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CAPITAL STRUCTURE AND FIRM GROWTH: R&D INTENSIVE COMPANIES

Master`s Thesis in Accounting and Finance

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1 INTRODUCTION

1.1 Background

Academics, business executives and government decision-makers all widely acknowledge the importance of firms` research and development (R&D) activities. In business, substantial investing in R&D is a catalyst for strategic growth. R&D is also associated with high profitability and employment growth. R&D enhances firms` competitive advantages and future business performance (Holtzman 2008, 1037-1038; Suomala & Jokioinen 2003, 213-227). R&D investments potentially create new investment and business opportunities and even completely new product markets (Puolamäki & Ruusunen 2009, 283).

Satisfying highly specialised market demands in a business world that is constantly under transformation is a challenging task for innovative companies. R&D is a characteristically expensive intangible investment that is also associated with severe uncertainties. (Azzone, Bertele & Masalla 1993, 44 - 50) This alludes that there are also challenges in financing R&D investments. Many studies suggest that the financing of R&D investments differ significantly from financing of `traditional` real-investments – especially small R&D intensive firms[1] are constantly struggling to acquire external funds. (Hall 2002, 48) Growth is likely to exacerbate this phenomenon (Himmelberg & Petersen 1994, 39).

Relatively many studies have examined corporate finance in the context of R&D activity. Large strand of scientific studies have examined how different financial phenomena affect R&D intensity (see for example Ughetto 2008; Müller & Zimmerman 2009). Studies have also emphasised financing constraints and how different types of securities are suitable for R&D firms (Czarnitzki 2006; Casson, Martin & Nisar 2008). The present study addresses the question: how do R&D firms finance their business in an environment where innovative activities play a pivotal role? This question directs the discussion toward corporate capital structure. Capital structure is the main outcome of firm`s financial decision-making. Many studies observe that capital structure of innovative companies is significantly different from non-intensive firms – evidence also exists from Finland (see for example Hyytinen & Pajarinen 2005). Yet, there are also inconsistencies among the R&D firm class – firm size, industry and other firm-specific characteristics.

[1] From this point forward, R&D intensive firm is a synonym for R&D firm or R&D company

Although, financial decision-making is different from non-innovators, modern corporate finance theories have difficulties explaining the reasons for this observation (see for example Tahvanainen 2003). To be more specific, empirical studies have shown inconsistencies and rather ambiguous results regarding financing theories.[2] In this context, it is only logical to presume that growth has a significant role. Growth is a particularly meaningful phenomenon to study in the context of R&D firms` financial decision-making. After all, R&D intensive companies seek to experience high and constant growth. This study expects that growth is likely to reveal many interesting aspects of financial decision-making of R&D companies and extend the scientific knowledge in this area.

Interestingly, financing of R&D and growth are rarely linked together. Many academics have conducted studies by examining different company size classes. Thus, scientific information exists about how size effects the financing of R&D. However, this does not necessarily provide any information about the relationship between growth and capital structure of an R&D firm per se. In these studies, time-perspective is static instead of longitudinal. How is capital structure of R&D firms influenced by growth itself? This question guides the present study.

1.2 Research questions and definition

The main research question of this study is the following: What is the impact of growth on R&D firms` capital structure decision-making and what are the main reasons for this observed behaviour? Thorough assessment of this requires that following questions should also be answered:

- What are the characteristics of R&D and R&D firms from financial point of view?
- How is the growth of an R&D firm constructed?
- How and why does the capital structure of an R&D firm change in growth?

The former two include in the theoretical part of the study. The latter question will be analysed in the theoretical part and in the empirical part by looking at the case data.

Integrating business growth and R&D finance is the prime contribution of this paper. This is apt to provide meaningful and important knowledge about the concept of R&D finance and extend modern theories of corporate finance that have often failed to explain the finance of R&D firms.

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[2] This concept is discussed in Chapters 4.2 and 4.3

This study applies the International Accounting Standards criterion to research and development activities. IFRS/IAS 38 separates R&D into a research phase and development phase. Research is defined as "original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding". Therefore, all the activities aimed to obtain, search, evaluate and select applications of new knowledge are considered to be research expenditures. This also applies to search, formulation, design and evaluation of possible alternatives for products, systems, devices and processes. The development includes the applications to plan or design the production of research phase findings – this is carried out before the commercialization. In practise, these may include designing and testing of prototypes, tools, jigs, pilot plants or improved materials. (KPMG 2009, 8) Thus, R&D intensive firms make substantial investments in these activities.

The present study defines business growth as sales growth. Other types of growth, for example, productivity-, employment- and asset growth, are not addressed in this study. It is justifiable to examine sales growth, since as stated earlier; R&D is an important catalyst for sales growth. Additionally, this study focuses on long-term growth, which is likely to increase the significance of growth for corporate`s financial decision-making.

Capital structure is understood as a broad concept. The true definition would also be comparatively close to financial structure.[3] Rather than tying this study down to rigid conceptual boundaries, the researcher applies a practical approach to financial patterns. The objective of this study is to meaningfully explain the topic and reveal interesting theoretical implications.

1.3 Philosophy of study and methodology

Generally, the researcher must acknowledge his or her approach for solving and answering research questions. The approach or philosophy and methodology guides the researcher throughout the study in exercising the basic function of science; obtaining new relevant scientific knowledge.

Burrell and Morgan (1979, 1) argue that all social scientists have implicit or explicit assumptions about their research disciplines and specifically about the social world and studying methods. The academics developed a framework that divides the assumed

[3] Note that there are neither universal definition for company capital nor capital structures

approaches in science to subjectivism and to objectivism.[4] Figure 1 illustrates the subjective-objective framework in Burrell and Morgan (1979) model.

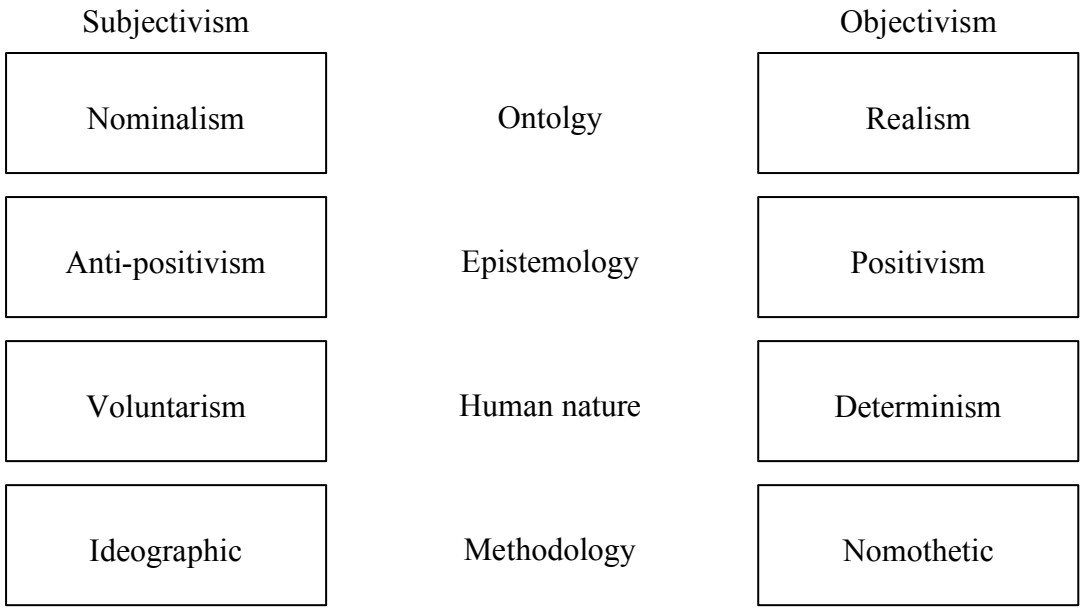

Figure 1. The subjective-objective dimensions (Burrell & Morgan 1979, 3)

Burrell and Morgan (1979, 1-3) argue that there are four main socio-philosophical debates or dimensions. In each dimension, a researcher has either an objective or subjective stance. Assumptions are made about: 1) the essence of the phenomenon under study (ontology) 2) the grounds of knowledge (epistemology), 3) the relationship between human beings (human nature) and 4) `the way` applied to investigate and obtain knowledge from the real world (methodology).

Ontology refers to the study of the nature and relations of being – the reality that a scientist chooses to address. The subjective approach or nominalism recognises that reality consists of concepts and labels that human beings have created in order to understand this reality. These creations do not have a meaning or significance per se; instead they are artificial tools to `organize` reality. The opposite concept is realism. A `realist` perceives reality as independent from the human mind. The concepts and labels exist regardless of human presence and contribution. (Burrell & Morgan 1979, 4)

Epistemology questions what knowledge is and how it is acquired. The Burrell and Morgan model categorises epistemological approaches to anti-positivism and positivism. Anti-positivism considers that the addressed reality can be understood only from the point of view of an individual or individuals. Thus, a scientist assuming a

[4] The model applies to social science

subjectivist point of view must perceive reality in similar manner as a studied individual would. In contrast, positivism aims observe to interactions and facts from said reality. A scientist should try to find objective knowledge with methods that are generally accepted. (Burrell & Morgan 1979, 5)

Burrell and Morgan (1979, 6) divide the human nature into subjective voluntarism and objective determinism. A scientist employing a subjective human nature approach sees individuals independent from the environment. Individuals have `free will` and ability to make decisions that cannot be universally explained. Determinism acknowledges that human behaviour is dependent from the environment that controls the reality. Human beings are rational agents.

The last dimension in Burell and Morgan (1979, 6-7) model is methodology. Ideographic stance derives from the subjective approach. The phenomenon addressed in a study can only be understood by gathering first-hand knowledge, for example, by observing the phenomenon in its own context. Nomothetic stance is research process derived and method oriented approach. A scientist assumes strict and homogenous rules to gather data. It is essential to develop hypotheses and apply generally accepted methods that are easily reproducible by other scientists.

This study assumes an objective approach in studying this phenomenon. The concepts addressed in the study are based on the universal theories of financing. The phenomenon is independent from the scientist and his actions. Corporate finance also makes strong assumptions about rationality. This rationality assumption is also acknowledged in this study. The present study does not aim to perceive reality from the point of view of individuals. The objective truth exists and is acquired by employing formal methods. The propositions are developed and tested.

Burrell and Morgan (1979, 21-23) extended their subjective-objective framework by analysing it in a sociological context. Specifically, the subjective-objective debate is examined together with a scientist`s attitude toward social change. The four disciplines include:

- The objective sociology of regulation of functionalism
- The subjective sociology of regulation or interpretivism
- The objective sociology of radical change or radical structuralism
- The subjective sociology of radical change or radical humanism

The social context in Burrell and Morgan (1979, 21-26) can be classified into regulation or radical change. Regulation rests upon the premise that society has an order. The society is relatively stable and based on consensus and cohesion – status quo. A scientist has no objectives to change the social reality. The opposite approach is radical change. The society is seen as constantly changing and disintegrating. There is a structural conflict in society. This study adopts a functionalist discipline to answer the

research questions. The study does not aim to change society; instead it accepts the status quo.

It is pivotal to link this study also to the framework of business economics science. Neilimo and Näsi (1980, 32-35) categorise methodological solutions and research approaches in business economics into conceptual, nomothetic, decision-oriented and action-analytic approaches. Later, Kasanen, Lukka and Siitonen (1991, 317) introduced and added constructive approach to this categorization. These methodological approaches and their dimensional concepts are illustrated in Figure 2.

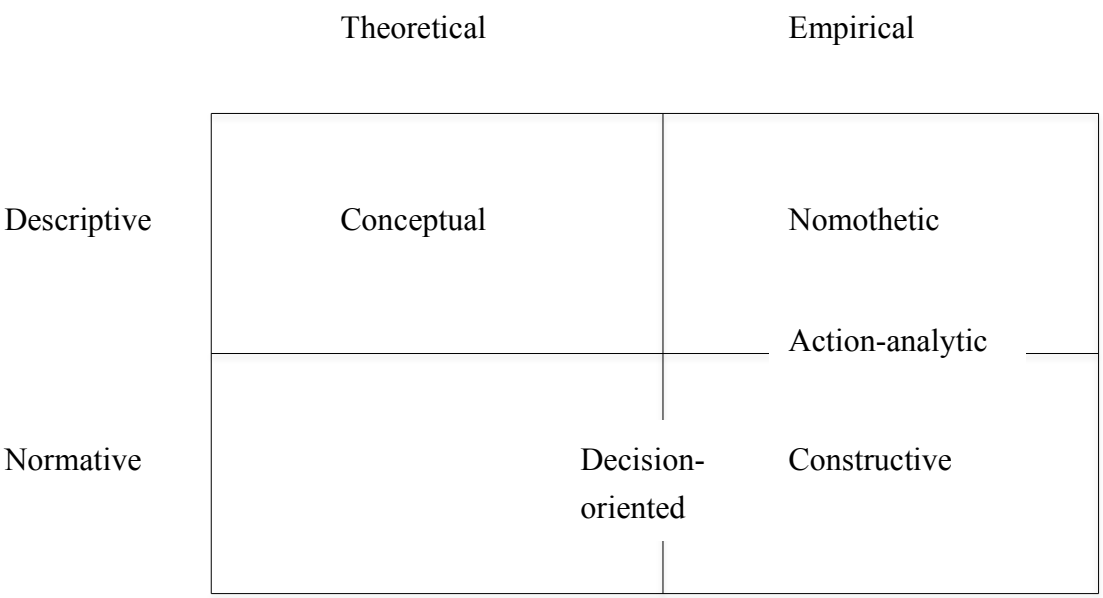

Figure 2. Research approaches in economics (Kasanen et al. 1991, 317)

Kasanen et al. (1991, 317) categorise research approaches under two dimensions. The descriptive-normative framework relates to the information content. A descriptive study is explanatory or suggestive. It addresses the question of what or why. In normative study, the emphasis is on the ideal of studied phenomenon. How it should be or how it should be done? The classification between theoretical and empirical approach is also fundamental. The former assumes a method of thought, while empirical study gathers data from field.

Conceptual methodology has traditionally had a pivotal role in Finnish business economic science. The prime contribution is reached by developing new concepts and conceptual systems. The results may be descriptive or suggestive. The decision-oriented approach is described as creative modelling. This approach aims to develop a method or normative policy for solving a problem in business. The special emphasis is given to decision-making and decision-makers. There are strong assumptions on rationality. The action-analytical approach assumes a method of understanding. It is a human based

approach that questions the idea of rationality. Thus, results are observed from the empirical world. (Neilimo & Näsi 1980, 32-35) Finally, a constructive study emphasises normative-empirical framework. Primarily, its objective is to solve a problem of challenge that occurs in the empirical world. (Kasanen et al. 1991, 317) However, it should be mentioned that in practise, studies might exceed the dimensions associated to their respective approach. This is especially the case in action-analytic and decision-oriented studies.

This study assumes a nomothetic approach. By applying the Kasanen et al. (1991) categorization, a nomothetic study is descriptive and empirical. According to Neilimo and Näsi (1980, 28) the nomothetic approach relates to the positivist tradition. A nomothetic study does not seek to fully explain the phenomena with developed theories; instead it aims to find conceptual interactions and causalities – prevailing facts. Lukka (1991, 170) argues that empirical data plays a pivotal role. There are strong `rules` in gathering, analysing and interpreting research data. The theoretical argumentation is constructed for empirical analysis. Nelimo and Näsi (1980, 32-35) point out that it is essential to confront the empirical findings with theoretical arguments.

Closer consideration of the research topic justifies the use of the nomothetic approach. Firstly, this study provides thorough argumentation about the interaction of growth, R&D and corporate capital structure. Secondly, the present study explains the causality between R&D intensive firm`s corporate finance and growth. Based on theoretical data, this study develops propositions about how capital structure of R&D firms should change regarding firms` growth. These propositions are tested with the empirical data. The criterion presented for nomothetic study is met in this study (Neilimo & Näsi 1980, 39-40):

- The purpose of the study is to explain
- A conceptual part is included into the study
- The study includes an empirical part that is relevant for the study
- The findings of empirical analysis and conceptual analysis are examined and compared
- A scientist does not have a subjective role in the study

1.4 Data and methods

In order to develop the propositions, this study applies a formal conceptual analysis. The study examines scientific literature – articles, dissertations and other relevant business economics literature. In the theoretical part, there is a strong dialog between theoretical studies and empirical studies. As the purpose of this study is to examine the

research topic empirically, it is essential to analyse the empirical reliability of different theories.

Traditionally, scientific studies have been classified according to the qualitative and quantitative discipline (Eskola & Suoranta 1998, 14). By assuming this rough classification, the empirical part of this study is conducted by applying quantitative methods. Eskola and Suoranta (1998, 14) further explain that this rough deviation is often misleading. It essential that a scientist chooses methods that provide meaningful answers to research questions – regardless of whether the methods are quantitative or qualitative.

The present study focuses on a few companies when analysing the R&D firm`s growth finance empirically. This is reasonable because only a few studies have examined this topic before. Additionally, the case firms are publicly listed. The reasons for this are practical. The international reporting standards concerning publicly listed companies have high demands toward corporate transparency and financial disclosure. Publicly listed companies are obliged to disclose their R&D expenditures and financial decision-making to investors and other stakeholders.[5] This is important, especially with R&D expenditures. Bear in mind that firms might be reluctant to reveal their R&D costs without an obligation – this is strategically important information for its competitors.[6] Choosing the sample in this study is similar to the logic in qualitative studies. Eskola and Suoranta (1998, 18) explain that empirical data in qualitative studies are samples that have gone through a thorough consideration; conducted by a researcher. Instead of focusing on random sampling, it pays off to analyse cases that extend and confirm the developed theories.

Focusing on a few companies naturally implies that the number of these cases should be defined. However, there are no universal rules to define this. Instead, the number of firms is defined by the `quality` of empirical findings. While introducing new cases does not bring up substantially new meaningful observations, the number of case firms is determined. Arguably, the emphasis should be on the methods and approach in general. (Eskola & Suoranta 1998, 61-62)

The method for analysing the case data is based on the financial indicators, which are obtained from the financials of the case companies. These economic indicators describe the capital structure and the financial decision-making of the firms. The method relates to the quantitative studies. Yet, this study extends the analysis beyond the indicators. Specifically, this study addresses the question of what is behind the economic indicators. Thus, aspects of quantitative and qualitative analysis are combined.

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[5] These are published, for example, in annual reports

[6] The sample and the logic behind the sample definition are explained more thoroughly in chapter 5.2.

1.5 Structure of study

After the introduction, this study thoroughly examines the main corporate structure theories. The scope is especially in trade-off theory and in pecking order theory that are often perceived as mainstream. Additionally, this study briefly analyses other corporate finance theories that have a role in explaining the main topic. The emphasis is also on empirical studies.

Chapter three focuses on R&D activity and how growth is associated with innovative activities in general. The study seeks to develop a solid foundation for understanding different elements in R&D firms. Firstly, knowledge is provided from the strategic importance of R&D. The second approach analyses R&D from financial perspective. How uncertain is R&D? How is asset structure associated to R&D? Finally and perhaps most importantly, the relationship between growth and R&D is addressed.

The fourth chapter aims to integrate the most important knowledge of corporate finance, R&D and firms` growth. Based on empirical studies this paper draws up a descriptive view on R&D firms` capital structure decision-making. After this part, the reasons for the observed capital structure and financing patterns are explained. Finally, these determinants are assessed under the growth framework. This is apt to provide implications for the results in the empirical part. The study develops propositions that are examined in the empirical part of the study.

