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# **Tests of optimal capital structure theory and pecking order theory using a binomial approach**

**- a study of Swedish firms**

**Authors:**  
Kent Ekeröth  
Emily Wahlberg

**Advisor:**  
Niclas Andréén

## **Sammanfattning**

Denna magisteruppsats avser att utreda om svenska börsnoterade företag följer optimal kapitalstrukturteori och/eller pecking order teori. Perioden som utreds är 1998-2004 och vi finner att varken optimal kapitalstrukturteori eller pecking order är giltig på den svenska marknaden. Från våra resultat drar vi slutsatsen att det inte existerar någon optimal punkt i kapitalstrukturen. Istället verkar den optimala punkten inte vara en ända punkt utan istället en ett intervall, från noll till branschens medel, där företag är indifferent angående deras skuldsättningsgrad. Våra resultat visar att svenska företag föredrar intern finansiering och därefter föredras nyemission framför lån.

**Uppsatsens titel:** Tests of optimal capital structure theory and pecking order theory using a binomial approach - a study of Swedish firms

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**Handledare:** Niclas Andréén

**Nyckelord:** Optimal kapitalstrukturteori, pecking order, skuldsättning, finansiella beslut, Sverige

**Syfte:** Syftet är att testa om svenska börsnoterade och icke-finansiella företag följer teorin om optimalkapitalstruktur och/eller pecking order teori under perioden 1998-2004.

**Metod:** För att uppfylla vårt syfte genomför vi en binomial analys. Data kodas i 1:or och 0:or beroende på huruvida de följer hypoteserna eller inte. Därefter genomförs binomial test i SPSS för att avgöra signifikansnivån.

**Teoretiska perspektiv:** Den teoretiska referensramen utgörs av tidsenlig och tidigare forskning angående optimal kapitalstrukturteori och pecking order. Hypoteser utformas utifrån den teoretiska referensramen.

**Empiri:** En binomial analys ligger till grund för fastställandet av optimal kapitalstrukturteori samt pecking ordet teorin. Inga av de tester som genomförs talar entydigt för att någon av de båda teorierna är gällande.

**Slutsatser:** De svenska företagen följer varken optimal kapitalstrukturteori eller pecking order teori.

## **Abstract**

This master thesis concerns whether Swedish non-financial listed firms act in accordance with the optimal capital structure theory and/or pecking order theory. The examined period is 1998-2004 and we discover that Swedish companies neither follow optimal capital structure theory nor pecking order theory. From our results we conclude that there exists no single point of the capital structure which is optimal. Rather it seems as if the optimal point lies in-between an interval from 0 to the industry average, where firms tend to be indifferent to their debt ratios. Our results show that Swedish companies prefer internal financing followed by equity and as last choice debt issuance.

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**Key words:** Optimal capital structure theory, Pecking order theory, debt ratio, financial decisions, Sweden

**Purpose:** The purpose of this analysis is to test if Swedish non-financial listed firms follow the theory of optimal capital structure and/or the pecking order theory during the period 1998-2004.

**Methodology:** To fulfil the purpose a binomial analysis is performed. Data is coded in 1:s and 0:s depending on how they behave relative to the hypotheses. After that the binomial tests are conducted in SPSS to determine if they are significant or not.

**Theoretical perspectives:** The theoretical background constitute of modern and prior research related to the theory of optimal capital structure and the pecking order theory. The hypotheses are designed from the theoretical background.

**Empirical foundation:** The binomial analysis is the foundation for determining whether optimal capital structure and/or the pecking order theory is valid or not. None of the tests conducted unambiguously talk in favour of either of the theories.

**Conclusions:** Neither optimal capital structure theory nor pecking order theory is valid on the Swedish market.

<b>CHAPTER 1 – INTRODUCTION .....</b>	<b>5</b>
1.1 BACKGROUND AND PROBLEM DISCUSSION .....	5
1.2 PURPOSE .....	7
1.3 TARGET GROUP .....	7
<b>CHAPTER 2 – THEORETICAL BACKGROUND .....</b>	<b>8</b>
2.2 THE OPTIMAL CAPITAL STRUCTURE THEORY (OCST) .....	8
2.2.1 <i>Literature on optimal capital structure theory</i> .....	9
2.3 THE PECKING ORDER THEORY (POT) .....	11
2.3.1 <i>Literature on pecking order theory</i> .....	12
2.4 TRENDS IN CAPITAL STRUCTURES .....	14
2.4.1 <i>Similarity of capital structures within the industry</i> .....	14
2.4.2 <i>Differences in capital structures between industries</i> .....	14
2.4.3 <i>Capital structures do not seem to differ very much between countries</i> .....	15
2.5 HYPOTHESES .....	15
<b>CHAPTER 3 – METHOD .....</b>	<b>18</b>
3.1 SCIENTIFIC METHOD .....	18
3.2 CHOICE OF METHOD .....	18
3.3 DATA COLLECTION .....	18
3.3.1 <i>Definitions</i> .....	18
3.3.2 <i>Selection</i> .....	19
3.3.3 <i>Primary and secondary data</i> .....	20
3.4 IMPLEMENTATION .....	20
3.5 CRITICISM OF METHOD .....	20
3.5.1 <i>Reliability</i> .....	20
3.5.2 <i>Validity</i> .....	21
3.5.3 <i>Systematic errors</i> .....	21
3.5.4 <i>Falling off analysis</i> .....	22
<b>CHAPTER 4 - EMPIRICAL DATA .....</b>	<b>24</b>
4.1 METHODOLOGY .....	24
4.1.1 <i>Descriptive statistics</i> .....	24
4.1.3 <i>Example of calculation</i> .....	25
4.2 BINOMIAL ANALYSIS .....	25
4.2.2 <i>Total sample</i> .....	25
4.2.3 <i>Industry specific</i> .....	26
4.2.4 <i>Observations by year</i> .....	29
<b>CHAPTER 5 - ANALYSIS .....</b>	<b>31</b>
5.1 OPTIMAL CAPITAL STRUCTURE THEORY .....	31
5.2 PECKING ORDER THEORY .....	33
5.4 CRITICISM OF THE THESIS .....	35
<b>CHAPTER 6 - CONCLUSIONS .....</b>	<b>37</b>
6.1 CONCLUSIONS .....	37
6.2 FUTURE RESEARCH .....	37
<b>CHAPTER 7 - REFERENCES .....</b>	<b>39</b>
<b>APPENDIX I .....</b>	<b>42</b>
<b>APPENDIX II .....</b>	<b>43</b>

# Chapter 1 – Introduction

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*In the initial chapter, the background and problem discussion of the thesis is presented. That is followed by the purpose of the study and the chapter ends with necessary definitions and the target group that this thesis is intended for.*

## ***1.1 Background and problem discussion***

How to design the capital structure is one of the most important concerns a company has to deal with (Jen et al. 2003). Despite of how important it is to have an appropriate balance in the capital structure, there exists no perfect direction which could tell us what firms actually have in mind when they are choosing their capital structures (Ibid).

However, researchers have through the history presented many tools and insights to the capital structure decision (among others Donaldson, 1962; Miller et al. 1958, 1963; Myers, 1984). Although they may not be complete tools they are still useful and helpful. Miller et al. (1958, 1963) argue that firms which have debt in their capital structure may benefit from the advantage that comes along with tax deductibility. They point out that increasing debt will give benefits until costs of bankruptcy and financial distress start to outweigh the tax benefits. This point in the capital structure may then be the optimal. According to Miller et al. (1963) firm value is maximized when firms reach their optimal point. So if this theory is correct, a firm which is concerned about its capital structure should have this target in mind when designing it. Lev (1969) and Bowen et al. (1982) find evidence that firms' financial ratios tend to converge with the industry mean. Bowen et al. (1982) also present a new technical method in which the industry mean of debt ratios serve as predictors of optimal capital structure. Claggett (1991) uses this method and confirm mean reversion among debt ratios. He explains the mean reverting tendency with the fact that firms within an industry face the same risks, tax-tradeoffs and conditions. Firms may then behave similar if they intend to achieve the optimal capital structure. These statements are parts of the optimal capital structure theory (Jen et al. 2003).

The optimal capital structure theory is well articulated in the literature and it was also the prevailing theory of optimal capital structure for a long time (Ibid). Based on the theory, researchers have tried to survey financial decisions and they transformed it almost into recommendations to managers (Ibid; Jen et al. 2003; Myers,1984). It has been tested numerous of times and there are plenty of researchers with empirical evidence, who claim that the theory of optimal capital structure only partly clarifies actual financing actions (among others Cai et al. 2003; Miao, 2005; Myers et al. 1999). Despite of this, there are many researchers that claim that financing actions cannot be explained in the absence of optimal capital structure theory since it regards financial distress and tax influences (among others Claggett 1991; Harris et al.1984).

When Myers published his article on firm capital structure in 1984, he stated that he wanted to push research in a new direction. If the optimal capital structure theory only seems to explain financing decisions partly, new researching must be produced. The article he published presents the well-known optimal capital structure theory and the less known pecking order theory as two approaches to thinking about capital structure. The pecking order theory was hardly new at this time, but he attracted some new important attention to it. He proposes, provocatively, that the pecking order theory works at least as good as the theory of optimal capital structure of explaining financing actions. Ever since it was published, analyses on capital structure have increased copious (Cai et al., 2003).

The pecking order theory generally suggests that firms prefer internal financing to external financing. When external financing is required, debt is preferred to new equity issue. Why this financing pattern is detect universally, is a question that remains. The theory suggests that financing resource is chosen based on costs and riskyness. According to the theory, this also why there exists no well defined debt ratio in firms' capital structures. Rather firms seem to choose debt level according to the conditions and circumstances firms face at the point for financing. This shows that managers do not have a target in mind when they choose financing in contrast to optimal capital structure theory. The foundation of pecking order theory was already offered by Gordon Donaldson (1962) if not earlier. Donaldson (1962) already then discovered that there exists this certain financial behaviour among corporations. However, pecking order may explain financing behaviour but not completely, since it does not explain how taxes and other frictions that exist on the real market influence financing decisions of firms (Jen et al. 2003).

