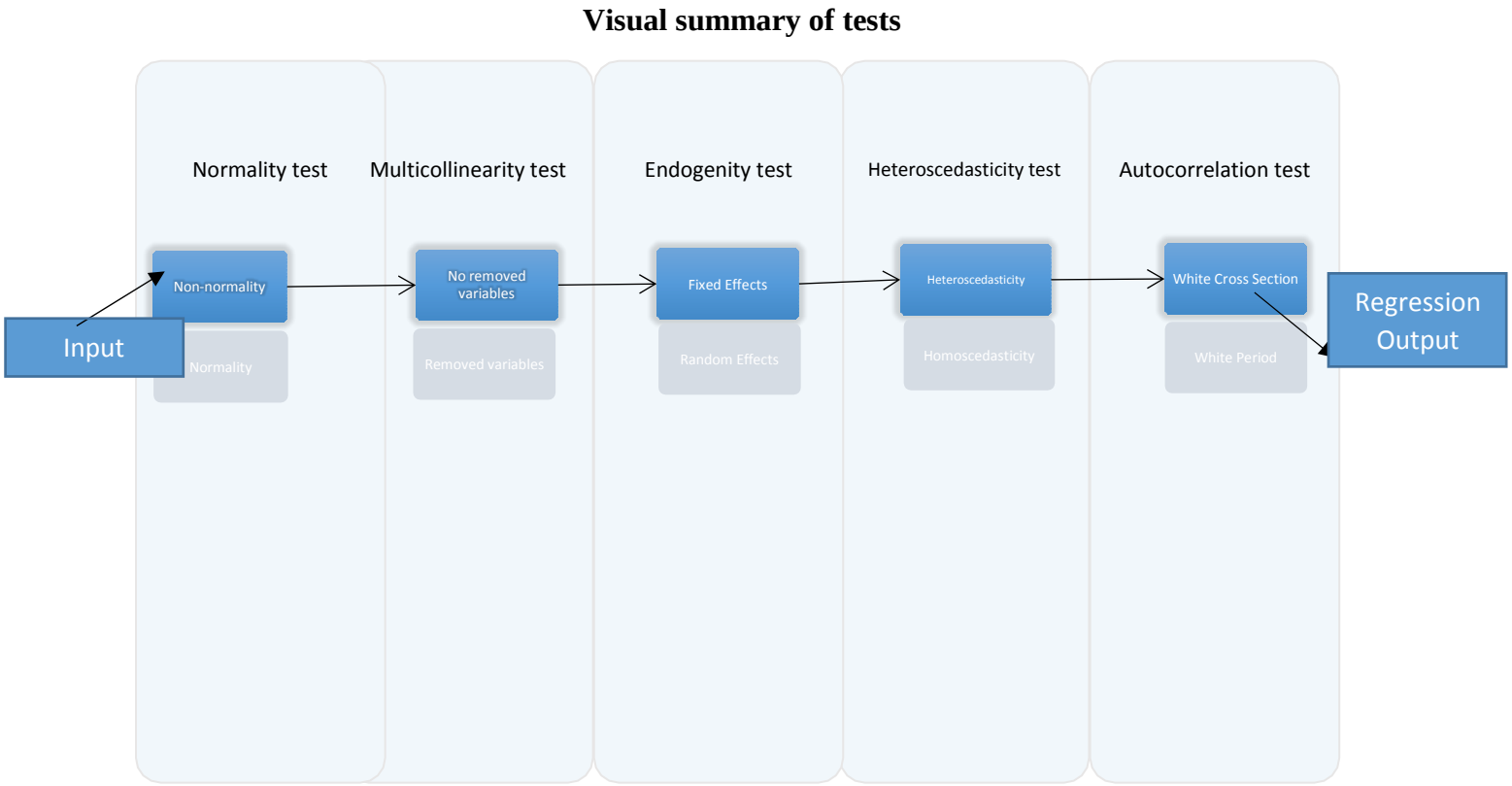


Figure 8: Visual summary of test results.

4.2 Final EViews Regressional output

Dependent Variable: DEBTCAPW
Method: Panel Least Squares
Date: 05/16/18 Time: 16:55
Sample: 2011 2016
Periods included: 6
Cross-sections included: 63
Total panel (unbalanced) observations: 242
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
GEOW	-0.001772	0.033299	-0.053204	0.9576
PRODW	-0.007159	0.064775	-0.110521	0.9121
ESGW	0.063447	0.030630	2.071370	0.0399
INTW	-0.062784	0.100650	-0.623790	0.5336
DIVW	-0.064801	0.017258	-3.754787	0.0002
GROWTHW	-0.166777	0.162197	-1.028237	0.3054
LIQW	0.003145	0.003219	0.976943	0.3300
PROFITW	-0.986230	0.217487	-4.534658	0.0000
RISKW	0.001694	0.003514	0.482008	0.6304
SIZEW	0.345140	0.084488	4.085054	0.0001
TANGW	0.650701	0.374582	1.737138	0.0843
C	-1.893183	0.537561	-3.521801	0.0006

Cross-section fixed (dummy variables)

Period fixed (dummy variables)

R-squared	0.935038	**Mean dependent var**	**0.303261**
Adjusted R-squared	**0.903951**	S.D. dependent var	0.236774
S.E. of regression	0.073380	Akaike info criterion	-2.128615
Sum squared resid	0.877704	Schwarz criterion	-0.989664
Log likelihood	336.5624	Hannan-Quinn criter.	-1.669804
F-statistic	30.07874	Durbin-Watson stat	1.509045
Prob(F-statistic)	0.000000		

Table 8: Final regression output.

5. Analysis

This chapter analyzes the results of the regression, starting with the industry-specific variables and finishing with the previously used variables. The predictions of the two theories are compared to each other and the results are compared to previous studies in this area. Tables have been added for increased reader understandability.

5.1 Industry-specific explanatory variables

5.1.1 Diversification (GEOW & PRODW)

Geographical diversification proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off*	Coefficient from Pecking order*
International sales/total sales	0.304325	-0.001772	0.9576	(+)	(-)

*: The authors' conclusion

Product diversification proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off*	Coefficient from Pecking order*
Sales largest product segment/total sales	0.345632	-0.007159	0.9121	(-)	(+)

*: The authors' conclusion

One of the proxies for diversification showed a result in line with the prediction of the trade-off theory, while the other one in line with the pecking order theory. However, as the coefficients are much smaller than the mean and statistically insignificant, it is difficult to draw any deeper conclusions from the results. The reason why the variables are statistically insignificant might be that they are not optimal measurements of diversification. For instance, the measurement of foreign sales does not eliminate country-specific risk, as a US company could in theory have ten percent of the sales in US while a large part of the remainder is derived from a few risky countries. This is unlikely, but there is no way to check for this with the current estimation method.

Regarding both the geographical diversification and product diversification, a profit measurement might be a better measurement as a large part of sales could generate little profit while some markets or products could be extremely profitable. For instance, the issuer of credit ratings Standard and Poor (2014) uses EBITDA when it is available instead of sales for pharmaceutical companies. However, this is inconsistent with previously mentioned research suggesting sales in regards to diversification measurements.

The mixed results also fail to confirm previous studies researching the influence of diversification on capital structure that argues for a positive correlation between diversification and debt (Kim & McConnel, 1977; Li & Li, 1996). The results could be explained by the findings of La Rocca et al. (2009), who showed that diversification's relationship with debt depends on the type of diversification. They found that firms that are relatedly diversified

actually have lower debt levels than specialized firms while unrelatedly diversified companies have the highest debt ratios. Since the two variables of this study only relate to related diversification, this would explain why they are not in line with the result of the findings of La Rocca et al.

The fact that the geographical coefficient was negative is not particularly surprising, as US firms constitute a large part of the data and Low and Chen (2004) found that international diversification was negatively correlated to leverage but only for American companies. Why US firms specifically differ in the area of diversification is not known but Wald (1999) speculates that the differences in general between US and non-US firms and the capital structure depend on differences in tax policies. As previously stated however, due to the low coefficient and the high p-value, it is difficult to arrive at any conclusive stance based on the diversification results of this study.

5.1.2 ESG - Corporate social responsibility (ESGW)

CSR proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off*	Coefficient from Pecking order *
ESG score	0.605053	0.063447	0.0399	(+)	(-)

*: The authors' conclusions from the theories and empirical findings.

The regression shows a positive coefficient and the variable is a statistically significant determinant for the capital structure of global pharmaceutical companies, albeit the coefficient is relatively low in comparison with the mean. This is in line with the speculation about what the trade-off theory would predict, while it contradicts what the authors reason the pecking order theory suggests.

It should be noted that previous research has shown that size is correlated with CSR, due to larger companies being more visible and are therefore under higher scrutiny (King & Soule, 2007). According to Baron, Harjoto and Jo (2011), the scrutiny is high for companies with large sales, which could explain the high correlation between Size which is based on sales and ESG (p=0.67).

The finding suggests that investments in CSR lower the risk of bankruptcy and therefore, according to the trade-off theory, enables the companies to increase their debt ratio to maximize their interest tax shield benefits. This is consistent with previously mentioned empirical research that found that CSR can increase profits (Baron, Harjoto & Jo, 2011; Mánescu, 2010; Orlitzky, Schmidt & Rynes, 2003) while decreasing the risk of financial distress (Ahn & Park, 2016; Al-Hadi et al., 2017; Chang, Yan & Chou, 2013). One possible explanation for why CSR is an important factor specifically for the pharmaceutical industry could be because of the bad reputation it has had for quite some time (Kessel, 2014), even though it has marginally improved lately (Reputation Institute, 2017).