The empirical part consists of the analysis of three case companies. First, the logic behind choosing the sample and research methods are presented. Chapter 5.2 consists of the case data – an introduction of the case firms and the financial analysis associated with the proposition developed in the theoretical part. Thereafter, this study examines the theoretical contribution of the empirical findings. The final chapter provides the summary of this study

2 DECISION-MAKING IN CORPORATE FINANCE

2.1 Capital structure of companies

The starting point for understanding the concept of capital structure is that companies own assets that are generated by its processes and investment activities. Naturally, companies have also had to finance the assets. This is done by acquiring funds from financial markets outside the company – funds are company`s liability to its investors. In this framework, capital structure refers to the question, what sources has a company used to finance its assets? (Brealey, Myers & Allen 2006, 7-8)

The term `capital structure` indicates that company`s capital consists of components that differ from each other as types of liabilities. Perhaps surprisingly, there is no universal definition for capital structure. Rather, the definition refers to, how the components that comprise the capital or liabilities can be categorized and examined.

Arguably, the most frequently used way to examine capital structure is to divide the capital to equity and debt finance. Sometimes hybrid finance is considered as a separate entity from equity and debt. It combines some aspects of both of these financing instruments (Laurila 2008, 89, 93; Megginson 1997, 305). Equity investors own firm shares that give a control rights over the company. Debt-investors provide loans that are later repaid. Thus, equity and debt simply refer to the form of liability. These forms reflect primarily financial factors that have an effect on the value of the security – control rights, obligations toward paying profit to investors, maturity etc. Table 1 illustrates the differences between equity and debt as components of capital structure.

Table 1. Main differences between debt and equity (Laurila 2008, 93-95)

Characteristic	Debt	Equity
Security requirements	Demand of collateral	No security collaterals
Payment of profit	Fixed interest	Dividend[7]
Payment priority	Primary priority	Residual claimant
Control allocation	No control rights	Managerial control rights
Tax deductibility	Tax deductible interests	No tax deductions allowed
Maturity	Predefined maturity	No maturity date
Repayment to investor	Obligated repayment	No repayment obligation

[7] Shareholders can decide over dividends by themselves as long as a company`s other liabilities are not endangered

Table 1 is not comprehensive. In practice, both debt and equity contracts might have terms that stereotypically do not relate to the respective financing instrument.[8] However, the listing in Table 1 brings up a good basis for the present study. It also helps us to understand how risk is related to the expected return of the security. Whilst, creditors of debt usually acquire fixed interest to the provided capital, which is usually secured with collateral, the shareholders` profits or dividends are primarily dependent from future financial performance of the company. However, there are no limits in what equity investors can gain in increased wealth. Thus, the expected and required rate of return in debt is lower than in equity financing. (Laurila 2008, 89-95)

In some cases, public grants are seen as a financing instrument of their own. This source of funds is primarily allocated to the firms that suffer or are apt to suffer from external financing constraints (Meuleman & De Maeseneire 2012, 589).[9] Firms that receive grants do not have to either repay the grant or pay interests. Yet, a closer examination of financial statements reveals that balance sheet does not include an entity of grants per se. Instead, grants are considered to be either asset deductions or other operative income – before that a grant is debt liability.[10] (KPA 1:6; KILA 1701, 2003)

According to Higgins (2000, 191 - 192) one of the most crucial decisions in finance is the choice between internal and external financing. Internal finance is generated by a company`s operative processes. This cash flow has not been repaid outside the company to the investors. In balance sheet framework, internal funds are also known as retained earnings and profit, which are equity components. External finance consists of external equity or common stock and debt (Laurila 2008, 89, 93; KPA 1:6; Brealey et al. 2006, 995). As there are no transaction costs in acquiring (or generating) internal finance, the cost of capital is considered to be cheaper than in external equity contracts (Brealey et al. 2006, 363).

In capital structure framework, financing instruments can also be examined based on maturity. As equity has no maturity dates, the classification applies mainly to debt[11]. For example, according to Finnish accounting standards (FAS) limited liability

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[8] For example; equity investors might require collateral for their investment; bondholders might require covenants i.e. control rights during financial distress

[9] Usually these are innovative start-up firms that require financing for internationalization or growth

[10] In order to retain grants, there might terms that must be met, before grants are free of liabilities.

[11] Note that there is no universal agreement on what comprises the capitalized debt. Sometimes only long-term debt is considered as capital. Yet, there is no universal agreement on short-term debt vs. long-term debt either (Antoniou, Guney & Paudyal 2006. 163). Other approach focuses on interest-bearing debt regardless of the maturity. In some cases debt capital in simply defined as the amount of debt that a company has in its balance sheet. For example in FAS, total amount of debt is considered as capital.

companies are required to disclose their debt capital by separating it into long-term and short-term debt. Short-term debt is due within one year, whereas the former`s maturity is longer than one year. (Laurila 2008, 180) Corporate finance theory claims that short-term debt is cheaper than long-term debt (Damodaran 2010, 158).

The capital structure categorization in finance is illustrated as follows in Figure 3. The interaction of these financing instruments can also be seen from the figure.

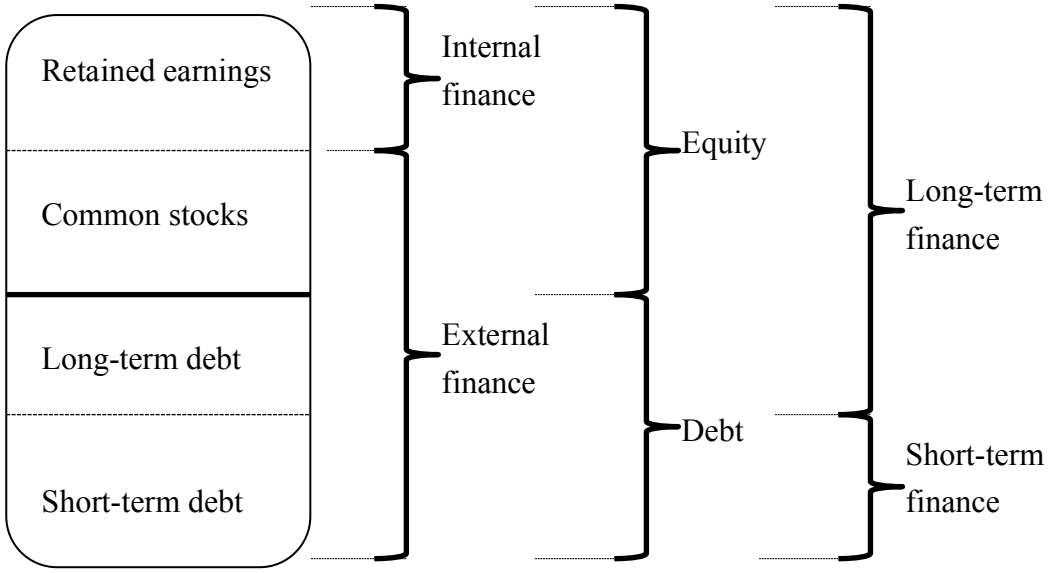

Figure 3. Framework for capital structure categorization

The capital structure in Table 3 is simplified, as it contains neither hybrid finance instruments nor grants. Yet, corporate financing seems to include at least three decisions or trade-offs that must be considered by the management. These are choices between 1) external and internal financing 2) equity and debt and 3) short-term and long-term debt. Interestingly, modern financial reporting standards demand that companies should disclose these choices ex-post (see for example KPA 1:6).

Financial type of liability approach does not consider the existence of institutional framework in acquiring finance. In addition to financial form of liability, we can examine what are the institutions that provide financing for companies. These can be, for example, private investors via public trade (arm`s length financing), current company owners or other financial institutions such as banks or governmental funding organizations (Seru 2007, 46; Wang & Thornhill 2010, 1149). Theoretically, financial institutions do not rule out any of the financial instruments. However, institutions characteristically provide funds in certain form.[12]

[12] For example banks provide usually debt

Why companies choose certain financing instruments to finance their assets? The next chapter is going to analyse this question thoroughly. Primarily, the scientific discussion has concerned the composition of the `optimal capital structure`[13] – and whether that exists or not. In addition, lately academics have emphasised the question of how companies finance their assets, rather than concentrating on the outcome of that process. (Frankfurter & Philippatos 1992, 1-15) There is no universal theory of capital structure and arguably there is no reason to expect one (Myers 2001, 81). Yet, we can see somewhat clear process from the first implications of the modern capital structure theory or the MM-theorem to the current scientific discussion that is mainly culminated in the trade-off theory and pecking order theory.

2.2 Irrelevancy of capital structure

According to Frankfurter and Philippatos (1992, 4) Modigliani and Miller (1958) established the foundation for modern corporate finance theory. Prior to the work of M&M, the approach to capital structure and more broadly to company valuation faltered between different income-based valuation frameworks that could be considered as ad-hoc theories. Instead of supplanting the old existing capital structure theory, Modigliani and Miller (1958) provided completely new scientific framework for studying capital structures of companies. (Frankfurter & Philippatos 1992, 4)

From the theorem we can find many theoretical contributions, but perhaps the most comprehensive of them all is that it specifies the conditions under which many corporate financing decisions are irrelevant. Modigliani and Miller (1958) constructed their theory on the basic assumption of perfect capital market. Capital markets are frictionless and neither contracting asymmetries nor taxes are present. (Titman 2002, 101-102) The academics also categorized companies to different return classes. That is, the return on shares issued by companies in the same class are consistent with each other. Regarding valuation framework, the most ground-breaking implication is that capital structure is irrelevant in company valuation, i.e. optimal capital structure does not exists because the average cost of capital is in fact the same in every company within the respective return class. Thus, the value of capital is the same regardless of the capital structure[14]. This argument (proposition I) was illustrated with the example of unlevered company 1 and levered company 2. (Modigliani & Miller 1958, 266-271)

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[13] The optimal composition of debt and equity that maximises the shareholder value

[14] Maximization of shareholder value -principle is irrelevant in capital structure framework

If the market values (V) based on company`s capital (equity and debt) within the same return class were different, an investor could eliminate this with personal financing arrangements – investing in shares and borrowing personal debt. Additionally, if the capital value of company 2 was higher than company 1`s capital value, oppositely the rate of return in company 1 would be higher. Therefore, it would pay off for company 2 owners to depress their ownership in company 2 (thus V2) and acquire shares from company 1 (thus increasing V1). The opposite phenomena would occur when V2 < V1. Thus, MM –proposition I stands: V1 = V2. Arbitrage prevents the market values from being different. Only the distribution of equity and debt may be different among value V. (Modigliani & Miller 1958, 268-271)

The investors` ability to "rearrange" a company`s capital structure is the key element in understanding the MM-theorem. From the theory we can further conclude that the only factor affecting the company value is the company`s ability to achieve operating profit[15] (Megginson 1997, 320).

The MM theorem proposition I indicates that as we move from unlevered company towards levered company the required rate of return in equity must become higher. This implication is know as the MM proposition II, which is illustrated in Figure 4. Specifically, it demonstrates the relationship between the cost of equity (e) associated with the average cost of the capital or WACC (w) and the cost of debt (d) when debt-to-equity ratio (D/E) changes.[16] (Watson & Head 1998, 215)

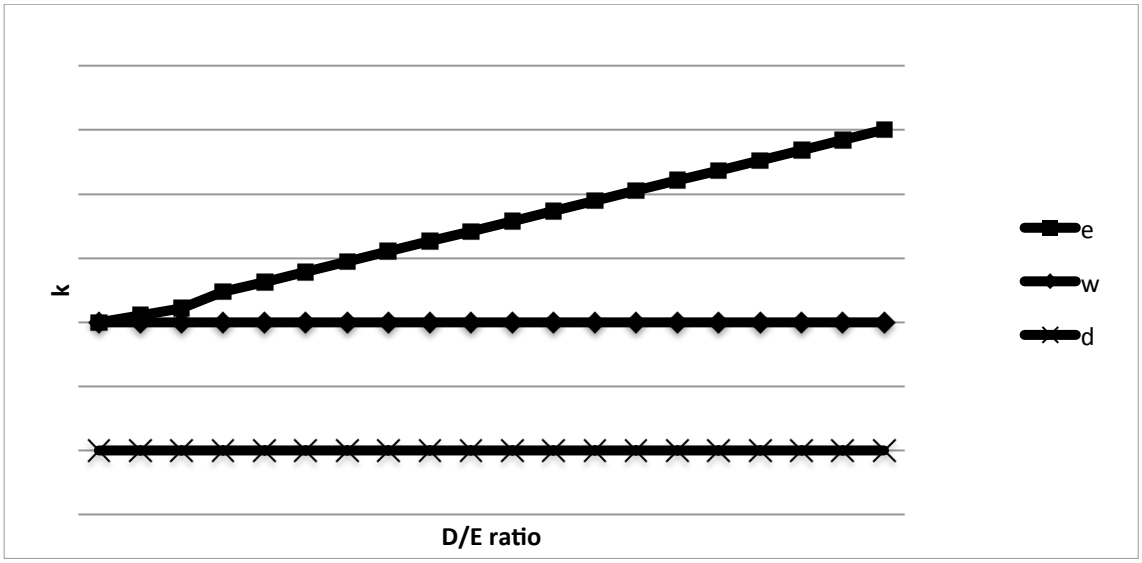

Figure 4. Proposition II in MM-theorem

[15] Operating profits are generated by assets

[16] The "k" in the axis is a cost of capital

The risky nature of increasing debt-to-equity ratio implies higher risk for shareholders, which further increases the cost of equity. Yet, the cost of debt and WACC remains in the same level regardless that the D/E ratio increases.

From the empirical world we can conclude that MM-theory`s conclusion about the irrelevancy of capital structure does not hold – many of the assumptions of the MM theorem are not realistic (Frank & Goyal 2007, 5; Frankfurter & Philippatos 1992, 4). Rather than considering this as a deficiency of the theory, the MM model instead shed some light on why the empirical world is not consistent with the theory. Modigliani and Miller (1963, 439) continued the scientific discussion, for example, by considering taxes` impact on the MM propositions. The academics concluded that because of taxes, companies should finance their assets entirely with debt. The tax deductibility of interests of debt makes debt preferable to equity. Thus, the optimal capital structure exists, if taxes are taken into account.[17]

Imminently after the introduction of the MM-theorem, large strand of the studies were motivated to determine what are the circumstances in which Modigliani-Miller theorem holds or does not hold. Robichek & Myers (1966, 12 - 13) argue that in addition to the perfect market assumption and lack of taxes the following conditions must hold to prove MM proposition I; firstly, there should not be any direct or indirect bankruptcy costs; secondly, leverage and future changes in financing have no impact on firm`s investment decision-making and on present shareholder value. Thus, it is the various market imperfections that create the phenomenon of optimality or relevance in firm capital structures. Other circumstances that are acknowledged are for example agency costs and transaction costs. (Frank & Goyal 2007, 5)

2.3 Trade-off –decisions in financing

The theory of irrelevant capital structure together with the empirical inconsistencies directed the scientific discussion toward more thorough examination of debt financing. The Modigliani-Miller theorem concludes that when company income taxes[18] exist together with perfect markets, capital structure should consist entirely of debt. Empirical findings provide only little proof for this conclusion. (Megginson 1997, 325) Thus, naturally debt should also have disadvantages compared to equity financing. The trade-

[17] V = U + T*D, where T is income tax rate (Brealey et al. 2006, 472)

[18] Note that the MM theory assumes a simple tax shield based on fixed tax rate. Corporate taxes are apt to contain some dynamic aspects as well (see for example Rasiah & Kim 2011, 154)

off theory of financing is culminated in the idea of equilibrium of benefits and disadvantages of debt resulting in optimal capital structure.[19]

According to Frankfurter and Philippatos (1992, 5) the biggest advantage of the trade-off theory is its simplicity. If one can bound all the benefits and costs together, the capital structure implications can be logically modelled. It also has managerial implications as it explains how the capital structure should be considered in value-maximization framework. The deviancy of the theory is that it lacks the mathematical mechanism of how these costs and probabilities should be bind together.

According to Brealey et al. (2006, 489) the trade-off theory successfully explains why empirically observed financial decision-making varies with industries. On the other hand, in some cases the theory is not able to explain some phenomenon occurring in empirical world that moreover conflict with the theory – for example, why the most profitable firms have in fact low leverage (Fama & French 2002, 30; Brealey et. al 2006, 489)?

2.3.1 Costs of financial distress

Regarding disadvantages of debt, probably the most obvious are the bankruptcy costs that increase with issuing debt. In the MM theorem, debt is issued with an assumption that the lender is able to meet the debt obligations i.e. interests and repayments of debt. However, taking existing market imperfections in consideration, a company might not earn this `promised` return on its debt and further would face financial distress and go bankrupt. Thus, an increase in debt level raises the probability of a company going bankrupt, which raises the costs of debt financing. (Kraus & Litzenberg 1973, 911-912) This phenomenon was widely recognized and analysed in the field of business finance, but it was first the work of Kraus and Litzenberg (1973) that modelled the classic argument that optimal leverage is a result of a firm balancing the tax shield benefit of debt with the deadweight costs of bankruptcy. (Frank & Goyal 2007, 7)

Firms should target a debt level that maximises the shareholder value. In Kraus and Litzenberg (1973, 912) framework tax shield increases the enterprise value, whereas bankruptcy costs decrease it. The academics modelled their argument with the deadweight bankruptcy costs, which can be direct or indirect. Direct costs are cash expenses related to filing and administrating bankruptcy. Indirect bankruptcy costs are

[19] As Frank & Goyal (2007, 6) suggest, the trade-off theory term is used by academics to describe a family of related theories

economic losses for example from loss of sales, diversion of management time and constrained R&D spending.[20] (Frank & Goyal 2007, 7; Megginson 1997, 333)

The trade-off theory should be understood in broader respect than just taxes vs. deadweight bankruptcy costs framework. Firstly, debt may come with many different benefits and costs from financial distress and bankruptcy. For example derived from perverse managerial incentives; this is addressed later in the chapter. Secondly, it is vital to understand (according to the theory) how firms finance their assets. The theory argues that optimal capital structure exists and this can be disclosed explicitly. The decision-maker evaluates a firm with various sets of marginal costs and benefits of leverage. Further, firms aim to attain this target debt ratio. (Myers 1984, 577-581)

There is much to say about bankruptcy and financial distress. The key idea is to understand, what are financial distress and bankruptcy. Ultimately, bankruptcy is an ownership reorganization, in which company shareholders use their option to default on the company debt and bondholders, who inversely become the shareholders of the company.[21] The bondholders will employ the assets as new shareholders. (Megginson 1997, 330)

Megginson (1997, 330-331) argues that financial distress discourages the use of debt only if: 1) financial distress reduces market demand for the products of the company; 2) financial distress gives managers incentives to undertake actions that are likely to reduce the company value and abandon opportunities that would maximize the enterprise value; and 3) going bankrupt imposes costs that would not be borne in a non-bankrupt firm. Intuitively these factors are likely to differ among the industry, product-mix or for example with asset structure – varies from firm to firm. A case in point, creditors should theoretically prefer firms with comprehensive level of tangible assets, since the second-hand markets are usually well established. Financial distress can be particularly harmful for a company employing mainly intangible assets, and specifically research and development intensive goods. The assets are mostly sunk costs that are later recovered with long-term sales. Also, `maintenance` of these intangible assets requires a lot of spending.

For the second factor in Megginson framework, we can bring up two possible hypotheses, how managers can play a game at bondholder's expense and increase the costs of financial distress[22]. These are the asset substitution problem modelled by Jensen and Meckling (1976) and the underinvestment problem introduced by Myers (1977).