As noticed before, Myers (1984) started a debate with his article. Since then, the recent corporate finance literature has focused on the two competitive theories to explain financing behaviour of firms. The empirical evidence seems to be robust for them both, although pecking order theory seems to have more support (Jen et al. 2003; Fama et al. 2005). If there exists more or less robust evidence for both theories, they must somehow explain parts of financing behaviour.

The fact that empirical data support arguments for both competing theories, a significant debate remains. Tests of optimal capital structure theory and pecking order theory are mostly made on Western non-financial corporations and the bulk of them are on American non-financial corporations. If we would ask today how Swedish companies choose their capital structures the answer probably would be; we do not know. At least not as much as we should have wanted. Swedish research, in which the pecking order theory and optimal capital structure theory are tested, is minor and thereby quite unexamined. Hamberg (2001) also supports that further research on Swedish corporate financing behaviour is required. This motives to observe how managers of Swedish firms choose their capital structures. What do they have in mind? Swedish non-financial corporations may then be good candidates for testing the theories.

Since financing behaviour is scarcely examined, more tests of the two theories are needed to push the research forward. Especially when there exists robust evidence for both theories, which makes it suspected that a hybrid model between the two theories might explain more than they do separately of financing behaviour. This fact is also supported of Cai et al. (2003, 1999), Claggett (1991) and Myers (1984).

With the above information, we formulate following questions:

Do Swedish firms converge to their industry means? If they do, do all Swedish industries converge? Can mean reversion be detect from both sides of the industry average? Do Swedish firms prefer internal financing to external? When external financing is required do firms prefer debt to equity? Do optimal capital structure theory coexist with pecking order?

## ***1.2 Purpose***

The purpose of this analysis is to test if Swedish non-financial listed firms follow the theory of optimal capital structure and/or the pecking order theory during the period 1998-2004.

## ***1.3 Target group***

This master thesis is intended mainly for teachers and students at university level. An additional target group is managers and owners in the corporate world. Finally, this thesis may concern researchers and those who have an interest in capital structure and financing behaviour. To be able to fully appreciate this thesis a background in statistics and corporate finance is advantageous.

## Chapter 2 – Theoretical background

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*In this section relevant theories and prior research, are presented. These will constitute our framework and tools for the analysis. First of all the theories and prior literature are presented. After that observed trends of capital structures are discussed. The chapter ends with hypotheses, which are based on the theoretical framework.*

In this study two theories regarding financing behaviour are important to examine, namely the optimal capital structure theory (OCST here) and the pecking order theory (POT here). The theories are constructed from American conditions, hence also the underlying assumptions. While OCST focus of the mix between debt and equity, POT is more management-oriented.

### ***2.2 The optimal capital structure theory (OCST)***

According to Modigliani & Miller (M&M) (1963) a company should have 100% debt in its capital structure. This way the company could take absolute advantage of the tax-shield. However, 100% debt in the capital structure does not exist in reality because of distress costs (Jen et al. 2003). The capital structure theory underline a unique optimal capital structure for a specific firm which consists of a limited level of debt. Optimal debt ratios between companies are diverse of two reasons. Taxes vary across companies and companies have different expectations about future costs of financial distress and bankruptcy because of higher debt ratio (Ibid).

The firm is described as regulating different insolvency costs or financial distress against the value of interest tax advantage to achieve the optimal capital structure. The value of the firm increases with increasing debt until a point where financial distress starts to cost more than debt is beneficial. Higher leverage means shareholders will claim higher profitability. According to the theory a profitable firm would be the ideal firm to take advantage of the tax shield of increasing debt. A more profitable firm is more resistant against bankruptcy and is therefore capable to increase its debt more than a less profitable firm. In this way the tax benefit will be greater (Ibid). The theory thereby show a positive correlation between indebt and profitability and points out that capital structures differ between industries and companies since the optimal debt ratio is individual and varies for specific firms. Firms with safe and trustable assets and which are profitable with taxable earnings should choose a higher debt ratio. Less profitable firms with risky and less trustable assets should choose lower high debt ratios (De Ridder, 1996). Companies which operate in constructing industries constitute a group with secure assets and borrow large amounts since their assets are considered as trustable. Fast growing industries such as pharmaceuticals and high-technology which assets are risky have lower debt ratios (Brealy et al. 2003).



The fact that a firm's financial actions over time may change the debt ratio could hence momentarily change the leverage from its optimum. If it is assumed that managers maintain the capital structure if it is optimal, or adjust it gradually toward its historical average if it is necessary, then debt ratios will show a mean reverting trend (this will be discussed more below) (Cai et al. 2003, 1999; Claggett, 1991; Jen et al. 2003). This indicates that if adjustments of capital structure would not mean various costs, all companies would always have their optimal debt ratio (Brealy et al. 2003).

### **2.2.1 Literature on optimal capital structure theory**

Already in 1958, M&M proposed that the capital structure in a firm is irrelevant with respect to firm value. However, this is only valid when perfect markets and no transaction costs are assumed. In 1963, M&M gave the idea about how corporate taxes affect the capital structure in a company. They suggest that a company will increase its debt ratio to benefit from the deductibility of interest rate. These proposals and studies of Miller (1977) and DeAngelo and Masulis (1980), which focused on the same matters, are the underpinnings of the optimal capital structure theory (Cai et al. 2003; Jen et al. 2003).

However, theories are always theories, with more or less empirical support. Especially the early theories were built by researchers who were more worried of constructing them than actually testing them. So what about empirical evidence on optimal capital structure theory and industry mean?

The controversial debate about mean reversion of capital structures has been going for some time. Lev argued already in 1969 that several ratios related to finance tend to converge to industry means. Also Bowen et al. (1982) argued that financial ratios tend to be mean reverting. Bowen et al. (1982) brought up a new method to evaluate optimal capital structure and their idea was that debt ratios of companies are likely to converge to the industry average as time passes by. Their study provides significant empirical evidence that debt ratios tend to converge to the industry average over a period of five and ten years.

Lots of researchers have tested the optimal capital structure theory with respect to if debt ratios converge with industry mean over time. In several studies are evidence of mean reversion observed when industry mean is used as predictor for optimal capital structure (Cai et al. 1999; Claggett, 1991; Marsh, 1982; Opler et al., 1994).

Harris et al. (1984) imply that the target (industry mean) is a motivating force in managerial financial behaviour<sup>1</sup>. They propose that real world factors such as restrictions and adjustment costs make companies correct successively to the target. Therefore they claim firms to have a trend of partial correction and the correction does not happen within each time period. In a

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<sup>1</sup> According to Harris et al (1984) the target is one of many driving factors behind managerial financial actions.

similar manner, Marsh (1982) suggests that managers act as if they have a target in mind when they are choosing level of leverage.

Claggett (1991) also find evidence on mean reversion and his conclusion of the study is that LTD/TA ratios have a tendency, within a period of one year, to shift toward the current previous industry average. The result of his study show that companies with debt ratios above the industry mean are more likely to correct their debt ratio toward the industry mean than companies with debt ratios which are below industry mean.

Similar interesting results do Cai et al. (2003) discover when they test optimal capital structure theory. They use data from Fortune 500 largest manufacturing companies. They detect that optimal capital structure is a *range* of values, starting with zero to the industry average, where a characteristic American company would be unconcerned to its leverage level. According to the authors this is more believable rather than that the optimal capital structure would be a single point where firm value is maximized. Consequently, firms with debt ratios out of this range, in this case above industry average, will be concerned about debt level and will hence adjust it toward the mean. Since Cai et al. (2003) only find evidence that debt ratios are mean reverting downwards they cannot conclude that OCST is valid. However, their study from (1999), in which data also are selected from fortune 500 largest manufacturing companies, support OCST. They limited their study to large (mature) companies and detect evidence that show that debt ratios converge to industry mean for both sides. As noticed, both their studies are based on data from large manufacturing companies. It would be interesting if their result would be the same in a sample consisting large and/or small firms in different industries.

When mean reversion is discussed it is easy to question the underlying assumptions. If managers actually adjust capital structure as if they had a target in mind, how can we define the target? Claggett (1991) argues that if these assumptions were excluded it would be complicated to measure targets of the optimal capital structure and perform practical analysis.

Optimal capital structure theory may possibly explain some of the trend associated with capital structure but barely all. As seen, there is empirical evidence which support OCST but there are also empirical evidence that do not. As noticed before, the theory suggests that profitable companies can take advantage of the tax shield because they can resist financial distress better. In reality there are several of studies which show that managers of profitable firms tend to stay away from high leverage and instead actually decrease it (Jen et al. 2003; Miao, 2005). So if there exists a certain debt level in capital structure where firm value is maximized, why do not these profitable firms try to reach it? One fact may be that managers do not have maximized firm value as primary concern. The respond on this contradiction of OCST is the pecking order theory.

### ***2.3 The pecking order theory (POT)***

A another way to look at capital structure decisions is to use pecking order theory (POT). It does not assume that managers and shareholders have the same intensions with the firm (maximize firm value) and thereby financial decisions will depend on management. The foundation of the hypothesis is that “the firm has no well defined debt-to-value ratio” (Myers, 1984: 576) and management has a preference to choose internal financing before external financing. When a firm is forced to use external financing sources, managers select the least risky and demanding resource first (Jen et al. 2003). Myers (1984) states that these preferences must somehow show firms’ costs of different resources. When it is necessary with external sources, debt issuance is preferred to new equity issuance. The theory may explain why the most profitable companies generally have the lowest debt ratio. The cause of this is not that these companies have a low debt ratio as financial goal, rather they do not need external capital. Less profitable companies borrow money since they do not have retained earnings obtainable and since borrowing is preferred after self-financing due to POT. To take advantage of tax-shields is of less importance according to POT, since the debt ratio change when there is an imbalance in self-financing, net dividends and real investments. Profitable companies with limited investment opportunities will then work their way down to a low debt ratio, while those with more investment opportunities than what they are able to afford have to borrow (Brealey et al. 2003).