The results seem to suggest that an increase in CSR does not lower information asymmetries, in accordance with the pecking order theory. As several empirical findings have shown that CSR can lower information asymmetries, the suggestion does not seem likely (Menz, 2010; Yang et al., 2017). One should be careful in comparing with previous studies, as this study has used a different variable to determine CSR than those studies. For example, the EGS measurement might not capture those investments in CSR that previous studies found lowered information asymmetries to a sufficient degree.

The question is whether pharmaceutical companies are aware that CSR has the properties that the trade-off theory could suggest. Results from Droppert and Bennett (2015) show that four out of six interviewed pharmaceutical companies expected a long-term financial gain from performing CSR activities. However, the authors also conclude that the pharmaceutical companies struggle with how to define CSR. Similarly, Salton and Jones 2015 argue that even though CSR is becoming increasingly important, global pharmaceutical companies are not considered to have truly comprehensive CSR policies. According to them, current major CSR guidelines are in large part not industry specific, creating a need for CSR guidelines that target issues relevant to the pharmaceutical industry. As the ESG score contains so many metrics, it is inherently difficult to analyze it deeper in relation to pharmaceutical companies.

5.1.3 Intangibles (INTW)

Intangibles proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
Intangibles/total assets	0.201553	-0.062784	0.5336	-	+

From the results, a negative coefficient is noted, which is not consistent with the notion that intangible assets generate cash and therefore support increased debt levels. Moreover, it is inconsistent with the trend with increased collateralization among intangible assets. It should be noted that among the companies in the sample that report patents and brands, this item constitutes on average only 8.3 percent of the total intangible assets, hence weakening the conclusions regarding patent backed securitizations.

The prediction of the trade-off theory is consistent with the result of a negative coefficient. The reasoning behind that prediction was that because intangible assets are associated with more risk and assumptions, they will lose most of their value if liquidated and therefor have a negative relation to debt.

However, there are undoubtedly Peters and Taylor (2017) assess that under the American accounting standard GAAP, intangible assets created within a firm almost never appear as assets on the balance sheet. The authors noted in their paper that a vast majority of the companies' intangible assets were missing from their balance sheets. Similarly, IAS 38 under IFRS, concludes that internally generated intangible assets are only recognized when a number of

conditions are fulfilled (IFRS, n.d.). In South Korea they appear more commonly on the balance sheet (Lee, 2018), while Japan demonstrate large differences compared with the US (Fukao, Miyagawa, Mukai, Shinoda & Tonogi, 2009).

Moreover, Goodwill is recorded on the balance sheet as intangible assets, and for pharmaceutical companies they represent the valuation of intellectual property and the acquiring of these (Bogdan & Villiger, 2010). Lately there have been notable differences in the conclusions around goodwill impairment globally. The goodwill impairment tests conducted under for instance GAAP and IFRS are mechanically different, questioning the cross-country comparability for this variable as goodwill is included. The fact that it is difficult to achieve a correct measurement for all intangible assets for a specific country, undermines the results.

5.2 Previously significant explanatory variables

5.2.1 Dividends (DIVW)

Dividends proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
Pay-out ratio	0.218317	-0.064801	0.0002	-	+

The coefficient of the regressions is negative which is in line with the trade-off theory and contradicts the predictions of the pecking order theory. It is much smaller than the mean around 0.22, suggesting that its effect on capital structure is low. However, it is statistically significant. The finding seems to confirm the trade-off theory's claim that the probability of financial distress increases when dividends are high, which would make management reluctant to increase leverage. It seems to disprove the claim that management follows a certain pecking order for different types of financing, as high dividends should, according to the pecking order theory, increase the need to finance through debt.

It also seems to disprove the idea that dividends signal a company's belief in future earnings and the financial health of the company. Looking at the average payout ratio for the companies included in the regression and specified in table 5, it was 22 percent in the time period. According to Ani (2016), a range of 35 to 55 percent is considered healthy and appropriate, while levels above this are considered high. The columnist Berman (2018) at Forbes perceived that pharmaceuticals are not often thought of as dividend stocks, an opinion supported by the low payout ratio in this sample. Dividend signal value could therefore be less relevant to the pharmaceutical industry, which weakens the pecking order theory as an explanatory power.

5.2.2 Growth (GROWTHW)

Growth proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
R&D/sales	1.487010	-0.166777	0.3054	-	+

The regression shows a negative coefficient, which is consistent with the trade-off theory and most of the previous empirical research. The theory suggests that higher degree of growth leads to higher cost of financial distress. Undertaking a lot of projects with unknown outcome, as only one tenth of all pharmaceutical projects on average reach the market, could be perceived as negative from the lender's perspective with the argument that increased growth leads to a higher cost of financial distress. In that sense, the explanation provided by the trade-off theory seems well-aligned with the inherent risks of pharmaceutical development.

The p-value is quite high however, implying that there might be better growth variables. One possible explanation is that R&D intensity does not measure growth properly, or less than it used to. The pharmaceutical industry has seen a significant change in operating model over the past couple of decades, including the declining productivity challenges and the growth of emerging markets as key revenue contributors (Khanna, 2012; Looney, 2010). Moreover, research from Munos (2009) show that the size of the R&D budget does not guarantee proportionate success.

There has also emerged a number of new interesting therapeutic areas, such as immuno-oncology, stem cell research and gene therapy. Over the past couple of decades, the portion of revenue from specialty medicines and biologics has increased for most larger pharmaceutical companies, and the same growth picture is painted for new therapies (Gautam & Pan, 2016). Munos (2009) argues that the R&D model that has powered the successful history of the pharmaceutical industry is showing signs of fatigue.

5.2.3 Liquidity (LIQW)

Liquidity proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
Current ratio	3.869453	0.003145	0.3300	+	-

As for liquidity, it displays a small coefficient, in addition to an insignificant p-value. The coefficient is slightly positive which is consistent with the trade-off theory. It suggests that the pharmaceutical companies with more liquidity have the possibility to raise debt, due to good financial health. It is however, not consistent with previous empirical research for companies in general. It also contradicts previous research by Sheluntcova (2014) who found that liquidity was negatively correlated with debt for Russian private pharmaceutical companies. Her study was, however, conducted during the global financial crisis which made the Russian companies less able or willing to accumulate debt.

Among smaller pharmaceutical companies, the more well-funded ones have a competitive advantage over their less funded peers, since cash implies further development of pharmaceutical assets, in addition to increased financial endurance against failures. However, research suggests that companies with high levels of cash tend to make poorer decisions compared to their peers with weaker balance sheets (Keegan, 2008). Consequently, it could suggest that the lenders look at how the capital is deployed, rather than the amount of liquidity, resulting in in a higher p-value as its role as capital structure determinant weakens.

It should be added that Liquidity turned out to be statistically significant on the one percent level as an explanatory variable in another regression with short-term debt as the dependent variable, while for long-term debt it was highly insignificant, similar to total debt.

5.2.4 Profitability (PROFITW)

Profitability proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
ROA	0.038534	-0.986230	0.0000	+	-

The regression shows a highly negative coefficient for profitability, which is statistically significant and consistent with the pecking order theory, making it the only statistically significant explanatory variable consistent with the theory. This is consistent with all previous research. Although Bodla and Kaur's (2015) did not obtain statistical significance for profit, they had a similar coefficient with the same proxy. The coefficient from their regression was slightly more negative, but the main point is that both were highly negative. Similar results for pharmaceutical companies were found by Sheluntcova (2014), in addition to Zambuto, Billitteri, and Nigro (2011).

The general explanation of the relation between profitability and debt offered by the pecking order theory was that profitable companies can use retained earnings as financing rather than debt, which is cheaper than debt.

As previously mentioned the asymmetric information is larger in industries with higher R&D expenditure levels such as pharma. Information asymmetry might be extra important in regards to profitability as profitable companies are able to use retained earnings as financing. Thereby they are not as affected by the negative effects of information asymmetry which increases the cost of debt and equity respectively and putting them further down the pecking order ladder.

Information asymmetries decrease when new value-relevant information is made public (Jeppsson, 2014). Denis and Sarin (2001) found that earnings announcements had a significant effect on the market reaction to new equity issues. Consequently, equity issues tend to follow these announcements. This raises the question regarding pharmaceutical companies' opportunities to raise equity, as pharmaceutical companies that are less profitable might not have these windows where they can announce equity issues.

5.2.5 Risk (RISKW)

Risk proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
Standard deviation of earnings	1.112447	0.001694	0.6304	-	-

The Risk coefficient is low, in addition to the p-value being statistically insignificant. This makes the variable more difficult to interpret. Considering that the mean of the variable is around one, there is no reason to think that the low coefficient is due to particularly low values of the risk observations. The high mean of standard deviation could also be due to some companies having an extremely high value, making the mean less indicative of the standard deviation for most companies in the sample. The median standard deviation of earnings is approximately 30 percent, compared to the mean of 112 percent. However, the coefficient is low compared to the median as well. The three years used in this paper for calculating the standard deviation includes the year of 2009 which as a part of the Great recession may have increased the mean standard deviation.

