Empirical evidence on the existence of a pecking order

A study about whether the pecking order theory is an accurate means to describe the incremental financing practices by firms in the European Union.

A Bachelor Thesis in the area of Business Administration
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Abstract: The objective of this research paper is to establish to which extent the pecking order theory of capital structure is empirically justified. It is a test of the pecking order theory among publicly-listed firms in the European Union. The pecking-order model as proposed by Shyam-Sunder and Myers (1999) is followed. Multiple tests are conducted, including a test where a possible time gap between the financing deficit and debt issuance is taken into account. Furthermore, companies were divided size into various categories based on firm size and nationality to further evaluate financing behaviors within the selected data. Following Frank and Goyal (2003), the pecking order theory is also tested against a more traditional model of financing behavior. Pecking order behavior is being investigated before the financial crisis and during the financial crisis. Lastly, all EU-countries in the sample period have been investigated separately. The results show that there is very little evidence in favor of the existence of a pecking order in the incremental financing practices of firms. The evidence suggests that the pecking order theory has little to very little support in any particular country in the European Union. There is little difference in pecking order behavior between firms of with various levels of total assets. Furthermore, there have not been any significant changes in financing practices before the global economic crisis in 2009 and during the global economic crisis.

Keywords: *capital structure, pecking order theory, incremental financing, financing behavior*

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1. Introduction

In order to finance their investments, firms can use internal or external sources. Internal sources include retained profit and other earnings, and external sources of financing include borrowing (issuing debt) or the issuing of stock (issuing equity). The decision about how to finance a firm is important because firms want to know how to investment in the best way possible. The research about these decisions is called the research about capital structure, which represents the amount of debt and the amount of equity financing needed to finance firms' assets and investments. "Capital structure varies widely from industry to industry and sector to sector (e.g. capital intensive industries such as capital goods firms, tend to have a debt-to-equity ratio above 2, while technology companies have a debt to-equity ratio under 0.5)" (Lara, 2009).

The theory of capital structure attempts to explain the sources and strategies firms use to make financing decisions. The field of capital structure determinants started with Modigliani and Miller (1958) who argued that under certain (theoretical) conditions, the real value of a firm will not be affected: The theorem states that, in a perfect market, how a firm is financed is irrelevant to its value. Since then, economists, managers and financial analysts and academics began to focus on capital structure as a field, because it provided the base that in the real world, capital structure is relevant: issues whether there could be something as 'an ideal, optimal capital structure' and what the determinants regarding capital structure are would be considered, in other words, why do companies choose for a particular kind of financing?

A few dominant theories emerged on this subject, the first one being the static trade-off theory. The theory is about explaining the idea that a company chooses how much debt finance and how much equity finance to use by balancing the costs and benefits, and also explains the fact that companies use both debt and equity as sources of finance (Kraus and Litzenberger 1973). It balances between the benefits (i.e. tax-shields) for debt or equity and the costs involved and thus holds there is an optimal capital structure.

Another theory very relevant to the explanation of the phenomenon of capital structure is the pecking order theory as proposed in articles by Myers (1984) and Myers and Majluf (1984). This article spawned what today is called pecking-order theory and proposes that, in general, firms will have a pecking order in ways to finance their business. That is, firms will prefer internal financing at first. When they will need more financing to do their business, they will chose to prefer debt over equity and will only as a last resort raise equity and give away (a fraction of the) control of the company. They do so because "equity is a less preferred means to raise capital because when managers (who are assumed to know better about true condition of the firm than investors) issue new equity, investors believe that managers think that the firm is overvalued and managers are taking advantage of this over-valuation (Myers and Majluf, 1984)."

In this research we are going to focus on the pecking order theory and its empirical evidence. Various academics have researched and performed statistical tests on comparing the pecking-order and trade off theories (e.g. Shyam-Sunder and Myers, 1999; De Jong, Verbeek and Verwijmeren, 2011) but that is outside of the scope of this research. In this study, it is tested how well the pecking-order theory performs in an empirical context. The expected relationships related to the pecking-order theory will be tested through the means of sampled data and statistical analysis, supported by theoretical explanation.

Capital structure is defined as the way a corporation finances its assets through some combination of equity, debt, or a combination of both. The composition, the 'structure' of how a firm is being financed is then called capital structure. In practice, capital structure is often highly complex and includes many sources of gathered capital.
The attributes that different theories of capital structure suggest may affect the firm's debt-equity choice. These attributes are denoted asset structure, non-debt tax shields, growth, uniqueness, industry classification, size, earnings volatility, and profitability (Titman and Wessels, 1988).

In contrast with the static-trade off theory mentioned earlier, there is no well-defined target debt-equity mix, because there are two kinds of equity, internal and external, one at the top of the pecking order and one at the bottom (Myers, 1984). Note that the pecking order theory is about incremental financing as evidenced in this example: "Consider three sources of funds available to firms—retained earnings, debt, and equity. Equity has serious adverse selection, debt has only minor adverse selection, and retained earnings avoid the problem. From the point of view of an outside investor, equity is strictly riskier than debt. Rational investors will thus revalue a firm's securities when it announces a security issue. For all but the lowest quality firm, the drop in valuation of equity makes equity look undervalued, conditional on issuing equity. From the perspective of those inside the firm, retained earnings are a better source of funds than outside financing. Retained earnings are thus used when possible. If retained earnings are inadequate, debt financing will be used. Equity is used only as a last resort. This is a theory of leverage in which there is no notion of an optimal leverage ratio. Although the pecking order theory is almost always framed in terms of asymmetric information, it can also be generated from tax, agency, or behavioral considerations." (Frank and Goyal, 2009) Therefore, we want to use a definition given by Frank and Goyal (2007) as to when a particular firm exhibits pecking order behavior: "A firm is said to follow a pecking order if it prefers internal to external financing and debt to equity if external financing is used."

This thesis is completely going to focus on the pecking-order hypotheses and will leave the competitive static tradeoff theory open for further research (see §5.5). The uniqueness and therefore relevance of this research is going to be in the area of sampling: the sample consists of publicly listed firms in the European Union so the area of focus is going to be different from the main body of empirical research in the academic literature. Most research has been done using data from US firms or industry specific research as in the case of Lara (2009) , even others who compare different firm types in different nations/economic climates (e.g. Seifert and Gonenc, 2007) but no research has explicitly focused on listed non-financial firms in the European Union. Another unique part of my research is going to be that I will, after I performed the general tests, split the sample into three subsamples regarding firm size (measured by total assets) and perform the regression tests again.

The main research question will be: *"Is the pecking order theory hypothesis an accurate means to explain the incremental financing of firms in the EU?"*

Furthermore, the subquestion *"Is there a difference regarding the empirical evidence in favor of the pecking-order theory between companies with various levels of total assets?*" will be investigated.

In other words, this means that we are going to research whether the pecking-order hypothesis is a good explanation for the firms' incremental financing, first in a simple linear regression model, then in a multiple linear regression model controlled for other relevant variables (for further operationalization, see chapter 3). After those tests, we are going to divide the original sample into three subcategories of company size, and observe whether there is a difference between the statistical tests executed again, on each subsample.

The sample comprises listed non-financial firms in the European Union and comprises of data recorded over the years of 2007 to 2012. Since 2007, the members of the European Union have remained constant so I will not have to exclude data from my sample from firms which would not have been part of the EU during the sampling period.

The tests that have been conducted are the following. The how's and why's will be explained in the theory section.

1. The test based upon the prediction that debt is used to fill the financing deficit.	$\Delta D_{it} = a_{po} + b_{po}DEF_{it} + e_{it}$.
2. The test based upon the prediction that debt is used to fill the lagged financing deficit.	$\Delta D_{it} = a_{po} + b_{po}DEF_{it-1} + e_{it}$.
3. The test from (1), investigating a subsample in the period before the crisis, and a subsample in the period during the crisis.	$\Delta D_{it} = a_{po} + b_{po}DEF_{it(\text{before crisis})} + e_{it}$ and $\Delta D_{it} = a_{po} + b_{po}DEF_{it(\text{during crisis})} + e_{it}$.
4. The test of the disaggregated deficit, where the financing deficit from (1) is broken up in its separate parts.	$\Delta D_{it}=a+b_{DIV}DIV_t+b_II_t+b_W\Delta W_t + b_RR_t-b_CC_t+e_{it}$,
5. The test from (1), investigating subsamples containing small, medium and large-sized firms.	$\Delta Dt=a+b_{PO}DEF_{i(lsmall)t}+e_{it}$ and $\Delta Dt=a+b_{PO}DEF_{i(medium)t}+e_{it}$ and $\Delta Dt=a+b_{PO}DEF_{i(large)t}+e_{it}$.
6. The test from (1), investigating each country separately.	$\Delta D_{it} = a_{po} + b_{po}DEF_{i(country)t} + e_{it}$.
7. The test from (2), investigating each country separately.	$\Delta D_{it} = a_{po} + b_{po}DEF_{i(country)t-1} + e_{it}$.
8. The pecking order tested against a traditional leverage model	$\Delta D_i= \alpha + \beta_T \Delta T_i+ \beta_{MTB} \Delta MTB_i+ \beta_{LS} \Delta LS_i+ \beta P$ $\Delta P_i+DEFi + \varepsilon$

Table 1. Tests that are conducted in this study

Results show that there is very little evidence in favor of the existence of a pecking order in the incremental financing practices of firms. Both the deficit and the lagged deficit have coefficients smaller than 0.1 where a coefficient of 1 is hypothesized. This means that financing deficit alone cannot explain the issuance of debt and thus the financing practices in the manner the pecking order theory hypothesized. All separate countries in the EU (where data was available) have been investigated separately, and again no signs of a pecking order appear. The country which followed the pecking order the closest was Cyprus with a coefficient of 0.38 where 1 was the hypothesis. The evidence suggests that the pecking order theory has very little support in any particular country in the European Union. However, there have been minor changes in financing practices before the global economic crisis in 2009 and during the global economic crisis.

There has been a portion of literature regarding the existence of pecking-order theory and the empirical evidence supporting (or opposing) the theory. The scientific relevance of this thesis has to do with that the research can contribute to the empirical evidence of the pecking-order

and its generalizability; because the sample that we use is quite different from other samples, it can serve as a confirmation that the pecking-order theory is externally valid (or invalid). This would mean that, for example, factors like economic climate will be redundant, because the hypotheses will be valid within another economic climate than the ones previous researches were conducted in. It can be also very contributing if evidence will be found regarding the existence of pecking-order theory in 'large' companies, while no supporting evidence will be found regarding the existence of pecking-order theory in 'small' companies by using this sample.

The practical relevance of this thesis is that especially in the current economic climate, companies are focused on being as efficient as possible. This includes the activity of efficient financial management and perhaps they are searching for an optimal capital structure (like static tradeoff theory claims this is existing) or perhaps they want to see what their capital structure is like: They could want to gain insight in motivators, determinants and implications for their choice of capital structure or use the empirical data as motivation for new decisions regarding corporate finance. A good pecking-order model also serves the aim of predicting what would happen for both a specific firm and its competitors in case new financing will be needed. Perhaps it can even change their policies or practices on whether to issue equity or debt.

In the first part of the article, the introduction, one will find a short explanation about capital structure and its main definitions, why it is relevant today. Following the short explanation, some literature will be examined and a hypothesis will be introduced as well as an explanation as to why the hypothesis is new/different from the existing literature (i.e. there is a gap). Then, details will be provided about the sample subject to this research and the main results will be summarized. The introduction closes with short argumentation regarding the contributions (both scientific and practical) from this article. In the second part of the article a portion of the literature regarding the pecking order theory will be reviewed. First the theoretical background will be explained in a chronological order, starting with the article that proposed the first version of the pecking order theory (i.e. Myers, 1984) and following up with additions/considerations made over time. After the theoretical part, the empirical results will be examined, and this will be structured in such a way that the articles supporting the pecking order will be mentioned in the first place and then the articles opposing the pecking order. The articles will be ordered chronologically. After the empirical part, some criticism and nuances on the opposing empirical findings will be explained. In the next part, the methodology, I will explain the methodology I use to test the pecking-order theory, the hypotheses, the methods of analysis and the specifications of each different test. In the fourth part, the results will be schematically represented in tables. Then, a short discussion section is used to place the results into the context of the theory and empirics. In the fifth part, conclusions will be drawn and limitations will be discussed, and in the last sections of the thesis, the references will be provided.