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[20] Note that there are many ways to categorize the costs of financial distress (see for example the work of Lintner 1982). However, direct vs. indirect –categorization provides a good foundation for this study.

[21] This is one of the basic characteristics and rights of shareholders in a limited company

[22] These are indirect costs of financial distress

The asset substitution occurs in a situation, when managers realize that the company is unable to repay the mature debt to the creditors. In order to illustrate the managers` hazardous behaviour, presume that a financially distressed company is facing an option to choose from two investment opportunities: 1) A project with high-risk, negative NPV and if successful its returns are sufficient to fully repay the loan 2) A project with low-risk, positive NPV but returns are insufficient to repay the loan. A manager pursuing to maximise the enterprise value should choose to invest in the second project. This is also in the interest of the bondholders. However, the manager has a perverse incentive to choose the first project, because it comes with a possibility to repay the loan back fully. This is also in the interest of the shareholders, since if the project is successful they are able to maintain the ownership in the company. On the other hand, if it is unsuccessful, the shareholders can simply hand the valueless company to the bondholders by exercising their option to default. Basically, managers and shareholders are gambling with bondholders` money. (Jensen & Meckling 1976, 334-337; Megginson 1997, 332)

The underinvestment problem occurs in a similar situation. Assume that there is a profitable investment opportunity whose return would be enough for repay the mature debt. In order to carry out the investment, the shareholders would need to provide the cash to the company. Accepting the project would maximise the firm value, but as the benefits would all be accrued to the bondholders, the shareholders would reason not to accept the project, i.e. not to provide equity to the company. Thus, the underinvestment problems encourage a company to abandon positive NPV projects at bondholders` expense. (Myers 1977, 152-155; Megginson 1997, 333)

Bondholders acknowledge the direct and indirect costs of bankruptcy including the hazardous behaviour of managers at their expense. This increases the costs of debt financing from company`s point of view. As a concluding remark for above, we can illustrate the value of the company by breaking it down as follows: (Megginson 1997, 337)

Value of firm = Value of unlevered firm + PV of tax shield - PV of financial distress[23]

The concept of bankruptcy costs and financial distress in capital structure decisions has been examined in numerous of empirical studies since the introduction of the bankruptcy costs argument. The costs are a fundamental argument in modern corporate finance theories, but the importance in empirical world is somewhat contradictory.

Regarding some earlier studies, the well-respected paper of Warner (1977, 345) found the significance of bankruptcy costs to be trivial in railroad industry.[24] In contrast,

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[23] PV stands for present value

[24] Note that the study of Warner (1977) examined only direct bankruptcy costs

Baxter (1967, 402) study and Van Horne (1974, 22) study observed that the costs are significant and substantial. Guffey and Moore (1991, 234) studied direct bankruptcy costs in US trucking industry. The academics concluded that the costs are very large relative to book ratios. The results showed that the costs were particularly large compared to some other industries.

Bar-Or (2000, 66) looked at a large sample of going-concern firms. The results show that the sum of direct and indirect costs comprised approximately 8 % on average of the enterprise value. The share of costs increases together with the leverage – the share was up to 25% among the high-levered companies Kwansa and Cho (1995, 348 – 349) claim that indirect costs of bankruptcy[25] are an important factor in financial decision-making. The academics further reason that these costs are perhaps even more substantial than direct bankruptcy costs. Also Opler and Titman (1994, 1037) suggest that increased leverage has a comprehensive negative effect on the corporate performance – market share, profits etc.

Jensen (1988, 79) study supported the modern theories of the capital structures. The study suggests that bankruptcy costs are not insignificant determinant of debt levels. They are not the only factors in the debt framework, but rather a conjunction with other factors.[26] This conveniently sheds some light on the next chapter, which analyses agency problems regarding to financial decision-making more thoroughly.

2.3.2 Agency conflicts

The previous chapter alluded that there is more in agency conflicts than just the interaction with the financial distress. Jensen and Meckling (1976), who examined the agency costs of debt and equity, arguably have made the biggest contribution. The academics laid the foundation to the modern hypotheses of agency conflicts.[27]

To sum up the implications of Jensen and Meckling (1976, 312-313), there are at least two types of agency costs that occur in financing: 1) The conflict between owner-managers and outside shareholders 2) The conflict between shareholders and bondholders. The academics suggest that a company whose value is not incurred by agency costs of equity is a company in which a manager or managers own the company

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[25] Indirect bankruptcy costs are difficult to quantify (Megginson 1997, 333)

[26] This partial determination is perhaps the most widely accepted characteristics of financial distress

[27] Sometimes agency conflict studies are considered to comprise a separate `agency theory of financing` that suggests that the capital structure is determined by agency costs of equity and debt. In the present study, agency costs are considered as part of trade-off theory.

100 per cent. Naturally, the interests of shareholders and managers are perfectly aligned. When management owns less than that, outside shareholders face agency costs resulting from management`s incentive to consume perquisites at outside-shareholders` expense. These agency costs increase as the fraction of outside-equity ownership increases. However, informed investors can expect this behaviour from owner-managers and thus are willing to pay only a price per share that reflects the decline of the firm value caused by the `perk` consumption. In other words, entrepreneurs bear the full costs. (Megginson 1997, 334-335)

Also other types of manager-shareholders conflicts have been recognized in the scientific literature. Amihud and Lev (1981, 615) concluded that there are strong incentives for managers to invest in projects that decrease their unemployment risks over positive NPV projects. Jensen (1986, 323-329) introduced the free-cash-flow hypothesis that suggests that managers have incentive to invest excessively in growth seeking projects that does not necessarily maximise the shareholder value, if it substitutes giving up control and managerial power by paying dividend to shareholders. Masulis (1988) added that managers might prefer short-term investments, in which returns are accumulated earlier rather than more profitable long-term investments. Managers seek to enhance their reputation quickly. Harris and Raviv (1990, 344) claim that managers are usually willing to continue operating the firm, despite the liquidation would be more favourable to shareholders. Finally, according to Hunsaker (1999, 21) managers want excessively lower the risk of bankruptcy by investing in low-risk projects and exhibiting low leverage.

Thus, manager-shareholder conflicts occur in many ways. The fundamental question in this context is, how to overcome these challenges that result in increasing agency costs of equity. Intuitively, increasing managerial ownership could help, as the interests of insiders and outsiders are more properly aligned. Also, dividend payments can constrain managers from consuming prerequisites.

Additionally, when debt is considered in the context the agency costs of equity, we can find some interesting implications. Specifically, increasing leverage can be seen as a tool to overcome agency costs of equity (Jensen & Meckling 1976, 323-326). Firstly, the more debt is issued the less outside equity is needed. Secondly, the fixed payments that are included in debt contracts, constrain managers to consume perks and further invest in unprofitable projects. (Megginson 1997, 335)

However, debt itself has also an agency cost. Some of this phenomenon was already addressed in the previous chapter. The problem derives from the situation in which bondholders begin taking an increasing share of the risks, but managers and shareholders still possess the control over the firm. This encourages managers to take an advantage of the bondholders` wealth and benefit themselves or the shareholders. As alluded with the asset substitution problem, managers could borrow funds from

creditors with a promise of allocating them to low-risk safe investment. However, in some cases it could benefit shareholders to invest the funds in high-risk projects. (Megginson 1997, 337)

Other kinds of agency conflicts between shareholders and bondholders include, for example, the underinvestment problem, which in present study is considered to include in the financial distress framework. Additionally, Smith and Warner (1979, 118) theorize that; 1) shareholders can increase their wealth at the expense of bondholders by increasing the dividend payments; and 2) firms can issue new debt with higher priority than the existing debt, which leads to the falling value of existing debt.

Bondholders can anticipate this behaviour and demand detailed covenants in to contracts, which constrains the hazardous behaviour of managers. These covenants are very difficult to negotiate and costly.[28] (Megginson 1997, 337)

To sum up, the starting point for understanding the fundamental idea behind the agency conflicts in capital structure decisions is that there is a costly conflict between managers and shareholders, which can be mitigated through debt financing. However, debt has also an agency costs, indicating (by applying the trade-off logic) that there is a balance between agency costs and benefits. Finally, we can sum up and break down all the components of the trade-off theory as follows (Megginson 1997, 338):
V = U + PV of tax shields – PV Financial distress + PV Agency costs of external equity – PV Agency costs of debt

As was the case bankruptcy costs, many studies have examined the existence of agency costs empirically. Jung, Kim and Stulz (1996, 182-183) empirically tested different financing theories with a large sample of new bond issues and primary stock issues. The academics state that the results strongly support the financial explanations provided by `the agency model`. Issuing equity is typically associated to firms that possess a valuable investment opportunities and experience asset growth, which fits well to the agency conflict framework. Additionally, Lasfer (1995, 279 - 280) looked at a sample of UK firms and concluded that the primary determinant of borrowing is the agency costs. The study suggests that firms with fewer growth options exhibit large rate of long-term debt. In addition, firms that are unlikely to face the problems of free cash flow exhibit relatively low debt-ratios. Further, Harvey, Lins and Roper (2004, 27) looked at a large sample of firms that are apt to suffer from severe managerial agency conflicts. The academics found that debt substantially mitigates the agency costs and increases shareholder value.

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[28] Other ways to resolve the bondholders-shareholders agency conflicts may include; 1) the issuance of convertible debt (Masulis 1988) and 2) demanding restrictions to dividend payments (Wald 1999, 207)

In contrast, Graham and Harvey (2001, 226) found only little or mixed evidence that the agency conflicts affect the capital structure decision by conducting a survey aimed for American and Canadian CFOs.

Regarding Finnish studies, the results are also fluctuating. Tahvanainen (2003, 55) study suggests that the agency conflicts are not a pivotal factor among small biotech firms` financing decision-making – only the hypothesis of the asset substitution problem of debt was somewhat supported. In contrast, Niskanen and Niskanen (2010, 29) studied managerial ownership in small Finnish companies and observed that agency costs prevail and bank take this into account in many complex ways throughout the lending process. Further the academics concluded that banks `punish` firms with high managerial ownership and reversely reward firms that have dispersed ownership structure as it is related to lower agency costs.

In addition to growth opportunities and ownership structure, empirical evidence suggests that the existence and importance of agency costs is in a sophisticated way interconnected with, for example, company age, size, industry, management characteristics, strategic choices and other firm-specific factors. (see for example Wellalage & Locke 2011, 185; Jurkus, Park & Woodard 2009, 185; Truong 2006, 167; Chiang & Ko 2009, 381)

2.4 Pecking order approach

2.4.1 Theoretical background

The prime contribution in pecking order theories of finance goes back to the work of Myers and Majluf (1984, 219). The academics explained that the implications of the static trade-off theory are not consistent with the observed empirical evidence. Instead, financial policies seem to be better explained by a behaviour that was introduced already by Donaldson (1961). Donaldson (1961) study observed that there is a preference order for a company to acquire finance. Internal finance is preferred over external finance. If firms need to issue funds from external sources, they first use debt, then hybrid financing and as a last resort equity. This sheds some light over the idea that companies do not apply the target leverage as trade-off theories imply.

As Myers (1984, 582) argued, this preference order described above used to lack scientific explanations and thus it was not necessarily considered to be a credible theory in modern finance. Megginson (1997, 339) claims that it “had largely been ignored by modern economists because it seemed to be based on irrational, value-decreasing corporate behaviour”. However, it was the theoretical work of Myers and Majluf (1984,

189, 219-220) that was perfectly aligned with this need of theoretical foundation. Along the existence of transaction costs[29] of issuing external funding, the academics introduced a hypothesis of asymmetric information in capital structure decision-making. The hypothesis suggests that when company managers have superior information[30] about the firm`s investment opportunities and generally about the firm value, a preference order as described by Donaldson is likely to occur. Also a pivotal assumption is that managers will act in the best interest of the firm`s old shareholders.

As a brief summary, there are two key elements in understanding the asymmetric information and its interplay in finance. Firstly, it is more costly to issue external securities than internal cash flow. Secondly, debt has advantages over riskier equity financing. (Myers 1984, 584)

Consider that a firm has a profitable investment opportunity – NPV is zero or positive, which maximises the firm value. The firm would need to issue funds from outside-investors, whom because of information asymmetries undervalue the company. The managers lack the abilities to convey the true value to the potential investors. If the value of the difference of true company value and the market value (over- or undervalued) is higher than the NPV of the investment, it pays of for managers acting in the best interest of the existing shareholder to pass up the opportunity[31]. In an undervalue situation, the benefits of the investment would accrue to new shareholders. Thus, issuing external financing could potentially result in a company to abandon a positive NPV investment opportunity that increases company value. A company faces an underinvestment problem. (Myers 1984, 582-584) According to Frank and Goyal (2003, 218) this can be also understood as an adverse selection problem.

To overcome the challenge of passing up positive NPV investments, managers could build up a large cash level that is enough to cover the financial need. Naturally, these resources are not infinite and managers may be forced to acquire funding from external sources. (Myers 1984, 584) This raises the question of whether to issue securities in form of debt or equity.

The riskier the securities are, the bigger the chances that the company will pass up positive NPV projects, i.e. the company is undervalued (Myers 1984, 584).[32] Thus a practical solution to this would be to issue low-risk securities – starting from default-risk free debt and then as they are exhausted, gradually move towards more risker

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[29] However, the role of transaction costs was mainly recognized by Myers (1984, 582), who further explained the model

[30] Compared to outside-investors

[31] This indicates that, when firm is overvalued, companies should always issue

[32] Myers (1984) explains this hypothesis is based on logical and intuitive assumptions

securities. In theory, the company never abandons a positive NPV investment if it is able to issue enough risk-free debt. As an issued debt becomes riskier, the option pricing theory indicates that a similar undervaluation is likely to occur as in the case of equity. However, undervalue is always less in debt than in equity (Myers & Majluf 1984, 207-208).

The theory implies that firms should retain a sufficient financial slack, defined as firm`s cash and marketable risk-free securities. Firms with adequate financial slack will not ever have to use risky debt or equity. (Myers 1984, 590) Megginson (1997, 340) calls for the importance of financial flexibility.

The example above assumes that the company is undervalued. Naturally the company may also be overvalued. The theory suggests that in this case, the company should issue equity. However, this is worth explaining further. Rational investors would reason that when a firm is issuing equity, the value of the company is overpriced. The investors would refuse to provide equity funding for a firm unless the debt capacity is fully exhausted. Thus, the investors are apt to force the firm to issue debt and further follow the pecking order. (Myers 1984, 584-585) This also implies that company`s capital structure choices have a signalling impact to the potential investors. The signalling framework is analysed more thoroughly in the next chapter.

The pecking order theory has some practical implications in financing decisions. The theory implies that an equity issue decreases the firm value, whereas riskless securities such as internal cash flow do not result in stock price changes. Thus, investment projects tend to be financed primarily with internal cash flow. In addition, underinvestment problems are apt to be less severe, when information asymmetries are less severe – such as when submitting annual reports. Also, firms with large amounts of intangible assets that are subject to information asymmetries are likely to face more underinvestment problems and issue primarily debt. (Harris & Raviv 1991, 306-308)

Myers and Majluf (1984) study has had many extensions in the scientific literature.[33] Their model is based on the assumptions of fixed investments and equity issues affecting the company value. In order to extend these ideas, Krasker (1986, 102-103) developed a model in which companies were “allowed” to choose the size of investment and equity issues. The suggestions of the pecking order theory were confirmed. The larger a stock issue, the worse signal to investors. Additionally, Narayanan (1988, 40-42, 48) reached similar results by considering information asymmetries to be valid only in project level. The only signal to outside investors is whether a project is carried out or not. Firms could issue either debt or equity. The main result was that firms should issue debt regardless of whether the investors are able to distinguish between low- and high-

[33] Harris & Raviv (1991) provide a very comprehensive review in this category

quality firms or not. Low-quality firms benefit from acquiring the average valuation from the firm `pool`. These firms can carry out negative NPV projects as its equity is overpriced. Thus, if high-quality firms are able to create barriers of entry to low-quality firms by issuing debt, higher leverage is more beneficial. The academics also argue that firms would either issue debt or reject the project.

Interestingly, some extensions to Myers and Majluf model cast doubt on the pecking order. These papers usually acknowledge that there is a large variety of securities that firms may issue. Wider range of financial choices may invalidate the implications of the pecking order theory. (see for example Noe 1988, 348)

As stated earlier also the existence of transaction costs cause a preference order in financing. For example, Baskin (1989, 27) argues that transaction costs in issuing equity are substantially larger than in issuing debt. Thus, these results partially explain the pecking order theory.

In addition to information asymmetries and transaction costs, the third approach to the pecking order theory emphasises control rights. The idea was introduced for example in Aghion and Bolton (1992, 474) study. Their model derives from the contractual incompleteness and wealth constraints. The pecking order is an interplay of tangibility of assets, control rights distribution and investors` participation constraints. Securities have specific control rights for their owner – equity giving the most fundamental control rights. Firms issue securities in an order that results in giving up the smallest share of control rights as possible. (Aghion, Bond, Klemm & Marinescu 2004, 278-279)

How does pecking order theory relate to other financing theories? The theory implies that balancing the disadvantages and benefits of debt are irrelevant or second-hand.[34] Changes in the capital structure are caused by disequilibrium between dividends, cash flow and investment opportunities. Thus, the determinant for capital structure choices is the needs in financing rather than the target capital structure as proposed in trade-off theories. (Brealey et al. 2006, 493; Shyam-Sunder & Myers 1999, 220 - 221)

2.4.2 Empirical evidence

Where the trade-off theory fails, the pecking order theory is able to provide some logical scientific explanations. For instance, the trade-off theory lacks scientific

[34] In the traditional pecking order, equity is considered to be the first source (internal finance) and also the last source (external equity finance). Thus making any assumptions about the optimal capital structure seems irrelevant. (Brealey et al. 2006, 493)

arguments why the most profitable companies have reasonably low leverage. Based on the implications of the pecking order theory, arguments can be made that this is merely due the fact that firms do not need to acquire debt. The cash flow of the firm is enough to cover the financial needs. (Megginson 1997, 338; Brealey et. al 2006, 493)

However, the pecking order theory has also empirical deviancies. For example, the well-respected Fama and French (2002, 30) study concluded that the pecking order theory was not able explain the observed large equity issues among small high-growth companies. Shyam-Sunder and Myers (1999, 242) further reason that the pecking order theory is likely to fail in explaining the financing behaviour of high-growth firms investing substantially in intangible assets.[35]

Large number of studies has tried to examine, how the pecking order theory explains the corporate financing patterns in practise. Ghosh and Cai (1999, 37) study examined the optimal capital structure hypothesis and pecking order theory with Fortune 500 firms over long time period. The results support both of the theories, but the academics argue that the most supporting evidence is accrued to the pecking order theory. Financial hierarchy is consistent in all the industries and regardless of time.

Watson and Wilson (2002, 576) conducted an empirical study with UK data. The survey collected detailed firm-specific data from SMEs in the manufacturing industry. The academics theorized that firms prefer retained earnings to debt that in turn is preferred to new stock issues. Empirical results confirmed this and the pattern seemed to be particularly strong in relation to the firms, in which information asymmetries are more apparent. The results also indicate that there might be a pecking order within debt securities. Shyam-Sunder and Myers (1999, 239, 242) claim that the pecking order theory is able to explain the financing behaviour in publicly listed mature phase corporations. The academics observed that leverage increases with financial deficit and decreases in opposite situation.