The results suggest that standard deviation of earnings might not be an optimal proxy for risk in the pharmaceutical industry, due to an inherently high earnings volatility. Patents are more important to the pharmaceutical industry than to most other industries (Mohan, Puranik, Sagar, Sreenivasa & Rao, 2014). A relevant factor affecting risk in this industry is the fact that patents expire, significantly decreasing the revenue generated by that drug and making the sales prospects more uncertain. The development of non-patented generic drugs is also a great deal cheaper than traditional pharmaceuticals, while is considered less risky (Grabowski, 2002).

Another relevant factor affecting risk in this industry is the field in which the company conducts research, and how likely it is that the development of drugs in that field get market approval. For example, no pharmaceutical drugs treating Alzheimer's disease have been approved since 2003 (Zheng, Fridkin & Youdim, 2015). Some fields, such as oncology have a low likelihood of market approval compared to the average of all fields (5.1 percent compared to the average of 9.6 percent), whereas others such as hematology at 26.1 percent have much higher likelihood than the average (Biotechnology Innovation Organization, 2016). When a company chooses to focus on the fields in which market approval is unlikely, the risk is greater than it would be when focusing on other fields with higher likelihood of market approval.

Furthermore, drugs with bigger markets are associated with higher likelihood of success (Odasso & Ughetto, 2011) which should make it less risky to develop the drugs that have large markets. Smaller markets however have less competition, which means lower competitional risk. This indicates a trade-off between development risk and competition risk, cementing the picture that risk in the pharmaceutical industry is a complex matter.

5.2.6 Size (SIZEW)

Size Proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
Ln(Sales)	5.527231	0.345140	0.0001	+	-

A positive coefficient and a highly significant p-value makes it clear how the variable affects debt. According to the trade-off theory, larger companies have more debt because they have a better reputation and lower risk, and consequently, it is cheaper or easier for them to increase the debt levels. A positive and significant coefficient is consistent with the findings of Bodla and Kaur (2015).

According to Abrantes-Metz, Adams and Metz (2004), larger firms have a higher success rate when it comes to taking drugs to the market. This is similar to Barrenho, Miraldo and Smith (2013) findings where the participation of at least one larger company in the research project is associated with a lower rate of failure of drug projects, in particular in the transition from the last clinical development phase to market launch.

At a later stage of the R&D process, more focus is dedicated to functional activities connected to the market launch, including scaling up manufacturing, logistics and distribution processes, marketing and regulatory compliance. Larger companies that have established these capabilities over a long period of time are consequently more successful at taking drugs to the market (Barrenho, Miraldo & Smith, 2013).

In this case, it could be argued that larger pharmaceutical companies have a lower perceived risk from the lenders perspective as they have developed capabilities that are synonymous with development success. Sheluntcova (2014) found instead that for private pharmaceutical companies in Russia size was negatively correlated to leverage. However, according to Bogdan and Villiger (2010) smaller and younger pharmaceutical companies have troubles raising debt as the risks from pharmaceutical projects are deemed too high, which invalidates a comparison as the samples differ in terms of company size, among others.

5.2.7 Tangibility (TANGW)

Tangibility proxy	Mean	Coefficient from result	P-value	Coefficient from trade-off	Coefficient from Pecking order
Tangibles to total assets	0.164420	0.650701	0.0843	+	-

The regression shows a positive coefficient, but the variable is not a statistically significant determinant for the debt ratio. This is in line with what previous research has shown, where the trade-off theory has consistently made the correct prediction, despite the belief that the pecking order theory should be more relevant for companies with less tangible assets (Harris & Raviv,

1991). The results are also in line with the findings of Sheluntcova's (2014) study of Russian pharmaceutical companies.

The reasoning behind the prediction of the trade-off theory is that tangible assets are safer and they retain most value in case of liquidation, so a company with more tangible assets can reasonably be expected to have more debt, and tangibility should because of this be positively correlated with debt (Myers, 2001).

Tangibility has generally decreased in the United States and in Europe lately (Wolf, 2017). Value is increasingly more often created by design, research, brands and software than by tangible assets. Furthermore, pharmaceuticals have lower tangibility than other industries, with for instance US pharmaceuticals having a tangibility at a mere 11.24 percent compared to the mean of (Damodaran, 2018). This raises the question of asset collateralization opportunities among pharmaceutical companies. In addition, there is also the question of leasing, which several studies suggest is a critical element of capital structure (Eisfeldt & Rampini, 2009; Smith & Wakeman, 1985; Sharpe & Nguyen, 1995).

Rampini and Viswanathan (2013) refer to the "low leverage puzzle" where some companies have very low leverage, which indicates leased tangible capital. In most cases companies with low leverage also have little tangible assets, according to them. The authors show that "true tangibility" is a key determinant of capital structure when leasing is accounted for. Leasing is even considered to be even more collateralizable since it can be easily repossessed, suggesting additional debt capacity.

The questions remain open whether *true tangibility* has been measured in this paper as no adjustments have been made to leasing, although it is uncommon in capital structure papers (Rampini & Viswanathan, 2013). All studies in the research summary with a significant coefficient for tangibility noted a positive relationship with debt, which makes the results unsurprising.

6. Concluding remarks

The answers to the research questions and the conclusions of the study are presented. This is followed by a discussion of the conclusions reached. Thereafter, the potential issues of the study are reflected upon and interesting topics in need of further research are suggested.

6.1 Conclusion

- *What are the capital structure determinants for pharmaceutical companies?*

This study found that dividends, profitability, size and CSR are all statistically significant determinants of the capital structure for global pharmaceutical companies. Dividends and profitability are negatively correlated with leverage while size and CSR are positively correlated with leverage. Growth, liquidity, risk, geographical and product diversification, tangibility and intangibles are not statistically significant determinants of capital structure.

- *Which of the established capital structure theories has a higher explanatory power for pharmaceutical companies?*

Trade-off theory is a better predictor for global pharmaceutical companies' capital structure than the pecking order theory. The trade-off theory correctly predicted three significant results, compared to the pecking order's one correctly predicted result. There are eight correct predictions in total for the trade-off theory, compared to two correct predictions for the pecking order theory.

6.2 Discussion

Most variables in this paper show results in line with the trade-off theory, with profitability being a significant exception, consistent with previous research. Frank and Goyal (2003) and Ni and Yu (2008) argues that pecking order works best in samples of large firms, since they are not usually considered to be firms that suffer the most from adverse selection problems. The pecking order is also a better predictor for smaller Russian private pharmaceutical companies, which was shown by Sheluntcova (2014), who found that profitability, assets' structure, size and short-term liquidity all were negatively correlated with leverage, which is what the pecking order predicts.

The results of the study prove Leary and Roberts (2009) findings and Myers (2003) claim, that incorporating both theories increase the accuracy of the model. Surprisingly however, in this study the roles are reversed, and it is the trade-off theory that provides the strongest explanation of capital structure choices and the pecking order is merely complementary. The reason for this might lie in the nature of global pharmaceutical companies as it is an industry with relatively high ratio of intangible assets which increases information asymmetry. However, according to Leary and Roberts (2009) the failings of the pecking order theory cannot be explained by variations in information asymmetry.

Since the diversification proxies had high p-values and low coefficients, they may not be optimal measurements of diversification. As La Rocca et al. (2009) have shown that different types of diversification have different effects on leverage, the proxies might have shown clearer results if

they had been divided into related diversification and unrelated diversification. A distinction between related and unrelated diversification should show a relation between leverage and unrelated debt in accordance with the prediction of the trade-off theory, according to La Rocca et al.

The most interesting result is that ESG turned out to be highly significant, with the coefficient showing some impact on the capital structure. Just as Baron, Harjoto and Jo (2011) found that the effect of corporate social responsibility on profitability depends on the industry, it could also be the case that the effect of corporate social responsibility on capital structure differs between industries and that the relation found in this study might not hold true for other industries, perhaps less contentious ones. Salton and Jones (2015) argue that out of all industries, pharmaceutical companies have the greatest responsibility to adopt correct standards of ethical social behaviour, suggesting that CSR is of increased importance for this industry.

This could have implications for various stakeholders. If a company or an industry fails to show a sufficient social responsibility, the willingness for investors to invest might decline due to ethical or purely economic reasons and the cost of debt might rise as lenders are less willing to lend, as shown by the recent case of Bank of America refusing to lend out to gun manufacturers that produce assault weapons (Keller & Mosendz, 2018).

Intangible assets displayed a negative coefficient, which was fairly surprising as intangible assets are highly synonymous with value for the pharmaceutical industry. Peters and Taylor (2017) noted in their study that a vast majority of companies' intangible assets were not on their balance sheets since they were generated internally. Judging by this, the book value of intangibles on balance sheets differ greatly from the "real value" of intangibles, rendering a measurement error for the variable in this paper. Moreover, securitization of intangible assets such as patents is currently a rare practice in the credit market. The authors of this paper do believe that going forward, the interest around asset structure and collateralization will increase. For instance, financial authorities in South Korea have recently announced new measures for companies to secure loans using assets such as intellectual property. This is obviously of high interest for intangible-heavy industries such as pharmaceuticals as it could help increase debt capacity.