Myers et al. (1984) propose that this observed financing behaviour is the result of the information asymmetry. They mean that the market is constantly uninformed about firms’ actions and investments. Consequently, the market is likely to undervalue firms’ investments and hence the securities which are issued to be able to finance the investments. Managers, who are assumed to behave due to shareholders’ interests, would subsequently discover that effective costs of external financing resources are relatively high. For this reason, collaterals may be a valuable signal to the corporate debt market. Collaterals may then act as a mitigating instrument for information asymmetry problems.

If firms choose financing according to pecking order ranking, this should indicate, that a company with small portion of debt in its capital structure and a powerful economic position comparative to others within the industry would act in a certain way. This firm would, most probably, use internal financing sources for investments to maintain its strong position. A firm that finance its investments with debt would possibly use new equity issue only as the last alternative because of the dilemma of ownership dilution associated with new issuance and the higher costs (Claggett 1991; Myers, 1984). Claggett (1991) suggests, according to POT, that this kind of firm probably frequently shift its capital structure away from the industry mean rather than towards it. A firm with relatively high debt ratio that issue more debt since it is not capable of using internal funds, will act in a similar way as in the previous case (Ibid).

POT assumes that management is risk averse when it comes to financing resources. Obviously the attitude toward risk is personal. What is said to be “optimal” finance politics for the specific firm must then be related to personal risk preferences (Arnold, 2002).

### **2.3.1 Literature on pecking order theory**

Although Myers gave pecking order a name in 1984, it is hardly a new theory. As early as in the 1962, Donaldson observed this certain managerial financial behaviour among large corporations. Pecking order would obviously be rejected easily if it was required to explain the whole capital structure decision phenomenon. Why do, for example, a lot of firms issue new equity when they are actually able to issue debt? An example of contrary behaviour to POT is provided of Hogan et al. (2005). They detect that Irish software companies do prefer internal financing as first source but rarely debt as second. Instead they have a preference, when external financing is necessary, to use equity as prime source. This behaviour in new-technology companies cannot totally be clarified by financing restrictions because the research and development based firms confront information asymmetry problems issuing debt. A study of Fama et al. (2005) also show evidence that menace pecking order theory. They suggest that a typical company (listed on NYSE, AMEX and Nasdaq) which issue new equity is a large business and normally not a firm with financing constrains. Large companies tend to be more profitable and the probability for be able to use internal financing is then higher. If large firms with no financing constrain issue equity, the pecking order ranking is not valid. Their estimation of year-by-year choice of external equity express that over 50 % of the firms in the sample violated POT. Fama et al. (2005) therefore state that pecking order cannot solely explain the capital structure decision. Frank et al. (2003) and Helwege et al. (1996) claim that new equity issue is becoming more well-liked as financing source. Firms issue new equity although they actually could obtain debt. Fama et al. (2005) explain this with that there may exist relatively cheap methods to issue new equity. This includes issuing to employees, direct purchase plans and rights issues.

POT assumes that there exist a agency conflict between management and shareholders. Stenshamn (2004) finds evidence that Swedish managers do not take action in shareholders interest as much as they are expected to do. This may be explained by the fact that Swedish firms traditionally do not focus as much on shareholders as American firms do (Jen et al. 2003).

Another point to highlight is when the economic conditions change, some industries will change their preference of financing source. Claggett (1991) finds evidence where firms in some industries do not choose debt before equity through times with harsh turmoil. In similarity Fan et al. (2004), investigate managers’ financial decision in Hong Kong under the Asian crisis. Their conclusion is that managers prefer equity to debt during the crisis and explain this with that managers had the crisis in mind when financial decisions were undertaken. Another example of that firms are dependant of economic conditions is the

evidence that Choe et al. (1993) find. They discover that firms, during their expansion period, tend to use new equity over debt. The expansion periods normally force companies to large investments and expansion periods are often associated with high risk. Such evidence still show that pecking order is valid since firms might be forced to obtain external capital and are sometimes forced to move down their priority list of financing source. In times of recession firms in some industries may earn less, firms could be constrained from more loan and firms may consider new equity cheaper since new equity does not have to be repaid. This might be reasons why firms work their way down the POT. That is why studies which reject POT should be questioned if they obtain sample periods with characteristics of turmoil. Otherwise POT could be rejected on false evidence.

As we can see there are a lot of questions about the POT but we should also have in mind that on average there are heavy evidence on internal financing and debt (Arnold, 2002; Cai et al. 2003, 1999; Claggett, 1991; Donaldson, 1962; Jen et al. 2003; Myers, 1984; Taggart, 1986) The result from study of Myers (1984) shows that 62% of non-financial corporation, during 1972-1982, use internal financing. When external sources are used, the bulk comes from loan. Funds from new issuance were never over 6% of external sources.

In recent studies, POT and optimal capital structure theory have been compared. Myers et al. (1999) and Fama et al. (2000) evaluated the explanatory power of the two theories and come to the conclusion that POT appears to do a better work describing capital structure. Myers et al. (1999) presented an approach to the inference of POT which follows up the statement that a firm has no precise optimal debt ratio. They propose that the attention of benefits from interest tax shields and the risk of financial distress are implicit second-order concerns when firms make their financial decisions. The incentive behind shifts in debt ratios is the requirement for external capital and not the incentive to achieve an optimal point of the capital structure. Therefore, managers do not have a target in mind when they make financial decisions according to their results. That is to say, their conclusion robustly supports POT to the optimal capital structure model. Their model, which is applied in the study, is on the other hand criticized by Chirinko et al. (2000). They imply that the model is not able to sufficiently distinguish between the theories. Taggart (1986) ends his study, corresponding to Myers et al. (1999), with suggesting that POT is more suitable than the optimal capital structure theory.

Cai et al. (1999) come to the conclusion that neither optimal capital structure theory nor POT can be excluded when trying to explain optimal capital structure. But POT does a better work since all their results on POT, for all years and industries, are significant. The evidence on optimal capital structure theory is only significant for the bulk of years and industries.

Hamberg (2001) mean that POT is quite uncomplicated and assume information asymmetry. On the other hand POT bears incapability to give explanation how bankruptcy expenditure, taxes and other market frictions influence capital structure decisions. Although POT cannot explain these issues, it gives explanation for several managerial actions and options associated

with rising funds. That is also why the pecking order theory, on marginal, works better than the optimal capital structure theory (Ibid).

Claggett (1991) and Opler et al. (1995) have a different vision. They tested both theories and found heavy evidence for each theory. Claggett (1991) concludes the study by stating that it might be time for a hybrid hypothesis between POT and OCST.

## ***2.4 Trends in capital structures***

Researchers have for a long time observed that there are important systematic variations in capital structure between firms in various industries, positions and time-periods (Jen et al. 2003)

### **2.4.1 Similarity of capital structures within the industry**

First of all, firms inside the same industry approximately tend to have fairly comparable structures of capital. A traditional explanation of this is the resemblance in businesses and operations and then also in business risk and operating risk. Firms which confront a high operating risk are less inclined to allow a high financial risk as well. Risk arises primarily when operating risk is inflated through the debt ratio (Ibid). There is international documentation on negative correlation between operating risk and financial risk (Mandelker et al. 1984).

That firms always have comparable capital structures in the same industry is obviously not always the scenario. Hamberg (2001) uses Hennes & Mauritz, Fjällräven, JC and Wedins in the Swedish clothing industry to illustrate this. These companies, which are listed on Stockholm Stock Exchange, can reasonably be said to be firms exposed to the same conditions. They have all quite different solvencies and this indicates that not always industry classification determines selection of capital structure. With other words, diverse companies have diverse capital structure.

### **2.4.2 Differences in capital structures between industries**

Capital structures of firms differ between industries. Although there are variations between different companies in the same industry, the variations are minor inside an industry group than for firms in diverse industries. As an example manufacturing firms are likely to have higher debt ratio than research oriented firms in industries such as biotech, software-services, and Technology Hardware and Equipment (Jen et al. 2003). There is evidence that leverage is likely to be higher in firms with a large proportion of PP&E. Bougheas (2004) observes that companies with a high ratio of intangible assets have a harder time rising debt. This can be explained with that banks tend to lend capital to companies with collateralizable assets. New technology and research founded firms tend to earn less than other firms during the starting up phase (Arnold, 2002). This may lead to that these firms need to involve external financiers.

### **2.4.3 Capital structures do not seem to differ very much between countries**

It has also been observed that capital structures do not diverge very much between countries. This while, as said before, capital structures differ considerably between industries within the same country (Rajan et al., 1995). If there are differences, it is mainly the corporate governance system which causes them. Institutional aspects impact the choice of capital structure and governments have sometimes the authority and motivation to affect the decision of capital structure which can be done through the tax rate or different taxes on diverse sources of financing. Firms in environments with high taxes will choose a higher leverage according to MacKie-Mason (1990) and this is consistent with OCST. However, Stenshamn C.(2004) claim that Swedish firms have low debt ratios despite of low interest rates and high taxes.