Empirical evidence is also gathered from developing economies. For example, Mazur (2007, 509-510) found supporting evidence for the pecking order theory. The sample consisted of Polish non-financial companies over the period 2000 – 2005. Thorough examination considered, for example, asset structures, growth opportunities and profitability. Mazur (2007) further states that the trade-off theory is not applicable in order to explain the financing behaviour of the examined firms.

The pecking order theory seems to be able to explain the financial behaviour in family companies. According to Tappeiner, Howorth, Achleitner and Schraml (2012, 50) this is derived by control rights instead of asymmetric information. Their empirical study analysed case data from 21 large family companies.

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[35] Interestingly, such as a growing R&D intensive company

However, many scientific studies have not find strong support for the pecking order hypothesis. Frank and Goyal (2003, 241) examined a large sample of publicly traded American companies over long time period. The academics found virtually no support to the implications of the pecking order theory. Firms acquired substantial amount external financing. Debt does not excessively dominate in external securities. Sanchez-Vidal and Martin-Ugedo (2005, 353) confirmed the pecking order among high-growth firms by looking at a Spanish data. In contrast, low-growth firms apply more balanced approach to financing.

Seifert and Gonenc (2008, 259) tested the hypotheses of the pecking order theory with international data – firms from US, UK, Germany and Japan. The academics motivated their study with the fact that information asymmetries are apt to rise from different reasons in different countries. In UK and US, investors are simply not able to get the information from the managers, whereas in Japan and Germany the problem is the quality of the received information. The result supported the pecking order theory only in Japan. In the other observed economies, financial deficit is usually covered with equity issues rather than with debt.

Tahvanainen (2003, 55) observed that the pecking order theory could only partially explain the financing behaviour of small biotech firms in Finland.[36] The relationship between profitability and leverage was negative, which supports the pecking order theory. In contrast, Tahvanainen (2003) observed that high-risk companies have low leverage levels, which supports the trade-off theory. Regarding other Finnish studies, Kjellman and Hansen (1995, 99) surveyed publicly listed companies` CFOs in 1993 and observed that firms follow a specific financing hierarchy in order to avoid control dilution. Yet, the main finding in the study was that primarily, firms aim to maintain the target leverage. The academics argue that studies conducted with US data have usually reached opposite results. This is arguably caused by the institutional changes in the Finnish economy due the banking crisis and deregulation in the early 1990s.

To sum up, most of the empirical studies have found supporting or partially supporting evidence for the pecking order hypothesis. Other obvious note based on the empirical studies introduced in this chapter is that large strand of studies have examined capital structures by confronting the pecking order theory and the trade-off theory. Interestingly, as Fama and French (2002, 30) point out, in many cases the two `rival` theories do not necessarily rule each other out. A similar argument is presented also in Ghosh and Cai (1999, 37) study. “The optimal capital structure hypothesis and pecking order theory coexists.”

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[36] Note that Tahavainen (2003) argues further that also trade-off theory explains financing behaviour only partially

2.5 Other theories and studies

2.5.1 Dynamic models of capital structure

The trade-off theory presented earlier is also known as the static trade-off theory. It regards time framework as single-period factor, during which fixed benefits and disadvantages of debt are balanced. (Frank & Goyal 2007, 7) As time is considered as a continuous and dynamic factor, it is only logical to assume that over time firm characteristics and market conditions change. These shocks potentially shift optimal leverage away from the current capital structure. The static trade-off theory suggests that companies immediately adjust their capital structure as the target changes. This adjustment is costless. (Brennan & Schwartz 1984, 605; Myers 1984, 577)

The deviancy of this logic is that adjustments are always costly due to the existence of transaction costs of issuing external securities. This indicates that firms might be reluctant to respond immediately to the `shocks` that shift them away from the optimal capital structure. More specifically, firms will wait to recapitalise, if the adjustment costs outweigh the benefits. (Leary & Roberts 2004, 1) This idea was theoretically modelled, for example, by Fischer, Heinkel and Zechner (1989).[37]

As an extension to the implications of the static trade-off theory, firms have an optimal range of capital structure – no-recapitalization region – instead of an optimal leverage. Within this range, firms are inactive with respect to their financial policy. (Leary & Roberts 2004, 1) Fischer et al. (1989, 39) model shows further that this range tends to be wider for firms that are smaller, riskier and have lower tax rate and bankruptcy costs. Further, the dynamic trade-off theory shows that it is `dangerous` and on the other hand misleading to view observed capital structures as optimal.

Regarding empirical studies, Leary and Roberts (2004, 35-36) looked at a sample of nearly 3.500 US firms and observed that their financial policy is largely consistent with the dynamic trade-off theory models. Capital structure adjustments are carried out infrequently but in clusters. Dudley (2007, 24) tested empirically how different financial indicators influence on financial policies. The results indicate that profitability and interest rates have a narrowing impact on the optimal range, whereas share price volatility has an opposite effect.

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[37] Fischer et al. model was later contributed for example by Leland (1994). Traditional dynamic trade-off models have assumed that a firm`s investment policy is fixed and assets are already in place. More recently, capital structure dynamics have been studied together with dynamic investment policy (see for example Childs, Mauer & Ott 2005).

2.5.2 Signaling with capital structure

The signalling theory of financing also derives from the information asymmetries. Thus, it is closely related to the pecking order theory, but often it is useful to consider it as a separate theory since the fundamental idea is somewhat different. The signalling theory relates more on the financial tactics that a firm is adopting in order to maximise its enterprise value by reducing the information asymmetries. Following illustration is based on the model of Ross (1977).

Managers have superior information compared to outsiders. They know how the profits are distributed. Additionally, managers who possess the favourable inside information have an incentive to disclose this to outside investors as it understandably increases stock prices. However, managers tend to lack conventional tools to do this. Simply, just announcing these good news would not do any good, because every other manager have also the same incentives, and investors are sceptical about any invalidated self-benefiting statements. (Megginson 1997, 342; Ross 1977, 27-28)

Interestingly, capital structure choices could serve as a tool to convey this favourable information to outsiders in a credible way. A high-value firm could exhibit a capital structure composition, which would be too costly for a less valuable company to mimic. According to the model high leverage signals good investment opportunities and high returns and further company`s high value. If less valuable companies were mimicking this capital structure, it would be too costly due the risk of facing bankruptcy. Thus, less-valuable firms rely more on equity. Logically, investors could easily differentiate between high- and low-value firms simply by looking at the capital structures of companies – high leverage indicating higher valuations assigned. (Ross 1977, 28-36; Megginson 1997, 342)

The market reactions in signalling model are similarly explained as in the pecking order theory. Issuing debt or implementing leverage increasing actions are seen as positive signals for firms` value, whereas in the case of equity the impact is opposite. (Miglo 2010, 14)

Ross`s model was contributed for example by Heinkel (1982, 1143, 1149). The model assumes that firms that try to convince markets that it is type other than its true type will gain from the overvaluation of one security but lose from the undervaluation of the other security. Signalling equilibrium exists when these marginal costs are balanced – high-value firm has equilibrium when leverage is high. In this situation low-value firm trying to mimic high-value company should issue more under-priced debt and reduce its over-priced equity, which is not feasible. The results of Heinkel model are consistent with Ross`s model as high leverage is a signal from high company value.

The signalling model is logical and simple. Unfortunately, the observed capital structure patterns provide little proof for the theory. A case in point, Markopoulou and

Papadopoulos (2009, 228-229) study found virtually no support for signalling theory when assessing the market reactions to security issues - the data was gathered from Greek stock exchange. Usually firms with high leverage are less profitable, whereas signalling theory would imply that an opposite pattern should occur.[38] The model also suggests that firms in industries that are apt to face more severe information asymmetries[39] have higher leverage. Again, exactly the opposite pattern is observed and concluded widely in empirical studies. However, signalling theory is able to explain some market responses to different types of security issues. (Megginson 1997, 342-343)

2.5.3 Market timing theory

Often market-timing theory is seen as a theorem that is effectively able to challenge the mainstream theories of trade-off and pecking order. The fundamental idea is simple. Capital structure is a consequence of managers trying to time equity markets by issuing shares at high market prices and repurchasing shares or issue debt at low market prices. Thus, in the market-timing approach, managers seek to utilize the market fluctuations. If market conditions are `normal`[40], firms follow the typical pecking order in finance, in which equity is issued as a last resort. (Huang & Ritter 2004, 3; Mahajan & Tartaroglu 2008, 754-755)

Huang and Ritter (2004, 3) explain further that the key difference between the pecking order theory and the market timing is that the former relies on semi-strong market efficiencies. Market timing hypotheses make no such a prediction. Because of various irrational or rational reasons, for example, external equity may not be more expensive than debt. This gives managers an open window to take an advantage of temporary overvaluations of securities.

The well-respected empirical study of Baker and Wurgley (2002, 28-29) argue that firm`s capital structure is mostly influenced by the historical securities pricing. Companies with low leverage tend to be those that raise funds when their valuations were high. Conversely, the valuations of high-leverage companies had been low. Thus, Baker and Wurgley (2002) study supports the market-timing hypothesis. The academics further reason that firm`s capital structure is a cumulative result of equity timing and there is no optimal capital structure. Regarding other empirical studies, Bayless and

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[38] However, note that some signalling models propose that high-value firms have low debt levels (see for example Brick, Frierman & Kim 1998)

[39] High degree of growth opportunities and intangible assets

[40] Huang and Ritter (2004, 3) claim that this is a special case in market timing approach

Diltz (1994, 88) examined public security offerings over 1974 – 1983. The results showed that firms aimed to minimize their transaction costs and time security issues in accordance with favourable market conditions. This finding supports the implications of the modern market timing theory.

The interaction between market conditions and financial policy has been widely acknowledged and concluded. Much the scientific discussion has instead concerned, how long lasting the impact is. In this field, the results are quite fluctuating. For example, Hovakimian (2006, 242) observed with data collected over 1983 - 2002 that the impact of equity market timing on capital structure is relatively short-term. In contrast, Huang and Ritter (2004, 29) found a long-lasting effect with their study concerning US publicly listed firms.

2.5.4 Imperceptible components in financing

The comprehensive insight[41] provided in the chapters earlier indicates that corporate financing is a complex concept. We can somewhat clearly see the path from those early hypotheses of MM theorem to modern theories of financing. Yet, as we move on towards deeper knowledge in capital structures, we can realize that there are several aspects that even current financial theories are not able to explain. As stated earlier in this paper, there are many empirical studies that have failed to find comprehensive support for mainstream theories in financing.

According to Barberis and Thaler (2003, 1053) traditional paradigms in corporate finance are based on the belief of rationality. The rationality is an obvious factor that should be questioned and the academics conclude that at least some phenomenon in financing are better explained if the irrationality of agents is acknowledged. Ritter (2003, 430-432) explains that in finance there are several cognitive reasons that lead to irrational behaviour and thus to unfavourable choices. For example, 1) decision-makers rely on `rules of thumb` and short-term experiences 2) are too overconfident and conservative and 3) are apt to separate decisions instead of combining them.

Psychological patterns always relate to individual human characteristics, which indicates that it is difficult to establish any general rules that would contribute the traditional theories in financing – optimal capital structure seems to be a second-hand

[41] Note that there are other theories in capital structure literature that were not addressed in the previous chapters. For example, a growing strand of financial literature considers corporate finance to be strongly influenced by corporate strategy and product characteristics. A good introduction to this topic is provided for example in Harris and Raviv (1991, 315-319) study.

issue when considering irrational behaviour. As Cronqvist, Makhija and Yonker (2012, 20) explain, corporate capital structure itself is a concept of personal preference. Thus, the optimal capital structure is rather a subjective ideal.

The theoretical framework presented above is called `behavioural finance`. This point of view used to belong to the ignored body of literature, but is steadily evolving into a mainstream approach in finance. (Ritter 2003, 437)

Empirical studies that have examined mainly qualitative data instead of quantitative data interestingly provide support for the arguments earlier. For example, Vasiliou and Daskalakis (2009, 29-30) observed several predominant managerial beliefs that are inconsistent with the neoclassical financing theories. Additionally, the main objective for managers acquiring funding for investments appeared to be to maintain the long-term viability. It is difficult to see that this is an important component in traditional financing theories. Thus, according to the academics, financial policies in Greece are better explained by behavioural finance.

The work of Ramos, da Silva, Saraiva and Lacerda (2008, 6-9) partly point to the same direction. The academics examined the views of CFOs[42] on long-term financial decision-making and how these comport with the capital structure theories. The academics concluded that the primary criterion for CFOs to acquire finance is to follow specific hierarchy of funds and to attain the target capital structure. However, nearly 30% of the managers applied some other criterion. Table 2 illustrates the criterion for issuing debt and common stocks in Ramos et al. (2008, 7-8) study.

Table 2. Evaluation of the factors in issuing debt and common stocks

Reasons for issuing debt	Reasons for issuing stocks
The level of interest rate	Maintaining target leverage
The volatility of earnings and cash flow	Financial deficit
Maintaining financial independence	Issuing shares is least risky
Pledge collateral	Stocks is cheapest source of funds
Ensuring effective managerial working	Issuing stocks signals good prospects
Credit ratings	Firm and investor taxation
Transaction costs of debt	Financing constraints
Financial flexibility	EPS dilution
Interest deductibility	Employee incentive plans
Competitors` leverage	Competitors` leverage

[42] CFO or chief financial officer is responsible for a company`s financial function

From Table 2, we can observe that the primary criterion for issuing debt or equity is mainly financial. Yet, there are also factors that are hardly a component of traditional financing theories – for example the financial flexibility and managerial effectiveness objectives. These results provide practical evidence that there are also behavioural aspects in capital structure choices.

Bearing in mind the knowledge provided in this chapter, we could conclude that financing theories are never able to fully explain the phenomena in financing. However, this does not mean that the theories would be utterly ineffectual; rather, each possess an important component in explaining the financing phenomena.

3 R&D ACTIVITY AND GROWTH

3.1 Strategic and financial excellence of R&D

Many studies recognise the importance of R&D for firm`s competitive advantages (see for example O`Regan, Sims & Ghobadian 2008, 377). Competitive advantages exist when a company is able to offer products and services that customers perceive as superior compared to the other alternatives available in the markets. Perhaps the most comprehensive work in this field is made by Porter (1985), who defines the main strategies that companies should adopt in order to create the advantages. The strategies include product differentiation and cost leadership strategy with either focusing on narrow market segments or markets in general.[43] A firm employing the product differentiation strategy aims to provide products that are different or have different features compared to its competitors` products. In contrast, a company who is adopting the cost leadership strategy tries to be the lowest-cost provider in the market. (Porter 1985, 11-16)

R&D activities have an essential role especially among companies that employ product differentiation strategy. Introduction of new products and technologies is the main output of this strategic approach. The lead innovators can charge high prices from its customers. In contrast, cost leadership strategy aims to lower costs, such as product R&D expenses. Yet, some studies claim that R&D is also important for cost effective companies. These firms emphasise process R&D rather than product R&D. (Miller 1986, 238-239) Also patents, which are one of the main outputs of innovative activities, help companies to create costs benefits compared to the other firms in the same product segment (Shapiro 2005, 189-221).

The strategic context in R&D has become recently even more important. It is a mainstream view that competition has become increasingly intense in the globalized world. Markets are more fragmented and product life cycles have shortened. In this situation even the smallest advantages in products and services can create an important competitive advantage that ultimately results in survival of products. Companies have to manage their limited resources effectively in order to achieve the market acceptance. (Holtzman 2011, 127) Miller and Cote (2008, 8) point out that firms need continuously to invest in R&D to stay in the competitive race.

The competitive advantages and strategies in R&D framework were empirically analyzed for example in Liao and Cheung (2002, 145-147, 153) study. The academics

[43] Note that there are also other models for strategies that are said to create competitive advantages

tested a sample of high-tech Japanese companies. Specifically the academics addressed the questions, how the companies with different strategic approaches employ R&D? Competitive strategies were classified into value adding strategies[44], cost leadership and differentiation. Additionally, companies focus on these entities based on narrow segmentation or generalization. The results indicate that product differentiation and high added value are the primary strategies that are contributed by R&D. It appears that the R&D firms focus on general markets rather than on narrow segments.

Holtzman (2008, 1037-1038) explains that R&D properly used is a pivotal tool for firms to create sustainable growth – as oppose to firm acquisitions and process improvements that are arguably hard to be sustained. R&D is an important strategic growth tool for firms employing particular market strategies – for example product differentiation, fast time-to-market and disruptive innovation tactics.

Overall based on the scientific literature, there are highly consistent views that R&D and strategic framework are – or should be – interconnected. For example, it is essential to link R&D to strategic planning. (Berg, Leinonen, Leivo & Pihlajamaa 2002, 35)

The positive impact of R&D can be seen in operational level. Often addressed benefit is the `knowledge spillovers` generated by R&D activities. An important output of R&D projects is, for example, technological competences. At least in theory, firm personnel possess this knowledge and are effectively able to exchange it with each other. Thus, there is a multiplicative effect in business level. (Fung 2006, 113) In addition to knowledge increase and growth, many studies claim that R&D has a positive impact, for example, on productivity, employment and customer relations (Belcher, Hassard & Procter 1996, 141; Morbey & Reithner 1990, 13; Brouwer, Kleinknecht & Riejnen 1993, 155-159).

The importance of R&D is examined financially in numerous of studies. Sougiannis (1994, 65) presents a flattering argument based on the empirical data that one dollar invested in R&D results in two-dollar profit increase and over seven years in five-dollar increase in market value. Johnson and Pazderka (1993, 21-22) claim that R&D intensity is associated to high market values in Canadian companies – thus, support for undervaluation could not be found. O´Regan et al. (2008, 395-397) reached similar results by looking at a sample of SME firms. R&D has a positive impact on innovation that leads to financial success. This relationship increases with R&D intensity. Generally, in their sample financially well performing companies are highly innovative and growth orientated. Finally, the work of Morbey and Reithner (1990, 13) indicates that R&D enhances both growth in sales and productivity regardless of firm size.

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[44] In high-value strategy, a firm aims to increase customer value by providing products with multiple commercial and technological possibilities

The praise of R&D is comprehensive and thorough.[45] R&D seems to have a positive impact on various critical business factors – such as growth, productivity, customer relations etc. However, it should be understood that the R&D derived success does not come without a challenge. Managing technologically and commercially challenging R&D is a difficult task for companies. This phenomenon is partly addressed in the next chapter through financial assessment.

3.2 R&D – financial approach

Academic literature approaches R&D activity from various points of views. R&D is for example discussed under project -, process - and investment framework. In this study, the adopted approach does not classify R&D separately into any of these per se. Rather, R&D is examined comprehensively through different point of views that brings up the financial aspects of R&D the most purposefully.

There are several characteristics associated with R&D activity. In addition to the strategic importance presented earlier, many studies also claim that R&D is risky, costly and lengthy intangible investment. These factors are all somewhat interconnected (Doctor, Newton & Pearson 2001, 79).

The risks in R&D activity are associated with `uncertainty` and this applies throughout the R&D process. The first component of uncertainty is technical – the risks that products, processes or devices developed simply do not meet the predefined standards. Secondly, there is strong commercial uncertainty. When the R&D output is finalised, it is uncertain whether it is feasible to be commercialised. Finally, the uncertainty is also economic. There are risks that after the commercialization, economic success does not increase the company value as expected (Baker 1975, 105-111). Empirical evidence shows that alone with commercialized products the success rates are very low (Crawford 1979, 9). Thus, an important concept is to effectively manage the risks associated with innovative activities in business.

In order to explain the first of two risk categories mentioned above, Keizer, Vos and Halman (2005, 303) introduced an in-depth insight into the types of risks in innovation. The data was gathered by interviewing researcher in the case firms. The results are presented in Table 3.