2. Literature review

2.1 Theory

In this section, the literature of the pecking order theory will be examined and the implications for this research will be discussed. Thus, we are going to outline the principles of pecking order theory and its origins, how exactly it emerges from theory of the firm and what the phenomena of asymmetric information and agency costs exactly have to do with the pecking-order theory. The determinants of capital structure have been researched by Harris and Raviv (1991), where they identified 4 categories of determinants of capital structure. These are "the desire to ameliorate conflicts of interest among various groups with claims to the firm's resources, including managers (the agency approach), the desire to convey private information to capital markets or mitigate adverse selection effects (the asymmetric information approach), the desire to influence the nature of products or competition in the product/input market, or the desire to affect the outcome of corporate control contests."

"The theory of capital structure however, has been dominated by the search for optimal capital structure. Optimums normally require a tradeoff, for example between the tax advantages of borrowed money and the costs of financial distress when the firm finds it has borrowed too much. In the pecking order theory, there is no well-defined optimal debt ratio. The attraction of interest tax shields and the threat of financial distress are assumed second-order. Debt ratios change when there is an imbalance of internal cash flow, net of dividends, and real investment opportunities. Highly profitable firms with limited investment opportunities work down to low debt ratios. Firms whose investment opportunities outrun internally generated funds borrow more and more. Changes in debt ratios are driven by the need for external funds, not by any attempt to reach an optimal capital structure (Shyam-Sunder and Myers, 1999, p. 221)."

"The basic pecking order model, which predicts external debt financing driven by the internal financial deficit, has much greater time-series explanatory power than a static tradeoff model, which predicts that each firm adjusts gradually toward an optimal debt ratio. (..) This is because there are three sources of funding available to firms: retained earnings, debt, and equity. "Retained earnings have no adverse selection problem. Equity is subject to serious adverse selection problems while debt has only a minor adverse selection problem. From the point of view of an outside investor, equity is strictly riskier than debt. Both have an adverse selection risk premium, but that premium is large on equity. Therefore, an outside investor will demand a higher rate of return on equity than on debt. From the perspective of those inside the firm, retained earnings are a better source of funds than is debt and debt is a better deal than equity financing (Frank and Goyal, 2003, p. 220)". Thus, a given firm will use retained earnings as a source of financing first, if possible. If retained earnings fall short for the future needs of financing for a given firm, a firm will issue debt in the first place, equity will not be used and the financing deficit will match the net debt issues.

As a result, the following model is introduced. The definition is going to be a hybrid between those of Shyam-Sunder and Myers (1999), Frank and Goyal (2003) and Atiyet (2012). The financing deficit is constructed from an aggregation of dividends, investment, change in working capital and internal cash flows because in reality, "... company operations and the associated accounting structures are more complex than the standard pecking order representation. This implies that in order to test the pecking order, some form of aggregation must be used (Frank &

Goyal, 2003, p. 220)". The following table will present the definitions of the financing deficit and the debt issued.

Ct	=	operating cash flows, after interest and taxes
$DIVt$	=	dividend payments
It	=	net investment in year t (i.e., I_t =capital expenditures+increase in investments+acquisitions+other use of funds−sale of PPE−sale of investment);
ΔW_t	=	net increase in working capital
Rt	=	current portion of long-term debt at start of period
Dt	=	long-term debt outstanding
At	=	net book assets, including net working capital
dt	=	D_t / A_t, the book debt ratio

(Frank and Goyal, 2003)

The financing deficit is given by the accounting identity firm i in year t: $DEF_{it} = (DIV_{it} + I_{it} + \Delta W_{it} + R_t - C_{it})$ / Total assets. The test is based upon the prediction on whether debt or equity is used to fill the financing deficit. Because a given firm a firm will issue debt in the first place in order to finance their deficit, equity will not be used and the financing deficit will match the net debt issues. Shyam-Sunder and Myers (1999) argue that, except for firms at or near their debt capacity, the pecking order predicts that the deficits will be filled entirely with new debt issues: $\Delta D_{it} = a_{PO} + b_{PO} DEF_{it} + e_{it}$, where e_{it} is an error term.

Following standard practice, all data points are going to be scaled, that is, the initial absolute result will be divided by the total firm assets. All components for firm i are scaled by total assets at year t. A firm with a lot of assets will generally need a lot more financing than a firm without a lot of assets so therefore there is a need for interpreting this data relative to each other instead of absolute. There has been a general consensus among researchers in this area that scaling is the best method: For example, the researches of Shyam-Sunder and Myers (1999), Atiyet (2012), Seifert and Gonenc (2012) and others scaled the debt issued relative to the amount of assets for each firm they sampled. This way, there is being controlled for asset size or differences in financing requirements due to the nature of the firm's business. "Scaling is most often justified as a method of controlling for differences in firm size." (De Jong, Verbeek and Verwijmeren, 2011)

Taking the argument of Shyam-Sunder and Myers (1999) in consideration, that is "we should consider whether the good fit of the pecking order specification has more to do with short-term adjustments than planned financing." The pecking order regression as explained above relate debt issues or retirements to contemporaneous deficits – that is – in the same year as the deficit arises, the debt will be issued. To take into account a certain 'buffer time' over which the firm can oversee its own financial deficit, we also test the regression of the long term debt issued from 2008-2012 on the deficit lagged one year: DEF_{t-1}, so from 2007-2011. Therefore the equation is going to be: $\Delta D_{it} = a_{po} + b_{po} DEF_{it-1} + e_{it}$. "This is consistent with the pecking order - information asymmetries provide one good reason why equity is not issued on short notice - but that theory is more convincing if companies also plan to cover deficits by issuing debt."(Shyam-Sunder and Myers, 1999)

In order to test the pecking order theory the data we use needs to be aggregated. The question is whether this step is justified. In the words of Frank and Goyal (2003): "It seems plausible that

there could be information in DEF_{it} that helps to account for ΔD_{it}, but not in the manner hypothesized by the pecking order theory. Consider the following specification,

$$\Delta D_{it} = a + {}_{bDIV}DIV_t + {}_{bI}I_t + {}_{bW}\Delta W_t + {}_{bR}R_t - {}_{bC}C_t + e_{it}$$

Under the pecking order theory, it is DEF_{it} itself that matters. A unit increase in any of the components of DEF_{it} must have the same unit impact on ΔD_{it}. If however, the significance is actually only driven by some of the individual components, then alternative coefficient patterns are possible."

The pecking order test makes different assumptions and uses different information than is conventional in empirical research on leverage and leverage-adjusting behavior, according to Frank and Goyal (2003). "Harris and Raviv (1991) explain the conventional set of variables and then Rajan and Zingales (1995) distill these variables into a simple cross-sectional model. (…)The conventional set of explanatory factors for leverage is the conventional set for a reason. The variables have survived many tests (Frank and Goyal, 2003, p. 223)." A regression model testing the influence of the financing deficit in combination with other variables is going to be executed in this form:

$$\Delta D_i = \alpha + \beta_T \quad \Delta T_i + \beta_{MTB} \quad \Delta MTB_i + \beta_{LS} \quad \Delta LS_i + \beta_P \quad \Delta P_i + \beta_{DEF} \quad DEF_i + \varepsilon_i.$$

D is defined as the ratio of total debt to market capitalization, *T*=Tangibility is defined as the ratio of fixed assets to total assets. MTB is the market-to-book ratio defined as the ratio of the market value of assets (book value of assets plus the difference between market value of equity and book value of equity) to the book value of assets. LS is log sales, defined as the natural logarithm of constant sales. *P* is profit defined as the ratio of operating income to book value of assets.

Seifert and Gonenc (2007) mention that "investors in the US and UK have an asymmetric information problem caused, in part, by the relatively widespread ownership of stock in these two countries where managers and insiders know more than outside investors. German and Japanese investors, on the other hand, face an information asymmetric problem arising from relatively less and sometimes distorted information flows and generally less investor rights." Therefore, in order to discover differences between firms from different countries, the same regression equation $\Delta D_{it} = a_{PO} + b_{PO}DEF_{it} + e_{it}$, will be ran but with separate regressions for every country in the EU. "Evidence shows that firm size is critical.

There is a monotonic improvement of the performance of the pecking order predictions as the firm size increases. For the largest quartile, there is reasonable support for the pecking order prediction. (..)For the smallest set of firms, the pecking order is rejected. [In order to]… to understand the evidence, it is important to recognize the differences among private firms, small public firms and large public firms. Private firms seem to use retained earnings and bank debt heavily. Small public firms make active use of equity financing. Large public firms primarily use retained earnings and corporate bonds. In the middle, the support for the theory grows with firm size" (Frank & Goyal, 2003, p. 237).

Seifert and Gonenc (2007) have published their results from a sample and differentiated between small and large firms (and high-growth and low-growth firms) but they have only tried two categories ('small firms' and 'large firms'), whereas I am planning to differentiate between

three categories, (small, medium and large) to get a more precise view of the differences in pecking order behavior between companies from different sizes. I will use the measurement Seifert and Gonenc (2007) and Frank and Goyal (2003) use, i.e. measure company size in terms of total assets instead of the alternative, proposed and researched also by Seifert and Gonenc (2007), that is, by growth rate because growth rate merely implies a potential to become large-sized instead of actually being large-sized (Measurement by total assets has its negative sides as well but they will be explained in §5.5). "Several prior studies have inquired the firm-size effect, such as Byoun and Rhim (2003), Frank and Goyal (2003), and Ağca and Mozumdar (2004). Byoun and Rhim (2003) find evidence to support the pecking order's prediction that small firms are more likely to follow the pecking order because of more potential problems of asymmetric information. Frank and Goyal (2003) conclude that large firms abide by the pecking order better than small firms do, which is contradictory to the theory's prediction (Zhang and Kanazaki, 2008)." These hypotheses follow the definition of size I am going to use, i.e. measurement of size in terms of total assets. The cut-off point, that is, how exactly I will divide the subsamples, will be argued for and specified in paragraph 3.4.

Then, at what point is equity introduced and what is the place of equity issues in the pecking order theory? "The strict interpretation suggests that after the IPO (Initial Public Offering), equity should never be issued unless debt has for some reason become infeasible. This leads to the notion of a debt capacity. The debt capacity serves to limit the amount of debt within the pecking order and to allow for the use of equity (Frank and Goyal, 2007)." "Our econometric investigation of the pecking order theory focuses on a sequential decision process that follows from Myers and Majluf. Managers have private information regarding the value of assets in place and investment opportunities that cannot be credibly conveyed to the market. Consequently, any risky security offered by the firm will not be priced fairly from the manager's point of view. The riskier the security, the less accurate is its pricing, because risk exacerbates the effects of asymmetric information. That is, the 'lemons premium' demanded for a risky security is even higher than for a fairly safe one. Thus, firms always prefer internal to external financing. If external financing is required, they prefer debt to equity. When debt is so risky that it is mispriced as much as equity, the incentive to issue debt over equity diminishes; for very risky firms, equity and debt are equally distasteful" (Helwege and Liang, 1996). Thus, equity is only issued as a last resort. *Y*ou will refuse to issue equity unless you have already exhausted the "debt capacity" - that is, unless the firm has issued so much debt already that it would face substantial additional costs in issuing more (Myers, 1984). Other factors that give incentives to lower debt ratios are the debt overhang problem (Myers, 1977), the cost of personal taxes (Miller, 1977), non-debt tax shields (DeAngelo and Masulis, 1980), and investments in employee well-being (Verwijmeren and Derwall, 2010). "The pecking order theory implies that the financing deficit ought to wipe out the effects of other variables. If the financing deficit is simply one factor among many that firms tradeoff, then what is left is a generalized version of the tradeoff theory." (Frank and Goyal, 2003). In case firms have unconstrained access to debt, the pecking order theory predicts that the amount of debt issued equals the deficit (...). In reality, a firm's debt capacity is limited due to financial distress costs (De Jong, Verbeek and Verwijmeren, 2007). "

The existence of a pecking-order is derived from the following argument: "equity capital -the most information-sensitive security- has large adverse selection cost so firms prefer to raise equity as a financing means of last resort. By contrast, debt capital has much less adverse

selection cost and internal funds completely avoid the problem." (Gao et al., 2012) Jensen and Meckling (1976) identified the existence of the agency problem. "Many problems associated with the inadequacy of the current theory of the firm can also be viewed as special cases of the theory of agency relationships. We define an agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent. If both parties to the relationship are utility maximizers, there is good reason to believe that the agent will not always act in the best interests of the principal. (Jensen & Meckling, p. 4-5). They proposed that there are two kinds of agency costs - agency costs of equity and debt. The conflict between managers and shareholders leads to agency costs of equity, and the conflict between shareholders and debt-holders leads to agency costs of debt. "The pecking order hypothesis posited by Myers and Majluf (1984) predicts that this information asymmetry between managers and investors creates a preference ranking over financing sources. Beginning with internal funds, followed by debt, and then equity, firms work their way up the pecking order to finance investment in an effort to minimize adverse selection costs (Learey and Roberts, 2010)."