Arnold (2002) states that firms who run their business in industries or countries where borrowing is specifically preferred tend to have higher leverage. A good example of how institutional factors can affect a capital structures is the situation in China. In a recent paper the determinants of capital structure are investigated in Chinese-listed firms (Chen, 2004). With significant result Chen (2004) concludes that the Chinese institutional differences together with financial constrains in the banking sector affect the leverage decision among firms. Neither the optimal capital structure model nor POT can be applied on Chinese conditions since the Western elemental assumptions, which base Western models, are not applicable in China. Another example of institutional differences that affect the capital structure in firms can be seen in Switzerland according to Bender et al. (2005). Their conclusion is that Swiss companies regulate their capital structure toward a target debt ratio, but the procedure is slower than in many Western countries. They suggest that the most rational reason of this is that it is not expensive for Swiss firms to be in disequilibrium. They mean that institutional circumstances affect the speed of adjustment but they stress that more research about institutional aspects, such as the impact of taxation, is required.

Although there are similarities between capital structures and industries in different countries it can be complicated to compare them since tax systems and accounting standards are different. According to Rajan et al. (1995; 1998) are differences in firm leverage between countries not that simple to explain by institutional variations which were considered important earlier. The foundation of observed relationship is still basically unanswered.

## ***2.5 Hypotheses***

Based on the theory presented in this chapter and the questions presented in chapter 1, we formulate following hypotheses.

Hypotheses and Lemma 1 a, 2 and 3 are inspired by Cai et al. (2003) and Lemma 1 b is inspired by Clagget (1991).

Hypothesis 1 a and 1 b are formulated for the optimal capital structure theory. Hypothesis 2 and 3 are formulated for the pecking order theory.

**Hypothesis 1 a:** There exists an optimal capital structure, where the firm maximizes its value when it is at the optimal debt ratio,  $L$ .

The theory says that a firm maximizes its value when it has the optimal capital structure. A proxy for the optimal capital structure is the industry's average debt level. Under the assumption that the goal of a firm is to maximize its value, a firm that does not lie on the optimal point  $L$  will adjust the capital structure to obtain this level. Those who are beneath  $L$  will adjust upwards and those above will adjust downwards. To test this hypothesis following lemma is used:

**Lemma 1 a:** There are  $n$  periods and  $N$  is the number of times a firm adjusts its capital structure towards the optimal level ( $L$ ). Each time a firm adjust towards the optimal level it is denoted by 1, otherwise with 0. If this hypothesis is correct, then  $p(N/n)$  will be significantly greater than 0.5.

**Hypothesis 1 b:** Both firms below and firms above the optimal debt level converge to the optimal level.

This hypothesis examines whether the behaviour of firms above and below the optimal level are similar or not. It is of interest to examine this aspect since there are different implications of having a high debt ratio, compared to having a low debt ratio. Will this difference affect the behaviour of the firms? To examine this hypothesis the firms are grouped in two; firms the lie above the industry's average debt level and firms the lie below the industry's average debt level. The group above is denoted with lemma 1 b:a, the group below is denoted with lemma 1 b:b.

**Lemma 1 b:a:** There are  $n$  periods and  $N$  is the number of times a firm adjusts its capital structure downwards, towards the optimal level. Each time a firm adjust towards the optimal level it is denoted by 1, otherwise with 0. If this hypothesis is correct, then  $p(N/n)$  will be significantly greater than 0.5.

**Lemma 1 b:b:** There are  $n$  periods and  $N$  is the number of times a firm adjusts its capital structure upwards, towards the optimal level. Each time a firm adjust towards the optimal level it is denoted by 1, otherwise with 0. If this hypothesis is correct, then  $p(N/n)$  will be significantly greater than 0.5.

**Hypothesis 2:** Firms normally prefer internal financing to external.



**Lemma 2:** There are  $n$  periods and  $Q$  is the number of times *external* capital is preferred. If this hypothesis is correct,  $p(Q/n)$  is significantly *below* 0.5 (since if external financing is significantly below 0.5, internal financing must be significantly above 0.5)

**Hypothesis 3:** When a firm uses external financing it prefers to use debt to equity.

**Lemma 3:** There are  $n$  periods of external financing and  $T$  is the number of times a firm uses debt financing. Each time debt financing is used it is denoted with 1, otherwise 0. If this hypothesis is correct, then  $p(T/n)$  will be significantly greater than 0.5.

## Chapter 3 – Method

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*This chapter describes the method used in this study. This is followed by a presentation of the variables and the data collection. After that the statistical aspects is briefly explained and the chapter concludes with criticism of our method.*

### ***3.1 Scientific method***

The aim is to examine the behaviour regarding capital structure for firms on the Swedish market. This study intend to be able to draw conclusions about the entire population and in order to do so, there must be a standardized way in which the units are examined (Jacobsen, 2002). Therefore the purpose would not be able to be achieved unless a quantitative approach is used, which is why it comes natural that method is the preferred choice.

The starting point of this thesis is from available theory and previous articles. A set of hypotheses are formed and they are thereafter either rejected or accepted in accordance with the results the analysis brings forward. This study is therefore using a deductive onset.

### ***3.2 Choice of method***

The method, which will be used in this thesis, is based on the method that Cai et al. (2003) employ. This method will be of binomial characteristics and the implementation is described in 3.4 and it will also be discussed in greater detail in chapter 4.

### ***3.3 Data collection***

Here we present and define the variables that are used and then the procedure of data collection is discussed.

#### **3.3.1 Definitions**

All definitions are inspired of the definitions that Cai et al. (2003) used in their study.

*External financing:* When the increase in long term debt *or* new equity is more than 5% of total assets, it is classified as using external financing. This measurement was used by Cai et al. (1999) and Cai et al. (2003). The percentage levels 4, 6, 7, 8, 9 and 10% is also tested.

*Internal financing:* When there is no external financing, the firm is classified as using internal financing. Since there are only internal and external financing, it is obvious that if not external financing is used, then internal is used instead.

*Optimal capital structure:* This is the point where the mix of debt and equity maximizes firm value according to OCST. As noted before, the value of the firm increases with increasing debt until a point where financial distress begins to cost more than the tax-shield is beneficial. The predictor for optimal capital structure is the industry mean of the firms' debt ratios. This is also called "optimal level", "optimal debt level", "industry average debt level", "target" and "industry mean". This definition is supported by Lev's (1969) study where he finds that "firms adjust financial ratios according to industry wide averages" (Lev 1969, p. 10). This proxy is also used by Cai et al. (1999) as well as Cai et al. (2003). Schwartz et al. (1967) also conclude that the different industries have developed financial structures that are "optimal for their operational risks and asset structures" (Schwartz et al. 1967, p. 10).

*New equity issue:* When a firm has issued new stocks, for both cash payment and non-cash issue. "Equity" is used as a synonym.

*Debt:* All types of loan which is included in long term debt. Loan, bank loan bowworingare also used as synonyms for "debt",

### **3.3.2 Selection**

Our selection is based on the whole public market in Sweden, rather than an index. This is to maximize the number of industries and firms the sample will consist of. The initial sample was the "Global Industry Classification Standard (GICS) for the Stockholmsbörsen Universe of Securities" for firms existing in August 2005 (Internet 1).

The length of the period was determined by investigating how far back data could be collected without letting the reduction in firms become too great. The aim is that all the firms are to be in the sample for the whole period, to make the study as consistent as possible. The starting year is chosen so that the industry with the smallest number of firms reaches enough number of observations, so that it is approximately normally distributed. The central limit theorem states that 30 observations is adequate for this (Internet 2). The lowest number of observations in this study for a given industry is 49 observations, which is well above the limit. Industries that fell below five firms were discarded due to statistical reasons such as inference problems. This is especially important considering that the observations will get smaller when looking at the different lemmas. The result is a sample period from 1997 until and inclusive of 2004. This period is reasonable considering macroeconomic effects since business cycle is covered and it is also a period that is up to date.

Financial (banks and insurance) and real estate firms are eliminated from the sample because their debt ratio is significantly influenced by investor insurance schemes. Also their debt is not strictly comparable to non-financial firms. Finally, these industries are regulated and minimum capital requirements affect capital structure directly (Rajan et al., 1995). The final result is 93 firms in seven industries. These firms are accounted for in appendix I.

### **3.3.3 Primary and secondary data**

The primary data consists of accounting measures; long term debt, total assets and new equity issues. This information is collected from the database “SixTrust” for the years 1997 until 2004. The figures obtained are then checked and complemented with the firms’ annual reports and data from Stockholmsbörsen (Internet 3).

## ***3.4 Implementation***

In the first step, the chosen firms are grouped in different industries according to Global Industry Classification Standard.

Thereafter the long term debt and total assets data for the different firms in the different industries are coded into dummy variables, depending on how the data behaves. These results are accounted for in chapter 4. Also tests for the total sample is made to see the general behaviour of all the firms together, to further deepen the understanding of sample and to cross check those results with the other examinations (industry specific and by year). Finally an examination on a yearly basis for all the firms is made, in accordance with Cai et al. (2003, 1999). This is to examine and detect any year specific trends and patterns.

After that, we test whether the behaviour that is investigated, is statistically significant using the binomial approach and test. If the occurrence of the behaviour is significantly larger than 50%, it is regarded as the prevalent behaviour.

There will therefore be three views; total sample, industry specific and yearly observations. These perspectives will be the base for the analysis in chapter and conclusions, found in chapter five and six respectively.

## ***3.5 Criticism of method***

To perform the study in a good and reliable manner, distance and neutrality to the material gathered is important. The goal is to minimize problems of reliability and validity.

### **3.5.1 Reliability**

To achieve good reliability, sources that are recognized are used, like known journals, publications and a database such as SixTrust. The data is also checked against the firms annual reports which increases the reliability of the data collected.

In situations where data has been flawed, parts missing or other irregularities, that data has been discarded in the study to avoid errors. That increases the falling off but also increases the reliability in this study.

The reliability of the results are regarded as satisfying, since we have used these procedures consistently through out this study.

### **3.5.2 Validity**

When examining the different hypotheses it is important for obvious reasons that we also measure what we really intend to measure. To optimize the validity of this study, we have started from Cai et al. (2003) and their method is used except from some adjustments to make it improved. Definitions and assumptions are inspired of the same study. The earlier study from Cai et al. (1999) has also been taking into consideration when performing these investigations.