[45] Not only in corporate framework

Table 3. Risk categories in innovation

Risk categories	Number of identified risks	Share (%)
Organization and project management risks	22	15
Commercial viability risks	17	12
Consumer acceptance and marketing risks	16	11
Product family and brand positioning risks	13	9
Manufacturing technology risks	12	8
Product technology risks	11	8
Supply chain and sourcing risks	11	8
Trade customer risks	10	7
Competitor risks	9	6
Public acceptance risks	8	6
Intellectual property risks	7	5
Screening and appraisal risks	6	4
Total number of perceived innovation risks	142	100

Table 3 clearly indicates that the risks in innovation and R&D are related to many types and concepts of uncertainty. The most frequently perceived risks relate to the technological and commercial uncertainties. In addition, internal management related risks are often perceived.

The uncertainty is associated also to the evaluation and project selection in R&D. Many studies indicate that managers lack practical and rational tools to evaluate R&D projects. Theoretically argued, traditional valuation methods – such as discounted cash flow methods – are poorly aligned with R&D that is difficult to quantify.[46] Although, there are several recently developed tools to evaluate R&D investment opportunities. (Petrick & Echols 2004; Azzone et al. 1993, 44)

Is there any financial evidence from the riskiness of R&D? This question was addressed for example by Wedig (1990, 299, 303). The study examined data from the US manufacturing sector by employing Capital Asset Pricing Model approach. The results indicate that the price of equity is significantly higher for small R&D intensive companies compared to non R&D firms. The firms may pay up to 9% premium from their `R&D equity`. Yet, among larger R&D companies the premium was almost non-existent.

[46] This is primarily due to the intangible nature of R&D activities

In addition, Ho, Xu and Yap (2004, 402-414) investigated the connection between R&D intensity and risk of common stock. The academics examined US data with Monte-Carlo simulations. The results showed that especially in the manufacturing sector R&D intensive firm have greater systematic risk in the stock markets. This is caused by intrinsic business risk, which is derived primarily from industrial macro factors and business characteristics, and operating risk.

High uncertainty is often associated with the life cycle of R&D activities. In fact, innovative projects are often long-term by their nature. Managing a long-term project itself is uncertain; longer the project lasts the riskier the outcomes are. Delays in time are often seen as a signal that the project might be failing (Sanchez & Perez 2004, 11-14). Mansfield (1969, 66) reports that primarily R&D projects are expected to be finished in five years. Powell, Koput and Smith-Doerr (1996, 123) explain that, for example, in biotechnological industry the project timelines may be up to 10 years. Many studies indicate that R&D projects are usually additionally very expensive[47].

R&D is often described as an intangible investment. This approach explains that the primary inputs and outputs in R&D are non-physical by their nature. Vuolle, Lönnqvist and van den Meer (2009, 27-29) categorise the inputs and outputs of R&D projects into human capital, structural capital and relational capital. Regarding inputs, human capital is, for example, human experiences, skills and ideas used in R&D process. Structural capital relates to the organizational commitment to R&D. How systems, tools and organizational culture is connected to R&D? Finally, relational capital concerns the inputs contributed by stakeholders, such as customers. Processing these inputs results in improved R&D process skills, increased knowledge, patents, new products, better customer relationship and organizational image. All of these outputs can be categorized under the same capital concepts as inputs. Pike, Roos and Marr (2005, 122) applied the same categorization in their case study and found some support that this `triangle` exists.

Option-pricing theory sheds also some light over the intangible aspects of R&D. The traditional investment evaluation methods do not recognise investment flexibilities. Instead, investments are carried out as planned regardless of what happens in future. However, investments can be, for example, expanded, abandoned or modified. Based on the scientific literature, R&D projects are apt to contain many of these features. R&D process includes multiple stages, after which management decides whether the investment enters into the next stage[48]. (Newton, Paxson & Widdicks 2004, 113)

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[47] There are surprisingly very few studies that address the question, how time-consuming and expensive R&D investments really are? However, these concepts are taken as given in the academic world.

[48] The stages include 1) research, 2) development and 3) commercialization

There are also the strategic aspects in option pricing theory. Investments may lead to follow-up investments. These follow-up investments can be understood as growth options. R&D projects are said to include high degree of opportunities that may enable companies to enter into completely new markets. (Perlitz, Peske & Schrank 1999, 264) Reuer and Tong (2007, 864) observed that firms investing in R&D have a positive impact on the value of growth options.

To sum up the implications of this chapter, R&D is a strategic intangible investment, whose success is uncertain and accrued over long-time period. This implies that R&D is a challenging concept from financial point of view.

3.3 R&D related growth construction

As this chapter previously has suggested, R&D has a positive effect on firms` growth. In order to develop the propositions in this study, the growth concept associated with R&D firms should be analysed more thoroughly. How R&D intensive firms typically grow? What business components are growing?

There are numerous theoretical models explaining business growth. Interestingly, growing strand of literature argues that R&D and innovations in business are an important determinant of growth. (Lehtoranta 2010, 17-27)

Empirical studies claim that growth is a particularly significant econometric outcome of R&D. By comparing innovative and non-innovative firms, the growth appears to be strongly and homogenously associated with R&D activity among innovative companies. Regarding non-innovators, the growth seems to be more sensitive to other business components, such as macroeconomic developments. (Geroski & Machin 1992, 88) O´Regan et al. (2008, 396) observed that innovation, growth and financial performance are strongly interconnected. However, R&D is the foundation for all of these components. Interestingly, firms` growth appears to be more significant in traditional sectors. Del Monte and Papagni (2003, 1012) argue that this is due to the high competitiveness that firms in traditional sectors enjoy. Thus, arguably business environment also plays a pivotal role in growth of R&D firms.

Although, it is somewhat inconclusive, whether R&D firms are growth-orientated or not, growth rates of R&D firms are usually higher compared to non-R&D firms (Freel 2000, 206-208). For example, Del Monte and Papagni (2003, 1007) observed that R&D firms` sales growth rates are almost ten per cent points higher than the rates of non-innovators – it seems that R&D intensity correlates with growth regardless of firm size. The results are based on large Italian data over 1992 – 1997. The situation is similar in growth of employment, yet it is a bit less significant. This positive relationship between growth and R&D is observed is several empirical studies and the sales growth seems to

be more significant than growth of employment.[49] Also Scherer (1965, 290-297) study suggests that business growth is a meaningful indicator of post-innovative performance.

Although the growth according to many empirical studies is rapid, the impact of innovation on sales growth seems to be short-lived and generated almost instantly after the introduction of innovation. This indicates that R&D firm aiming to achieve constant growth should constantly commercialise innovations. (Geroski & Machin 1992, 81)

By examining the relationship as a simple duality, R&D is a catalyst for growth. Naturally the relationship between R&D and growth is not so simple. By combining the models of Martinez-Ros and Tribo (2006, 194) and O`Regan et al. (2008, 396), we can illustrate the network between R&D and growth as follows, in Figure 5:

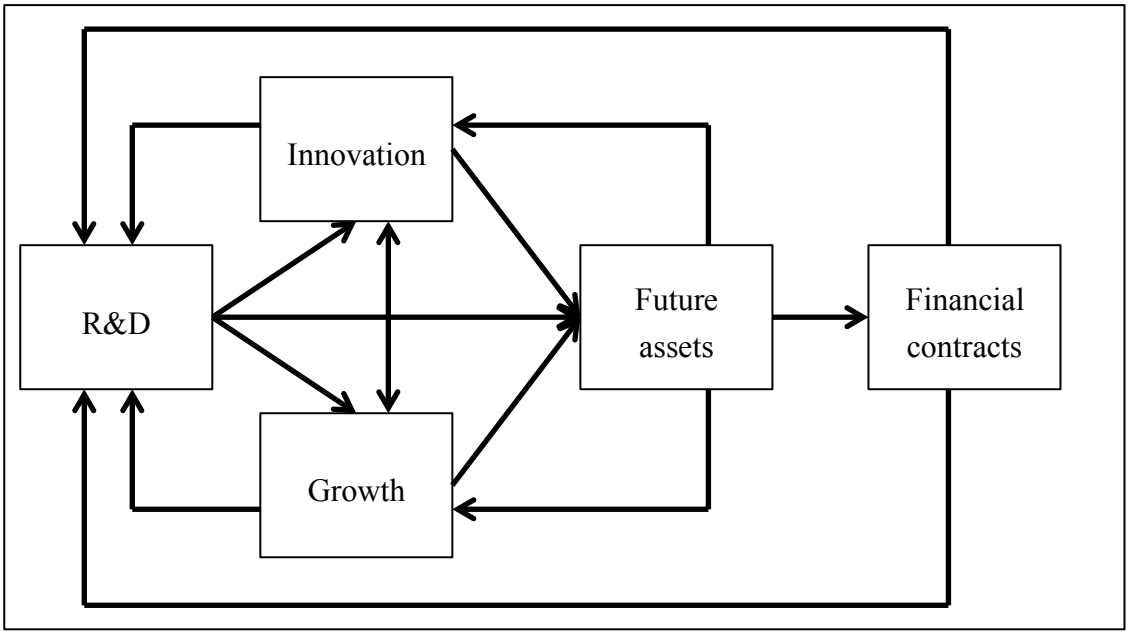

Figure 5. The growth framework of R&D intensive company

R&D spending appears to be a foundation for a process the leads to innovation and growth and ultimately to company value. Yet, the process is also reversal, since these components influence R&D spending. A particularly meaningful observation for this study is that growth has an effect on future assets or value of R&D intensive companies, which for its part effects on the financial contracting. Thus, the present study should focus on the assessment of how growth in fact effects on the assets. The concept of asset should be understood in a broad extent.

[49] Del Monte and Papagni (2003, 105) present a thorough empirical literature review on innovations` impact on firms` growth

4 CAPITAL STRUCTURE OF AN R&D INTENSIVE FIRM

4.1 Research in R&D finance

The scientific discussion concerning the interplay of finance and R&D has fundamentally culminated in two different entities. Although, these entities are also somewhat interconnected. Firstly, there is the difficultness of acquiring funds for R&D activities.[50] The roots of this hypothesis go back to the work of Nelson (1959) and Arrow (1962), who contributed the ground-braking hypotheses of Schumpeter (1942). The lack of funding is especially harmful for R&D intensive companies as it hampers growth that is contributed by strategically important R&D activity. Secondly, R&D intensive companies have served as an important testing ground to examine the modern financing theories in practice – the trade-off theory together with the agency costs and more recently the pecking order theory.

The first entity relates to the financing constraints faced by R&D intensive companies. Large proportion of the studies has examined the existence and importance of this phenomenon. Additionally, an important approach has been to investigate how to overcome these challenges – specifically, what financing instrument and solutions are suitable. Also, a mainstream approach has been to examine the availability of different financing instruments both in micro- and macroeconomic level and what is their impact on R&D activity. The latter concerns the political importance of R&D activity. As R&D has positive contributions to the national economy, it is in the policymakers` interests to establish well-functioning financial markets to meet the demands set by R&D intensive companies.

The second entity alludes that there is something very unique in R&D associated with financial decision-making. Modern financing theories derive from the logical assumption that there are imperfect markets. Many studies in R&D finance have been motivated by the suggestions that these imperfections are apt to be very severe among R&D companies.[51] This is caused by the nature of R&D activity as was suggested for example by Hyytinen and Pajarinen (2005, 131) in their study concerning innovative ICT firms: “The financing of the ICT firms is not special per se. Rather, it is the R&D of an ICT firm that makes it special…” The present study applies the fundamental logic of this observation.

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[50] Hall (2002) has provided a good chronological review in this approach

[51] The reasons for this are analysed in Chapter 4.2

Thus, empirical studies have been the backbone of R&D finance studies for decades. Primarily, studies have looked at large databases that are accessible through various public sources and analysed the data statistically. Studies have varied for example by gathering data from different industries, geographical locations[52], company size classes and companies with distinctive managerial characteristics. Additionally, comprehensive information exists about the unique types of financial liabilities in R&D finance. Thus, there is a good understanding about the fundamental nature of capital structure of R&D intensive companies. However, the modern financing theories have not been able to fully explain what causes the typical composition of capital structure, which emphasises the importance of studying R&D finance.

Interestingly, growth`s impact on financing decisions has remained somewhat unexplored[53]. This is surprising since R&D and growth are interconnected. R&D is an important catalyst for growth, which is widely recognized throughout the scientific community, business and policymakers. Many studies in R&D finance have shed some light over the impact. Studies have categorized the research sample according to size and concluded that the financing is significantly different among size classes. However, we must understand that this approach does not make any difference whether companies have grown or not. In other words, the studies in fact have not measured the growth`s impact on R&D finance, but plainly how size impacts on financing. As this study applies the modern financing theories in examining the financial decision-making related to R&D, it is pivotal to determine how the hypotheses change when a company growths. This is a different approach compared to the traditional studies. The approach is also longitudinal – the focus is on change, rather than static situation.

In the next chapter the study is going to provide descriptive information on the capital structure choices in R&D financing. The approach to this is comprehensive indicating that the analysis goes beyond the equity vs. debt point of view. For example, the institutional framework in financing decisions is analysed.

4.2 Financing decision – descriptive approach

As claimed earlier, the financial behaviour of R&D firms differs significantly from the firms whose R&D activities are not intensive. Next, the present study analyses the

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[52] Although, majority of empirical studies have been conducted by looking at US samples. Examining these issues also in other countries is advisable

[53] To the researchers knowledge, no studies have yet been devoted to examine growth`s impact on the financial decision making in R&D firms.

financing decision making of an R&D firm and specifically assesses the characteristics of the use of different financing sources.

Based on the theoretical literature, there are highly consistent views that internal cash flow is the primary source of finance of research and development activities. This is especially the case at the SME level as was argued for example by Hall (2002, 48) in theoretical study. Regarding empirical studies, this issue is addressed for instance in Bloch`s (2005, 221) paper concerning Danish publicly traded firms. He argues that availability of internal finance enhances R&D. Himmelberg and Petersen (1994. 49), Ughetto (2008, 992) and Czarnitzki and Hottenrott (2011, 80) came to the same conclusion in their statistical empirical studies. These studies covered company data from the USA, Italy and Germany and from high-tech or manufacturing sector. In contrast, unavailability of internal funds hampers R&D activities decisively (Savignac 2006, 20; Mohnen, Palm, van der Loeff & Tiwari 2008, 212). We can also mention the work of Rapoport (1990, 67). His case study consisted of 13 small firms in the medical devices industry. Firms had used altogether 38 financial sources to finance their innovation. Internal funds together with owners` personal funds and funding from other non-predefined organizations were the most frequently used financing sources.

Regarding studies examining the financing of mainly larger R&D companies, Hall (1992, 20) found a highly significant positive relationship between liquidity and R&D investment in the US manufacturing sector. Carpenter and Petersen (2002, 67, 69) observed that established R&D firms use primarily retained earnings and exhibit low dividend payout ratios. In Harhoff (1998, 421) study the reported effect was weak but still significant.

Interestingly, Guerard, Bean and Andrews (1987, 1424-1425) found with their sample of US manufacturing companies that an increase in R&D investments decreases dividends that are internally generated funds. Thus, R&D and dividends are from a financial point of view substitutes and the primary financial source of R&D is internally generated funds.

Yet, there are some studies that have not found the excessive use of internal finance among R&D firms. A case in point, Blass and Yosha (2003, 446) looked at a sample of mature Israeli and US publicly listed firms. They found that Israeli firms did not rely more on internally generated funds than non-R&D firms. Instead companies preferred external financing. These cases brought up the question as to whether this was a result of the external equity boom in the 1990s. In order to motivate their study concerning smaller companies, Himmelberg and Petersen (1994, 38) stated that most of the previous studies had been conducted by examining a sample of large companies. Significant connection between R&D and internal finance often had not been found in these papers or at least the results had been inconclusive.

Thus, the commitment to internal finance or cash flow seems to be in some cases related to company size. Whilst small R&D companies rely primarily on internal finance – and this is widely examined and concluded – the situation can be quite different among larger R&D companies. Some studies provide strong arguments that large R&D companies also rely on internal finance, while other studies cannot find such a connection. However, Hall (2002, 48) argues that internally generated cash flow has a pivotal role also in large R&D companies` financing. As the company size differs, the arguments to use internal finance also vary. Cincera and Ravet (2010, 460) study supports this conclusion as they observed that internal finance is important for large firms in UK and US, but only UK firms suffer from liquidity constraints.

Newman (2000, 94 - 95) directed the scientific discussion toward industry`s effect on internal finance in R&D. By looking at a sample consisting of companies in the US manufacturing industry, Newman (2000) suggested that generally internal finance fosters R&D. Yet, in some manufacturing sectors the relationship was opposite, thus indicating that the operating environment also plays a role in R&D financing.

Despite the fact that there are some results that differ from rather generally accepted phenomena between internal finance and R&D, it can be argued that internally generated funds are regardless of the company size and industrial factors, a pivotal source of funds for an R&D intensive company – this is recognized throughout this study. However, it is justified to presume that internal cash flow is a more decisive factor for a smaller R&D company than it is for a larger company.

The choice between debt and equity has been addressed in many scientific papers concerning R&D finance. Scientific literature presents very interesting and sometimes rather adversarial results. In this context, it is reasonable to examine these sources by categorizing them under the external financing frame but also as individuals. External financing naturally is often seen in its entirety as a substitute for internal financing (see Bougheas 2004). Additionally, debt and equity are substitutes rather than complements in the field of innovation financing (see for example Audretsch & Lehmann 2004, 351).

Financing theories and empirical evidence suggest that debt financing is an unsuitable external alternative to finance R&D (see for example Belin, Cavaco & Guille 2009, 2,16). In contrast, equity is often argued to have many advantages for an R&D firm (Wang & Thornhill 2010, 1150; Müller & Zimmermann 2009, 317). The reasons for this are examined in the next chapter, but as a summary there are some forces that conflict with the interests of the outsiders and insiders. These conflicts sometimes make further whole external financing an unsuitable source to finance R&D.

Debt financing`s impact on R&D has been examined in numerous of studies. Most of the studies observe a negative impact of debt on R&D. Firms with high leverage usually are not and have never been R&D intensive – R&D firms are consistently characterized with low leverage and this applies also to the industries that are generally seen as R&D

intensive. (Martinez-Ros & Tribo 2006, 199; Hall 1992, 20; Chiao 2002, 116) R&D intensive companies also have their bank loan applications rejected more often than non-R&D intensive companies (Freel 1999, 717). Opler and Titman (1994, 1037) observed that high leverage has a negative impact on corporate performance – loss of sales and market share – mainly among R&D intensive companies.

Regarding equity financing, Müller and Zimmermann (2009, 317) conducted a study on German SME firms. They observed that equity has a positive influence on R&D. According to Acs and Isberg (1991, 324) large R&D firms prefer equity from external sources. Similar conclusions were reached by Blass and Yosha (2003, 439 - 440) with a sample of US firms and Chen, Hsu and Huang (2010, 329) with Taiwanese SMEs.

From Finnish studies we can bring up the empirical research of Hyytinen and Pajarinen (2005, 131). With their sample concerning small ICT (information and communication technology) companies, the low leverage phenomenon was confirmed. The academics argue that R&D possibly makes the company equity-dependant.

The scientific literature examining the relationship between debt and equity in an R&D financing context is comprehensive and thorough. Casson et al. (2008, 220) applied the control rights approach to their empirical study. They found that R&D firms have a specific financial policy. As R&D intensity increases the probability of equity funding rises monotonically and conversely the probability of issuing debt declines. Carpenter and Petersen (2002, 64 - 68) prepared an interesting study on publicly traded high-tech firms` financing decision during initial public offerings (IPO) and in the mature phase. Debt financing is not obtained in extensive level. The IPOs are usually major sized and equity related. However, the use of equity drops dramatically after IPO and use of internal finance increases significantly.