"Managers use their informational advantage to issue securities when they are overpriced, but investors, aware of management's incentive, discount the price that they are willing to pay for the securities. The result of this discounting is a potential underinvestment problem, as managers forgo profitable investment opportunities. To avoid the underinvestment problem, firms prefer to use internal funds because they avoid informational problems entirely. When internal funds are insufficient to meet financing needs (i.e., financing deficit), firms turn first to risk-free debt, then risky debt, and finally [outside] equity, which is at the top of the pecking order" (Leary and Roberts, 2005). Thus, "raising capital under asymmetric information exposes firms to potential value dilution. When insiders have better information than investors on firm value, firms of better-than-average quality will find that investors price their securities below the value perceived by their insiders. Under these circumstances, Myers and Majluf (1984) suggest that firms can reduce dilution (i.e., mispricing) by issuing debt rather than equity (…) (Fulghieri, Garcia and Hackbarth, 2013)."

Concerning the matter of differences in pecking order behavior between countries, Seifert and Gonenc (2007) distinguish three categories of financial environments which are relevant to pecking order behavior: the institutional setting, the investor rights and the information flows. As far as the institutional settings go, Seifert and Gonenc (2007) mention that the US and the UK have been classified as market-based systems while Japan and Germany as relationship-oriented or bank-based systems. In market-based systems the market plays a pivotal role. More funds are supplied to corporations in market-based systems through equity and bond markets. Seifert and Gonenc (2007) also mention that "investors do not want to supply capital unless they can reasonably be expected to recoup their investment as well as earn a fair rate of return on their money. Therefore, investors will not want to provide money unless they are entitled to certain rights and if those rights are not fulfilled they should be able to seek damages effectively (cheaply and with good results) in court." Then, since there are differences in legal systems concerning investment, it follows that there are differences in investment practices between different countries. With regards to information flows, the information asymmetry problem in the US and the UK may be the result of the relative widespread ownership of stocks (La Porta et al., 1999). Many small investors may simply not get the information that managers possess. "In relationship-oriented systems, banks and other companies are the dominant players (the

insiders control the system). Banks typically hold both equity and debt in the firms they represent (Seifert and Gonenc, 2007)." Since information asymmetry is the driving force of the pecking order theory (Myers, 1984) one might assume that these differences in financial environments might lead to differences in pecking order behavior among firms operating in different countries.

2.2 Empirics

In this section, we are going to examine the conclusions on the empirical evidence of the pecking-order hypothesis in the past and under what conditions tests were made (in other words: what are the assumptions being made in this research for which this conclusion can be drawn?). At first we are going to examine results in favor of the pecking order hypotheses, and after that we will provide some contra-evidence and as a finalization we will provide some criticism to the contra-evidence. After that, we will introduce the models for testing, based on the above theory and empirics.

A significant research in favor of the existence of a pecking order is the paper by Shyam-Sunder and Myers (1999). "[It] introduces an empirical test for the pecking order theory. According to this test, the pecking order implies that firms issue or retire an amount of debt equal to the funds flow deficit, which is the inadequacy of internal cash flows for real investments and dividend commitments. In a simple regression of a firm's net debt issued on the financing deficit, the slope coefficient provides information on the proportion financed by debt of a one dollar increase in deficits and the pecking order implies that this coefficient is close to unity. Using a small sample of firms that survive the entire 1971-1989 period, Shyam-Sunder and Myers (1999) conclude that the pecking order model is an excellent first-order descriptor of financing behavior because they find an estimated pecking order coefficient of 0.75" (De Jong, Verbeek, Verwijmeren, 2011)."

Chrinko and Singha (2000) offer some criticism in the form that "if, contrary to the pecking order, firms follow a policy of using debt and equity in fixed proportions, then the Shyam-Sunder and Myers regression will identify this ratio. As a result, finding a coefficient near one would not disprove the tradeoff theory (Chirinko and Singha, 2000)." Chirinko and Singha's cautionary note reinforces an important methodological point: Most empirical tests have various weaknesses. It is therefore important to examine the predictions of a theory from a number of points of view rather than relying solely on a single test. (Frank and Goyal, 2003) Autore and Kovacs (2005) report that "we provide evidence in favor of a multi-period pecking order in which time varying adverse selection costs can make equity issues optimal (even for firms with sufficient debt capacity). We find that time-varying adverse selection costs are directly related to firms' preference for internal over external funds and for debt over equity financing." Mayer and Sussman (2005) have found evidence in support of pecking order behavior: "Consistent with the pecking-order theory we find that projects are predominantly financed with debt, particularly in large and profitable firms."

A study by Frank and Goyal (2007) shows that "to understand the evidence, it is important to recognize the differences among private firms, small public firms and large public firms. Private firms seem to use retained earnings and bank debt heavily. Small public firms make active use of equity financing. Large public firms primarily use retained earnings and corporate bonds." The same research holds that "at the aggregate level, the financing deficit is very close to debt issues. This holds for large public firms and for private firms. This does not hold for small public firms.

For small public firms, financing deficits very closely match equity issues." (Frank and Goyal, 2007, p. 241). Frank and Goyal thus attempt to differentiate different types of firms and attribute different financing behavior to different firm types. We noted the results of Lemon and Zender (2009) who found that pecking order theory gives a good description of firms' behaviour: "Our main results are that if external funds are required, in the absence of debt capacity concerns, debt appears to be preferred to equity. Concerns over debt capacity largely explain the use of new external equity financing by publicly traded firms. Finally, we present evidence that reconciles the frequent equity issues by small, high-growth firms with the pecking order. After accounting for debt capacity, the pecking order theory appears to give a good description of financing behaviour for a large sample of firms examined over an extended time period." (Lemmon and Zender, 2010)

De Jong , Verbeek and Verwijmeren (2011) mention that they "find that for our sample of US firms the pecking order theory is a better descriptor of firms' issue decisions than the static tradeoff theory. In contrast, when we focus on repurchase decisions we find that the static tradeoff theory is a stronger predictor of firms' capital structure decisions." The implication of this research is that for the upper part of figure 2 (§2.1) the pecking-order theory seems to be more accurate at describing and predicting the behavior of firms, while for the lower part of the figure, static tradeoff theory appears to be more valid.

There is also research which founds that there is no or not enough evidence to conclude on the existence of a pecking order. For instance, Helwege and Liang (1996) note that "evidence on the decision to obtain external financing provides little support for the pecking order theory. That is, firms do not appear to tap the capital markets because of a shortfall in internal funds - the size of the deficit, measured in a number of ways, has no predictive power for the decision to obtain external funds." "Shyam-Sunder and Myers (1999) focus on a regression test of the pecking order. In this test one needs to construct the financing deficit from information in the corporate accounts. The financing deficit is constructed from an aggregation of dividends, investment, change in working capital and internal cash flows. If the pecking order theory is correct, then the construction of the financing deficit variable is a justified aggregation. Under the pecking order, each component of financing deficit should have the predicted dollar-for-dollar impact on corporate debt. The evidence does not support this hypothesis (Frank and Goyal, 2003, p. 218)."

Again, Frank and Goyal (2003) dispute the claim of Myers (2001), who reports that "external finance covers only a small proportion of capital formation and that equity issues are minor, with the bulk of external finance being debt. These key claims do not match the evidence for publicly traded American firms, particularly during the 1980s and 1990s. External finance is much more significant than is usually recognized in that it often exceeds investments. Equity finance is a significant component of external finance." Frank and Goyal (2003) test the pecking order model using a more comprehensive data set. They find substantially lower coefficients and demonstrate that larger firms exhibit greater pecking order behavior than smaller firms. This size effect is corroborated by Fama and French (2002). "From a pecking order perspective, this correlation is counterintuitive as small firms have the highest potential for asymmetric information, which is the actual driver of the pecking order in the Myers and Majluf (1984) model." (De Jong, Verbeek, Verwijmeren, 2010)

3. Methodology

In this part of the paper, we are going to describe how the research question is going to be operationalized, how we get to an hypothesis regarding both research questions according to theory and empirics, how we are exactly going to test the pecking order and apply its hypothesis into regression formulas.

The research design is going to be a cross-sectional design (for multiple firms) over a period of time. We use data over a period of 5 (book) years, so there are 5 observations per firm. The firms data is sampled in the period of 2007-2012. The sample contains listed, non-financial firms in the European Union, which comprised as of 2012 the countries Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain ,Sweden and the United Kingdom. Regression tests conducted include the temporal precedence and therefore the direction of causality (further explanation can be found in the theory section). The data source is ORBIS, an international database containing high quality standardized data from firms all over the world.

The main research question will be: *"Is the pecking order theory hypothesis an accurate means to explain the incremental financing of firms in the EU?"*
Following the main question, a sub-question is also investigated: "*Is there a difference regarding the empirical evidence in favour of the pecking-order theory between companies with various levels of total assets?*"

3.1 Hypotheses

We are going to execute a few regressions on the captured data as to examine whether the pecking-order theory is in line with the data contained in the sample. "In its simplest form, the pecking order model of corporate financing says that when a firm's internal cash flows are inadequate for its real investment and dividend commitments, the firm issues debt. Equity is never issued, except possibly when the firm can only issue junk debt and costs of financial distress are high" (Shyam-Sunder and Myers, 1999). The basis pecking-order equation is thus given as: $\Delta D_{it} = a_{PO} + b_{PO} DEF_{it} + e_{it}$. The strong form test of the Pecking Order Model is that firms meet their financing deficit by relying only on debt finance, and the associated null hypothesis is $a_{PO}=0$ and $b_{PO}=1$, following Chirinko and Singha (2000). This means that the financing deficit will fully explain the debt issued, thus, that no equity will be issued. However, "In case firms have unconstrained access to debt, the pecking order theory predicts that the amount of debt issued equals the deficit, and hence the pecking order coefficient (b_{po}) equals one, and the intercept term α is zero. In reality, a firm's debt capacity is limited due to financial distress costs. (De Jong, Verbeek, Verwijmeren, 2007). Therefore, we hypothesize that the pecking order coefficient b_{po} is close to one, but not precisely one. Also, in line with Shyam-Sunder and Myers' (1999) reasoning (to take into account a certain 'buffer time' over which the firm can oversee its own financial deficit), we hypothesize that pecking order coefficient $b_{po\ it-1}$ will be higher than $b_{po\ it}$.

With regards to the disaggregation of the financial deficit, we will follow the hypothesis posed by Frank and Goyal (2003): "it seems plausible that there could be information in DEF_{it} that helps to account for ΔD_{it}, but not in the manner hypothesized by the pecking order theory. The pecking order hypothesis is thus bDIV=bI=bW=bR=bC=1." This means that all separate parts of the

financing deficit will explain the debt issued and thus no equity is issued. "If that hypothesis is correct, then the aggregation in Eq. (1) is justified. If however, the significance is actually only driven by some of the individual components, then alternative coefficient patterns are possible."

Consider the following specification:

Δ Dit = a + $_{bDIV}$DIV$_t$ + $_{bI}$I$_t$ + $_{bW}$ Δ W$_t$ + $_{bR}$R$_t$ − $_{bC}$C$_t$ + e$_{it}$. Under the pecking order theory, it is DEFit itself that matters. A unit increase in any of the components of DEFit must have the same unit impact on Δ Dit. The pecking order hypothesis is thus bDIV=bI=bW=bR=bC=1. If that hypothesis is correct, then the aggregation in is justified. If however, the significance is actually only driven by some of the individual components, then alternative coefficient patterns are possible (Frank and Goyal, 2003, p. 223)."