The industry average is used in this thesis as a predictor for optimal capital structure. This is a common way to approximate the optimal level (Jen et al. 2003) but if this approximation is false, then the validity is threatened. But to be able to examine the reality approximations must be used (Jacobsen, 2002).

This method does not take the size of the issues into account, but instead the number of times the different financing options are used. This answers our hypotheses, but only from that perspective.

Cai et al. (1999, 2003) are published and recognized in well-known and respected journals. By using the same or similar method, variables and definitions, this study's validity is further strengthened.

As we know managers sometimes want to beautify their annual reports for different reasons, it is important to be critical to this kind of information. However, since chartered accountants have approved the annual reports we consider the information close to correct and as close as objective as we can get.

With the above in mind, we consider the validity to be satisfactory.

### **3.5.3 Systematic errors**

Körner et al. (1996) says that a sample is never an exact copy of the population it is trying to describe. The estimates from a sample are usually higher or lower than the real values. A systematic error is defines as (translated) "the difference between the estimated value and the correct value" (Körner et al., 1996, s. 192). Of course, the correct value is seldom, if ever obtained.

To minimize the measure errors, we have worked as described above.

Observations or subjects that belong to a population that is examined but is not in the sample, classifies as “under covering”. The opposite is called “over covering” (Körner et al., 1996). Since the population for this study are public firms in Sweden and the sample is a selection of the whole population, the problem with over covering is minimized.

A more difficult problem is under covering. There are 93 firms left in our sample and that constitutes approximately 30% of the total population. Even though the sample size is considerable, the study would most likely improve the accuracy of its results with more observations.

### **3.5.4 Falling off analysis**

At the industry group level, there are 22 different industries. This study’s selection comprise of 7 industries, which constitutes 32% of the total. Here follows a list of the omitted industries. In parenthesis is the number of the firms in the industry, not counting the exclusions that has been made for this study:

Energy (3), Transportation (4), Automobiles & Components (2), Consumer Durables & Apparel (8), Consumer Services (5), Media (7), Retailing (10), Food & Staples Retailing (1), Food Beverage & Tobacco (4), Household & Personal Products (2), Banks (4), Diversified Financials (24), Insurance (2), Real Estate (13), Telecommunication Services (4).

Financials, Insurance, Real Estate and Banks are excluded as explained in section 2.2.2 “selection”. Industries where the numbers of firms are below five is discarded since they do not reach 30 observations, which is the limit according to Central Limit Theorem. That leaves Consumer Durables & Apparel (8), Consumer Services (5), Media (7) and Retailing (10). But the falling off within these industries puts them below the five firms limit, which is why they are not in the final sample.

The question is if the sample used in this thesis is adequate for generalizing to the whole population.

The industry level which is used in this thesis is called “Industry group”. A rougher classification is the “Sector” level. One way to determine whether the sample can speak for the missing industries is to investigate whether the omitted industries are a part of a sector, where included industries exist. This is because the industry classification reveal what firms that are related in some way.

Capital Goods and Commercial Services are a part of “Industrials”. Transportation is also apart of this sector indicating that they are related. This sector is well covered since it is only

Transportation that is not included among the “Industrials”-firms. Furthermore, Transportation is most likely an capital intensive industry, which is similar to Capital Goods.

Automobiles & Components (2), Consumer Durables & Apparel (8), Consumer Services (5), Media (7), Retailing (10) are all a part of the sector “Consumer Discretionary”. We have no representation in our sample of firms from this sector. It raises a question mark about the possibility to draw conclusion about these industries.

The same reasoning goes for Food & Staples Retailing (1), Food Beverage & Tobacco (4), Household & Personal Products (2), which are a part of the “Consumer Staples” sector, that is, there are none of these firms in the sample.

Telecommunication Services (4) is not in the sample but is to some extent related to the Hardware industry sector due to the related businesses.

All in all, there are mostly concerns regarding the Consumer Discretionary and Consumer Staples sectors. Besides these two sectors, we find that our sample should adequately represent the Swedish market.

## Chapter 4 - Empirical data

*This chapter describes the empirical results. First are the industries described and then data for the different binomial test are presented.*

### 4.1 Methodology

The statistics programme "SPSS" is used to perform the different statistical tests and Excel is used for structuring and handling the data.

#### 4.1.1 Descriptive statistics

The firms are first grouped in different industries according to Stockholmbörsens classification. The final selection comprise of 93 firms in 7 industries. The number of firms times seven years, make out the maximum number of observations each industry can get. As seen in this chapter, these observations will be lower for different lemmas since the number of observations vary with the examined data.

*Table 4.1: Industry grouping*

No.	Industry	No. of firms	No. of observations
1	Materials	12	84
2	Capital Goods	31	217
3	Commercial Services & Supplies	9	63
4	Healthcare Equipment and Services	8	56
5	Software & Services	15	105
6	Technology Hardware & Equipment	11	77
7	Pharmaceuticals & Biotechnology	7	49

*Table 4.2: Industry statistics (billions Kr)*

No.	Industry	Av. Total Assets	Av. Long Term	Av. Equity Issues
1	Materials	12,5	2,1	0,170
2	Capital Goods	18,3	3,2	0,56
3	Commercial Services & Supplies	4,4	1,1	0,60
4	Healthcare Equipment and Services	6,1	0,91	0,084
5	Software & Services	1,0	0,11	0,14
6	Technology Hardware & Equipment	18,8	2,5	0,11
7	Pharmaceuticals & Biotechnology	0,44	40,1	0,16

From now on, these industries will be called; Materials, Capital Goods, Commercial Services, Healthcare Equip, Software, Hardware and Biotech.



### 4.1.3 Example of calculation

To make it perfectly clear how the calculations are made, here follow a short walk-through.

	<b>Total Assets</b>	<b>Long Term Debt</b>	<b>Long Term Debt ratio</b>
<b>1997</b>	359 720 992	50085000	0,139232909
<b>1998</b>	464198016	58856000	0,126790719

The long term debt, divided by the total assets gives the long term debt ratio. At the start of 1998 the firm therefore has a debt ratio of approximately 13.92% and at the end of that year it has about 12.68%. This means that it has lowered its debt ratio. Assuming that the industry's average for that year is 12%, that result in that the firm is classified as having adjusted its ratio towards the mean. Such a movement towards the mean is denoted with a 1. If it had moved in the opposite direction, that is, increased its ratio, that observation would have been denoted with a 0.

This method would then eventually lead to a series of ones and zeros, where each 1 represents a movement towards the industry's average debt level. A mean for this binomial series is calculated and that mean is tested to examine whether it is significantly different from 50%.

The same principle is used for all the lemmas.

## 4.2 Binomial analysis

In this part the different hypotheses are examined according to the belonging lemmas.

### 4.2.2 Total sample

First, the whole sample data is presented. All the firms combined behaviour are accounted for in table 4.2. For lemma 1 a and 1 b, every time a firm adjusts its debt level towards the optimal level, that observation is denoted with 1, otherwise 0. The observations in lemma 2 is denoted with 1 whenever external financing is used, otherwise 0. Each time debt is used, lemma 3 denote that observation with 1, otherwise 0. E(%) is the frequency for the stated behaviour. The Z-test examines if E(%) is significant in regards to our hypotheses.

**Table 4.2: Total sample**

<b>Lemma</b>	<b>N</b>	<b>n</b>	<b>E (%)</b>	<b>Z - test</b>
Lemma 1 a (OCST; firms above and below)	301	651	46.24	0.06
Lemma 1 b:a (OCST; firms above)	142	248	57.26	0.026*
Lemma 1 b:b (OCST; firms below)	159	403	39.45	0.000
Lemma 2 (POT; ext. fin. usage)	235	651	36.10	0.000
Lemma 3 (POT; pref. debt)	96	235	40.85	0.006

\* = 95% confidence interval    \*\* = 99% confidence interval

The results from the total sample indicates that all lemmas, except for 1a, are significantly different from 50%, but it is only Lemma 1 b:a, that is significantly above that level. Lemma 1b:b have a frequency of adjusting towards the industry mean at 36.10%, which is significantly below 50%. This demonstrates that firms above their optimal level adjust downwards, but firms below that level do not. Note that lemma 1 a is insignificant at the 95% level, but it would be significant at the 94% level.

Internal financing is indeed preferred to external, since the probability of using external financing (lemma 2) with its 36.10%, which is significantly below 50%. Probability of debt financing is 40.85% (lemma 3). This is also significantly below 50% and indicates that whenever a firm uses external financing, debt is not the preferred choice.

### 4.2.3 Industry specific

#### Lemma 1 a

To determine whether or not a firm adjusted its capital structure towards the optimal debt level we compare the LTD/TA ratio at the beginning and end of each year to the average debt level in that industry. There are  $n$  observations and let  $N$  be the number of times a firm adjusts its ratio towards the optimal level. Each movement towards this level is denoted with 1, otherwise 0.  $E(MOV)$  is the likelihood that a firm in a certain industry moves towards the optimal debt level. If  $E(MOV)$  is significantly *above* 0.5 then hypotheses 1 a is true. The Z-test examines if  $E(MOV)$  is significantly different from 0.5.

**Table 4.3 Lemma 1 a – likelihood that a firm moves towards optimal capital structure**

No	Industry	N	n	E(MOV) (%)	Z – test
1	Materials	44	84	52.38	0,744
2	Capital Goods	103	217	47.47	0,497
3	Commercial Services	35	63	55.56	0,450
4	Healthcare Equip	17	56	30.36	0,005
5	Software	48	105	45.71	0,436
6	Hardware	32	77	41.56	0,172
7	Biotech	22	49	44.90	0,568

\* = 95% confidence interval      \*\* = 99% confidence interval

The only industry where the movement is significantly different from 50% is “Healthcare Equip”, and that industry is significantly *below* 50%. Healthcare Equip surely does not move towards the optimal capital structure. The results from the other industries reveal that no industry has a certain majority of moves towards the optimal capital structure.