Many studies suggest that although generally debt is unsuitable in R&D financing, those firms that do rely on debt use a particular type. Although, based on the literature, it is difficult to establish any consistency. Seru (2007, 63-64) claims that R&D firms prefer arm`s length financing in debt. That is, financing type, in which funds are issued from private investors. Relational debt funding institutions i.e. banks are observed to provide only little financial support to growing R&D firms (Audretsch & Lehmann 2004, 355). This was also confirmed by Rapoport (1990, 67), when only one firm out of 13 had used bank loans in financing its` R&D investments.

Yet, Bougheas (2004, 15) claims that Japanese R&D companies strongly prefer bank finance. We can also mention the study of Benfratello, Schiantarelli and Sembenelli (2008, 215). They suggest that positive developments in banking sector enhance R&D in Italy. Bravo-Biosca (2007, 124) found similar results with US data, although patent quality did not improve, as was the impact of development in equity markets. Wang and Thornhill (2010, 1158) extended the framework of debt by categorizing debt to different types when studying the capital structure of R&D firms. Based on the empirical data,

the researchers concluded that when R&D intensity increases there is an U-shaped relationship with convertible debt and an inverted U-shaped relationship with relational debt. The hypothesis of a negative relationship with transactional debt was not confirmed. According to Bah and Dumontier (2001, 690) debt maturity is usually long, whereas Freel (1999, 718) found that R&D firms usually prefer short-term debt.

The type of equity has also been under examination in scientific literature, although not as often as in debt. Mainly, the discussion has taken place around common equity, preferred stocks and venture capital[54]. According to Wang and Thornhill (2010, 1152 - 1156), R&D is positively influenced by common stock – the relationship is monotonic and significant. Further, in preferred stock the relationship is U-shaped indicating that R&D intensive companies use frequently preferred stock financing. In Rapoport`s (1990, 67) case study one of the main findings was that the company owner`s personal funds in the form of equity played a crucial role in financing innovation. Additionally, R&D firms also prefer arm`s length equity financing (Seru 2007, 63 - 64).

Corporate venture capital (CVC) is often considered as a funding source that is aimed for innovative and fast-growing SME companies (Hall 2002, 45). Yet, it is still somewhat unclear, what is the ultimate role of venture capital. Caselli, Gatti and Perrini (2009, 106) employed a statistical analysis to find that in the case of publicly traded Italian firms venture capitalists did not foster innovation. Rather, the emphasis was in growth[55]. Audretsch and Lehmann (2004, 355) reported the same result with their German sample. Still, this finding fits well in the framework of this study[56].

Again, as was the case in internal finance, the composition and the relationship of debt and equity does not always hold in literature. The differences may come with size or industry. For example, Acs and Isberg (1991, 324) observed that while larger US R&D firms rely on equity financing, smaller firms acquire their funds more likely in debt. We can again bring up the implications of Bougheas (2004, 15) study that suggests that Japanese firms have a strong preference for bank financing among external sources. Chiao (2002, 113 – 114) observed that R&D firms rely more on debt in the US non-science manufacturing sector[57]. Kang (2004, 116) has conducted a comprehensive study concerning debt financing`s strategic impacts on R&D. By looking at a sample of Korean publicly traded manufacturing firms, Kang (2004) observed that companies with a high debt/asset -ratio exhibit a high level of R&D investments.

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[54] Venture capital could theoretically be something else than equity by its nature

[55] Still, corporate venture capital is an important source for R&D companies

[56] The role and characteristics of CVC will not be analysed more thoroughly in this study

[57] In the science sector, the leverage was significantly low indicating that as science sector is more R&D intensive, R&D may have bigger impact

Financing sources are also committed to R&D firm`s managerial characteristics and strategy. Low leverage is related to the companies that are managed by experienced and older people. More educated managers with high stock ownership usually prefer more debt financing. (Chen et al. 2010, 329-330). Aggressive R&D strategy is related to the significant use of debt financing (Newman 2000, 95).

From an external finance entity, the role of public subsidies and governmental grants[58] should also be briefly mentioned. Theoretically argued, public funding – like CVC – is suitable especially for small start-up firms. The importance was concluded for example by Czarnitzki (2006, 351) with a German sample and by Freel (1999, 718) with UK firms. Public subsidies are important especially for Finnish R&D intensive companies (Czarnitzki, Ebersberger & Fier 2007, 1362 - 1364). Yet, the role of public funding and the extent of which R&D firms use these sources requires further study[59].

Previously this study has mainly analysed the financing at the firm level. There are only a few studies that have explored the connection of R&D and finance at the investment or process level. Rapoport (1990) is one of the few exceptions. The work of Krusinkas and Vasiliauskaite (2005, 20) is also worth mentioning. The researchers summed up a sequential model based on empirical and theoretical European studies. It must be understood that the funding mix of investment or process does not necessarily reflect the capital structure of an R&D firm per se. However, it might reveal interesting implications about the characteristics of it. The model is illustrated in Figure 6. It presents an institutional framework for external financing of innovation process.

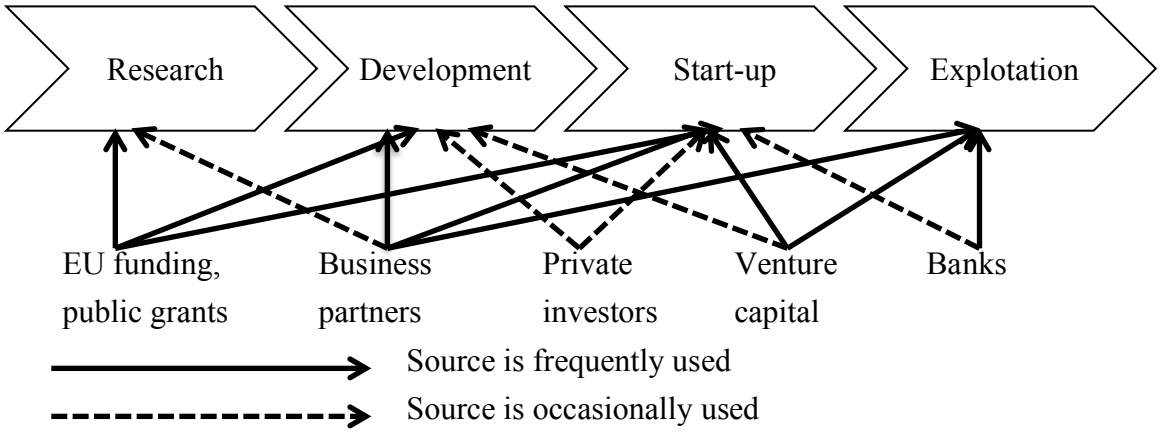

Figure 6. Stage-specific funding of technological innovation

[58] Public funding is not necessarily a component in capital structure – rather it is an institutional entity in financing

[59] This was addressed also by Hall (2002)

Based on the model, we can conclude some of the characteristics that are pointed out also earlier in this chapter. Banks provide only little support in innovation – mainly the exploitation stage receives funding from banks. Venture capital is an important source, but as presented earlier it is more directed to growth i.e. to start-up and exploitation. Research and development stages acquire funds from four sources out of five frequently or occasionally. According to the model, public funding and business partners are the most important for R&D from external sources.

When analysing the characteristics of R&D firms` financing decisions, we can conclude that there are many factors involved in R&D financing that go beyond the R&D function framework[60]. We have seen that in addition to company size and industrial environment, the results of the statistical analysis vary geographically and this goes for both internal and external financing[61]. However, this implies further examination of R&D and its relationship to these three entities.

We can sum up the main characteristics of this chapter as follows. In the next chapter, we will analyse the question, what is causing these results?

- Internally generated funds are the primary source of finance in R&D firms
- The preference of debt or equity is not consistent, but the majority of studies indicate that equity financing in all its types has many advantages over debt financing
- R&D activities are concerned with many special funding opportunities such as venture capital and government subsidies and these sources are reasonably often used in R&D financing[62]
- The decision-making in finance among R&D firms, vary at least geographically and with company size, management characteristics and industry

[60] Although, R&D function plays perhaps the most pivotal role in financing decisions of R&D firms

[61] Especially studies concerning Japanese companies have reached different conclusion compared to studies examining Anglo-Sax companies

[62] Note also the case of financial derivatives. They are not necessarily capital structure components. Still in general they comprise a pivotal entity in financial decision-making. Interestingly, Dolde (1995) study suggests that high degree of R&D is related to the substantial use of financial derivatives. R&D financing has also a pivotal commitment to organizational type (see for example Ayayi 2009, 103).

4.3 Determinants of the capital structure

Based on the capital structure theories presented in Chapter 2, we can bring up some explanations, why capital structures and financial patterns of R&D firms are as described previously. Also in R&D finance, the mainstream literature focuses on the trade off theory versus pecking order theory approach[63]. In this chapter, the capital structure patterns of R&D firms will be examined mainly in accordance with the trade trade-off theory and the pecking order theory. However other financing theories are also examined in order to present supportive knowledge on the research topic.

The trade-off theory is committed to explain corporate leverage – capital structure is a component of corporate value. As stated earlier, capital structure `optimality` is a second-hand concept in the pecking order approach. Corporate capital structure is a result of a firm following a specific order in acquiring finance. Thus, capital structure is derived from financial need, rather than value-maximization. However, both of the theories are able to explain the observed financial policies of R&D firms.

The trade-off theory does not recognise the fundamental difference between internal and external finance. The theory is based on the equity versus debt debate.[64] In contrast, the pecking order theory is able to provide some practical explanations, why internal finance is the most frequently used funding source to finance R&D activities. R&D firms` reliance on internal finance relates to two different elements. A difference should be made between financing constraints that prevents company from issuing external funding and companies preferring internal funding for different reasons.

Many studies suggest that there are strong information asymmetries between insiders and outsiders in R&D firms (Bah & Dumontier 2001, 675; Hall 2002, 38). The returns of R&D are skewed and highly uncertain. Managers lack proper tools to convey the R&D investment information to outside investors and also investors often lack competences to evaluate R&D. (Ughetto 2008, 911) This is a typical problem with investments whose primary inputs and outputs are intangible. Investors would prefer traditional real investments because of their specific nature (Bah & Dumontier 2001, 675). Because of these reasons, investors – especially debt-holders – are likely to overestimate the risks associated with innovative projects and demand high premium. In equity financing, investors may demand high ownership stakes, which reduces shareholder wealth. Information asymmetries are high for both equity and debt, but regarding capital costs, these are more valid in debt – because of the unique nature of

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[63] At least, the focus is on the elements that are addressed by the theories (see for example Bah & Dumontier 2001, 672-676)

[64] Equity comprising both internal and external finance

R&D. (Chen et al. 2010, 322) Lewis, Rogalski and Seward (2003, 158) claim that information asymmetries are severe among firms with high degree of growth options.

Information asymmetries are also the reason why R&D intensive firms prefer arm`s length financing. Investors providing relational finance must obtain significant information on the firm. Thus, it is pivotal for the investor to possess necessary skills to evaluate complex projects. Lacking these skills results in managers being discouraged to invest in innovative projects. In contrast, arm`s length financing offers managers more discretion to invest in innovative projects. (Seru 2007, 46)

An interviewee`s comment in Rapoport (1990, 68) study crystalizes the role of asymmetric information between innovative companies and external investors: "These guys (venture capitalists) will fund ten projects knowing that 9 will fail and the 1 big success will more than cover those losses. Their terms are based on this assumption. Why should I have to pay for the failure of 9 other firms?" This clearly suggests that investors have difficulties in understanding the `true value` and potential of R&D firms. Instead, investors evaluate R&D companies based on the averages and past experiences.

The signalling theory provides also explanations why R&D firms prefer internal financing. According to Bhattacharaya and Ritter (1983, 331-332) firms have very little incentives to issue external financing, as it requires a disclosure of strategically important R&D projects to external stakeholders. A company endangers its competitive advantage, since the knowledge could leak out to the competitors. The commitment to internal finance might be stronger for smaller firms that generally have fewer capabilities to protect their innovations compared to larger companies (Ughetto 2008, 912). Signalling approach implies that R&D firms prefer either internal finance of privately placed debt (Bah & Dumontier 2001, 675).

Based on the trade-off theory, low debt ratios indicate 1) the bankruptcy costs and financial distress associated to R&D activity are severe 2) tax-benefits are second-hand 3) agency costs of debt are severe and/or 4) managerial agency costs are not substantial. There is strong evidence that innovative firms face high bankruptcy costs. R&D is uncertain intangible investment. The main outputs are patents, improved knowledge and skills, which banks and other debt-holders are not able to use as collateral. Large strand of empirical studies claim that high bankruptcy costs are the most important reason for observed low leverage. (see for example Aghion et. al 2004, 278) Williamson (1988, 589) explains that when asset specificity is high, transaction costs of debt are also substantial because bondholders have to protect their investment by thorough oversight over the company. Specific assets imply high uncertainty on firm liquidation value, which increases bondholders` premium demand.

Titman and Wessels (1988, 3) explain that agency costs are particularly high for companies that have low levels of collateralised assets. Monitoring the capital outlays is very difficult. Arguably, the agency costs are high between shareholders and managers

and between shareholders and debt-holders in R&D intensive companies. Additionally, increasing debt does not necessarily lower the agency costs between managers and shareholders or at least it is second-hand. Shareholders and managers have strong incentives and ways to shift wealth from debt-holders. (Francis & Smith 1995, 385; Bah & Dumontier 2001, 673) Martinez-Ros and Tribo (2006, 194) explain that agency conflicts of debt primarily derive from the nature of asset creation in R&D. The academics explain that intangible assets are borne before the financial assets. The latter are created after the commercialization. Managers may undertake the option or not. Thus, there is a strong possibility for severe underinvestment problem, which was explained in Chapter 2. Debt-holders can anticipate the potential hazardous behaviour and demand for premium. Bah and Dumontier (2001, 673) claim that the asset substitution problems are also severe among R&D firms. R&D projects are very risky, which is apt to increase abilities to carry out wealth transfers from debt-holders to shareholders. The former have only little abilities to monitor the company. Because R&D intensive firms are apt to contain a lot of agency conflicts, the firms should prefer equity. If debt should be acquired, R&D firms would prefer short-term contracts.

The argumentation above implies that debt-holders are reluctant to provide funding for R&D intensive firms because of the uncertain nature and the asset uniqueness of R&D. However, arguments can also be made that the reluctance prevails also among the issuers. It is critical for innovative companies to constantly invest in R&D projects – high volatility in R&D spending can severely hamper firms` competitive advantages. A company issuing debt is `engaged` with rigid interest payments and repayments of debt. This is potentially harmful for a company that is adopting an aggressive investment and growth strategy[65]. Thus, high leverage potentially leads in severe underinvestment problem for R&D firms. Establishing high levels of financial slack is essential for innovative companies and equity capital ensures this. (O`Brien 2003, 418-420) This is an intriguing observation from trade-off theory`s point of view. It appears that debt is not able to lower the agency costs between managers and shareholders without causing a serious underinvestment problem.

The pecking order theory explains that debt funding is acquired before equity financing. Intuitively, it would seem that R&D intensive firms may well acquire funding from debt-holders before shareholders – this observation was made also in Casson et al. (2008, 220) study. An interesting question is, however, to what extent

[65] Aggressive R&D investment strategy indicates that managers and owners do not necessarily recognise the phenomenon of overinvestment problem – rather, overinvestment is a strategy. Hall (2002, 39) explains that managers might actually be more risk-averse than shareholders in R&D intensive companies.

companies raise debt before it is more feasible to issue equity. Bearing in mind that leverage is usually lower for R&D intensive firms compared to non-intensive firms, the debt-capitalization region is likely to be shorter. However, control rights approach provides evidence that firms are strongly committed to issue debt financing before equity. Firms that have high degree of intangible assets in place result in outside investors to demand high ownership stakes in order to satisfy their ex ante participation constraint. Thus, firms follow a hierarchy of funds as explained by the pecking order theory because managers want to retain the current control rights set. (Aghion et. al 2004, 279) However, Fulghieri, Carcia and Hackbarth (2012, 2-3) model that firms with high growth option volatility have incentives to raise equity before debt financing.

Because of the reasons explained earlier, it is easy to explain why R&D firms raise substantial amount of funds through special funding arrangements – such as venture capital, public subsidies and grants and funding organization arrangements. These securities have an important purpose of making external financing more accessible for innovative companies (Meuleman & De Maeseneire 2012, 589; Hall 2002, 45). For example, public subsidies are often connected to financing arrangements with debt.[66] Justifiably, Hyytinen and Pajarinen (2005, 131) bring up the question whether public subsidies should be in larger extent focused on enhancing the availability of equity financing, which appears to be more important security for R&D firms.

Why low leverage and preference of internal finance does not always hold? Market-timing theory might explain this empirical observation further. Some empirical studies have observed that positive supply shifts in securities have a significant effect on the usage of the respective security. For example, Martinsson (2010, 1223) found that positive developments in equity markets enhance R&D in European high-tech firms. Benfratello et al. (2008, 215) study suggests that banking developments in Italy have a similar effect. Blass and Yosha (2003, 446) reasoned that equity boom of 1990s was potentially the reason that Israeli firms did not rely more on internal financing. This provides some evidence that firms time their funding decisions based on the developments in the financial sectors and finance R&D with a security whose markets are perceived as the most optimal. Other way to explain this is that companies suffer from financing constraints. If the `access` to financial markets is gained, it is a second-hand question, whether funds are raised as debt or equity.

It might be that the balance in demand and supply has strong effect especially on the type of debt. As firms would prefer more transactional debt, the significant use of that would be associated to those countries and industries where financial markets are favouring issuers. However, in countries where financial institutions are developed

[66] For example, collateral for loan is provided by a public organization (finnvera.fi)

mainly around the traditional institutions such as banks, debt funding would be issued mainly as relational debt. There are some studies that support this argument. Bougheas (2004, 15) claims that Japanese R&D firms do not face strict external financing constraints, because of strong banking sector. Japanese banks have strong incentives and tools to monitor their funds. By extending the logic, Seru (2007, 63-64) study with US sample would imply that the financial markets are more developed around transactional financial markets.

R&D intensive firms are especially difficult from corporate finance`s point of view. Many empirical studies have examined R&D intensive companies based on financing theories and have failed to find any significant connection. For example, Tahvanainen (2003, 55) has conducted an interesting study on innovative biotech SMEs` capital structure. Study aimed to test the eight hypotheses that were derived from the trade-off theory and the pecking order theory. The results were highly ambiguous and thus the theories could explain the capital structures only partially. According to Newman (2000, 95) among R&D intensive companies, firm specific characteristics play a vital role in the capital structure – although the outcome is not necessarily universal. Same conclusion can also be found from Hyytinen and Pajarinen (2005, 131) study. The academics point out that R&D makes the capital structure to differ from other companies. This observation partially explains, why company size has a statistical impact on capital structure of R&D companies. Overall, the impact of R&D on a capital structure tends to be smaller in larger companies (Chen et. al 2010, 322-323).

4.4 Financing growth in R&D firm

There are relatively few studies that analyse growth`s impact on firm`s capital structure decisions. In brief, the first approach to this relationship emphasises the increased financial need and the second derives from the growth opportunities by focusing on information asymmetries, control rights and agency costs.