For the testing of the pecking order on firms of different sizes, it will be hypothesized that small firms will adhere stronger to the pecking order than the larger firms. The line of thought behind this is that large firms face less adverse selection than small firms, there are more potential problems of asymmetric information [in small firms than in large firms] (e.g. Frank & Goyal, 2003; Gao et al., 2012). "The pecking order theory is based on a difference of information between corporate insiders and the market. The driving force is adverse selection. Accordingly, it is natural to examine firms that are commonly thought to be particularly subject to adverse selection problems, such as small firms (...)" (Shyam-Sunder and Myers, 1999).

As far as the other regression model,
$\Delta D_i = \alpha + \beta_T \quad \Delta T_i + \beta_{MTB} \quad \Delta MTB_i + \beta_{LS} \quad \Delta LS_i + \beta_P \quad \Delta P_i + \beta_{DEF} \quad DEF_i + \varepsilon_i.$
goes, "firms with high market-to-book ratios are often thought to have more future growth opportunities. As in Myers (1977), there may be a concern that debt could limit a firm's ability to seize such opportunities when they appear. Frank and Goyal (2003) find that "when growth opportunities of defense firms decline, these firms increase their use of debt financing. Barclay et al. (2001) present a model showing that the debt capacity of growth options can be negative. (…) One might expect that firms with few tangible assets would have greater asymmetric information problems. Thus, firms with few tangible assets will tend to accumulate more debt over time and become more highly levered. Hence, Harris and Raviv argue that the pecking order predicts that β T<0. The common prediction is that βMTB<0. Large firms are usually more diversified, have better reputations in debt markets, and face lower information costs when borrowing. Therefore, large firms are predicted to have more debt in their capital structures. The prediction is that βLS>0. The predictions on profitability are ambiguous. The tradeoff theory predicts that profitable firms should be more highly levered to offset corporate taxes. Also, in many asymmetric information models, such as Ross (1977), profitable firms are predicted to have higher leverage. But Titman and Wessels (1988) and Fama and French (2002) show that this is not a common finding. Instead, the literature finds profits and leverage to be negatively correlated. While MacKay and Phillips (2001) challenge this common finding, we expect to find that βP<0 (Frank & Goyal, 2003, p. 224)."

For the subsamples, no hypothesis regarding which countries will adhere most to the pecking order will be assumed because each country and each environment has its own asymmetric information problems. In the words of Seifert and Gonenc (2007): "On one hand, the information asymmetry problem in (…) the UK may be the result of the relative widespread ownership of stocks. Many small investors may simply not get the information that managers possess. On the

other hand, outside investors in Germany (…) seem to have an information asymmetry problem because they receive less information and the information obtained is more likely to be distorted or managed." Afterwards, an explanation will be sought.

In order to test the pecking order theory the data we use needs to be aggregated. The question is whether this step is justified. Consider the following specification, $\Delta Dit = a + {}_{bDIV}DIV_t + {}_{bI}I_t + {}_{bW}\Delta W_t + {}_{bR}R_t - {}_{bC}C_t + e_{it}$. As explained in the hypothesis, a unit increase in any of the components of DEFit must have the same unit impact on Δ Dit. The pecking order hypothesis is thus bDIV=bI=bW=bR=bC=1. "If however, the significance is actually only driven by some of the individual components, then alternative coefficient patterns are possible" (Frank & Goyal, 2003).

Taking the argument of Shyam-Sunder and Myers (1999) in consideration, i.e. that "we should consider whether the good fit of the pecking order specification has more to do with short-term adjustments than planned financing." The pecking order regression as explained above relate debt issues or retirements to contemporaneous deficits – that is – in the same year as the deficit arises, the debt will be issued. To take into account a certain 'buffer time' over which the firm can oversee its own financial deficit, we also test the regression of the long term debt issued from 2008-2012 on the deficit lagged one year: DEF_{t-1}, so from 2007-2011. "This is consistent with the pecking order - information asymmetries provide one good reason why equity is not issued on short notice - but that theory is more convincing if companies also plan to cover deficits by issuing debt (Shyam-Sunder and Myers, 1999, p. 222)."

3.2 Variables

In this research, several models are cast, and they include several variables.

Dependent variables: In all of the tests except the test with the tangibility, market-to-book ratio, sales and profitability included, I am going to use the same dependent variable, thereby following both Shyam-Sunder and Myers (1999) and Frank and Goyal (2003): the change in long-term debt for a particular company i in year t divided by total assets: It is measured by the difference between the long-term debt levels of the year t and the year t-1:$D_{it} = (D_{it} - D_{it-1}) /$ total $assets_{t-1}$.

The other dependent variable *D*, only used in the model containing the financing deficit together with the tangibility, market-to-book ratio, sales and profitability, will be the change in debt-to-market capitalization ratio. It is measured by the difference between the long term debts of year t related to the market capitalization of year t and the long term debts in year t-1 related to the market capitalization of year t-1: (Long term $debt_{it}$/ (1000*Market $capitalization_{it}$)) – (Long term $debt_{t-1}$/ (1000*Market $capitalization_{it}$)). The market capitalization variable is multiplied by a factor of 1000 because it was only available in ORBIS in millions of Euros while the rest of the variables are measured in thousands of Euros.

Independent variable: The financing deficit DEF_{it} for each firm i in the year t is calculated as follows: $DEF_{it} = DIV_{it} + I_{it} + \Delta W_{it} + R_t - C_{it}$ / Total $assets_{t-1}$.

The following table illustrates how components from the deficit will be calculated in ORBIS:
Table 2: The financing deficit as defined in ORBIS

Variables in the financing deficit	Calculated in ORBIS as follows:
Dividends paid DIV_{it}	Cash dividends $paid_{it}$
Investments I_{it}	Increase/decrease in $investments_{it}$ + PPE_{it} – PPE_{it-1} + $Depreciation_{it}$ – Funds from other $activities_{it}$
Change in working capital ΔW_{it}	Working $capital_{it}$ – Working $capital_{it-1}$
Current portion of long term debt R_{it}	Current portion of long term $debt_{it}$
Operating cash flows after interest and taxes C_{it}	Cash $flow_{it}$ - interest $paid_{it}$ - $taxation_{it}$

Then, the financing deficit will be scaled by total $assets_{t-1}$. The lagged financing deficit DEF_{it-1} is calculated in the same way.

Control variables: A regression model testing the influence of the financing deficit in combination with other variables is going to be executed in this form:

$$\Delta D_i = \alpha + \beta_T \quad \Delta T_i + \beta_{MTB} \quad \Delta MTB_i + \beta_{LS} \quad \Delta LS_i + \beta_P \quad \Delta P_i + \beta_{DEF} \quad DEF_i + \varepsilon_i.$$

D is defined as the ratio of total debt to market capitalization, *T*=Tangibility is defined as the ratio of fixed assets to total assets. MTB is the market-to-book ratio defined as the ratio of the market value of assets (book value of assets plus the difference between market value of equity and book value of equity) to the book value of assets. LS is log sales, defined as the natural logarithm of constant sales. *P* is profit defined as the ratio of operating income to book value of assets.

Table 3: A conventional leverage model tested against the pecking order, as defined in ORBIS

Variables in the traditional leverage model:	Calculated in ORBIS as follows:
Change in tangibility ΔT	(Fixed $assets_{it}$ / Total $assets_{it}$) – (Fixed $assets_{it-1}$ / Total $assets_{it-1}$).
Change in market-to-book ratio ΔMTB	(((1000*Market $capitalization_{it}$ + Total liabilities and $debt_{it}$) – Revaluation $reserves_{it}$ – Other shareholders $reserves_{it}$)/Total $assets_{it}$) - (((1000*Market $capitalization_{it-1}$ + Total liabilities and $debt_{it-1}$) – Revaluation $reserves_{it-1}$ – Other shareholders $reserves_{it-1}$)//Total $assets_{it-1}$)
Change in the natural logarithm of sales ΔLS	ln($Sales_{it}$) – ln($Sales_{it-1}$)
Change in profitability ΔP	Operating $revenues_{it}$/Total $assets_{it}$ – Operating $revenues_{it-1}$/Total $assets_{it-1}$.
Change in total debt to market capitalization ΔD	(Total liabilities and $debt_{it}$ / 1000* Market $capitalization_{it}$) – (Total liabilities and $debt_{it-1}$ / 1000* Market $capitalization_{it-1}$)

The financing deficit is calculated as mentioned before.

In order to test the pecking order on firms of different sizes of the sample firms we have chosen to define from the 3rd quartile of the sample and above (so the largest 25% of the sample according to total assets) to be a large firm. Starting from the 1st quartile and lower, firms will be defined as small firms. This means that the remaining middle 50% of the sample will be

classified as 'medium' firms. This is chosen above the more intuitively reasonable distribution of 33%-33%-33% because of the nature of the distribution of sample. Firms in the top 25% are more likely to be focused on really large firms (i.e. outliers) and firms in the lower 25% are more likely to be focused on really small firms, so that the huge mass of the firms which is near the average will more likely be in the medium sample rather than in the large or small one.

Of course, in the data, there is a possibility that firms, instead of a financing deficit, will experience a financing surplus. The way I have operationalized the variables, this would mean that the dependent and independent variable, according to the pecking-order theory should be negative and this does not interfere with the regression equation: "The Myers-Majluf reasoning works in reverse when the company has a surplus (DEFt <0) and wants to return cash to investors. If there are tax or other costs of holding excess funds or paying them out as cash dividends, there is a motive to repurchase shares or pay down debt. Managers who are less optimistic than investors naturally prefer to pay down debt rather than repurchasing shares at too high a price. The more optimistic managers, who are inclined to repurchase, force up stock prices if they try to do so. Faced with these higher stock prices, the group of optimistic managers shrinks, and the stock price impact of an attempted repurchase increases. If information asymmetry is the only imperfection, the repurchase price is so high that all managers end up paying down debt. Thus the simple pecking order's predictions do not depend on the sign of DEFt. In principle the firm could become a net lender if funds surpluses persist. Of course share repurchases could occur, even in a Myers-Majluf model, if there are significant tax or other costs of operating at a very low or negative debt ratio (Shyam-Sunder and Myers, 1999)." "According to the pecking order hypothesis, the coefficients in the equation mentioned above should be the same (0 for the constant and 1 for the Deficit variable) regardless of whether the firm has a deficit (Deficit > 0) or a surplus (Deficit < 0). In the case where the firm has a surplus and desires to return money to its investors, managers will want to pare down the debt first because any attempt to repurchase equity will result in a stock price increase that will dampen the desire to repurchase equity." (Seifert and Gonenc, 2007)

3.3 Method of analysis

The main research question will be addressed by using regression models on our data. For now, we will use several linear OLS-regression models. The models will consist of one huge pooled cross-section containing the variables per year over the given period. The variables, and the theoretical background are treated in §3.2 and §2. After the data has been described and investigated, and the results have been shown, we will draw conclusions on the empirical validity of the pecking-order theory.

3.4 Descriptives

In this section the univariate analysis is shown for the entire sample (panel A), for the data points within the years before the financial crisis and the years during the financial crisis (panel B) and for the data actually used in the most important regressions, because this requires data for both the IV and the DV simultaneously (panel C). After that, correlation tables will be presented, both sample-wide and regression-only tables. The univariate histograms have been checked, and it appears to be fairly normally distributed. In most cases, the dependent variable (long term debt issued) appears to center stronger around the mean than a normal distribution.

The variables of which the financing deficit is composed seem to have their mean all in the range of a little less than 1% of total assets to 6% of total assets. For non-financial firms this makes

sense intuitively. The cash dividends and the current portion of long term debt have a way smaller N on average than the other variables of which the financing deficit is composed. Because the financing deficit requires data simultaneously on cash dividends paid, investments, working capital, current portion of long term debt and internal cash flow, there are fewer observations to be made for the financing deficit as well as the lagged financing deficit because of the lack of availability of this information.

The variables which are tested in the traditional model, change in tangibility, change in market to book ratio, change in log sales, change in probability and change in debt to market capitalization ratio have a huge availability because they are mostly composed of variables which have great priority on a balance sheet. The change in MTB ratio and change in profitability ratio have a negative mean, but all aforementioned variables nevertheless have a huge standard deviation which indicates a great variability in these variables.