*Lemma 1 b*

This lemma examines if there is a difference in convergence toward industry mean between firms above and firms below the industry's average debt level. Firms that lie above the average debt level and firms below the average debt level are examined as separate groups. Every observation that firms move towards the optimal level is denoted with 1, otherwise 0. The Z-test tells us whether E(MOV) is significantly different from 50%.

**Table 4.4 Lemma 1 b:a – likelihood that a firm above the optimal level moves towards it**

No	Industry	N	n	E(MOV) (%)	Z – test
1	Materials	18	36	50.00	1.000
2	Capital Goods	58	104	55.77	0.281
3	Commercial Services	15	22	68.18	0.134
4	Healthcare Equip	7	11	63.64	0.55
5	Software	13	22	59.09	0.523
6	Hardware	20	37	54.05	0.743
7	Biotech	11	16	68.75	0.210

*\* = 95% confidence interval      \*\* = 99% confidence interval*

From table 4.4 no industry show significance. Even though the probability of moving towards the optimal debt level for the firms *above* their industry mean is 50% or more, the small number of observations prohibits them from being statistically different from 50%.

Table 4.5 show that there is no significant evidence that firms that lie *below* the industry average, in any industry, have a tendency to move towards the optimal level. Capital Goods (39.82%), Healthcare Equip (22.22%) and Hardware (30.00%) are significantly below 50%, while Commercial Service (48.78%), Software (42.17%) and Biotech (33.33%) are below but not significantly so. Materials have a frequency of 54.17%, the only industry over 50%, to adjust towards the optimal debt level, but is not significant.

**Table 4.5 Lemma 1 b:b – likelihood that a firm below the optimal level moves away from it**

No	Industry	N	n	E(MOV) (%)	Z – test
1	Materials	26	48	54.17	0.665
2	Capital Goods	45	113	39.82	0.038
3	Commercial Services	20	41	48.78	1.000
4	Healthcare Equip	10	45	22.22	0.000
5	Software	35	83	42.17	0.187
6	Hardware	12	40	30.00	0.017
7	Biotech	11	33	33.33	0.08

*\* = 95% confidence interval      \*\* = 99% confidence interval*

In opposite to table 4.4, show that firms do not correct their debt level when below the optimal level, since no result with certainty indicates this.

Observe that the number of observations for firms that lie below their industry average debt level (table 4.5) are much higher than the number of observations for firms that lie above that level (table 4.4). This may help to explain why there are more results that significantly differ from 50% in table 4.5 than in table 4.4, even though none are significant according to the hypotheses.

### Lemma 2

If a firm issues debt or equity to more than 5% of the total assets of the firm during a year, then it is considered to use external financing. To measure this, the firm's debt at the beginning of the year is subtracted from the value at the end of the year, divided by the total assets for that year. When that amount exceeds 5% then the firm is classified as using external financing with debt. If the new equity for that year exceeds 5% of total assets, it is considered to use external financing with equity. There are  $n$  observations and  $Q$  times a firm used *external* financing. In the situation when  $Q/n$  is greater than 0.5 it is said to external financing, and thus the hypothesis is rejected. Internal financing used, if  $Q/n$  is significantly below 0.5.  $E(\text{EXT})$  is the likelihood that a firm uses external financing.

**Table 4.6 Lemma 2 - likelihood that a firm uses external financing**

No	Industry	Q	n	E(EXT) (%)	Z – test
1	Materials	27	84	32.14	0,000
2	Capital Goods	55	217	25.35	0,000
3	Commercial Services	19	63	30.16	0,002
4	Healthcare Equip	18	56	32.14	0,01
5	Software	53	105	50.48	1.000
6	Hardware	35	77	45.45	0,494
7	Biotech	28	49	57.14	0,392

\* = 95% confidence interval    \*\* = 99% confidence interval

Table 4.6 shows that no industry uses external financing significantly more than 50% of the time. On the other hand Materials, Capital Goods, Commercial Services and Healthcare Equip have a significant majority for the use of internal financing (since the use of external financing is significantly below 50%).

### Lemma 3

When external financing is used, the firm use debt  $T$  number of times. There are  $n$  observations where external financing is used (debt and equity). If  $T/n$  is significantly greater than 0.5, then hypothesis 3 is true. Z-test examines if  $E(\text{DBT})$  is significantly different than 0.5.

**Table 4.7: Lemma 3 – Likelihood that a firm prefers debt**

No	Industry	N	n	E(DBT) (%)	Z – test
1	Materials	13	27	48,15	1.000

2	Capital Goods	42	55	76,36	0.000**
3	Commercial Services	15	19	78,95	0.018*
4	Healthcare Equip	6	18	33,33	0.238
5	Software	7	53	13,21	0.000
6	Hardware	11	35	31,43	0.042
7	Biotech	2	28	7,14	0.000
* = 95% confidence interval    ** = 99% confidence interval					

There are only two industries where they prefer to use debt when financing their activities; Capital Goods and Commercial Services. All the others either have a significant usage of equity (industry 5,6 and 7) or as in the case of Materials, undetermined. Healthcare Equip seems to have a preference for equity also, but it is not statistically certain at the 95% level, most likely due to the small number of observations.

#### 4.2.4 Observations by year

After each industry and the whole sample have been tested, another point of view is to examine the lemmas by year. This may reveal trends or further information that can be attributed to a certain year. The problem that arises when splitting the sample by year is that the number of observations become much smaller, making it harder to get significant results.

**Table 4.8: Observations, per year; (%)**

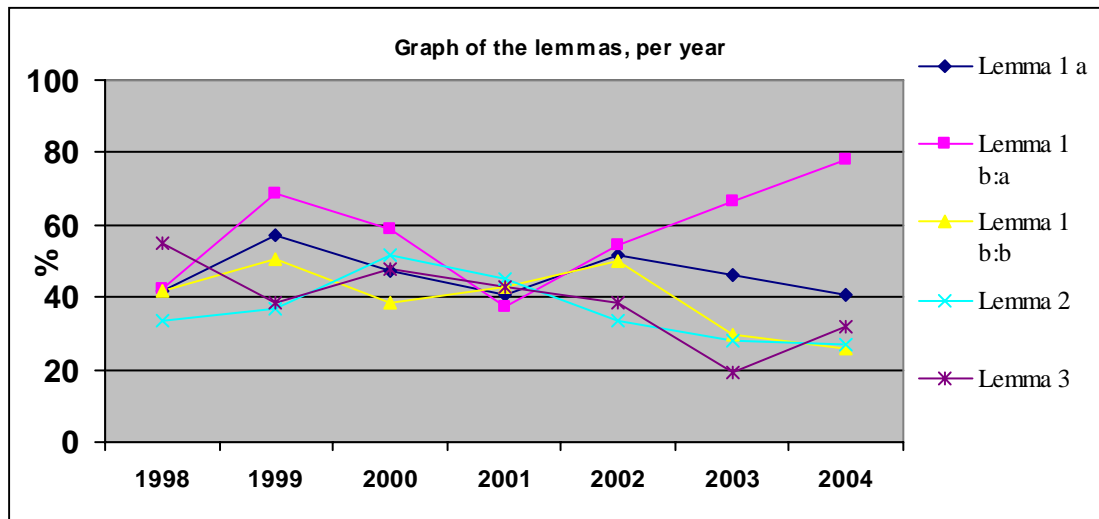
	1998	1999	2000	2001	2002	2003	2004
Lemma 1 a (OCST; firms below above)	41.94	56.99	47.31	40.86	51.61	46.24	40.86
Lemma 1 b:a ( OCST; firms above )	42.11	<b>68.75*</b>	58.53	37.14	54.54	<b>66.67*</b>	<b>77.78**</b>
Lemma 1 b:b ( OCST; firms below )	41.82	50.82	38.46	43.10	50.00	<b>29.41**</b>	<b>25.76**</b>
Lemma 2 (POT; use of ext. fin.)	<b>33.33</b>	<b>36.56</b>	51.61	45.16	<b>33.33</b>	<b>27.96</b>	<b>26.88</b>
Lemma 3 (POT; use of debt)	54.84	38.23	47.92	42.86	38.71	<b>19.23</b>	32.00

\* = 95% confidence interval    \*\* = 99% confidence interval

Regarding *Lemma 1 a*, there is no year, where the movements significantly differ from 50%. Therefore there is no evidence that firms trend towards the optimal capital level. For *lemma 1 b:a and 1b:b*, it is only for 2003 and 2004 there are significant results for both of them. Firms above the optimal level tend to move downwards, while firms below the optimal level does not tend to move upwards.

*Lemma 2* is the only part where there is a majority of significant results. For five out of seven years the results indicate that internal financing is preferred to external.

Even though six out of seven years for *lemma 3* is not significantly different from 50%, there is at least an indication that the use of debt is not the preferred choice when external financing is required. Again, the reason why many of the years are not significant is most likely due to the small number of observations that arise when looking on a yearly basis (see appendix II).



Above is a graph describing table 4.8. The most noticeable line is lemma 1 b:a, which shows a clear trend upwards starting from year 2001. In comparison, lemma 1 b:b has a trend in the other direction. This shows that the behaviour for the two groups have developed differently. Firms above the average debt level acts more frequently to correct its debt level, while those below the optimal debt level are not that concerned when it comes to adjusting the debt ratio to the optimal debt level. Those results are especially valid for the last two years (2003 and 2004), because of the significance in those results (77.78%\*\* and 25.76%\*\*). Lemma 1 a have a stable development, where the value at the beginning of the period is about the same at the end of the period (41.94% compared to 40.86%). Lemma 3 trends downwards, which indicates that the preference of debt to equity has changed to the opposite, when comparing the first and last year of the sample period. Lemma 2 shows that there was a peak at year 2000, when the use of external capital was at its highest level. After that peak, the trend reverted indicating lower frequency in the use of external financing.