Diversification and risk are certainly two interesting concepts for the pharma industry, considering that few pharmaceutical projects will reach the market. The standard deviation of earnings in this case incorporates indirectly such factors as patent falloffs, margin reductions and sales pipeline. However, the inherent nature of the pharmaceutical industry creates volatility. Patents are confined to a time period while pharmaceutical drugs fail more often than succeed. Consequently, other risk metrics than volatility could be suitable for the pharmaceutical industry.

Measuring risk on a therapeutic area level could be interesting where companies with, for instance, a large amount of oncology projects are statistically assumed to fail more often than others. This could indicate a higher risk. However, even if oncology is a negative outlier in terms success rate today, it might be due to other unobserved factors such as market trends. For instance, immuno-oncology is an emerging therapeutic area which could have an explanatory effect explaining a larger part of the development failures. The authors do believe however that incorporating

statistical success rates into the risk concept is necessary in order to outline future risk, which is of high interest from both the lenders' and investors' perspective. Even though historic success rates are not entirely correct in determining outcomes, they can provide a guideline. Moreover, the metric can also and maybe more importantly serve to highlight reduced risk, where less risky therapeutic areas within pharmaceuticals are attributed a lower risk profile.

There is also the question of asymmetric information in relation to risk. Because R&D is vital to the pharmaceutical industry, just as the need to keep important research from the competitors, asymmetric information will always be present in the pharmaceutical industry to some degree. Consequently, risk will not be obvious to investors and lenders. However, there could still be room for improvements when it comes to decreasing the information asymmetry by using risk disclosures. For instance, one example is what cost of capital the pharmaceutical companies use to determine the value or cost of pharmaceutical projects. This information is often mentioned in the annual report, but briefly, inconsistently and sometimes it is not mentioned at all. If pharmaceutical companies communicate what cost of capital they use and mention the underlying assumptions for the cost of capital to a higher degree, it could make it easier for lenders and investors to value the R&D, which reduces the information asymmetry. Another issue worthy to mention is the fact that companies are reluctant to cover their failed developments of drugs to the same extent as their successful ones. This can also obstruct the evaluation of the risk of the company but might relate more to regulation as it is in no company's self-interest to showcase development failures.

6.3 Reflections

The adjusted R-squared is high, consistent with Sheluntcova's (2014) result with the same regression method. A regression without fixed effects leads to an adjusted R-squared around 30 percent, similar to results in earlier capital structure determinant papers (see appendix VI). Because of the use of fixed effects, it was not a possibility to introduce dummy variables related to specific heterogeneities on country and sector level, as biotechnology is included. Previous research suggest that the capital structure determinants are similar across countries, but there undoubtedly country-specific and possibly sector-specific factors that the regression model does not pinpoint. Panel effects renders omitted variable bias where relevant variables are left out less of a problem, but the research goal was to identify specific capital structure and not achieve a high adjusted R-squared. Moreover, in practice data can have both spatial and time series aspects resulting in hybrids of standard error methods, which was not used.

The paper is broad in scope. This has implications for the amount of focus that can be dedicated to each explanatory variable. For instance, it would be interesting to delve deeper into pharma specific CSR, the importance of diversification or intangible assets and patent backed securities. However, devoting too much focus to one area of interest would deviate from the purpose of the paper, which is to identify the capital structure determinants for global pharmaceutical companies. Thus, the paper is kept at an abstract level in order to correctly describe general properties. On the other hand, too little focus on specific areas would instead weaken the analysis. More emphasis was naturally put on the industry-specific variables. To conclude, the balance between scope and depth is believed to be adequate.

Lastly, the authors have attempted to analyze the coefficients deeper in relation to the theory from a pharma perspective, rather than just stating whether the coefficient is positive or negative. As the pharmaceutical industry is quite complex, it implies an increased possibility of less adequate conclusions. This is believed to be offset by consistently referring to and applying pharma-specific research.

6.4 Suggestions for further research

Since there is a difference between industries and the correlation between CSR and profitability (Baron, Harjoto & Jo, 2011) it would be interesting to research if there is a correlation between CSR and profitability in the pharmaceutical industry as this could be the explanation to why it is a significant determinant for the capital structure in this industry. It would also be interesting to see if similar findings as this study have made could found in other industries with some degree of reputational problems.

It would be interesting to see which type of CSR activities are financially beneficial for pharmaceutical companies, rather than using a total ESG score. Judging from interviews, several pharmaceutical companies believe that CSR activities will yield a positive financial effect in the long term. More quantitative CSR research specific to Pharma is percieved to be of high interest, considering the importance of the area for the industry while there seems to be room for improvement when it comes to the understanding of the concept and its positive benefits.

A relatively new valuation measure called the Market-Derived Capital Asset Pricing Model (MCPM) could be interesting as a diversification measurement. Avance (2008) studies in what stages the company's different drug projects are, and from that calculates a discount rate. A low discount rate according to MCPM could be a better measurement of pipeline diversification, although probably more appropriate for smaller pharmaceutical companies with fewer products on the market.

Additionally, further pharma specific research when it comes to intangible assets, valuation of these and the implications for capital structure is another suggestion for further research. Since a small portion of the real total of intangible assets are actually on the balance sheet, it is necessary to find a more accurate valuation of these in order to examine how they affect capital structure for pharmaceutical companies. This will likely require a country-specific study as it has been the format in recent previous research on the subject, but it is a very interesting study area considering it could provide a better understanding of the value intangibles generate, amid increased collateralization trends.

Regarding information asymmetry in the pharmaceutical industry, it would be interesting to identify the determinants of equity mispricing and compare it to previous research in order to demonstrate an adverse selection cost of the R&D intensity. Another suggestion related to this issue is how the market reacts to bad and good earnings reports from larger pharmaceutical companies compared to other sectors, as profitability seems to have a central role according to the regression performed in this paper.

The last suggestion for further research is to identify the capital structure determinants for pharmaceutical companies with different types of debt, such as short-term debt and long-term

debt. Are certain capital structure determinants more relevant to some debt types than others, and how does this relate to capital structure theory? Moreover, are there perhaps other capital structure theories suitable for the industry at hand?

7. Bibliography

7.1 Articles, reports and working papers

Aboody, D. & Lev, B. (2000). Information Asymmetry, R&D, and Insider Gains. *The Journal of Finance*, vol. 55 no. 6, pp. 2747-2766

Abrantes-Metz, R.M., Adams, C.P. & Metz, A. (2004). Pharmaceutical Development Phases: A Duration Analysis, working paper, no. 274, Bureau of Economics

Ahn, SY. & Park, DJ. (2016). Mediating role of Social Capital and Moral Legitimacy in Korea, *Journal of Business Ethics*, pp. 1-18 Available online: https://doi.org/10.1007/s10551-016-3161-3 [Accessed 10 May 2018]

Allen, C. & Jabado, G. (n.d.). The Relation of Biotech and Big Pharma: Feeding the Pipeline [pdf] Available at: http://web.iese.edu/mba/health/Master/Reports/Boitech%20Pharma%20Allen%20Jabado.pdf [Accessed 11 May 2018].

Alsumidaie, M. (2014). M&A VS R&D: Is Valeant's Strategy Financially Viable?, *Applied Clinical Trials*, 21 April, Available online: http://www.appliedclinicaltrialsonline.com/ma-vs-rd-valeants-strategy-financially-viable [Accessed 17 May 2018]

Alves, S. & Martins, J. (2014). The Impact of Intangible Assets on Financial and Governance Policies: A Simultaneous Equation Analysis, *Journal of Applied Finance & Banking*, vol. 4, no. 1, pp. 61-89

Al-Hadi, A., Chatterjee, B., Yaftian, A., Taylor, G. & Hasan, M. (2017). Corporate social responsibility performance, financial distress and firm life cycle: evidence from Australia, *Accounting and Finance*, vol. 0, no. 1, pp. 1-29, Available online: https://doi.org/10.1111/acfi.12277 [Accessed 10 May 2018]

Ani, G. (2016). What Is an Ideal Payout Ratio?, *Dividend*, 26 April, Available online: http://www.dividend.com/dividend-education/what-is-an-ideal-payout-ratio/ [Accessed 6 May 2018]

Attig, N., Ghoul, S. & Guedhami, O. (2013). Corporate Social Responsibility and Credit Ratings, *Journal of Business Ethics*, vol. 117, no. 4, pp. 679-694

Avance. (2008). Discount Rates for Biotech Companies. [pdf] Available at: http://www.avance.ch/newsletter/docs/discount_1.pdf [Accessed 28 May 2018]

Bah, R. & Dumontier, P. (2001). R&D Intensity and Corporate Financial Policy: Some International Evidence. *Journal of Business Finance & Accounting*, vol. 28, no. 5-6, pp. 671-692.