Table 4: Univariate analysis.
Panel A: Sample-wide

	N	Mean	Median	SD	Min	Max
Cash dividends paid$_t$	9427	0.030	0.018	0.046	-0.293	0.568
Investments$_t$	14637	0.062	0.047	0.326	-9.551	10.227
Δ Working capital$_t$	18978	0.008	0.002	0.125	-1.808	1.809
Current portion of Long term debt$_t$	8094	0.040	0.017	0.070	-0.029	0.966
Internal cash flow$_t$	20854	0.007	0.034	0.226	-2.721	2.663
Financing deficit DEF$_t$	4094	0.035	0.025	0.121	-0.602	0.685
Financing deficit DEF$_{t-1}$	4061	0.034	0.024	0.133	-0.670	0.800
Long term debt issued D$_t$	21209	0.007	0.000	0.111	-1.150	1.171
Change in tangibility ratio	26581	0.009	0.002	0.113	-0.744	0.759
Change in market to book ratio	17058	-0.053	-0.021	2.564	-108.891	114.343
Change in log sales	24419	0.023	0.034	0.387	-1.988	2.034
Change in profitability	25989	-0.009	0.000	0.438	-8.513	8.428
Change in debt-to-market-cap ratio	16522	0.213	0.029	1.459	-7.814	8.467
Panel B: The deficit before and during the global financial crisis (Sample-wide)						
	N	Mean	Median	SD	Min	Max
Financing deficit before crisis	2350	0.078	0.063	0.161	-0.728	0.837
Long term debt issued before crisis	12051	0.015	0.000	0.120	-1.048	1.111
Financing deficit during crisis	2461	0.086	0.076	0.139	-0.789	0.879
Long term debt issued during crisis	12953	0.007	0.000	0.113	-1.205	1.202

Footnote: Following Frank and Goyal (2003) and Seifert and Gonenc (2010) there are some adjustments to the data: Occasionally there are recording errors and there are outliers which interfere with the assumption of normality in a regression. As a result, the most extreme observations (outliers) have been removed: The top and bottom 0.5% ($z > 3.29$ in absolute value) of the variables is removed. It differs thereby from the practice of De Jong, Verbeek and Verwijmeren (2010) who use an absolute criterion (any variable which exceeds 400% of the firm's total book assets will be omitted).

Panel B shows the descriptive statistics of a subsample. The reason why this is in a separate panel is because it is composed out of the financing deficit DEF_{it} and the long term debt issued D_{it} in panel A. The observations for the financing deficit and the long term debt issued have been split into the observations made before the financial crisis and during the financial crisis. Again, because the financing deficit requires data simultaneously on cash dividends paid, investments, working capital, current portion of long term debt and internal cash flow, there are fewer observations to be made for the financing deficit than for the long term debt issued. The financing deficit before and during the crisis both seem to have a mean about equal and a standard deviation about equal. The minimum and maximum values are equally alike. So at first sight, there does not appear to be some change in the financing behavior. The average long term-debt issued albeit with a large standard deviation, seems to be much smaller than the financing deficit, which does not seem to follow the hypothesis that the financing deficit is entirely 'filled' with debt issuance.

Table 5 shows only the descriptive statistics of the data used in the regression tests. Consequently, the amount of observations of both the dependent variable and the independent variable need to be of the same amount. The financing deficit and the lagged financing deficit does not seem to be very different from each other and neither does the long term debt issuance, their means and standard deviations are alike and in both cases the median and mean from the deficit seems to be much higher than the mean and median from the long term debt issued, implying that the deficit is on average way higher than the debt issuance. There is, in absolute sense, not at all a lot of debt being issued, only 0.7% of total assets in the first regression and 0.8% of total assets in the second regression.

Table 5: Univariate analysis of data used in the regression.
Panel A: The test based upon the prediction that debt is used to fill respectively the financing deficit and the lagged financing deficit.

	N	Mean	Median	SD	Min	Max
Financing deficit DEF_t	4092	0.077	0.067	0.145	-0.683	0.879
Long term debt issued D_t	4092	0.007	-0.001	0.086	-0.533	1.037
Financing deficit DEF_{t-1}	3933	0.083	0.070	0.158	-0.804	1.007
Long term debt issued D_t	3933	0.008	-0.001	0.088	-0.485	1.037

Panel B: The deficit before and during the global financial crisis

	N	Mean	Median	SD	Min	Max
Financing deficit before crisis	2347	0.077	0.064	0.161	-0.728	0.837
Long term debt issued before crisis	2347	0.018	0.000	0.106	-0.485	1.732
Financing deficit during crisis	2460	0.085	0.076	0.139	-0.789	0.879
Long term debt issued during crisis	2460	0.005	-0.001	0.087	-0.533	1.037

Panel C: The disaggregated deficit

	N	Mean	Median	SD	Min	Max
Cash dividends paid$_t$	4065	0.025	0.016	0.039	-0.293	0.529

Investments$_t$	4065	0.063	0.056	0.124	-1.443	1.244
Δ Working capital$_t$	4065	0.005	0.003	0.065	-0.558	1.235
Current portion of Long term debt$_t$	4065	0.033	0.016	0.048	-0.004	0.628
Internal cash flow$_t$	4065	0.052	0.050	0.076	-0.883	0.617
Long term debt issued D_t	4065	0.008	0.000	0.089	-0.533	1.037

Panel D: The pecking order against a traditional model

	N	Mean	Median	SD	Min	Max
Change in tangibility ratio	3828	0.004	0.002	0.054	-0.429	0.500
Change in market to book ratio	3828	-0.066	-0.017	0.415	-10.541	3.503
Change in log sales	3828	0.035	0,044	0.204	-1.750	1.805
Change in profitability	3828	-0.003	0.003	0.212	-3.995	1.946
Financing deficit	3828	0.075	0.066	0.140	-0.683	0.832
Change in debt-to-market-cap ratio	3828	0.192	0.030	1.415	-7.728	8.463

Footnote: Following Frank and Goyal (2003) and Seifert and Gonenc (2010) there are some adjustments to the data: Occasionally there are recording errors and there are outliers which interfere with the assumption of normality in a regression. As a result, the most extreme observations (outliers) have been removed: The top and bottom 0.5% ($z > 3.29$ in absolute value) of the variables is removed. It differs thereby from the practice of De Jong, Verbeek and Verwijmeren (2010) who use an absolute criterion (any variable which exceeds 400% of the firm's total book assets will be omitted). The different long-term debt variables come from the fact that the same independent variable has different data points for each regression because of the available data. They have been separately included in each panel.

Panel B shows the descriptive statistics of the data used in the regression tests. The variables are subsamples, composed out of the financing deficit DEF_{it} and the long term debt issued D_{it} in table 4, but because it shows the data only used in the regression, the amount of observations of both the dependent variable and the independent variable need to be the same. In both cases, the mean and median of the financing deficit before the crisis and during the crisis are about equal, the financing deficit as fraction of the total assets during the crisis being a little higher, which makes sense as the financial crisis most likely caused companies to have larger deficits or smaller surpluses. The dependent variable, the long term debt issued, however, marks a significant change in the mean: before the crisis, the average debt issued was 1.8% as a fraction of total assets, and during the crisis only 0.5%. In general, during the crisis, companies have been more reluctant to issue debt it seems. In this case too it seems that on average, the mean of the financing deficit is way larger than the debt being issued in order to finance the deficit.

Panel C shows the descriptive statistics of the data used in the regression test regarding the disaggregation of the financing deficit. Because it shows the data only used in the regression, the amount of observations of both the dependent variable and the independent variable need to be the same. There seems to be a large spread within the investments as part of total assets on average, given the large standard deviation compared to the other variables. The long term debt issued seems to be only 0.8% of the total assets on average, while the financing deficit in its disaggregated form seems to be much larger.

Panel D shows the descriptive statistics of the data used in the regression test regarding the pecking order against a traditional model of leverage. Because it shows the data only used in the regression, the amount of observations of both the dependent variable and the independent variable need to be the same. The availability of the data for the variables in the traditional model was huge, as seen in panel A, but the availability of the financing deficit was significantly smaller, so that is why the number of observations is relatively low. The (negative) change in profitability and market to book ratio on average do logically come hand in hand with an average financing deficit rather than a surplus.

4. Results and Discussion

4.1 Correlation tables

Table 6 shows sample wide correlations. Presented here is the correlation table from the entire sample, so not only the observations included in the regression. Significance is indicated in parentheses. Firstly, D_{it} and DEF_{it}, then D_{it} and DEF_{it-1}, then $D_{it\ before\ crisis}$ and $DEF_{it\ before\ crisis}$, and then $D_{it\ during\ crisis}$ and $DEF_{it\ during\ crisis}$ are being correlated with all observations being taken into account. At first we note a correlation coefficient between D_{it} and DEF_{it} of 0.113, and between D_{it} and DEF_{it-1} of 0.109, where the pecking order hypothesis would naturally imply a correlation coefficient of 1, this, at first, seems not very promising for the pecking order theory although a mild positive correlation does suggest that the data makes sense. Another thing to note is that the correlation coefficient between D_{it} and DEF_{it} before the crisis is a little lower than D_{it} and DEF_{it} during the crisis, imply stronger pecking order behavior during the crisis.

Table 6: Sample-wide correlations between D_{it} and DEF_{it}, D_{it} and DEF_{it-1}, a subsample of $D_{it\ before\ crisis}$ and $DEF_{it\ before\ crisis}$ and a subsample of $D_{it\ during\ crisis}$ and $DEF_{it\ during\ crisis}$.

	D_{it}	DEF_{it}	DEF_{it-1}	D_{it} before crisis	DEF_{it} before crisis	D_{it} during crisis	DEF_{it} during crisis
D_{it}	1.000						
DEF_{it}	0.113 (0.000)	1.000					
DEF_{it-1}	0.109 (0.000)	-	1.000				
D_{it} before crisis	-	-	-	1.000			
DEF_{it} before crisis	-	-	-	0.091 (0.000)	1.000		
D_{it} during crisis	-	-	-	-	-	1.000	
DEF_{it} during crisis	-	-	-	-	-	0.104 (0.000)	1.000

D_{it} is defined as long term debt issued, and DEF_{it} is the financing deficit, for firm i in year t.

Table 7 shows sample wide correlations. Presented here is the correlation table from the entire sample, so not only the observations included in the regression. On first sight, it seems that all correlation coefficients are low and not in favor of a pecking order theory. The sample-wide correlations do seem to support the hypothesis that small firms adhere closer to the pecking order theory than larger firms, as the correlation coefficient is higher in small firms, lower in medium firms and the lowest in large firms.

Table 7: Sample-wide correlations between D_{it} and DEF_{it} in subsamples of respectively small, medium and large firms.

	D_{it} Small firms	DEF_{it} Small firms	D_{it} Medium firms	DEF_{it} Medium firms	D_{it} Large firms	DEF_{it} Large firms
D_{it} Small firms	1.000					
DEF_{it} Small firms	0.171 (0.435)	1.000				
D_{it} Medium firms	-	-	1.000			
DEF_{it} Medium firms	-	-	0.100 (0.000)	1.000		
D_{it} Large firms	-	-	-	-	1.000	
DEF_{it} Large firms	-	-	-	-	0.072 (0.000)	1.000

D_{it} is defined as long term debt issued, and DEF_{it} is the financing deficit, for firm i in year t.

Table 8 shows the correlation table for different variables which have been tested together, for the data which is in the regression. Firstly, D_{it} and DEF_{it}, then D_{it} and DEF_{it-1}, then $D_{it\ before\ crisis}$ and $DEF_{it\ before\ crisis}$, and then $D_{it\ during\ crisis}$ and $DEF_{it\ during\ crisis}$. Significance is indicated in parentheses. Compared to the sample-wide results, the observations which are eligible for the regression show significantly smaller correlation coefficients than their sample-wide counterparts. Thus, it seems possible that the results presented in chapter 4 do show a bias towards observations that show lower support for the pecking order theory. With regards to the correlation between D_{it} and DEF_{it} before and during the crisis, it shows only a marginal difference with the sample-wide correlations.

Table 8: Correlations for data used in the regression between D_{it} and DEF_{it}, D_{it} and DEF_{it-1}, a subsample of $D_{it\ before\ crisis}$ and $DEF_{it\ before\ crisis}$ and a subsample of $D_{it\ during\ crisis}$ and $DEF_{it\ during\ crisis}$.