## Chapter 5 - Analysis

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*In this chapter we first discuss aspects of the optimal capital structure then goes on to the pecking order theory. After that a combination of the two is discussed and the chapter is concluded with criticism of the study.*

### **5.1 Optimal Capital Structure Theory**

*Hypothesis 1 a:* There exists an optimal capital structure, where the firm maximizes its value when it is at the optimal debt ratio,  $L$ .

None of the three perspectives (total sample, industry specific and by year) from our empirical result supports hypothesis 1 a.

*Thus we reject hypothesis 1 a.*

*Hypothesis 1 b:* Both firms below and firms above the optimal debt level converge to the optimal level.

The *total sample* perspective, provide significant evidence that does not endorse *hypothesis 1 b*. The *industry specific* point of view strengthens the derived conclusions from the whole sample perspective. Admittedly the z-tests from lemma 1b:a are not significant, but they show that there is a general tendency among the firms above to adjust downwards. Also no single industry has a result that distorts the combined sample. That is, there is no extreme value that distorts the final outcome of the total sample value. Thus the total sample value for lemma 1 b:a accurately represents the behaviour that the firms above the industry mean, in the different industries, have. The same line of reasoning can be used for lemma 1 b:b. This evidence also indicate that the total sample result from lemma 1 b:b accurately represents the behaviour that the firms below actually have. *Yearly observations* are, for both lemma 1b:a and lemma 1b:b, for a majority of the years not significant, but when they are, they behave in the same way as the results for the total sample.

Since only firms above the optimal debt level tend to converge, *we reject hypothesis 1 b.*

The first result that comes to mind is that the OCST is not supported by this study. All of the approaches indicate that there is no evidence supporting lemma 1 a; that firms tend towards the optimal level. It also appears that there is no difference over time to what extent a firm corrects its debt level. The percentage that corrects is about the same in 1998 as it is in 2004 and no large deviations in between. But the interesting aspect is that there is a correction, when firms above and below the average debt level are examined individually. Thus, the two sides put together makes the result significantly below 50%, since firms below drag the

average down. Nevertheless the data reveals that there may indeed exist an optimal *range* as found by Cai et al. (2003).

Our result therefore suggest that Swedish firms do not have an optimal target in mind when making their financing decisions. First of all, if OCST is correct and there exists an optimal point where firm value is maximized, our results show that managers do not care about maximizing the value of the firm. In accordance, Stenshamn C.(2004) suggest that Swedish firms do not act in the shareholder interest to the extent they are expected. This intrinsically contradicts the OCST, since the theory assumes that managers act to maximize firm value. On the other hand, managers may in fact try to optimize firm value, but are not aware of the target. The third possibility is that the predictor of the optimal level (industry mean), is a false estimate for calculating the optimal capital structure. If this is true, that explains why we reject the OCST.

Regarding movements on each side of the industry mean, our results for firms *below* industry average indicate that there may be a range of individual optimal points rather than one single optimal point for the capital structure, where firm value is maximized. The results imply that firms below the industry mean seem to be more satisfied with their capital structure since they do not adjust to the industry mean. This may indeed be optimal for a given firm, but it can also depend on that management act in self interest and deliberately chooses a sub-optimal debt level. This likely shows that management in firms below do not care about possible alternative costs of not lying on the optimal point.

Our results show that firms that lie *above* their industry average, reflect the OCST, since they tend to adjust downwards. One reason for this comes directly from the OCST, suggesting that the risk of bankruptcy and financial distress increases when above the industry mean. The advantages with tax shield benefits is offset by bankruptcy costs and financial distress when above the industry mean. Also loss in competitiveness which is associated with costs of financial distress may be a motivating force when choosing debt level. This possibly explains why firms tend to correct downwards. It is simply too expensive to remain above. It seems that managers actually have a target in mind when choosing their capital structure, at least if they are above the mean. This result corresponds with Claggett (1991) and also Cai et al. (2003). Either managers are motivated to increase firm value causing firms above to adjust downwards, or the incentive to lower the debt ratio stems from managers unwillingness to have debt. In both cases though, managers and stockholders goals are more aligned than what they are when firms lie below, since both parties gain from lowering its debt.

Even though there are few yearly observations, the graph of the yearly observations visualize that there is a breaking point for lemma 1 b:a and 1b:b. Starting from 2001 there is a clear trend that firms above (1 b:a), to an increasing extent, adjust toward the industry mean. Firms below show opposite behaviour, starting from 2002. Reason for this turning point may be interesting to examine, but is beyond the scope of this thesis.



Finally we note that there is a majority of observations that lie below their industry's averages. 62% more observations are found below the mean compared to observations above. This indicates a preference to be below one's industry's average. This notion hints that there may lie some truth to the previous conclusion about an optimal range.

## ***5.2 Pecking Order Theory***

*Hypothesis 2:* Firms generally prefer internal financing to external financing.

The *total sample* perspective for lemma 2 significantly discloses that firms in general prefer internal financing. This supports the first stage in the POT. The *firm specific* perspective is not as uniform. This view reveals that Materials, Capital Goods, Commercial Services and Healthcare Equip uses internal financing a significant majority of the times. However, Software, Hardware and Biotech do not show the same tendency. They do not use internal capital to the same extent as the first four industries. There is consequently a difference between these different industries, which will be discussed below. Looking from the *yearly observations* viewpoint, it supports the findings that the usage of internal financing is the dominant method of financing. The first stage of POT therefore seem intact.

*We cannot reject hypothesis 2.*

*Hypothesis 3:* When a firm uses external financing it prefers to use debt to equity.

The *total sample* perspective for lemma 3 lets us know that firms in general do not prefer debt to equity. The *industry specific* viewpoint, reveals that there are significant differences between the different industries and will also be discussed further below. Finally the *yearly observations* do not support hypothesis 3.

*We reject hypothesis 3.*

Our results show that POT is not supported. The results only correspond with the first stage in that theory. Swedish firms prefer internal financing to external, but they do not prefer debt to equity. One argument for this financing behaviour stems directly from POT. Internal financing is classified as the cheapest form of resource a firm can use and together with the assumption from POT that there exists an agency conflict between managers and shareholders, it comes natural that managers have a preference to keep away from external financing. From an industry perspective we detect that there are two groups with distinctly different characteristics. Materials, Capital Goods, Commercial Services and Healthcare Equip have a definite preference for internal financing, while Software, Hardware and Biotech do not. Since new technology and research based firms usually are not profitable in the beginning of their life cycle, that may account for lack of internal financing opportunities (Choe et al. (1993).

When external financing is used, new equity issues are preferred. This violates the POT. There are other recent studies that disclose that equity is becoming a more popular choice, such as Fama et al. (2005), Helwege et al. (1996) and Frank et al. (2003). One explanation that Fama et al. (2005) brings forward, is that there may be cheaper methods to issue new equity, including issues to employees, direct purchase plans and rights issues. Methods which also may be viable on the Swedish market.

We cannot explain the frequency of debt usage in our sample with different levels in the interest rate. Comparing Riksbankens reporänta over the sample period (internet 4) with the usage of debt, there is no pattern where low interest rate brings higher debt usage and vice versa. Similarly Stenshamn C.(2004) suggest that Swedish firms have low debt ratios despite of low interest rates. A high interest rate, according to POT, could make certain firms work their way down the pecking order ranking. If this is combined with lower issuance costs as stated above, that may result in that the POT being side stepped, and firms choosing equity before debt. Even with a low interest rate, it might be cheaper to issue equity for some firms given that there is cheap ways to issue equity. However, the conclusions regarding the POT can be disturbed by the fact that our method does not reveal information whether a firm is limited from issuing debt or not. The point is that we cannot tell if a firm in fact has the possibility to issue debt, but instead chooses to issue new equity. Our results will that in case show an increase in preference for equity, which would lead us to think that POT is not valid. That is not necessarily true. A firm could issue new equity, because it has not got the choice to issue debt, which would not violate POT. This ambiguity show that even if firms in general use equity before debt, that does not necessarily refute the POT.

According to Choe et al. (1993), firms in a phase of expansion tend to prefer equity to loans if financiers have a positive outlook to the future of that firm. Software and Biotech are new industries and can be suspected to belong to industries in expansion phases. Our result show that Software and Biotech actually prefer equity issuing to debt. Also, Bougheas (2004) states that firms that have a lot of intangible assets and have a high risk associated with them cannot as easily obtain debt, thus forcing them to rely on equity. If these industries indeed are restricted from borrowing, POT may still be valid even though our results, at first glance, posit that POT is not valid. This is a good example of our discussion about the ambiguity of “choosing” equity.

Due to Sweden’s high rate of taxation, a higher frequency of debt issues would be expected for companies to take advantages of tax-deductibility. We could ask ourselves why Swedish firms do not prefer to use debt more frequently than they really do?

## 5.4 Criticism of the thesis

During this thesis, some questionable aspects about the method used have come up.

The first problem that comes to mind is that this method cannot definitely determine if POT is valid or not. That is a major flaw but Cai et al. (2003) used the same method and drew conclusions about the POT with basis from this method. The method might give indications, but not for sure determine if POT is valid or not. If there is a large majority for the use of equity to debt, one might surely suspect that it does not follow the POT, since probably not that many firms are precluded to use debt. Even though this may be logically plausible, it does not for certain prove it, thus leaving the question about POT to a certain extent unanswered.