There is consistent empirical evidence that growth firms usually prefer equity financing or internal finance. Lang, Ofek and Stultz (1996, 27-28) showed that leverage is negatively correlated with growth. Carpenter and Petersen (2002b, 307) study suggests that internal finance is the most often used source to finance growth of small firms. Further, growth seems to be constrained by internal funds. Generally, it seems that capital structure decisions associated with growth are similar as with R&D.

Theoretically argued, the most fundamental difference between growing and non-growing firms is logically the growth itself. From financial point of view, growth has to be financed. The pecking order theory explains that as the need of funds increases, firms follow a specific hierarchy (Myers 1984, 581). Thus, growth is likely to make firms

more reliant to external funds and – by assuming the hierarchy – first debt financing and finally equity. Logically, the dependence would increase together with growth rate.

As was the case with R&D, firms might be reluctant to use debt to finance growth – especially among growth-oriented innovative firms. This is simply because of the liquidity effect. Firms with more debt service have fewer funds available to finance growth. In order to ensure a constant high growth and preventing chronic underinvestment problem from occurring, companies should prefer equity. Debt reduces equity-holders value because fewer opportunities are exercised if the firm is highly levered. (Lang et a. 1996, 4; Jong 1999, 56) Myers (1977, 156-158) theorize that short-term debt would also mitigate the underinvestment problem in growth.

Growth has also a pivotal role in agency conflicts between innovative firms` managers and investors. Firstly, managers have incentives to invest in high growth projects and beyond the efficient scale, since managers tend to emphasise firm size and low bankruptcy risks. (Hall 2002, 39; Bethel & Liebeskind 1993, 16).[67] The fundamental element is that asset structure changes rapidly among firms that exercise their growth opportunities (Childs et al. 2005, 669). Thus, it is also difficult to monitor these firms (Smith & Watts 1992, 269).

However, agency conflicts may also result in growth firms preferring debt to equity. Specifically, growth and growth opportunities may lead to investors demand high ownership stakes (McCahery & Vermeulen 2006, 44). Thus, firms should use external equity as a last resort. The effect of R&D plays also a vital role, as existing investors do not want their innovative projects to leak out. Also Mueller (2008, 2733) study suggests that corporate control has a strong impact on firms` growth and vice-versa. The study hypothesizes that managers of high growth company are apt to lose control when the firm expands. Thus, these firms prefer small equity increases, low growth and high leverage.

Growth opportunities are associated with severe information asymmetries, which naturally indicates that external financing has high capital cost compared to internal finance (Jenter 2005, 1940; Myers 1984, 584).[68] Information asymmetries are influenced by growth in numerous of other ways also. Fulghieri et al. (2012, 3) present a theoretical model, which implies that growth severely increases information asymmetries between companies. A key concept in the model is intangible asset volatility that is likely to increase when a company is growing. The academics explain that the traditional hierarchy of funds does not necessarily hold in this situation – firms should acquire equity before debt.

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[67] Assessing the efficient scale in innovative companies should be difficult

[68] In fact, many studies use growth options as a proxy for asymmetric information (Jenter 2005, 1940)

Jenter (2005, 1910) study empirically observed that disagreements with managers and financial markets about firm value have a fundamental role in growth firms` financial decision making. Interestingly, managers in growth firms have usually contrarian views on the firm value – in this case managers often perceive corporate value as overpriced. This explains why managers in their firms are expected sell equity substantially. This pattern applies also in managers` personal securities, as they tend to reduce their exposure over time.

Also signalling theory provides implications on growth finance. Firms with high degree of growth options face strong information disparities. Thus, high leverage would be optimal for these firms, because they lack abilities to disclose their true high value (Smith & Watts 1992, 272). However, empirically observed low leverage among growth firms provides no proof for this argument. Why signalling theory does not hold with growth firms? The researcher[69] argues that the theory might well hold among firms who plainly possess growth options, but for some reason are not growing. Yet, if we assume that R&D firms aim to grow, it is unlikely that these firms are highly levered either; debt impairs growth. The deviancy of the traditional signalling theory is that it rigidly assumes that capital structure is the only way to convey the high value information to investors. Intuitively, growth itself is the most credible and strongest signal to investors on the true type of the firm. Thus, growth firms do not need to signal with capital structure, because growth has a substitutive role. Arguably, growth is a proxy and signal that a firm 1) possess a lot of growth opportunities, 2) is in expanding markets and 3) is likely to grow in future (Degryse, de Goeij & Kappert 2009, 8-9; Jong 1999). Also in R&D framework, investors are able to obtain the information that the firm is successfully exercising its innovation opportunities and more importantly that customers have accepted the developed products (Birnbaum-More, Weiss & Wright 1994, 259). Presuming that growth helps investors to perceive the true type of firm, the financial behaviour associated with the respective type is likely to exacerbate in companies` growth. Arguably, growth attracts equity investors and evicts debt investors.

Special emphasis should be given to the difference between beginning of growth and constant growth. Presumably, the attraction suddenly increases after the firm has grown relatively long period.

Although, the model presented above has not been scientifically tested, there are some studies that allude that the model might be able to explain the financial behaviour of growth-oriented firms. For example, Jenter (2005, 1939-1940) interestingly points out that for some reason, growth firms do not necessarily have to signal the firm value to financial markets, because markets are already convinced about the quality of

[69] The following idea is developed by the researcher himself

investments. Thus, growth might reflect the potentiality of future benefits for investors. This would explain the financing behaviour in growth. Shi (2003, 250-252) explains that bondholders perceive the riskiness and uncertainty to dominate the future benefits. As bondholders are able to distinguish between different firms by looking at growth, leverage is negatively associated with growth – debt-investors are now able perceive the high potentiality of agency conflicts etc. The opposite phenomenon would occur with equity investors. A case in point, market response to equity issues in high growth firms is usually positive (Pilotte 1992, 393). In other words to describe the ideas above, growth decreases information asymmetries between the firm and investors who now have better understanding about the true type of firm, which in this case attracts equity-investors and evicts debt-investors.

It is essential to analyse the effect of profitability on growth firms` capital structure. Firstly, constant and high profitability is likely to decrease the need of external finance. On the other hand, this implies that firms` leverage decreases constantly. The dynamic trade-off theory suggests that as this phenomenon continues firms would face an obligation to adjust its over-unlevered capital structure. Theoretically argued, the optimal capital structure of R&D firm is highly unlevered. Also, adjustment costs are particularly high (Himmelberg & Petersen 1994, 39). Thus, in profitable growth, firms allow their capital structure to be shifted away from optimal point before carrying out any costly rearranges. Also, if firms adjust their leverage substantially, they are likely to do so with equity. Firms do not prefer issuing debt in general. Also, debt as a rigid security does not usually allow firms to repay the loans on advance.

Bearing in mind that innovative firms must find sources to finance high amounts of R&D investments and high growth, presumably these firms are heavily depended on the external sources – both debt and equity regardless that firms would prefer internal financing. The firms might prefer equity but are `forced` acquire debt substantially. An interesting note is that R&D and growth have a similar impact on the financial decision-making both from investors and company`s point of view. This study develops following propositions on the interaction of R&D, growth and capital structure:

- Proposition 1: Growing R&D firms are heavily reliant to external financing
- Proposition 2: Growth of R&D firm affects negatively on leverage
- Proposition 3: Substantial increases in the share of long-term debt are due to control rights issues
- Proposition 4: In debt finance, growth increases the share of short-term debt
- Proposition 5: Since R&D firms face high adjustment costs and prefer equity, firms allow their capital structure shift in high equity frame – if firms adjust they are likely to carry it out with equity transactions
- Proposition 6: Growth is apt attract investors because growth reveals investors the true type of the firm

5 EMPIRICAL ANALYSIS

5.1 Definitions

5.1.1 Sample

In the present study, the data is gathered over the period 2003 – 2008. By doing so, the financial crisis that began in 2009 is properly controlled. It is expected that firms over this period experienced `normal` macroeconomic conditions. Also, it is likely that crisis has negatively affected on firms` growth. Thus, it might difficult to obtain data that is relevant for the study.

Defining the sample of this study comes down to two different elements. Firstly, the experienced growth of R&D intensive firms must relevant for the firm. Of course, the relevancy is worth defining further. For example, OECD defines high growth firm to experience growth over three years, 20% per annum (OECD growth). Based on the large survey conducted by Finnish public funding agency Tekes (Autio, Miikkulainen & Sihvola 2007, 9), innovative companies grew typically 22% in three years or roughly a six per cent a year. This presents a `normal` or perhaps a relevant level of sales growth. Also, analysed firms should pursue to grow and set business objectives regarding to growth. Yet, this study should not fall on the rigid definitions. Instead, present study acknowledges that there are many different paths for companies to grow and many ways how growth may be relevant. In order to obtain meaningful insights how growth affects the capital structure of R&D firm, it is essential to analyse different types of growth. What is the impact of steady growth, rapid growth or high growth?

Secondly, the sales growth must associated to R&D expenditures. According to OECD definitions, highly innovative companies exhibit annually more than five per cent R&D expenditures of sales (OECD R&D). The firms analysed in this study are much more innovative compared to the five per cent threshold – the impact of R&D should be very strong on growth. Growth enhanced by R&D also implies that the impact of mergers and acquisitions should be trivial. Some of the companies analysed in this study acquired other companies over the years 2003 – 2008. However, these transactions were financially rather marginal compared to R&D and assets in general. Thus, the sales figures have not been adjusted with corporate acquisitions.

The data is gathered from firms that operate within the same or similar industries. This improves the generalizability of the results. It is likely that firms within similar industries, encounter similar challenges and questions in corporate financial decision-

making. The industrial sector examined in this study can be understood as information technology- or information communication technology –intensive industry.

The definitions above imply that this study focuses on relatively narrow firm segment. This is also the reason for the chosen studying methods. By deeply analysing the financial characteristics of only few companies, we are likely to observe interesting empirical facts about the studied phenomenon. The corporates in this study are F-Secure, Teleste and Tekla – each meeting the criterion concerning growth and R&D intensity.

5.1.2 Methods

The analysis is primarily based on the key economic indicators that are obtain from the annual reports of the companies. Although, all the relevant information presented in the annual reports and other reports are analysed in capital structure framework. Following indicators are used to examine the capital structure decisions of R&D intensive growth firms:

- Equity per capital -ratio (ECR) = Equity/(Equity + Long-term debt)[70]
- Internal finance per capital –ratio (IFCR)[71]
- Short-term debt per asset –ratio (SDAR)

The indicators presented above are employed to analyse especially Propositions 1 – 5. This study does not pre-define any indicator to test Proposition 6. Instead, this study assumes different indicators – bear in mind that Proposition 6 has not been tested in earlier studies.

Generally, the dialog between empirical data and theoretical arguments is essential in this study. The discussion takes place around the developed propositions that were presented in the Chapter 4.4. The findings observed in next chapter and their theoretical contribution is drawn together in Chapter 5.3.

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[70] From debt category, only long-term debt is considered to be a capital component, since this is aligned with the modern capital structure theories. ECR can also be understood as equity-to-capitalization rate.

[71] Share splits and other similar transactions that change the value of retained earning is eliminated from internal finance. Thus, internal finance is an interplay of profits, dividends and other non-share –related transactions.

5.2 Case data

5.2.1 F-Secure Oyj

F-Secure Oyj is a Finnish IT security firm that is listed in the NASDAQ OMX Helsinki Ltd. It was founded in 1988 and currently it employs circa 940 people all around the world (F-secure.com). F-Secure is a highly innovative company. In 2008 it announced that its primary values are "innovation, reliability and speed of response – these are the qualities that have made F-Secure one of the world`s leading IT security provider". The company aims to protect its customers' irreplaceable digital content and online interactions – regardless of time, place and device. Table 4 illustrates the financial characteristics of F-Secure over 2003 – 2008[72]:

Table 4. Financial performance and situation of F-Secure (million EUR)

Indicator / year	2008	2007	2006	2005	2004	2003
Sales[73]	113,0	96,8	80,7	61,8	47,3	39,0
Change in sales%	17 %	20 %	31 %	31 %	21 %	-
R&D per sales%	23 %	22 %	28 %	24 %	23 %	23 %
Profit/Loss	19,6	15,4	7,3	6,6	13,5	-
Profit per sales%	17 %	16 %	9 %	11 %	29 %	-
Equity	41,1	67,5	54,2	57,1	45,3	30,2
Internal finance	14,7	5,3	-7,9	-5,1	-12,2	-26,0
Long-term debt	7,5	6,2	5,7	6,2	3,1	2,1
Short-term debt	46,2	40,9	35,2	30,8	23,8	21,4
Assets total	94,9	114,7	95,1	94,0	72,1	53,7

F-Secure experienced a long-lasting growth over 2004 – 2008. By 2008, corporate sales growth has declined from the highest level of 31% in 2005 and 2006. The volatility of growth has been reasonably high. F-Secure meets the OECD standards for high-growth company between 2004 and 2007. Regarding R&D expenditures, it appears that F-Secure is highly innovative company (see for example OECD definition). Share from sales is constantly over 20%. R&D expenditures seem to `follow` the sales –

[72] F-Secure (2003, 2004, 2005, 2006, 2007, 2008). All the data presented in this chapter is based on the annual reports of the case firm from 2003 to 2008

[73] During 2003 – 2008 F-Secure has acquired only one company. This happened in 2005, when F-Secure acquired the shares of Rommon Oy with 4,9 million EUR. Thus, sales figures have not been adjusted, because corporate acquisitions had only a minor role in F-Secure.

R&D has a variable cost nature, rather than fixed. During the period F-Secure has also been profitable – from moderate 9% to excellent 29%. Based on the financial data, F-Secure can be understood as a highly innovative company that has experienced a long-lasting high growth. Key econometric indicators of F-Secure are presented as follows:

Table 5. Econometric indicators of F-Secure

Indicator / year	2008	2007	2006	2005	2004	2003
ECR	85 %	92 %	90 %	90 %	94 %	93 %
IFCR	30 %	7 %	-13 %	-8 %	-25 %	-80 %
SDAR	49 %	36 %	37 %	33 %	33 %	40 %

To begin with Proposition 1, growing R&D firms should be heavily depended to external finance. Financials of F-Secure partly support this. In 2003, IFCR is highly negative implying that most of the capital is external. Thus, external finance might have a `push effect` regarding firms` growth.[74] It could be argued that external finance is a catalyst for growth of F-Secure, who enters into to the growth phase in 2004. However, as the growth continues and is constant, the role of external finance decreases and the role of internal finance increases. Logically, this is mostly due to high profitability during the period. F-Secure paid dividends in 2006, 2007 and 2008, but the net cash flow effect is still positive, when considering retained earnings. Public issues and other external finance related transactions were only minor throughout the period. This observation is in line with the pecking order theory, which explains that the reason for companies not acquiring external finance is simply because they do not need to. Internal cash flow or financial slack is able to cover the financial need of F-Secure between 2003 and 2008.

Regarding Proposition 2, leverage should be negatively associated to growth. The financials of F-Secure do not support this per se. Growth does not seem to enhance ECR. Instead, ECR is constant from 2003 to 2007. However, the data verifies that high growth R&D firms are highly unlevered. Nine tenth of F-Secures` long-term assets are financed with equity. Overall, it appears that F-Secure is more associated to equity related transaction than debt related transactions. During the period, F-Secure had an option program and the warrants were frequently subscribed. The firm also had public offerings during 2004 and 2005. In addition to dividends, F-Secure carried out a repayment of equity capital to its equity-investors. This repayment was a substantial amount – almost 36 million EUR. During the period there are not any debt issues, bank

[74] As background information, the turnover in 2003 and 2002 was practically the same, which indicates that F-Secure `entered` into the growth phase in 2004.

transactions or repayments. The debt capital in balance sheet consists primarily of deferred revenues. This also implies that Proposition 3 cannot be tested, because F-Secure did not acquire interest bearing long-term debt during the assessment period. Thus, there is a strong evidence that equity is much more important source of finance for high growth R&D firms than debt.

Proposition 4 suggests that share of short-term debt should increase in growth, because firms would want to solve the potential underinvestment problems. SDR rate is very high throughout the period – from 33% to 49%. The amount of short-term debt `follows` the increases in assets. However, it is difficult to see any consistency on, how the share of short-term debt per assets would increase in growth. The only interesting observation is the change between 2008 and 2007. In 2008 almost 50% of the exhibited liabilities is short-term debt – more than 10 percentage points higher than 2007. The reason for this is logical. In 2008, F-Secure adjusted its capital structure by repaying substantial amount of equity back to its investors. The negative impact on cash and short-term deposits is partly financed with short-term debt. The total amount of short-term debt increases, whilst assets in total decrease. We can find little support to Proposition 4, but an interesting note is that short-term debt is a capital structure adjustment component in growth. To be more specific, it is a substitute for long-term debt adjustments.

This observation gives us an easy transition to Proposition 5. It claims that firms allow their capital structure to shift far away from the `optimal` level and adjust the leverage with equity, if necessary. To the former claim, evidence is provided by the change in 2008. The `drop` in ECR is the most dramatic change during the period and this is due to the capital structure adjustment carried out by F-Secure. The firm has also acquired its treasury shares – yet, this is rather trivial compared to the repayment. However, the shift is not as dramatic as expected. Yet, F-Secure might not want to endanger its ability to grow. Dramatic leverage increasing transactions could result in potential underinvestment problems. The latter claim of Proposition 5 is perfectly aligned with F-Secure`s observed capital structure. Repaying substantial amount of equity capital to investors carries out the adjustment.

This study did not pre-define any methods to analyse Proposition 6, which claims that that growth attracts equity investors who are able to perceive the true nature of growth firm. F-Secure is a good source of data to analyse this proposition, because during the period, it enters into a high-growth phase. Thus, there should be clear evidence that investors perceive F-Secure as an interesting firm with good opportunities. How to analyse the Proposition 6? One possible way could be to look at the trading volume of F-Secure`s shares. F-Secure carried out some public equity offerings during the period – in 2004 and 2005. However, these comprise only few per cent of the equity book value. More interesting is the time of these offerings. Both

include in the period, when company has just entered into the growth. Investors` attraction could result in increase in stock price. Therefore it is feasible for a company to offer shares. There is no financial need to carry out the issue in 2004 and 2005. Additionally, profitability does not explain the possible `attraction` of investors, since in 2005 the profitability is substantially lower than in 2004.

Other way to test Proposition 6, is to look into the trading volume[75] also between the company`s existing and potential investors. This indicator together with change of growth is illustrated in Table 6:

Table 6. Trading volume and growth of F-Secure

Indicator / year	2008	2007	2006	2005	2004	2003
Trading volume%	42 %	52 %	61 %	46 %	41 %	31 %
Growth rate%	17 %	20 %	31 %	31 %	21 %	1%

Table 6 provides strong evidence for Proposition 6. High growth rate of F-Secure results in substantial increase in trading volume. The trading volume is the highest in 2006, when also the growth rate is the highest during the period. As growth rate declines the trading volume follows. The correlation coefficient of these two variables is approximately 0,8. This indicates strong linear relationship between them. By applying the arguments made in chapter 4.4, in 2004 – 2006 investors receive a signal that F-Secure is expanding and has high degree of interesting growth opportunities. However, in 2005 and 2006 declining growth rate is a signal to the investors that F-Secure has exercised its most high-growth options and is likely to experience conservative market `expanding` in future.