	D_{it}	DEF_{it}	DEF_{it-1}	D_{it} before crisis	DEF_{it} before crisis	D_{it} during crisis	DEF_{it} during crisis
D_{it}	1.000						
DEF_{it}	0.030 (0.058)	1.000					
DEF_{it-1}	0.052 (0.001)	-	1.000				
D_{it} before crisis	-	-	-	1.000			
DEF_{it} before crisis	-	-	-	0.096 (0.000)	1.000		
D_{it} during crisis	-	-	-	-	-	1.000	
DEF_{it} during crisis	-	-	-	-	-	0.104 (0.000)	1.000

D_{it} is defined as long term debt issued, and DEF_{it} is the financing deficit, for firm i in year t.

Table 9 shows the correlation table for different variables which have been tested together, in this case the subsamples of D_{it} and DEF_{it} of small, medium and large firms, for the data which is in the regression. Significance is indicated in parentheses Because it shows the data only used in the regression, the amount of observations of both the dependent variable and the independent variable need to be the same and naturally, some observations which only have data for 1 variable are necessarily left out. Compared to the sample-wide correlations between D_{it} and DEF_{it} of small, medium and large firms, these coefficients are significantly lower. As was the case with the subsamples regarding the crisis, it again seems possible that the results presented in section 4 do show a bias towards observations that show lower support for the pecking order theory. It is also noted that these correlations aren't significant so conclusions must be taken with caution.

Table 9: Correlations for data used in the regression between D_{it} and DEF_{it} in subsamples of respectively small, medium and large firms.

	D_{it} Small firms	DEF_{it} Small firms	D_{it} Medium firms	DEF_{it} Medium firms	D_{it} Large firms	DEF_{it} Large firms
D_{it} Small firms	1.000					
DEF_{it} Small firms	0.026 (0.435)	1.000				
D_{it} Medium firms	-	-	1.000			
DEF_{it} Medium firms	-	-	0.058 (0.162)	1.000		
D_{it} Large firms	-	-	-	-	1.000	
DEF_{it} Large firms	-	-	-	-	0.021 (0.326)	1.000

D_{it} is defined as long term debt issued, and DEF_{it} is the financing deficit, for firm i in year t.

Table 10 shows the correlation table for the variables in the test regarding the disaggregation step of the deficit, for the data which is in the regression. Significance is indicated in parentheses. Because it shows the data only used in the regression, the amount of observations of both the dependent variable and the independent variable need to be the same. None of the variables correlated with one another show a real strong coefficient. The most interesting part is the first column, where all the variables are simultaneously correlated with D_{it}. In all of the cases the coefficients are significant, but not as high as expected.

Table 10: Correlations for data used in the regression to test the disaggregation step of the financing deficit.

	D_{it}	DIV_{it}	I_{it}	ΔW_{it}	R_{it}	C_{it}
D_{it}	1.000					
DIV_{it}	0.114 (0.000)	1.000				
I_{it}	0.090 (0.000)	0.148 (0.000)	1.000			
ΔW_{it}	0.194 (0.000)	0.061 (0.000)	0.267 (0.000)	1.000		
R_{it}	0.113 (0.000)	-0.100 (0.000)	-0.009 (0.282)	-0.019 (0.115)	1.000	
C_{it}	0.073 (0.000)	0.366 (0.000)	0.333 (0.000)	0.196 (0.000)	-0.088 (0.000)	1.000

Footnote: D is long term debt issued, DIV is cash dividends paid, I is net investments, Δ W is change in working capital, R is current portion of long term debt, C is cash flows minus interest and taxation, all for firm i in year t.

Table 11 shows the correlation table for the regression test with the financing deficit combined with the traditional model, for the data which is in the regression. Significance is indicated in parentheses. Again, the most interesting part of the table is the first column., in which the market to book ratio has a relatively strong coefficient, which makes sense because when firms' market value rises, the need of debt financing diminishes. The financing deficit has a higher coefficient (and is significant) than the other variables, albeit not as high as hypothesized.

Table 11: Correlations for data used in the regression test with the financing deficit against a traditional leverage model.

	ΔD_{it}	ΔT_{it}	ΔMTB_{it}	ΔLS_{it}	ΔP_{it}	DEF_{it}
ΔD_{it}	1.000					
ΔT_{it}	0.027 (0.046)	1.000				
ΔMTB_{it}	-0.236 (0.000)	-0.095 (0.000)	1.000			
ΔLS_{it}	0.055 (0.000)	-0.070 (0.000)	-0.064 (0.000)	1.000		
ΔP_{it}	0.006 (0.361)	-0.108 (0.000)	0.017 (0.141)	-0.517 (0.000)	1.000	
DEF_{it}	0.161 (0.000)	-0.061 (0.000)	-0.120 (0.000)	0.208 (0.000)	0.045 (0.003)	1.000

Footnote: D is defined as the ratio of total debt to market capitalization, T is tangibility and is defined as the ratio of fixed assets to total assets. MTB is the market-to-book ratio defined as the ratio of the market value of assets (book value of assets plus the difference between market value of equity and book value of equity) to the book value of assets. LS is log sales defined as the natural logarithm of constant sales. P is profit defined as the ratio of operating income to book value of assets.

4.2 Regression results

The following regression results were obtained: the tables represent the results of ordinary least squares regressions. In all tables, significance levels are indicated with stars: * = 10% significance or smaller, ** = 5% significance or smaller and *** = 1% significance or smaller. Both R^2 and the adjusted R^2 are reported because sample sizes vary and the amount of variables used varies. All the tables give the results of a standard OLS-regression. Standard errors are reported in parentheses.

The part from table 12 that is labeled (1) represents the results for the regression test of the pecking order. The firms sampled are firms from the European Union, publicly listed and non-financial firms, from the years 2008 to 2012. There are no selection criteria regarding firm size, or reporting consistency such as in Shyam-Sunder and Myers (1999). However, univariate outliers have been removed. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio. The independent variable is the financing deficit. The pecking order theory predicts that the debt issues equal the firm's financial deficit, or, in the case of a financing surplus, the debt retirements equal the financing surplus, up to a certain maximum debt level. This implies a pecking order coefficient $bDEF_{it}$ of 1 or near one.

Table 12. Regression results. The dependent variable is the amount of long term debt issued in the period of 2008-2012, scaled by the book value of assets, or the change in the debt-to-asset ratio. Independent variable is for (1) the financing deficit over 2008-2012 and for (2) the lagged financing deficit over 2007-2011. In (3) and (4), the variables from (1) have been divided into subsamples before the 2008 financial crisis het Europe (3) and after the 2009 crisis hit Europe (4). Pecking order equations predict debt issues (retirements) equal to each firm's financial deficit (surplus), implying a pecking order coefficient of $bDEF_{it}$=1. The table gives Ordinary Least Squares. Standard errors are in parentheses

	Change in Long term debt issued/assets	Change in Long term debt issued/assets	Change in Long term debt issued/assets before crisis	Change in Long term debt issued/assets during crisis
	(1)	(2)	(3)	(4)
Constant	0.006***	0.006***	0.013***	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Pecking order coefficient ($bDEF_{it}$)	0.021**		0.059***	0.066***
	(0.011)		(0.013)	(0.013)
Pecking order coefficient ($b_{DEFit-1}$)		0.035***		
		(0.011)		
N	4092	3933	2347	2460
R^2	0.001	0.003	0.009	0.011
Adj. R^2	0.001	0.002	0.009	0.010

All tests have been checked for heteroskedasticity, autocorrelation and multicollinearity and wherever issues were found it is reported.

The part from table 12 that is labeled (2) represents the results for the regression test of the pecking order with a lagged financial deficit. The firms sampled are firms from the European Union, publicly listed and non-financial firms, from the years 2008 to 2012. This test is done in order to investigated a possible 'buffer time' over which the firm can oversee its own financial deficit, so the sample period for the independent variable, the financing deficit is from 2007 to 2011. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio in the period of 2008 to 2012. This is consistent with the pecking order theory and, as in table 10, still predicts that the debt issues equal the firm's financial deficit, or, in the case of a financing surplus, the debt retirements equal the financing surplus, up to a certain maximum debt level. This implies a pecking order coefficient $bDEF_{it}$ of 1 or near one.

The coefficients for DEF_{it} and DEF_{it-1} show that there is little support for the pecking-order in the EU. Over the entire sample, coefficients remain low, as low as 0.021, so that on every, for every euro of financing deficit firms experience, only 0.021 of it will be financing with debt. From these results, we may conclude that there is little support for the pecking order theory and that the financing deficit is not a good explanatory variable for explain the debt firms issue, that is, without contingent factors. Then, the constants of both regressions are significant and close enough to zero to conclude that on average, firms will not issue debt (or at least, not much) when they experience no financing deficit. The low R-squared in both cases supports the case that the variation in the financing deficit of the year t can only explain ~1% of the variation in long term debt in year t. The R-squared of DEF_{it-1} is a little bit higher, but still only ~3% of the variation in long term debt can be explained with this model.

The first significant factor that is necessary to discuss is the robustness of the test whether the financing deficit would cause the debt issued or vice versa. The second factor is the issue about whether the financing deficit in a given year would cause a firm to directly respond by issuing debt as the pecking order theory dictates, or whether there would be a gap between the moment the firm takes notice of a financing deficit and the action required to issue debt, say, a (book) year, and the way to test this phenomenon was taken over from Shyam-Sunder and Myers (1999).

So, in the first place, the results would imply that the firms would rather react with the proposed lag of a given period in their finance behavior instead of the alternative, the hypothesis that firms would immediately take action as soon as they have a financing deficit, because the coefficient for DEF_{it-1} is higher than the coefficient for DEF_{it}. In the second place, it is to be concluded in my opinion that the coefficients are more or less equal, the R^2 is almost equal and that we have to remain agnostic as to whether the pecking order is stronger when the deficit is lagged or when it is not lagged because the coefficients and the R^2 are both low. The fact that the coefficients are more or less equal supports the claim that the financing deficit would cause the debt issued instead of vice versa. It should be noted that the correlations for the entire sample (instead of the correlations for only the observation in the regression) are higher, so perhaps it could be possible fact that observations with no data for the regression show stronger pecking-order behavior than the observations included in the regression analysis.

The part from table 12 that are labeled (3) and (4) represent the results for the regression test of the pecking order in subsamples. The subsamples are divided into the observations before when the financial crisis hit Europe, so all observations before 2009 (1) and during the financial crisis, i.e. after 2009 (2). The firms sampled are firms from the European Union, publicly listed and non-financial firms, from the years 2008 to 2012. There are no selection criteria regarding firm size, or reporting consistency such as in Shyam-Sunder and Myers (1999). However, univariate outliers have been removed. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio. The independent variable is the financing deficit. The pecking order theory predicts that the debt issues equal the firm's financial deficit, or, in the case of a financing surplus, the debt retirements equal the financing surplus, up to a certain maximum debt level. This implies a pecking order coefficient bDEFit of 1 or near one. The pecking order behavior from before the financial crisis is thus compared with the pecking order behavior after the financial crisis.

When a closer look is taken at the results found in (3) and (4), the model where pecking order behavior is tested before and during the global economic crisis when it struck the firms in my sample, in 2009, it is to be concluded that a minor change in financing behavior has occurred. The coefficient increased from 0.59 to 0.66 and is significant. This means that on average, firms would issue less debt when they experienced a financing deficit before the financial crisis than after the financial crisis. Nevertheless, both coefficients remain very low and thus show very little support for the existence of a pecking order. The limitation of this way of testing is that it only differentiates between periods and does not appoint a specific cause of the change in financing behavior. Nevertheless, it is plausible to assume the crisis as a cause because it is well known that during the financial crisis it became more difficult to obtain credit from external parties in general. The explanatory power in both tests remains low which supports the conclusion at the previous text that the pecking order theory does not explain the amount of debt issued very well.

Table 13 represents the results for the regression test of the pecking order for the disaggregated deficit. The financing deficit is composed of different variables, and the separate variables of which the financing deficit is composed are expected to have the same effect on the debt issued. It is thus tested if this aggregation step is justified or whether there are some variables in the financing deficit which stronger influence the debt issued than other variables. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio. The firms sampled are firms from the European Union, publicly listed and non-financial firms, from the years 2008 to 2012. There are no selection criteria regarding firm size, or reporting consistency such as in Shyam-Sunder and Myers (1999). However, univariate outliers have been removed.