This is because our method does not allow us to see the upper limit of the size of the issues, but instead only the frequency of the issuing. As we only measure the number of times a specific action is taken (e.g. issue of debt), the size of the additional debt or equity that is issued is not taken into account. This may lead to that one form of financing have the highest frequency, and therefore will be regarded as the prevalent one, while the other form of financing may end up with the highest value of total issues. So, what is more important; the frequency or the actual amount? Which of them reflects POT the most? The method answers which financing option is used most frequently, therefore it examines POT from that perspective and it answers our hypotheses.

We argue that only considering the number of issues over 5% can lead to misconceptions about the preferences for debt and equity. That is why further tests were done, in order to see what effect different percentage levels will have (see appendix II, table 8 and graphs 1-3).

What can be seen by these tests is that our results for the different industries show a consistent pattern. Again, Software, Hardware and Biotech show no signs of preference for debt, rather the opposite. Materials and Healthcare show no preference for any of the two financing options Commercial services show a preference for debt for a majority of the percentage levels. It is natural that the inclination to use either financing option gets smaller with increasing percentage level, and since the observations where external financing is used also gets fewer with increasing percentage levels, the end result is that the basis for the tests gets weaker. Nevertheless, altering the percentage levels does not seem to affect our results very much. Total sample does not change either. For neither level there is a preference for debt.

Another flaw is that when looking at the industry specific level, the number of observations become rather small, making it difficult to get significant results. It would of course be advantageous to have many more firms in the sample and this would especially help the analysis of the industry specific characteristics.

To examine the distribution of different firms *within* each industry have not been the aim of this thesis. Because of this, the important aspect of investigating whether for instance large

and/or profitable firms in the different industries are more comparable with each other, than with smaller and/or less profitable firms in their own industry. Has, for example, Ericsson more in common with SCA, than a small firm in Ericsson's own industry? Other studies like Cai et al. (2003), Cai et al. (1999) have chosen a sample that consists of large firms within the manufacturing sector. This is a more homogenous sample than what is used in this thesis. The theory suggests that capital structures differ between industries and therefore it might in fact be better to examine more uniform groups. Otherwise the supposedly large differences between the industries might be blurred, especially when combined to one "total" sample. This thesis tried to find out any industry differences and regarding the use of external vs. internal financing and debt vs. equity, there was. However, we believe that the results would be more accurate and valid if more homogenous groups had been examined.

Finally, as OCST and POT are based on American conditions are they in fact applicable on Swedish conditions? As noticed, we could not find evidence of either theory. We cannot determine what extent the differences in underlying assumptions affect the outcome.

## Chapter 6 - Conclusions

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*In this chapter the conclusions are presented, which are intended to, in a short and concise manner, answer the questions at issue and thereby fulfil the purpose of this master thesis. The chapter is concluded with suggestions on future research.*

### 6.1 Conclusions

The purpose of this thesis is to test if Swedish non-financial listed firms follow the theory of optimal capital structure and/or the pecking order theory during the period 1998-2004. We conclude that neither the theory of optimal capital structure nor the pecking order are valid on the Swedish market. The purpose is thus regarded as fulfilled.

We claim that there is no optimal point for the capital structure, but instead a range of optimal points from 0 to the industry mean where firms are indifferent to debt level. To explain this we use the same concept of optimal capital structure range as Cai et al. (2003).

We argue that the pecking order for Swedish firms starts with internal financing, followed by equity and then debt. Thus we have a different pecking order.

The method has imperfections but it answers the question of what financing option is most frequently used. We answer the hypotheses and thereby also the research questions.

### 6.2 Future research

There are many aspects that is suitable for future research.

- A method that takes the *size* of the issues into account, instead of only *a* movement.
- Use a different sample with a more homogenous group and have a larger sample.
- Increase the time period for the investigation.
- Examine whether firms *below* show any kind of pattern in the debt ratio. Are they indeed indifferent altogether, or merely indifferent in regards in their industry mean?
- Examine more thoroughly the choice or no choice when deciding how to finance the firm. Does the firm have both debt and equity to choose from?
- Examine what affects the debt level.
- Perform a qualitative to examine if managers in fact has an optimal level in mind.
- Because POT ask if *debt* is preferred, observations where both equity and debt are used, does not count as a preference for debt. So the results regarding usage of debt is “pure”, while usage of equity obtains both pure equity usage and equity and debt combined. Therefore it might be misleading, but still answers what POT asks. The method could be adapted to account for this.

- Examine how debt issuance is related to a firms PP&E.

## Chapter 7 - References

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# Appendix I

(93 firms)

Profilgruppen	Riddarhyttan	Scanmining	Tricorona	Höganäs	SSAB	Rörvik Timber AB
Rottneros	SCA	CTT Systems	Assa Abloy	Fagerhult	Svedbergs	NCC
Skanska	Consilium	Midway Holdiing	Westergyllen	Haldex	Scania	VBG
Beijer Alma	Cardo	Duroc	Hexagon	Xano Industri	Munters	NIBE industrier
Seco Tools	SKF	Tivox	Beijer G & L B	Bergman & Beving	Klippan	Peab
Sintercast	OEM International	Intellecta	Strålfors	Nefab	Securitas	Ångpanneföreningen
Expanda	Gunnebo	HL Display	Biacore	Biolin	Elekta	Getinge
Feelgood Svenska	Gambro	Raysearch Lab AB	Active Biotech	Maxim	Artimplant	Biophausia
Diamyd Medical	Meda	Mandator	Know It	Modul 1 Data	Resco	Semcon
WM Data	Daydream Software	IBS	Intentia	Trio	Protect Data	Holmen
Volvo	Sandvik	ATCO	Bong Ljungdahl	Ortivus	Medivir	Teleca
Närkes El. AB	Enea	AcandoFrontec	DORO	Ericsson	Nolato	MultiQ International
XponCard group	ElektronikGruppen	PartnerTech	Pricer	Senea	Skanditek I.	Onetwocom
Scribona	Berg & Co					

## Appendix II

**Table A1: 1998**

Industry	T	n	E(DBT) (%)	Z - test
Lemma 1 a	39	93	41.94	0.146
Lemma 1 b:a	16	38	42.10	0.418
Lemma 1 b:b	23	55	41.82	0.281
Lemma 2	31	93	33.33	0.002
Lemma 3	17	31	54.84	0.720
* = 95% confidence interval    ** = 99% confidence interval				

**Table A2: 1999**

Industry	T	n	E(DBT) (%)	Z - test
Lemma 1 a	53	93	56.99	0.213
Lemma 1 b:a	22	32	68.75	0.05*
Lemma 1 b:b	32	61	50.82	1.000
Lemma 2	34	93	36.56	0.012
Lemma 3	13	34	38.24	0.229
* = 95% confidence interval    ** = 99% confidence interval				

**Table A3: 2000**

Industry	T	n	E(DBT) (%)	Z - test
Lemma 1 a	44	93	47.31	0.679
Lemma 1 b:a	24	41	58.54	0.349
Lemma 1 b:b	20	52	38.46	0.126
Lemma 2	48	93	51.61	0.836
Lemma 3	23	48	47.92	0.885
* = 95% confidence interval    ** = 99% confidence interval				

**Table A4: 2001**

Industry	T	N	E(DBT) (%)	Z - test
Lemma 1 a	38	93	40.86	0.097
Lemma 1 b:a	13	35	37.14	0.175
Lemma 1 b:b	25	58	43.10	0.358
Lemma 2	42	93	45.16	0.407
Lemma 3	18	42	42.86	0.441
* = 95% confidence interval    ** = 99% confidence interval				

*Table A5: 2002*

Industry	T	n	E(DBT) (%)	Z - test
Lemma 1 a	48	93	51.61	0.836
Lemma 1 b:a	18	33	54.54	0.728
Lemma 1 b:b	30	60	50.00	1.000
Lemma 2	31	93	33.33	0.002
Lemma 3	12	31	38.71	0.281

\* = 95% confidence interval    \*\* = 99% confidence interval

*Table A6: 2003*

Industry	T	n	E(DBT) (%)	Z - test
Lemma 1 a	43	93	46.24	0.534
Lemma 1 b:a	28	42	66.67	0.044
Lemma 1 b:b	15	51	29.41	0.005
Lemma 2	26	93	27.96	0.000
Lemma 3	5	26	19.23	0.002

\* = 95% confidence interval    \*\* = 99% confidence interval

*Table A7: 2004*

Industry	T	n	E(DBT) (%)	Z - test
Lemma 1 a	38	93	40.86	0.097
Lemma 1 b:a	21	27	77.78	0.006
Lemma 1 b:b	17	66	25.76	0.000
Lemma 2	25	93	26.88	0.000
Lemma 3	8	25	32.00	0.108

\* = 95% confidence interval    \*\* = 99% confidence interval

*Table A8: Binomial test for preference for debt for different percentage levels*

	4%	5%	6%	7%	8%	9%	10%
<b>Materials</b>	1,00	1,00	0,83	0,33	0,30	0,30	0,30
<b>Cap Goods</b>	<b>0,00</b>	<b>0,00</b>	<b>0,05</b>	0,08	0,16	0,34	0,31
<b>Comrc Serv</b>	<b>0,00</b>	<b>0,02</b>	<b>0,05</b>	0,06	<b>0,04</b>	<b>0,04</b>	0,11
<b>Hcare</b>	0,36	0,24	0,48	0,30	0,12	0,12	0,12
<b>Software</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>
<b>Hware</b>	<b>0,04</b>	<b>0,04</b>	<b>0,00</b>	<b>0,01</b>	<b>0,01</b>	<b>0,00</b>	<b>0,00</b>
<b>Pharma</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>

*Table A9: Total sample test for different percentage levels*

	4%	5%	6%	7%	8%	9%	10%
<b>Lemma 2</b>	0,00	0,000	0,00	0,00	0,00	0,00	0,00
<b>Lemma 3</b>	0,01	0,006	0,00	0,00	0,00	0,00	0,00

### Appendix graphs 1-3