Baker, M. & Wurgler, J. (2002). Market Timing and Capital Structure, *The Journal of Finance*, vol. LVII, no. 1, pp. 1-32

Baltagi, B.H., Feng, Q. & Kao, C. (2012). A Lagrange Multiplier Test for Cross-Sectional Dependence in a Fixed Effects Panel Data Model, *Journal of Econometrics*, vol. 170, no. 1, pp. 164-177

Baranes (2017). Financialization in the American Pharmaceutical Industry: A Veblenian Approach, *Journal of Economic Issues*, vol. LI, no. 2, pp. 351-358

Baron, D., Harjoto M. & Jo, H. (2011). The Economics and Politics of Corporate Social performance, *Business and Politics*, vol. 13, no. 2, pp. 1-48

Barrenho, E., Miraldo, M. & Smith, P.C. (2013). The determinants of attrition in drug development: a duration analysis, Imperial College London [pdf] Available at: http://spiral.imperial.ac.uk:8080/bitstream/10044/1/12204/4/Barrenho%202013-04.pdf [Accessed 4 May 2018]

Behner, P., Vallerien, S., Ehrhardt, M. & Rollmann, D. (2011). Booz&co. Pharmaceutical Companies in the Economic Storm - Navigating from a Position of Strength [pdf] Available at: https://www.strategyand.pwc.com/media/file/Pharmaceutical_Companies_Economic_Storm.pdf [Accessed 4 May 2018]

Berman, K. (2018). Big Pharma, Big Dividends, *Forbes*, 18 January, Available Online: https://www.forbes.com/sites/kenberman/2018/01/18/big-pharma-big-dividends/#20e1f4a6547b [Accessed 28 May 2018]

Bhaduri, S. (2002). Determinants of corporate borrowing: Some evidence from the Indian corporate structure, *Journal of Economics and Finance*, vol. 26, no. 2, pp. 200-215.

Bharath, S.T., Pasquariella, P. & Wu, G. (2006). Does Asymmetric Information Drive Capital Structure Deecisions?, EFA 2006 Zurich Meetings, Available Online: http://dx.doi.org/10.2139/ssrn.789725 [Accessed 26 May 2018]

Bhattacharya, S. & Ritter, J. (1983). Innovation and Communication: Signalling with Partial Disclosure. *The Review of Economic Studies*, vol. 50, no. 2, p. 331-346

Biotechnology Innovation Organization (2016). Clinical Development Success Rates 2006-2015 [pdf] Available at: https://www.bio.org/sites/default/files/Clinical%20Development%20Success%20Rates%202006-2015%20-%20BIO,%20Biomedtracker,%20Amplion%202016.pdf [Accessed 12 Apr. 2018]

Bodla, B. & Kaur, R. (2015). Determinants of Capital Structure – A Study of Selected Pharma Companies, *Asian Journal of Research in Business, Economics and Management*, vol. 5, no. 10, pp. 28-34

Bolek, M. & Lyroudi, K. (2015). Is there any relation between intellectual capital and the capital structure of a company? The case of polish listed companies, Financial Internet Quarterly, vol. 11, no. 4, pp. 23-33

Bradley, M., Jarrell, G.A. & Kim, E.H. (1984). On the Existence of an Optimal Capital Structure: Theory and evidence, *Journal of Finance*, vol. 39, no. 3, pp. 857-878.

Cameron, A. & Miller, D. (2015). A Practitioner's Guide to Cluster-Robust Inference, *Journal of Human Resources*, vol. 50, no. 2, pp. 317-372

Chang, T.C., Yan, Y.C. & Chou, L.C. (2013). Is default probability associated with corporate social responsibility?, *Asia-Pacific Journal of Accounting & Economics*, vol. 20, no. 4, pp. 457-472, Available online: https://doi.org/10.1080/16081625.2013.825228 [Accessed 10 May 2018]

Chaplinsky, S. & Niehaus, G. (1993). Do inside Ownership and Leverage Share Common Determinants?, *Quarterly Journal of Business and Economics*, vol. 32, no. 4, pp. 51-65

Degryse, H., de Goeij, P. & Kappert, P. (2009). The Impact of Firm and Industry Characteristics on Small Firms' Capital Structure, *Small Business Economics*, vol. 38, no. 4, pp. 431-447

Deesomsak, R., Paudyal, K. & Pescetto, G. (2004). The Determinants of Capital Structure: Evidence from the Asia Pacific Region, *Journal of Multinational Financial Management*, vol. 14, no. 4-5, pp. 387-405

De Jong, A., Kabir, R. & Nguyen, T.T. (2008). Capital structure around the world: The roles of firm- and country-specific determinants, *Journal of Banking & Finance*, vol. 32, no. 9, pp. 1954-1969

Denis, D. & Sarin, A. (2001). Is the Market Surprised by Poor Earnings Realizations Following Seasoned Equity Offerings?, *The Journal of Financial and Quantitative Analysis*, vol. 36, no. 2, pp. 169-193

Droppert, H. & Bennett, S.C. (2015). Corporate social responsibility in global health: An exploratory study of multinational pharmaceutical firms, *Globalization and Health*, vol. 11, no. 1, pp. 1-8

Efrata, T.C. (2008). R&D Intensity and IPO Underpricing: Case Study on Pharmaceutical and Biotech Industries in the US, *Accounting and Investment Journal*, vol. 9, no. 1, pp. 1-21

Eisfeldt, A.L. & Rampini, A.A. (2009). Leasing, Ability to Repossess, and Debt Capacity, *The Review of Financial Studies*, vol. 22, no. 4, pp. 1621-1657

EvaluatePharma (2017). World Preview 2017, Outlook to 2022 [pdf] Available at: http://info.evaluategroup.com/rs/607-YGS-364/images/WP2017-SUM.pdf [Accessed 27 May 2018]

Fama, E. & French, K. (2002). Testing Trade-Off and Pecking Order Predictions about Dividends and Debt, *The Review of Financial Studies*, vol. 15, no. 1, pp. 1-33

Fishman, E. (2003). Securitization of IP royalty streams: assessing the landscape, *Technology Access Report*, vol. 16, no. 5, pp. 490–491

Frank, M. & Goyal, V. (2003). Testing the pecking order theory of capital structure. *Journal of Financial Economics*, vol. 67, no. 2, pp. 217-248.

Frank, M.Z. & Goyal, V.K. (2009). Capital structure decisions: Which factors are reliably important?, *Financial Management*, vol. 38, no. 1, pp. 1-37

Friend, I. & Lang, L. (1988). An Empirical Test of the Impact of Managerial Self-Interest on Corporate Capital Structure, *The Journal of Finance*, vol. 43, no. 2, pp. 271-281

Fukao, K., Miyagawa, T., Mukai, K., Shinoda, Y. & Tonogi, K. (2009). Intangible Investment in Japan: Measurement and Contribution to Economic Growth, *Review of Income and Wealth*, vol. 55, no. 3, pp. 717-736

Gautam, A. & Pan, X. (2016). The changing model of big pharma: impact of key trends, *Drug Discovery Today*, vol. 21, no. 3, pp. 379-384

Glen, J. & Singh, A. (2004). Comparing capital structures and rates of return in developed and emerging markets, *Emerging Markets Review*, vol. 5, no. 2, pp. 161-192

Grabowski, H. (2002). Patents, Innovation and Access to New Pharmaceuticals. *Journal of International Economic Law*, vol. 5 no. 4, pp. 849-860.

Graham, J., Leary, M. & Roberts, M. (2016). The Leveraging of Corporate America: A Long-Run Perspective on Changes in Capital Structure, *Journal of Applied Corporate Finance*, vol. 28, no. 4, pp. 29-38

Hall, B. (1992). Investment and Research and Development at the Firm Level: Does the source of Financing Matter?, working paper, no. 92-194, University of California at Berkeley, Department of Economics

Han, J., Kim, H. & Yu, J. (2016). Empirical study on relationship between corporate social responsibility and financial performance in Korea. *Asian Journal of Sustainability and Social Responsibility*, vol. 1, no. 1, pp. 61-76.

Harris, M. & Raviv, A. (1991). The theory of Capital Structure, *The Journal of Finance*, vol. XLVI, no. 1, pp. 297-355

International Monetary Fund (2015). World Economic Outlook October 2015: Adjusting to Lower Commodity Prices [pdf] Available at: http://www.imf.org/external/pubs/ft/weo/2015/02/pdf/text.pdf [Accessed 9 May 2018]

Jensen, M. (1986). Agency Cost of Free Cash Flow, Corporate Finance, and Takeovers. *American Economic Review*, vol. 76, no. 2, pp. 323-329

Jeppsson, H. (2014). Asymmetric information, disclosures of R&D and the choice of equity-selling mechanisms, *Auckland Finance Meeting*, 18-20 December, Auckland, New Zealand

Khanna, I. (2012). Drug discovery in pharmaceutical industry: productivity challenges and trends. *Drug Discovery Today*, vol. 17, no. 19-20, pp. 1088-1102.

Keller, L.J. & Mosendz, P. (2018). BofA Will Stop Lending to Makers of Assault-Style Guns, *Bloomberg*, 10 April, Available online: https://www.bloomberg.com/news/articles/2018-04-10/bofa-will-no-longer-lend-to-some-gunmakers-vice-chairman-says [Accessed 22 May 2018]

Kessel, M. (2014). Restoring the pharmaceutical industry's reputation, *Nature Biotechnology*, vol. 32, no. 10, pp. 983-990

Kester, C.W. (1986). Capital and ownership structure: A comparison of United States and Japanese manufacturing corporations, *Financial Management*, vol. 15, no. 1, pp. 5-16.