Table 13. Regression results of the disaggregation of the financing deficit. The following regression is estimated: $\Delta Dit=a+bDIVDIVt+bIIt+bW\Delta Wt + bRRt-bCCt+eit$, where ΔD_t= the change in the long-term debt to net assets ratio, Div_t is the amount of cash dividends paid, I_t is the investments, ΔW_t is the change in working capital, R_t is the current portion of Long-term debt and C_t is the internal cash flow after interest and taxes. Standard errors are in parentheses

	Change in long term debt issued/assets
	(1)
Constant	−0.008***
	(0.002)
Cash dividends paid	0.259***
	(0.038)
Investments	0.019
	(0.012)
Δ Working capital	0.250***
	(0.022)
Current portion of long term debt	0.237***
	(0.028)
Internal cash flow	-0.002
	(0.020)
N	4065
R^2	0.065
Adj. R^2	0.064

All tests have been checked for heteroskedasticity, autocorrelation and multicollinearity and wherever issues were found it is reported.

The coefficients for the 5 variables in this regression show that, given the bad results of the pecking order in general, the aggregation is quite justified. The coefficients for cash dividends paid, the change in working capital, and the current portion of long term debt are significant and are all around 0.250. The cash flow and the investment variable show the correct sign of the coefficients (investments should be positively related to the debt issued, and the cash flows negatively related). Taking the different results into account, these results are following the same pattern as that of Frank and Goyal (2003), because the coefficients are mostly about the same size (around 0.250) except for the internal cash flow and the investments, but these are not significant. Frank and Goyal (2003) note that "at the typical firm, internal cash flow does lead to some reduction in debt issues, but the magnitude of the effect is surprisingly small once one includes the behavior of firms that do not have complete trading records." This explains the low coefficient we find on internal cash flow.

The pecking order theory is based on an information asymmetry between managers inside the firm one the one hand and the market on the other. The driving force is adverse selection. Therefore, the following test examines firms that are supposedly prone to adverse selection problems, for example, small firms. Therefore the difference in pecking order behavior between small, medium and large firms is investigated. Table 14 represents the results for that regression

test. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio. The independent variable is the financing deficit. The pecking order theory predicts that the debt issues equal the firm's financial deficit, or, in the case of a financing surplus, the debt retirements equal the financing surplus, up to a certain maximum debt level. This implies a pecking order coefficient $bDEF_{it}$ of 1 or near one.

Table 14. Regression results for pecking order tests for sub-samples of small, medium and large firms. Firms are sorted into quartiles based on average total assets (Small firms <Q1, Medium small and large firms Q1 > Subsample < Q3, Large firms >Q3). The following regression is estimated: $\Delta D_{it}=a+bPODEF_{it}+e_{it}$, where ΔD_{it}= the amount of net debt issued, and DEF_{it} is the sum of dividends, investment, current portion of long term debt, change in working capital, minus the cash flow after interest and taxes. All variables are scaled by net assets.

	Small firms (1)	Medium firms (2)	Large firms (3)
Constant	−0.006	0.012**	0.029***
	(0.009)	(0.005)	(0.005)
Pecking order coefficient (b_{DEFit})	0.011	0.036	0.016
	(0.069)	(0.036)	(0.035)
N	41	292	447
R^2	0.001	0.003	0.001
Adj. R^2	-0.025	0.000	-0.002

All tests have been checked for heteroskedasticity, autocorrelation and multicollinearity and wherever issues were found it is reported.

In these tests, all the firms in the main sample had to be divided into subsamples regarding firm size, measured in total assets. Firms were then divided into subsamples, where the data points <Q1 would be called small firms, the data points which fell into Q1> data points <Q3 where to be called medium firms, and the firms >Q3 are called large firms. In this case, Q1=3368.24 in this case, and Q3=144477.17. The N is relatively small because in order to be put into a subsample, there had to be data available on total assets for 2007-2011. The results show that the model has very low explanatory power for all firm sizes. It is unlikely that the firm size might influence pecking order behavior. This is also evidenced by the coefficients: the hypothesis that small firms might exhibit stronger pecking order behavior because of more asymmetric information problems does not account for the findings here. It is also to be noticed that the coefficients are not close (enough) to zero. The interpretation of this is that even when the firms experience no financing deficit, they will still issue debt, on average.

Table 15 represents the results for the regression test of the pecking order for each separate country in the European Union, except Croatia, because it was not a member of the EU during the sample period. Countries have different economic, institutional and legal contexts. This regression tests the pecking order in each separate country so that factors which may influence pecking order behavior may be found. The firms sampled are firms from the European Union, publicly listed and non-financial firms, from the years 2008 to 2012. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio. The independent variable is the financing deficit. The pecking order theory predicts that the debt issues equal the firm's financial deficit, or, in the case of a financing surplus, the debt retirements equal the financing surplus, up to a certain maximum debt level. This implies a pecking order coefficient $bDEF_{it}$ of 1 or near one.

Table 15. Regression results for pecking order tests for different countries in the European Union: where ΔD_{it}= the amount of net debt issued, and DEF_{it} is the financing deficit. Italy, Sweden and Spain have no data available in the sample so are not included in the table. Croatia is not included because it only became a member of the EU in 2013 which is outside the sample period. All variables are scaled by net assets. Standard errors are reported in parentheses. Countries with less than 20 observations (N < 20) have been regrouped under 'other'.

	Constant	$bDEF_{it}$	*N*	R^2	*Adj.* R^2
Country					
United Kingdom	-0.002 (0.004)	-0.002 (0.032)	516	0.000	-0.002
Netherlands	-0.017 (0.007)	-0.032 (0.050)	194	0.002	-0.003
Germany	0.009*** (0.003)	-0.022 (0.022)	895	0.001	0.000
France	0.003 (0.003)	0.088*** (0.023)	944	0.016	0.015
Austria	0.008 (0.006)	0.033 (0.049)	174	0.003	-0.003
Belgium	-0.004 (0.007)	0.258*** (0.048)	159	0.158	0.152
Cyprus	-0.011 (0.013)	0.380*** (0.075)	49	0.354	0.340
Denmark	0.003 (0.007)	0.082 (0.065)	147	0.011	0.004
Estonia	-0.021 (0.021)	0.218 (0.134)	20	0.128	0.080
Finland	0.008 (0.007)	0.201*** (0.073)	218	0.034	0.030
Greece	0.008 (0.007)	-0.289*** (0.049)	255	0.122	0.119
Ireland	0.034* (0.018)	0.347** (0.153)	22	0.205	0.165
Lithuania	-0.002	-0.285***	29	0.240	0.212

Table 15. Regression results for pecking order tests for different countries in the European Union: where ΔD_{it}= the amount of net debt issued, and DEF_{it} is the financing deficit. Italy, Sweden and Spain have no data available in the sample so are not included in the table. Croatia is not included because it only became a member of the EU in 2013 which is outside the sample period. All variables are scaled by net assets. Standard errors are reported in parentheses. Countries with less than 20 observations (N < 20) have been regrouped under 'other'.

	Constant	$bDEF_{it}$	*N*	R^2	*Adj.* R^2
Country					
	(0.013)	(0.098)			
Luxembourg	0.012 (0.013)	0.000 (0.099)	42	0.000	-0.025
Poland	0.005 (0.020)	0.153 (0.121)	68	0.023	0.009
Portugal	-0.008 (0.034)	0.220 (0.135)	24	0.107	0.067
Other	0.001	0.064	59	0.023	0.006

Footnote for table 7: In the regression test of Irish firms I found a Durbin-Watson coefficient of 1.006 which may be a sign of autocorrelation. Since the sample size is only 22, conclusions will be taken with caution.

From the analysis of each separate country, several countries stand out: At first there is Cyprus with a significant coefficient of 0.380 – which is still not even near the hypothesized 1 – but it shows that on average firms finance their deficit with 0.38 cents of debt per euro. The N is relatively small – only 50 – but the coefficient is significant. Other countries that stand out are Ireland, again with a small N but with a significant coefficient of 0.347 – which is among the results we get the closest to pecking order behavior – but it doesn't come near a coefficient of 1.

There are several countries with coefficients of >0.2 (and with a sufficient N) but the effect of bad results from countries with a huge number of observations has outweighed them in the main test. Some results are strange and nuance the relatively good results of some countries – for example, Lithuania shows a coefficient of -0.285 which is significant. This would mean that when companies experience a financing deficit, they would buy back their outstanding debt on average, which nuances the results obtained from other countries with an about equal number of observations.

Table 16 represents the results for the regression test of the pecking order for each separate country in the European Union, except Croatia, because it was not a member of the EU during the sample period. This time, the independent variable is the proposed lagged financing deficit explained in test 2, to investigate whether the pecking order has a possible 'buffer time' over which the firm can oversee its own financial deficit or not. This regression tests the pecking order in each separate country so that factors which may influence pecking order behavior may be found. The dependent variable is the amount of long term debt issued, scaled by the book value of assets, or the change in the debt-to-asset ratio. The pecking order theory predicts that the debt issues equal the firm's financial deficit, or, in the case of a financing surplus, the debt retirements equal the financing surplus, up to a certain maximum debt level. This implies a pecking order coefficient $bDEF_{it}$ of 1 or near one.

Table 16. Regression results for pecking order tests for different countries in the European Union: where ΔD_t= the amount of net debt issued, and DEFt-1 is the lagged financing deficit. Romania, Italy, Spain and Slovakia have no data available in the sample so is not included in the table. Croatia is not included because it only became a member of the EU in 2013 which is outside the sample period. All variables are scaled by net assets. Standard errors are reported in parentheses. Countries with less than 20 observations (N < 20) have been regrouped under 'other'.

	Constant	$bDEF_{it-1}$	*N*	R^2	*Adj.* R^2
Country					
United Kingdom	-0.003 (0.004)	0.039 (0.027)	546	0.004	0.002
Netherlands	0.017** (0.007)	0.055 (0.050)	188	0.006	0.001
Germany	0.013*** (0.003)	-0.021 (0.024)	805	0.001	0.000
France	0.000 (0.003)	0.101*** (0.021)	900	0.024	0.023
Austria	0.009 (0.006)	0.028 (0.051)	161	0.002	-0.004
Belgium	0.013 (0.009(	0.025 (0.060)	158	0.001	-0.005
Cyprus	0.013 (0.014)	0.035 (0.078)	48	0.004	-0.017
Denmark	0.004 (0.007)	0.005 (0.059)	154	0.000	-0.007
Finland	0.007 (0.007)	0.160** (0.066)	232	0.025	0.021
Greece	-0.009 (0.007)	0.096* (0.050)	265	0.014	0.010
Lithuania	-0.019 (0.020)	-0.017 (0.124)	22	0.001	-0.049
Luxembourg	0.010 (0.014)	-0.027 (0.091)	40	0.002	-0.024
Poland	0.003 (0.011)	-0.034 (0.052)	38	0.012	-0.016

Table 16. Regression results for pecking order tests for different countries in the European Union: where ΔD_t= the amount of net debt issued, and DEFt-1 is the lagged financing deficit. Romania, Italy, Spain and Slovakia have no data available in the sample so is not included in the table. Croatia is not included because it only became a member of the EU in 2013 which is outside the sample period. All variables are scaled by net assets. Standard errors are reported in parentheses. Countries with less than 20 observations (N < 20) have been regrouped under 'other'.

	Constant	$bDEF_{it-1}$	*N*	R^2	*Adj.* R^2
Country					
Portugal	0.002 (0.030)	-0.074 (0.103)	27	0.021	-0.019
Sweden	0.014*** (0.005)	0.045 (0.041)	276	0.004	0.001
Other	0.014*	-0.097	69	0.028	0.014

All tests have been checked for heteroskedasticity, autocorrelation and multicollinearity and wherever issues were found it is reported.