Kim, E. & McConnel, J. (1977). Corporate Mergers and the Co-Insurance of Corporate Debt, *The Journal of Finance*, vol. 32, no. 2, pp. 349-365

Kim, S. (2016). IP Asset Value as Collateral: The Increasing Use of Patents as Collateral in Asset-Based Lending, *abfjournal*, January/February, Available online: http://www.abfjournal.com/articles/ip-asset-value-as-collateral-the-increasing-use-of-patents-as-collateral-in-asset-based-lending/ [Accessed 18 May 2018]

Kim, W.S. & Sorensen, E.H. (1986). Evidence on the Impact of the Agency Costs of Debt on Corporate Debt Policy, *The Journal of Financial and Quantitative Analysis*, vol. 21, no. 2, pp. 131-144

King, B. & Soule, S. (2007). Social Movement as Extra-institutional Entrepreneurs: The Effect of Protests on Stock Price Returns, *Administrative Science Quarterly*, vol. 52, no. 3, pp. 413-442

Kraus, A. & Litzenberger, R. (1973). A State-Preference Model of Optimal Financial Leverage, *The Journal of Finance*, vol. 28, no. 4, pp. 911-922

La Rocca, M., La Rocca, T., Gerace, D. & Smark, C. (2009). Effect of diversification on capital structure, *Accounting and Finance*, vol. 49, pp. 799-826

Leary, M. & Roberts, M. (2009). The pecking order, debt capacity, and information asymmetry, *Journal of Financial* Economics, vol. 95, no. 3, pp. 332-355

Lee, K. (2018). Most S. Korean Pharmaceutical and Biotech Firms Treat R&D Spending as Intangible Assets, *The Korea Bizwire*, 14 March, Available Online: http://koreabizwire.com/most-s-korean-pharmaceutical-and-biotech-firms-treat-rd-spending-as-intangible-assets/113941 [Accessed 26 May 2018].

Lewellen, W. (1971). A Pure Financial Rationale for the Conglomerate Merger, *The Journal of Finance*, vol. 26, no. 2, pp. 521-537

Li, D. & Li, S. (1996). A Theory of Corporate Scope and Financial Structure, *The Journal of Finance*, vol. 51, no. 2, pp. 691-709

Lim, S., Macias, A. & Moeller, T. (2014). Intangible Assets and Capital Structure, Paris December 2016 Finance Meeting EUROFIDAI - AFFI, Available online: http://dx.doi.org/10.2139/ssrn.2514551 [Accessed 22 May 2018]

Long, M. & Malitz, I. (1983). Investment Patterns and Financial Leverage, working paper no. 1145, National Bureau of Economic Research

Long, M. & Malitz, I. (1985). The Investment-Financing Nexus: Some Empirical Evidence, *Midland Corporate Finance Journal*, vol. 3, no. 3, pp. 53-59

Looney, W. (2010). Strategies for Emerging Markets: Seven Keys to the Kingdom, *Pharmaceutical Executive*, 10 August, Available online: http://www.pharmexec.com/strategies-emerging-markets-seven-keys-kingdom [Accessed 22 May 2018].

Loumioti, M. (2012). The Use of Intangible Assets as Loan Collateral, The University of Texas at Dallas, Avaialble Online: http://dx.doi.org/10.2139/ssrn.1748675 [Accessed 25 May 2018]

Low, P.Y. & Chen, K.H (2004). Diversification and Capital Structure: Some International Evidence, *Review of Quantitative Finance and Accounting*, vol. 23, no. 1, pp. 55-71

Marsh, P. (1982). The choice between equity and debt: An empirical study, *Journal of Finance* vol. 37, no. 1, pp. 121-144

Medtech Europe (n.d.). Medical devices and pharmaceuticals: Two different worlds in one health setting, Available Online: http://www.medtecheurope.org/node/679 [Accessed 26 May 2018]

Menz, K. (2010). Corporate Social Responsibility: Is it Rewarded by the Corporate Bond Market? A Critical Note, *Journal of Business Ethics*, vol. 96, no. 1, pp. 117-134

Modigliani, F. & Miller, M. (1958). The Cost of Capital, Corporation Finance and The Theory of Investment, *The American Economic Review*, vol. XLVIII, no. 3, pp. 261-297

Mohan, S.B., Puranik, S.B., Sagar, P., Sreenivasa, S. & Rao, M.C. (2014). Patents - An Important Tool for Pharmaceutical Industry, *Research & Reviews: Journal of Pharmaceutics and Nanotechnology*, vol. 2, no. 2, pp. 12-16.

Munos, B. (2009). Lessons from 60 years of pharmaceutical innovation. *Nature Reviews Drug Discovery*, vol. 8, pp. 959–968

Myers, S. (1977). Determinants of Corporate Borrowing, *Journal of Financial Economics*, vol. 5, no. 2, pp. 147-175

Myers, S. (1984). The Capital Structure Puzzle, *The Journal of Finance*, vol. XXXIX, no. 3, pp. 575-592

Myers, S. (2001). Capital Structure, *Journal of Economic Perspectives*, vol. 15, no. 2, pp. 81-102

Myers, S. & Majluf, N. (1984). Corporate Financing and Investment Decisions when Firms have Information that Investors do not have, *Journal of Financial Economics*, vol. 13, no. 2, pp. 187-221

Ni, J. & Yu, M. (2008). Testing the Pecking-Order Theory: Evidence from Chinese Listed Companies, The *Chinese Economy*, vol. 41, no. 1, pp. 97-113

Odasso, M. & Ughetto, E. (2011). Patent-backed securities in pharmaceuticals: what determines success or failure?, *R&D Management*, vol. 41, no. 3, pp.219-239.

Oolderink, P. (2013). Determinants of capital structure: Static trade-off theory vs. Pecking-order theory, University of Twente

Orlitzky, M., Schmidt, F. & Rynes, S. (2003). Corporate Social and Financial Performance: A Meta-analysis, *Sage Journals*, vol. 24, no. 3, pp. 403-441, Available online: https://doi.org/10.1177/0170840603024003910 [Accessed 10 May 2018]

Pesaran, M.H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels, Faculty of Economics, University of Cambridge, Avalaible Online: https://doi.org/10.17863/CAM.5113 [Accessed 25 May 2018]

Pesaran, M.H. (2014). Testing Weak Cross-Sectional Dependence in Large Panels, *Econometric Reviews*, vol. 34, no. 6-10, pp. 1089-1117

Peters, R.H. & Taylor, L.A. (2017). Intangible capital and the investment-q relation, *Journal of Financial Economics*, vol. 123, no. 2, pp. 251-272

Rajan R. & Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data, *The Journal of Finance*, vol. 50, no. 5, pp. 1421-1460

Rampini, A.A. & Viswanathan, S. (2013). Collateral and capital structure, Journal of Financial Economics, vol. 109, no. 2, pp. 466-492

Reprisk (2014). Insight – ESG Risk in the Corporate World [pdf] Available at: https://www.reprisk.com/content/5-publications/6-archive/6-reprisk-e-zine-issue-6-pharmaceuticals/Ezine-Pharmaceuticals.compressed.pdf [Accessed 11 May 2018]

Reputation Institute (2017). ABBVIE, Novo Nordisk and Takeda have the best reputations among pharma companies according to reputation institute global pharma reputation [pdf] Available at: https://cdn2.hubspot.net/hubfs/2963875/Reputation_Institute_Jun2017/pdf/globalpharmareptrak2017-pressrelease_170530c.pdf?t=1511193351903 [Accessed 10 May 2018]

Salton, R. & Jones, S. (2015). The corporate social responsibility reports of global pharmaceutical firms, *British Journal of Healthcare Management*, vol. 21, no. 1, pp. 21-25

Schoubben, F. & Van Hulle, C. (2004). The Determinants of Leverage; Differenes between Quoted and Non Quoted Firms., *Tijdschrift voor Economie en Management*, vol. 49, no. 4, pp. 589-621

Sharpe, S.A. & Nguyen, H.H. (1995). Capital Market Imperfection and the Incentive to Lease, *Journal of Financial Economics*, vol. 39, no. 2-3, pp. 271-294

Sheluntcova, M. (2014). Capital Structure of Private Pharmaceutical Companies in Russia, *Journal of Economics and Management*, vol. 8, no. 2, pp. 315-325

Shyam-Sunder, L. & Myers, S. (1999). Testing static tradeoff against pecking order models of capital structure, *Journal of Financial Economics*, vol. 51, no. 2, pp. 219-244

Smith, C.W. & Wakeman, L.M. (1985). Determinants of Corporate Leasing Policy, *The Journal of Finance*, vol. 40, no. 3, pp. 895-908

Song, J.Y. (2004). Have We Resolved The Issues Related to International Capital Structure? Empirical Evidence from The OECD Countries, PhD thesis, Department of Finance, University of Tennessee, Available Online: http://trace.tennessee.edu/utk_graddiss/2242/ [Accessed 27 May 2018]

Standard & Poor (2014). Key Credit Factors For The Pharmaceutical Industry [pdf] Available at: http://maalot.co.il/publications/MT20141001143230.pdf [Accessed 26 May 2018]

Thomson Reuters, (2012). 2012 CMR International Pharmaceutical R&D Factbook [pdf] Available at: http://www.techstreet.com/direct/2012-RD-Factbook-Executive-Summary.pdf [Accessed 12 May 2018]

Throckmorton, R. (2004). Securitization can be a gold-mine for IP owners. *Intellectual Asset Management*, vol. 1, pp. 17–35.

Titman, S. & Wessels, R. (1988). The Determinants of Capital Structure Choice. *The Journal of Finance*, vol. 43 no. 1, pp. 1-19.

United Nations (2013). World Economic Situation and Prospects 2013 [pdf] Available at: http://www.un.org/en/development/desa/policy/wesp/wesp2013/wesp13update.pdf [Accessed 24 May 2018]

Valeant Pharmaceutical International, Inc., (2018). Valeant Pharmaceutical International Annual report 2010, Available Online: http://ir.valeant.com/annual-reports-archive [Accessed 17 May 2018]

Valeant Pharmaceutical International, Inc., (2018). Valeant Pharmaceutical International Annual report 2017, Available Online: http://ir.valeant.com/annual-reports-archive [Accessed 17 May 2018]

Wald, J. (1999). How Firm Characteristics Affect Capital Structure: An International Comparison, *The Journal of Financial Research*, vol. XXII, no. 2, pp. 161-187

Watanabe, H. (2004). Intellectual Property as Securitized Assets. *Bulletin of The Institute of Intellectual Property*, pp. 142-147, [pdf] Available at: https://www.iip.or.jp/e/e_summary/pdf/detail2003/e15_20.pdf [Accessed 24 May 2018]

Wolf, M. (2017). The challenges of a disembodied economy, *Financial Times*, 28 November, Available online: https://www.ft.com/content/a01e7262-d35a-11e7-a303-9060cb1e5f44 [Accessed 17 May 2018]

Yang S., He, F., Zhu, Q. & Li, S. (2017). How does corporate social responsibility change capital structure?, *Asia-Pacific Journal of Accounting & Economics*, vol. 25, no. 3-4, pp. 352-387

Zambuto, F., Billitteri, C. & Nigro, G. (2011). Capital Structure Decisions in the Biopharmaceutical Industry, Dipartimento di Tecnologia Meccanica, Produzione e Ingegneria Gestionale, University of Palermo

Zheng, H., Fridkin, M. & Youdim, M. (2015). New Approaches to Treating Alzheimer's Disease, *Perspectives in Medicinal Chemistry*, vol. 7, no. 7, pp. 1-8.

Zwiebel, J. (1996). Dynamic Capital Structure under Managerial Entrenchment, *The American Economic Review*, vol 86, no. 5, pp. 1197-1215

7.2 Books

Asquith, P. & Weiss, L. A. (2016). Lessons in Corporate Finance: A Case Studies Approach to Financial Tools, Financial Policies, and Valuation, Hoboken: Wiley

Berk, J. & DeMarzo, P. (2017). Corporate Finance, Boston: Pearson

Berry, W. & Feldman, S. (2008). Multiple regression in practice. Newbury Park: Sage Publications.

Bogdan, B. & Villiger, R. (2010). Valuation in life sciences. Berlin: Springer.

Brealey, R., Myers, S. & Allen, F. (2011). Principles of corporate finance. New York, N.Y.: McGraw-Hill/Irwin.

Brooks, C. (2008). Introductory econometrics for finance. Cambridge [England]: Cambridge University Press.

Frank, M. & Goyal, V. (2008). Trade-Off and Pecking Order Theories of Debt, in Eckbo, E. (eds), *Handbook of Empirical Corporate Finance*, Vol. 2, Amsterdam: Elsevier B.V, Chapter 12, pp. 136-171

Friend, I. & Hasbrouck, J. (1988). Determinants of Capital Structure, in A. Chen (ed), Research in Finance, vol. 7, New York: JAI Press Inc., pp. 1-19

Keegan, K. (2008). Biotechnology valuation: An Introductory Guide, Chichester, England: John Wiley & Sons.

Mánescu, C. (2010). Economic Implications of Corporate Social Responsibility and Responsible Investments, Hylte: Geson Hylte Tryck

Myers, S. (2003). Financing of Corporations, in G. Constantinides, M. Harris & R. Stultz (eds), *Handbook of the Economics of Finance*, Amsterdam: Elsevier, pp. 215-253

Pandit, A. (2015). Demystify Pharma Volume 1: An introduction to a typical pharma company, [e-book] Smashwords, Available through Smashwords' website https://www.smashwords.com/books/view/508884 [Accessed 19 May 2018]

Skärvad, P. & Lundahl, U. (2016). Utredningsmetodik, 4th ed. Lund: Studentlitteratur.

Wooldridge, J. (2012). Introductory Econometrics - A Modern Approach, Boston: Cengage Learning

7.3 Websites

Bloomberg (2018). Available online: https://www.bloomberg.com/quote/VRX:US [Accessed 17 May 2018]

Damodaran, A. (2018). Debt to capital & debt to equity ratios, with key drivers, New York University, Available Online: http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/dbtfund.htm [Accessed 15 May 2018]

Hyndman, R. (2010). Different results from different software, web blog post avaialable at: https://robjhyndman.com/hyndsight/estimation/ [Accessed 10 May 2018]

IFRS (n.d.). IAS 38 Intangible Assets, Available Online: https://www.ifrs.org/issued-standards/list-of-standards/ias-38-intangible-assets/ [Accessed 24 May 2018]

Statistics Solutions (2013). Normality. Available online: http://www.statisticssolutions.com/academic-solutions/resources/directory-of-statistical-analyses/normality/ [Accessed 24 May 2018]

Thomson Reuters (n.d.). ESG research data, Available Online: https://financial.thomsonreuters.com/en/products/data-analytics/company-data/esg-research-data.html [Accessed 10 May 2018]

Uhy International (n.d.). Corporate taxes vary widely between countries, UHY study finds. Available Online: http://www.uhy.com/corporate-taxes-vary-widely-between-countries-uhy-study-finds-2/ [Accessed 28 May 2018]

World Bank Group (n.d.). World Bank Country and Lending Groups, Available Online: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519 [Accessed 10 May 2018]

World Bank Group (n.d.). World Bank national accounts data, and OECD National Accounts data files. Available Online: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD [Accessed 17 May 2018]