For the test with the lagged deficit, it seems that, contrary to test (2) in table 12 (this test investigated the entire sample, not subsamples of country), there seems to be less pecking order-like behavior than when the deficit in the same year is used. The highest significant coefficients are, both with a substantial number of observations, France, with a coefficient of 0.101 and Finland with a coefficient of 0.160, which show that on average, for each 1 euro of debt issued by a firm, then financing deficit accounts for 10 respectively 16 eurocents. This is still very low compared to the original pecking order hypothesis which expects coefficients near 1. Therefore, the pecking order does not a good job in explaining the incremental financing practices in any separate country, even when a lag of 1 (book) year is taken into account. The constants however, are near zero in almost every case, which is interpreted as when companies do not experience a financing deficit, they will not issue any debt.

Table 17 represents the results for the regression test of the pecking order against a traditional leverage model. The dependent variable is the change in the amount of long term debt issued to market capitalization, or the change in the debt-to-market-cap ratio. The independent variables from the traditional model are the change in tangibility ratio, the change in market to book ratio, the change in the natural logarithm of the sales and the change in profitability ratio. These factors together form a traditional explanatory model about a firm's financing practices. To augment this model, the financing deficit is added and tested together with this model, in order to investigate its explanatory power on top of the 'traditional' variables.

Table 17. Regression results for the pecking order against a conventional leverage model. The basic regression is $\Delta Di=\alpha+\beta T\Delta Ti+\beta MTB\Delta MTBi+\beta LS\Delta LSi+\beta P\Delta Pi+\varepsilon i$. Here D is defined as the ratio of total debt to market capitalization, T=Tangibility is defined as the ratio of fixed assets to total assets. MTB is the market-to-book ratio defined as the ratio of the market value of assets (book value of assets plus the difference between market value of equity and book value of equity) to the book value of assets. LS is log sales defined as the natural logarithm of constant sales. P is profit defined as the ratio of operating income to book value of assets. In (2), the basic regression is augmented with the financing deficit. Standard errors are in parentheses.

	Change in debt to market capitalization	Change in debt to market capitalization
	(1)	(2)
Constant	0.215***	0.037
	(0.012)	(0.025)
Δ Tangibility	0.276*	0.404
	(0.142)	(0.414)
Δ Market-to-book	−0.088***	−0.743***
	(0.009)	(0.054)
Δ Log sales	0.004	0.109
	(0.039)	(0.129)
Δ Profitability	-0.136***	-0.019
	(0.038)	(0.122)
Financing deficit		1.334***
		(0.162)
N	15481	3828
R^2	0.009	0.074
Adj. R^2	0.008	0.073

All tests have been checked for heteroskedasticity, autocorrelation and multicollinearity and wherever issues were found it is reported.

Frank and Goyal (2003) mention that "even if a theory is wrong, it could still be helpful if it does a better job of accounting for the evidence than competing theories. The pecking order is a competitor to more conventional empirical leverage specifications." Here it is tested how well the financing deficit does in comparison with a conventional leverage regression. The regression is first run without the financing deficit in (1), and in (2) the deficit is added. As can be seen, the addition of the financing deficit in the predictor variables greatly increases the explanatory power from the regression. Although it is still not very high, it is significantly higher than the R-squared in the first regression.

5. Conclusion

5.1 Main results and contributions

Results show that there is very little evidence in favor of the existence of a pecking order in the incremental financing practices of firms. Sample wide, both the deficit and the lagged deficit have coefficients smaller than 0.1 where a coefficient of 1 is hypothesized. This means that financing deficit alone cannot explain the issuance of debt and thus the financing practices in the manner the pecking order theory hypothesized. This means that in practice, publicly listed firms in the EU will either finance their funds flow deficit with a lot of equity too, or that the debt issued by firms is not be explained by the financing deficit, so that firms can issue more or less debt than the financing deficit would account for. This exactly was the main hypothesis of the pecking-order theory (the financing deficit accounts for all the debt issued) and my results show no evidence supporting that hypothesis.

The results show that there is no significant difference in whether small, medium sized or large companies follow the pecking order and certainly not in the way as hypothesized: All three separate categories show very low coefficients and small firms of which the hypothesis was that the coefficient should be larger, obtained the lowest coefficient. So there is no evidence in this study supporting the claim that small firms should follow the pecking order more closely than large firms because of more and severe information asymmetry.

The results of the tests related to the hypothesis regarding firm size shows a bias in my sample towards medium and large sized firms (in terms of total assets) as the sample sized of the entire cross-section of small firms (the first quartile in terms of mean total assets) contains only 24 data points and therefore cannot be rendered significant, while for medium and large firms the coefficients are significant but the constants aren't. The coefficients show, as in the main results, that the pecking order theory has little empirical support, for small as well as medium and large firms, as well as the sample-wide results with the financing deficit DEF_{it} and the lagged deficit DEF_{it-1}. This does not mean that companies issue equity in very large numbers instead of debt *per se* (though it could be possible, the data is not interpreted that way), but rather that financing deficits and debt issuance practices aren't aligned in the slightest way, according to these results.

All separate countries in the EU (where data was available) have been investigated separately, and again no signs of a pecking order appear. The country which followed the pecking order the closest was Cyprus with a coefficient of 0.380 where 1 was the hypothesis. The evidence suggests that the pecking order theory has very little support in any particular country in the European Union. Results however lack significance because of the low sample size in some particular countries. However, there have been minor changes in financing practices before the global economic crisis in 2009 and during the global economic crisis: as the coefficients indicate, the

The results of this research are largely contrasting previous research with regards to the pecking order theory. This may be due to the selection criteria of the sample: whereas most researchers use samples from a very specific industry or other strong selection criteria (e.g. Shyam-Sunder and Myers (1999), Frank and Goyal (2003), Lara (2009)). Our results are mostly in line with Zhang and Kanazaki (2008), who researches a sample kind of similar to the sample used in this research, i.e. publicly listed firms belonging to no specific subcategory or industry.

The results provide an alternative to existing research in favor of the pecking order theory, in that it nuances the universal appeal or existence of a pecking order, because only after a great deal of selection the pecking order becomes applicable, i.e. only in certain circumstances.

5.2 Limitations

Up until now, research upon pecking order theory confirmation has been executed a lot in comparison with the static tradeoff theory (e.g. Shyam-Sunder and Myers, 1999; Fama & French, 2002; Tong & Green, 2005). This particular study focuses on the pecking-order theory exclusively and therefore doesn't 'test' the validity of one against the other, even though they are contenders, although the pecking-order theory is about incremental financing and the static trade-off theory about the level of financing. The sample requires data for firms over 6 year's time. This means that we can only use for our regression companies that provide data for the years we need that specific data. Selection companies who are eligible for observation may "bias our sample toward relatively large firms with conservative debt ratios, because small firms with unconservative debt ratios are more likely to drop out of the sample" (Shyam-Sunder and Myers, 1999).

There is no reason to assume this data is externally valid so there is plenty of room for research elsewhere, in different (economic) climates and within different conditions and factors of influence. This has been countered in the research design of Seifert and Gonenc (2007) but the external validity / generalization problem is apparent in some way in all of the other empirical researches I have referred to in this research proposal.

The operationalization of company size in terms of asset size is a bit ambiguous. It makes sense to measure company size in terms of revenue but it can also make sense to do this in terms of company value, employee size, among others. When choosing for one over another, we have to be clear about the assumptions and definitions. I have chosen for company size to be measured in terms of total assets. This is in the first place following standard practice (Fama and French, 2002; Frank and Goyal, 2003; Seifert and Gonenc, 2007) and in the second place because a firm with a large amount of assets can only in specific cases by a small firm (for example an industry company with a relatively low market share) and a firm with a small amount of assets can be a large firm (for example a software developing firm), so these are the limitations we take for granted, because the alternatives (growth-rate, employee size) are generally more distorted selection variables.

Unlike the researches of for example Frank and Goyal (2003) and Shyam-Sunder and Myers(1999) this research does not conduct the in-depth step of using the regression models for data outside of the scope of the data used for the regression. Thus, it does not investigate statistical power of the found model. For this paper the same goes as for Shyam-Sunder and Myers (1999): "the analysis in this paper is restricted to book debt amounts and to book debt ratios, defined as the ratio of long-term debt to the book value of assets."

De Jong, Verbeek and Verwijmeren (2007) extend the basic pecking order model of Shyam-Sunder and Myers (1999) by "separating the effects of financing surpluses, normal deficits, and large deficits. (…) Using a broad cross-section of publicly traded firms for 1971 to 2005, we find that the estimated pecking order coefficient is highest for surpluses (0.90), lower for normal deficits (0.74), and lowest when firms have large financing deficits (0.09). These findings shed light on two empirical puzzles: first, small firms – although having the highest potential for

asymmetric information – do not behave according to the pecking order theory, and second, the pecking order theory has lost explanatory power over time." They provide a solution to this phenomenon by showing that the frequency of large deficits is higher in smaller firms and increasing over time. Their findings support a pecking order theory "that considers firms' debt capacities." This study does not conduct this step, while it is certainly possible that the size of the deficit or surplus could have explanatory power regarding pecking order behavior.

5.3 Suggestions for further research

As mentioned before, compared to the work of for example Shyam-Sunder and Myers (1999) we are leaving the tests regarding static tradeoff theory out of the research. In a future research, this could be done as well in the European Union in order to further asses the empirical relevance of the pecking-order theory. Also, research could be conducted about this hypothesis to test for what kind of influence different economic climates and different legal systems etc. have on the validity of the pecking-order hypotheses. The most significant thing to do is, taking these results into account, a research in specific industries. As the results imply, the pecking-order theory does not explain why and when firms issue debt or equity. A research could be carried out to test pecking order behavior on industry-specific samples, as companies from various industries have very heterogeneous assets and thus very heterogeneous needs for capital.

Also, following De Jong, Verbeek and Verwijmeren (2007) the same pecking-order tests could be run for different subsamples regarding the size of the financing deficit, that is, using the same regression equation on a subsample with firms which experience financial surpluses, a subsample with firms which experience normal deficits and a subsample with firms experiencing large deficits. As a result, the findings support a pecking order theory that considers firms' debt capacities.

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7. Dutch Summary

Deze bacheloropdracht is een onderzoek over het al dan niet bestaan van een zgn. pikorde, een 'pecking order' in het financieringsgedrag van ondernemingen. Vanuit het perspectief vanuit een willekeurige onderneming houdt die pikorde in dat financiering uit eigen middelen aantrekkelijker (d.w.z. goedkoper, minder informatiegevoelig) is dan externe financiering. Als deze interne middelen niet voldoende blijken te zijn om aan de financieringsbehoefte te voldoen, zal vreemd vermogen worden aangesproken omdat het minder informatiegevoelig is dan eigen vermogen, dat als laatst optie zal worden uitgegeven. Het doel van dit onderzoek is het testen van deze zogenaamde pikorde, d.w.z.: in hoevere is de praktijk in overeenkomst met deze pikorde? Dit zal getest worden op een sample van alle beursgenoteerde, niet-financiele ondernemingen in de Europese Unie.

Bij het testen wordt het model van Shyam-Sunder en Myers (1999) gevolgd, met een paar aanpassingen om het financieringstekort te berekenen. Er worden meerdere testen uitgevoerd, zoals een test met betrekking tot causaliteit, met betrekking tot nauwkeurigheid , een test met betrekking tot de invloed van de crisis op de mate waarin ondernemingen zich aan de pikorde houden. Daarnaast wordt de originele sample opgedeeld in drie subsamples gecategoriseerd op grootte van de total assets om te onderzoeken of pecking order gedrag misschien afhangt van de grootte van de onderneming. Verder wordt in de originele sample ook onderscheid gemaakt tussen verschillende landen, zodat het bestaan van een pecking order verder gespecificeerd kan worden naar land. Als laatst is de pecking order ook nog getest tegenover een traditioneel model over financieringsgedrag om te onderzoeken hoe sterk de pecking order het doet in verhouding tot andere theorieen in het voorspellen van financieringsgedrag.

Uit de resultaten blijkt dat er erg weinig bewijs is voor het bestaan van een pecking order in het financieringsgedrag van ondernemingen. De pecking order heeft evenwel geen empirische grondslag in ook maar een enkel land in de Europese Unie, noch in ondernemingen van een specifieke grootte. Er is wel gebleken dat er een verandering in het financieringsgedrag van ondernemingen heeft plaatsgevonden in de periode tijdens de crisis t.o.v. de periode daarvoor, maar in beide periodes afzonderlijk zijn er desalniettemin geen aanwijzingen voor het bestaan van een pecking order.