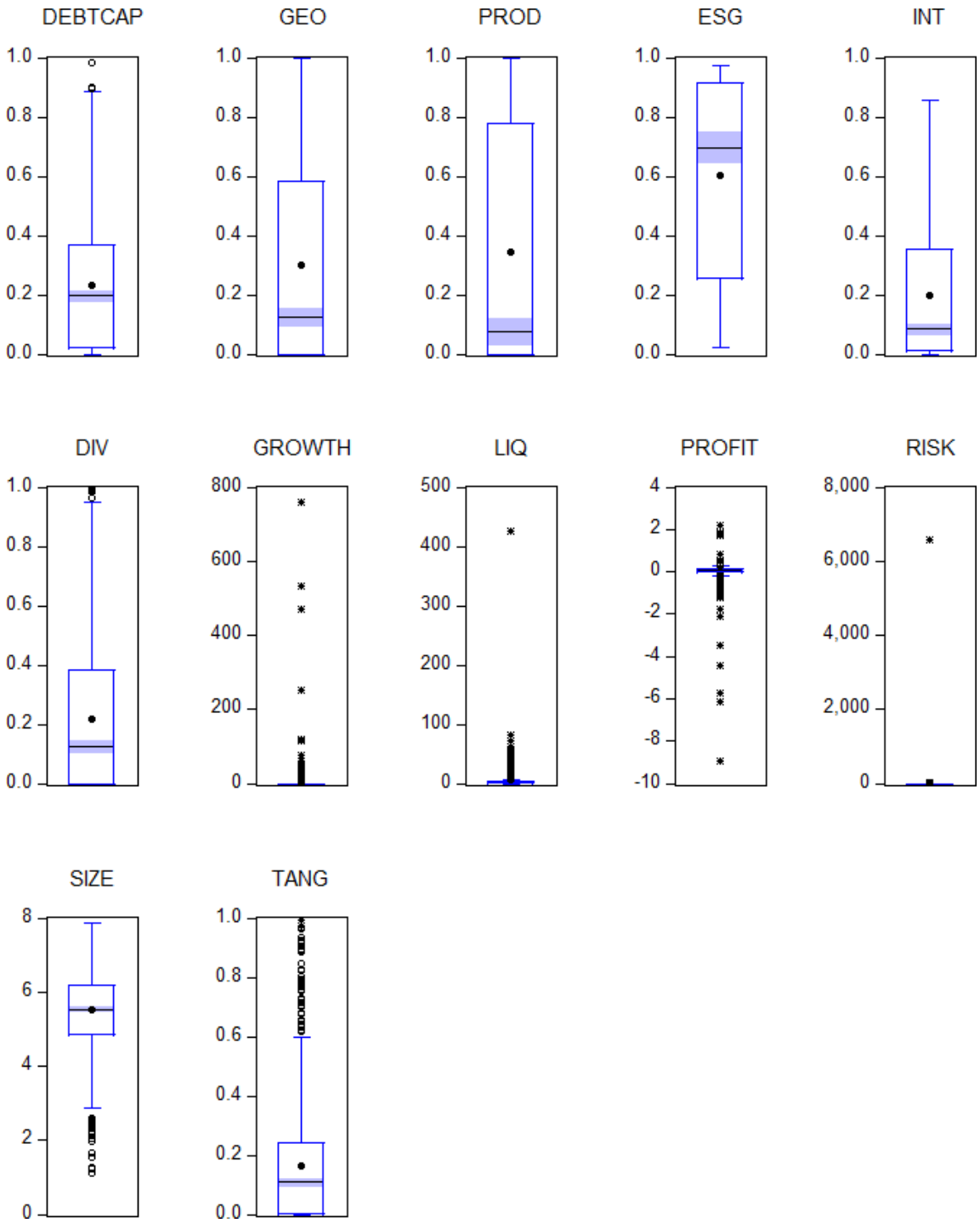
8. Appendices

8.1 Appendix I: Research study

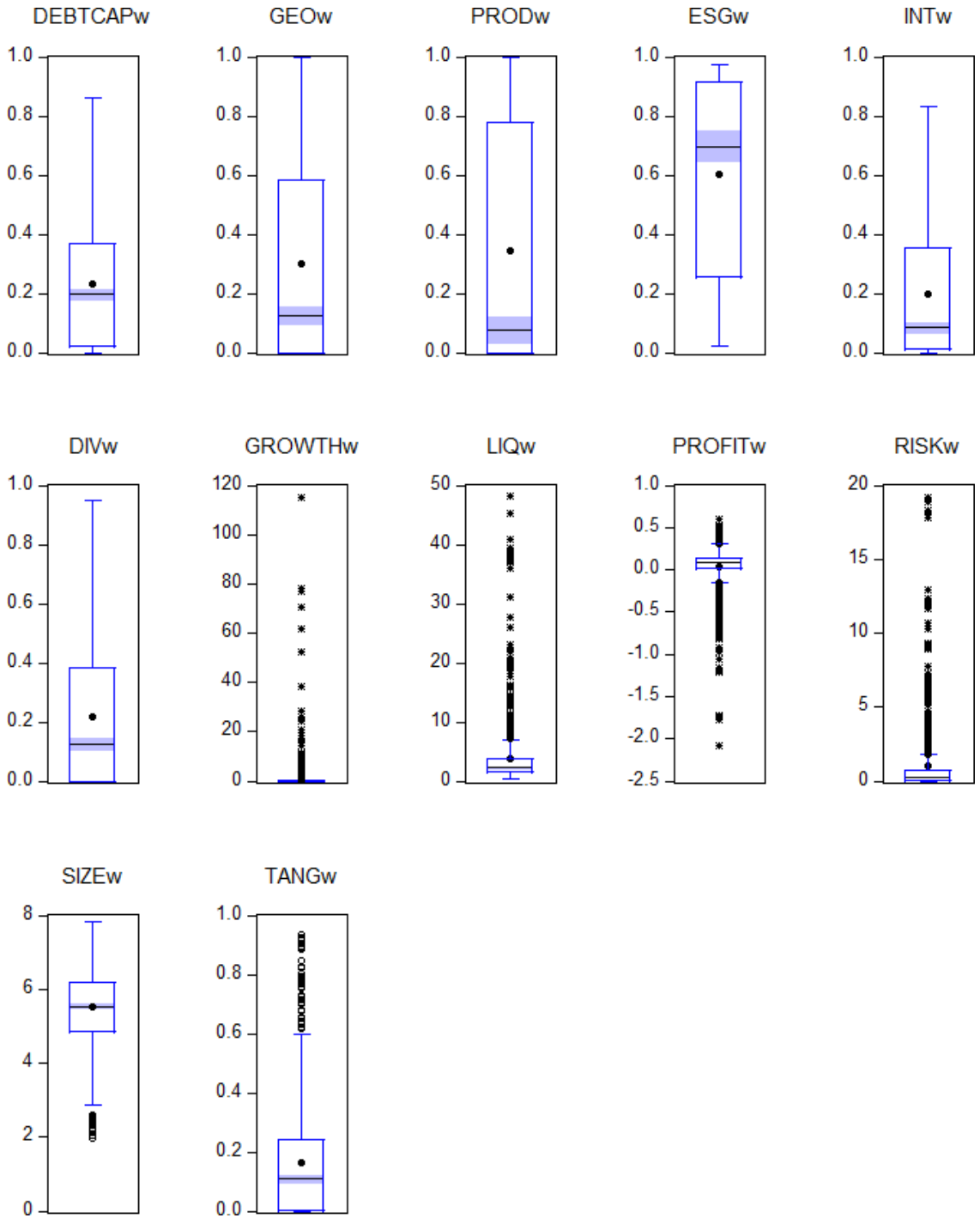
Authors	Year	DIVERS.	ESG	INT	DIV	GROWTH	LIQ	PROFIT	RISK	SIZE	TANG
Kim & McConnel	1977	+									
Lewellen	1977	+									
Marsh	1982									+	+
Bradley et al	1984								-		
Long & Malitz	1985										+
Kester	1986					+		-		-	
Kim & Sorenson	1986					-			+		
Friend & Hasbrouck	1988							-	-		+
Titman & Wessels	1988							-			
Chaplinsky & Niehaus	1990						-				
Li & Li	1996	-									
Wald (1999)	1999					-		-	-	+	+
Frank & Goyal	2003					-		-		+	+
Low and Chen	2004						-		-	+	
Schoubben & Van Hulle	2004							-		+	
Deesomsak, Paudyal & Pescetto	2004							-	+	+	+
Degryse, De Goeij, & Kappert	2009			+		+		-		+	+
Frank & Goyal	2009				-			-			+
Rocca et al.	2009	+									
Menz	2010	-	+								
Zambuto, Billitteri & Nigro	2011					-		-		+	
Attig, Ghoul and Guedhami	2013	+									
Lim, Macias & Moeller	2014			+							
Sheluntcova	2014						-	-		-	
Bodla & Kaur	2015									+	
Yang et al.	2017	-									
Positive signs (%)		57	100	100	0	25	0	0	33	89	100
Negative signs (%)		43	0	0	100	75	100	100	67	11	0

8.2 Appendix II: Before and after winsorization

Before winsorzation



After winsorization



8.3 Appendix III: Stata Hausman test

	Fixed Effects	Random effects	Difference	S.E.
GEOW	.0032733	.0215682	-.0182948	.0230021
PRODW	.0039418	.0720818	-.0681401	.03892
ESGW	.036208	-.0049497	.0411577	.018948
INTW	-.074692	.0382029	-.1128949	.0426405
DIVW	-.0701031	-.0447252	-.0253779	.0198133
GROWTHW	-.1675368	-.1071032	-.0604336	.0891874
LIQW	.0033253	.0030967	.0002285	.00198
PROFITW	-.9746419	-.7361036	-.2385383	.090383
RISKW	.0019885	.0014395	.0005491	.0006974
SIZEW	.318538	.1405729	.1779652	.0562609
TANGW	.6802114	.1906222	.4895893	.2230722
$\boldsymbol{Prob > \chi 2}$	0.0027			

8.4 Appendix IV: EViews White test

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
GEOW	0.005228	0.002291	2.281854	0.0238
PRODW	0.004483	0.005148	0.870738	0.3852
ESGW	-0.004977	0.004607	-1.080206	0.2816
INTW	-0.002237	0.003457	-0.647015	0.5185
DIVW	-0.000191	0.002434	-0.078536	0.9375
GROWTHW	-0.013234	0.011757	-1.125630	0.2620
LIQW	0.000180	0.000249	0.720025	0.4725
PROFITW	0.007554	0.005484	1.377515	0.1702
RISKW	0.000178	0.000128	1.389398	0.1666
SIZEW	-0.009443	0.009788	-0.964714	0.3361
TANGW	0.022992	0.034358	0.669201	0.5043
C	0.062560	0.058553	1.068443	0.2869
F STATISTIC	2.422265			
P-VALUE	0.000001			

8.5 Appendix V: Stata Cross-sectional dependence test

Variable	CD-test (Pesaran)	p-value	mean corr. (ρ)
DEBTCAP	-.026	0.979	+ 0.00
DIV	-.597	0.551	+ 0.00
PROFITADJ	.426	0.670	+ 0.00
GROWTHADJ	4.884	0.000	+ 0.01
RISKADJ	1.826	0.068	+ 0.00
TANG	2.166	0.030	+ 0.01
SIZE	47.748	0.000	+ 0.13
GEO	3.877	0.000	+ 0.01
LIQADJ	.004	0.997	+ 0.00
PROD	-.622	0.534	+ 0.00
ESG	27.951	0.000	+ 0.03

8.6 Appendix VI: EViews Regression without fixed effects

Dependent Variable: DEBTCAPW
Method: Panel Least Squares
Date: 05/24/18 Time: 13:45
Sample: 2011 2016
Periods included: 6
Cross-sections included: 63
Total panel (unbalanced) observations: 242
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GEOW	-0.106734	0.033333	-3.202044	0.0016
PRODW	0.143601	0.027634	5.196458	0.0000
ESGW	-0.178467	0.046488	-3.838986	0.0002
INTW	0.285874	0.055761	5.126815	0.0000
DIVW	0.018151	0.066857	0.271482	0.7863
GROWTHW	-0.059638	0.078799	-0.756838	0.4499
LIQW	0.009469	0.005509	1.718613	0.0870
PROFITW	-0.339635	0.043054	-7.888568	0.0000
RISKW	0.004060	0.002864	1.417663	0.1576
SIZEW	0.153017	0.017993	8.504165	0.0000
TANGW	0.135011	0.094013	1.436087	0.1523
C	-0.698512	0.096381	-7.247436	0.0000

R-squared	0.362467	Mean dependent var	0.303261
Adjusted R-squared	0.331976	S.D. dependent var	0.236774
S.E. of regression	0.193522	Akaike info criterion	-0.398536
Sum squared resid	8.613673	Schwarz criterion	-0.225531
Log likelihood	60.22289	Hannan-Quinn criter.	-0.328844
F-statistic	11.88776	Durbin-Watson stat	0.214236
Prob(F-statistic)	0.000000		