In this context, it is reasonable to bring up the findings of Jenter (2005) study, which claims that managers have contrarian views about the growth firms` value. From managers` point of view, the value of growth firm is usually overpriced and managers apply this in their personal investment-portfolio decisions and in corporate decision-making. The public offerings of F-Secure could serve at least as a `circumstantial evidence` for this argument. However, it is reasonable to ask, whether implications of Jenter (2005) study would also apply to insider-investors. Intuitively, the insider-investors would have superior firm information compared the potential investors who are attracted by growth. As these interests meet, the insider-investors prefer to sell their shares that they perceive to be overpriced in the financial markets. Logically, a clear indicator from this should be a substantial increase in trading volume.

[75] The trading volume indicator presents the share of stocks being exchanged during the year

The financial data of F-Secure does not confirm all the propositions developed in Chapter 4.4. Little support can be found for example for Propositions 3 and 4. Also, in other propositions the support is partial rather than thorough. Yet, the most significant theoretical contribution is that the F-Secure case was able to bring up other very interesting implications and explanations for R&D firms` growth financing. For example, this case extends the ideas of Proposition 6 that was developed by the researcher. Also many facts indicate that long-term debt is unsuitable security for high growth R&D firms. F-Secure is unlevered, not acquiring or exhibiting interest bearing long-term debt and not using long-term debt in capital structure adjustments.

5.2.2 Teleste Oyj

Teleste Oyj was established in 1954 – headquarters is in Turku, Finland. In 2011 it employed circa 1300 people (Teleste.com). Teleste is an international technology group focusing on telecommunication-, broadband video- and other communication solutions. In 2008, Teleste announced that its "goal is to become the leading provider of broadband video technology and services for operators". Table 7 presents the financial characteristics of Teleste from 2003 to 2008[76]:

Table 7. Financial performance and situation of Teleste (million EUR)

Indicator / year	2008	2007	2006	2005	2004	2003
Sales[77]	108,7	125,1	101,8	82,6	66,0	54,2
Change in sales%	-13 %	23 %	23 %	25 %	22 %	-19 %
R&D per sales%	12 %	10 %	10 %	10 %	10 %	11 %
Profit/Loss	5,5	9,4	6,9	6,0	3,9	1,7
Profit per sales%	5 %	7 %	7 %	7 %	6 %	3 %
Equity	46,6	46,7	37,7	32,3	27,7	27,0
Internal finance	33,9	32,6	26,6	22,4	18,5	15,9
Long-term debt	2,5	3,3	1,5	1,7	9,5	10,0
Short-term debt	26,4	27,9	29,0	20,8	17,2	9,2
Assets total	75,5	77,9	68,2	54,8	56,2	48,1

[76] Teleste (2003, 2004, 2005, 2006, 2007, 2008). All the data presented in this chapter is based on the annual reports of the case firm 2003-2008.

[77] Teleste has acquired few companies during the high-growth period – acquisitions in total are approximately 9 million EUR. Compared to assets, R&D expenditures and investments in general, the role of acquisitions is very marginal. Thus, the impact of sales is likely to be second-hand

The financial development of Teleste from 2003 to 2008 seems to be ideal for this study. Teleste has many similarities with F-Secure. Both of the firms are R&D intensive[78] and high-growth companies. However, the financial stability of Teleste is a striking feature. During 2004 – 2007 the annual growth rate is very stable – 22% - 25% throughout the period. The stability also applies to R&D expenditures and profitability. Particularly meaningful element for this study is that Teleste experiences a growth spurt beginning in 2004, after a negative sales growth in 2003. This growth spurt ends in 2008. Thus, there is a clear period, during which growth can be studied. Additionally, the effect of non- or negative growth can be perceived. The key economic indicators are presented as follows:

Table 8. Econometric indicators of Teleste

Indicator / year	2008	2007	2006	2005	2004	2003
ECR	95 %	93 %	96 %	95 %	75 %	73 %
IFCR	69 %	65 %	68 %	66 %	50 %	43 %
SDAR	35 %	36 %	43 %	38 %	31 %	19 %

Compared to F-Secure, in 2003 Teleste exhibits higher degree of internal finance in its balance sheet (see the IFCR in Table 8). Thus, similar catalyst effect cannot be perceived with Teleste. However, in growth, Teleste`s internal cash flow increases substantially and this relationship is linear. The share of external financing decreases gradually. The most dramatic capital structure event is in 2005, when Teleste repaid its bank loan with almost 9 million EUR. The increases in equity have little to do with external transactions – although, there are some minor public offerings and subscriptions regarding option programs. Teleste is paying dividend to its shareholders throughout the period, but net effect to retained earnings is still positive. Internal finance is sufficient with the financial need. Thus, the data does not support the arguments made by Proposition 1 – on the contrary.

Table 8 presents strong arguments that equity is the primary capital component of Teleste in its growth. Already in 2003, ECR is relatively high proving that the firm is unlevered. As growth continues, in 2005, there is a positive shift in ECR. This is due to the mentioned repayment of the loan. After this year, there are little changes in ECR. Teleste implemented quite evenly some equity- and debt -related transactions – repayments, public offerings, option programs etc. These do not provide strong explanations for the observed ECR. Again, the pecking order theory can explain, how

[78] Although, Teleste is less R&D intensive than F-Secure (it is still well above the OECD definition)

profitability helps companies from acquiring external securities. Yet, Teleste`s financial data is perfectly aligned with Proposition 2.

The negative growth rate in 2008 does not seem to cause any significant changes to IFCR and ECR. The total amount of equity and long-term debt both decrease, but the decrease is proportionally even.

Regarding Proposition 4, SDAR -indicator is experiencing an interesting inverted U-shape development over 2003 – 2008. When Teleste enters into the growth phase in 2004, the share of short-term debt grows. However, SDAR declines by the end of 2008 together with the sales rate. SDAR level is also very similar to F-Secure indicating that growth has a similar impact to short-term debt in companies within the same industrial sector. Closer look of the short-term debt finance alludes that it may have an interesting role in Teleste – specifically by looking at the financial structure development in 2005 and 2006. In 2005, Teleste performed perhaps the most `dramatic` change of its capital structure as it advanced its payment schedules and repaid the long-term bank loan[79] – total amount almost 9 million EUR. Yet, at the same time Teleste acquired short-term bank loan of 3 million EUR and a year later short-term bank loan of 4 million. Intuitively, the firm substituted its long-term debt capital with short-term debt finance. As argued in the Chapter 4.4, short-term finance is more suitable for R&D intensive growth-firms, since it mitigates the underinvestment problem. In order to ensure its constant growth, Teleste might have wanted to adjust its growth-constraining capital structure. Thus, the Teleste case provides support for Proposition 4.

The advanced long-term debt repayment is a clear signal from capital structure adjustment behaviour. The assumption is that advance payments are unanticipated rather than planned. Proposition 5 argues that firms would use equity as an adjusting component, since debt is a rigid security for adjustments. However, it appears that exactly the opposite phenomenon is occurring with Teleste case – long-term debt is depressed. Intuitively, this is a negotiating issue. Teleste case practically shows that it was able to renegotiate the terms of its loan contracts. Short-term debt explains this further. It is probable that by being allowed to repay the long-term bank loan on advance, Teleste committed to acquire the short-term bank loan as a substitute. This is feasible also for the creditor who does not have substantial reinvestment problems with the unanticipated repayment.

We must bear in mind that Teleste could have financed the advance repayment also with equity issue. Thus, short-term bank loan is a substitute for equity also. Regardless of the adjustment method, ECR would have been virtually the same. However, Teleste

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[79] Bank loan is relational debt. Often is argued that relational debt provides little support for growing R&D firms (Audretsch & Lehmann 2004, 355).

also adjusts its capital-to-asset -ratio. Findings presented earlier do not provide support to Proposition 5 per se. Rather, it extends it by defining the role of short-term debt in the adjustment behaviour.

The `direction` of the adjustment is also very interesting. The trade-off theory claims that firms adjust their capital structure to the optimal composition of debt and equity capital. Adjustment toward being even more unlevered strongly suggests that the claimed benefits (tax benefits, mitigating overinvestment problems etc.) of debt are second-hand for high-growth R&D intensive firm. This observation supports the implications of Proposition 2.

In F-Secure case, this study analysed the relationship between growth and firm`s stock trading volume%. The same method can be applied to Teleste also. Also Teleste`s public equity issues are rare during 2003 – 2008. Thus, trading volume% is a meaningful indicator. However, it is also feasible to analyse the average stock price changes during the assessment period. Table 9 illustrates these economic indicators.

Table 9. Growth attraction and growth rate of Teleste

Indicator / year	2008	2007	2006	2005	2004	2003
Trading volume%	65 %	41 %	81 %	62 %	71 %	57 %
Stock price change	-13 %	-29 %	-3 %	123 %	2 %	-20 %
Growth rate%	-13 %	23 %	23 %	25 %	22 %	-19 %

Based on Table 9, we can conclude that trading volume% increases from 2003 and reaches its highest level in 2006. Interestingly, the patterns seem to be very similar with F-Secure and same reasoning also applies in Teleste. After few years of steady growth, investors are convinced about the true type of the firm with its valuable opportunities – this is suggested by high trading volume in 2006. The asymmetric information between existing and potential investors explains the observation.

Average stock price development provides perhaps even stronger arguments than trading volume. Substantial increase in 2005 fits well to the intuitive notion that investors might not be convinced immediately after when firm begins to grow. Instead, investors need `reassurance` and constant long-lasting growth is the most credible signal. The stock price development in 2007 and 2008 implies that the `bubble bursts`. Overpricing from 2005 was recognised by investors, which caused the stock price decline. It is justifiable to ask, why Teleste did not issue external equity during 2005 and 2006, when arguably the market overpricing exacerbated? High ECR is a potential reason for this. It might be that Teleste had reached its limits in equity capital. Overall, also Teleste case provides strong support for Proposition 6.

Similarities with F-Secure logically are apt to cause the compatible findings in Teleste. Yet, Teleste case is able to explain the capital structure phenomena further.

This is especially the case with Proposition 4, 5 and 6. The data also confirms Proposition 2 – leverage is negatively associated with sales growth. However, Teleste case does not find strong arguments for Proposition 1.

5.2.3 Tekla Oyj

The two case firms analysed in this study earlier, are relatively similar. Both of the firms were highly innovative companies experiencing a long-lasting, high and somewhat steady growth. Tekla case is different in terms of growth. The company experienced short-term rapid growth with high volatility. This is likely to reveal some interesting aspects from the relationship between growth and capital structure decisions. Tekla Oyj is a Finnish software company offering its customers solutions in construction, infrastructure and energy industries. During 2004 – 2008 it was listed in Helsinki stock exchange. Currently, it employs circa 500 people. (Tekla.com)

The data is gathered over the period 2004 – 2008. In 2004, Tekla implemented an extensive adjustment to its business portfolio and sold some of its operations. From 2005 to 2008 its structure was relatively stable, which implies that the experienced growth was endogenous and due to its high R&D input. Financial data of Tekla is presented in Table 10[80]:

Table 10. Financial performance and situation of Tekla (million EUR)

Indicator / year	2008	2007	2006	2005	2004
Sales[81]	58,9	58,2	49,8	38,0	31,1
Change in sales%	1 %	17 %	31 %	22 %	-
R&D per sales%	26 %	22 %	21 %	25 %	29 %
Profit/Loss	11,0	15,6	10,2	5,8	-
Profit per sales%	19 %	27 %	20 %	15 %	-
Equity	30,3	31,5	24,7	17,2	23,8
Internal finance	19,6	20,8	14,0	6,4	0,6
Long-term debt	0,2	0,2	0,7	1,2	1,9
Short-term debt	14,3	14,6	13,8	10,2	7,8
Assets total	44,8	47,0	39,8	28,6	33,5

[80] Tekla (2004, 2005, 2006, 2007, 2008). All the data presented in this chapter is based on the annual reports of the case firm 2004-2008

[81] An adjustment is made to sales figures in 2004 due to the relevant structural change in 2004. Between 2005 – 2008, the structural changes were trivial.

As stated earlier, Tekla experienced a relatively high and volatile growth from 2005 – 2007. The `peak` was reached in 2006, after which turnover change began to decline. In 2008, there was no relevant change in turnover. Tekla is a highly innovative company exhibiting R&D per sales constantly over 20%. However, Tekla was very profitable during the assessment period – even compared to the data of F-Secure and Teleste. The economic indicators are presented in Table 10.

Table 11. Econometric indicators of Tekla

Indicator / year	2008	2007	2006	2005	2004
ECR	99 %	99 %	97 %	94 %	92 %
IFCR	64 %	66 %	55 %	35 %	2 %
SDAR	32 %	31 %	35 %	36 %	23 %

IFCR tells a similar story with Tekla as in F-Secure. In 2004, Tekla was almost fully capitalised with external securities. Thus, there is evidence for the catalyst effect of external finance in growth. However, continuing growth leads to the increasing share of internal finance. The high profitability during 2005 – 2007 is an obvious reason for this. During this period, Tekla implemented hardly any external financing transactions. An exception is the year 2005. Tekla repaid equity capital to its investors – total amount is 12 million EUR. Annual reports present no reason for this action, but arguably the structural changes in 2004 had impacted on the asset structure – capital was not required in the same extent as before. The repayment was financed with short-term deposits i.e. financial slack. Thus, also Tekla case does not support Proposition 1, although there is evidence for the catalyst effect of external finance.

Tekla case supports strongly Proposition 2. Tekla is an unlevered company in 2004 and growth shifts it into being even more unlevered. Positive cash flow enhances the ECR and high dividend payments in 2006 – 2008 have little impact on the capital structure. ECR in Tekla is a striking feature when bearing in mind the `optimality` propositions made by the trade-off theory. The optimal level in Tekla appears to exist, when practically no long-term debt is acquired.

It is difficult to find any strong evidence for Proposition 4. SDAR is in constant level throughout the period, with exception of the change in 2004 and 2005. This refers to the equity capital repayment in 2005. Tekla adjusted its capital-to-asset –ratio, which decreases. This naturally results in the increase of SDAR. However, the adjustment is arguably derived by the asset structure change, rather than growth.

Unlike F-Secure and Teleste, Tekla did not implement any adjustments that have a clear impact on its ECR. As the share of long-term debt is marginal, even dramatic changes in equity are not perceivable just by looking at the ECR. However, Tekla case provides support for Proposition 5. Firm is actively engaging equity related capital

adjustment activities. The equity capital repayment implemented in 2005 provides evidence for this.

F-Secure and Teleste case provided support for Proposition 6. Investors seem to be attracted by growth. These claims are based on the changes in trading volume and in stock prices. In Tekla case, the analysis is based on the trading volume% and price per earnings indicator. Arguably, the latter is a valuable indicator for testing markets` expectations of the firm`s future success. Higher the P/E, the higher proportion of the share`s market value is contributed by future expectations. The figures are presented in Table 12.

Table 12. Growth attraction and growth rate of Tekla

Indicator / year	2008	2007	2006	2005	2004
Trading volume%	31 %	61 %	61 %	36 %	17 %
Price per earnings	7,60	18,40	17,50	13,20	-
Growth rate%	1 %	17 %	31 %	22 %	-

Again, trading volume% provides support for Proposition 6. High growth and trading volume seem to have a linear relationship.[82] Trading volume is highest in 2006 and 2007, when growth has lasted more than one year. In 2008 the indicator declines together with growth.

P/E –indicator strongly implies that long-lasting growth attracts equity investors. Similar to Teleste, the second year of growth seems to be a valuable signal for the investors – just one-year growth perhaps is not enough for the investors to be convinced that the firm has valuable opportunities. The change is also positive in 2007, but only barely. In 2008 P/E falls together with growth rate indicating that investors were overoptimistic about the firm`s opportunities. Arguments can be made that trading volume% and P/E changes simply follow the profitability during the period. However, profitability is not able explain the findings in 2008. The profitability is high – almost 20 % and compatible with 2007 and 2006. Still, price per earnings dramatically declines. How much of this decline is due to the financial crisis that began in 2008 is difficult to examine. Yet, at least by looking at the development in 2004 – 2007, the study again finds strong support for Proposition 6.

Tekla case does not bring up many new implications from growth and capital structure relationship. Instead, it mainly supports the findings made with F-Secure and Teleste. This implies that high-growth R&D intensive firms face similar questions and challenges in financial decision-making. More importantly, these firms make similar

[82] Reasons for this were analysed in the cases presented earlier

decisions compared to each other and arguably different decisions compared to firms that are non-growing and non-R&D intensive. Also, in Tekla case the research motivation was in the particular type of growth compared to F-Secure and Teleste. As findings are quite homogenous, it is justifiable to presume that type of growth has little impact on the financial decision-making.

5.3 Contribution to capital structure theories

The study provided a deep insight into high-growth R&D intensive firms` financial decision-making. In the previous chapter, the present study analysed the developed proposition with the empirical data – the propositions were based on the modern capital structure theories. What can we say about the financial decision-making based on the case data examined in this study? What is the theoretical contribution to the modern capital structure theories?

This study does not find support to the implication that growth enhances the use of external financing. The relationship is opposite. Firms significantly increase their internal finance levels during the growth. In the cases analysed in this study, profitability was the primary component in this issue. However, arguments can be made that external finance is enhancing firms to enter into a growth phase. A firm, beginning to exercise its growth opportunities, is backed with external finance. This observation was made in two out of three case firms. The preference of internal finance can be explained with the pecking order theory. The observed high profitability suggests that growing R&D firms simply do not need to issue external funds. However, asymmetric information, ownership issues and transaction costs could also explain the observed internal-external financing mix. After all, the theoretical arguments for all of these concepts were found and presented in Chapter 4.4.

Equity is the primary capital component for growing R&D firms. Firstly, R&D intensive companies seem to be equity capitalised per se – regardless of growth. When an R&D firm grows, equity`s share of capital tends to increase or at least stay in a constant level. Long-term debt is unsuitable for the firms analysed in this study. The firms exhibit little long-term debt in their balance sheet and its role decreases in firms` growth. A case in point, Teleste paid its bank loan on advance – maybe because the firm considered the debt to be growth constraining. This resulted in Teleste being even more unlevered.

The firms also carried out more equity-related transactions than debt related transactions. For example, all the firms established option programs and the warrants were subscribed. The fact that Proposition 3 could not be tested, strongly indicates that long-term debt is rarely used increasingly in R&D firm`s growth.

Firms appear to aim to maintain the growth oriented capital structure. The case data implies that this is more importantly associated with low leverage or not issuing long-term debt, rather than to the preference of external equity finance.

The case data also provided some interesting implications on the role of short-term debt in growth finance. The study did not find strong support that growth increases the share of short-term debt. Yet, there is strong evidence that short-term debt is a substitute sometimes for equity finance and sometimes for long-term debt finance. A clear example of this was brought up in Teleste case. The company paid long-term loan on advance and acquired short-term debt to balance the difference – intuitively the firm adjusted its growth constraining capital structure. Thus, short-term debt serves as a substitute for equity also. Short-term debt is a `bridge-builder` between equity and debt in high sales growth.

Propositions 2 and 4 were developed primarily from the implications of the static trade-off theory. Based on the capital structures of the case firms, growing R&D firms face either stronger benefits in relaying on equity or stronger disadvantages in acquiring debt finance. The present study argues that the latter is the probable reason. Growth increases the agency costs of debt. Also, debt would create a chronic underinvestment problem for growing firms. The role of short-term debt also brings evidence for this. The study suggests that benefits of leverage are second-hand for growing R&D firms.

All the firms carried out some capital structure adjustment activities. In F-Secure and Tekla this was done by repaying equity capital to the investors – the amounts were very significant. In Teleste, the adjustment was made with long-term debt. This is not aligned with the propositions presented in Chapter 4.4. Yet, the closer look tells us that long-term debt was, as stated earlier, substituted by short-term debt. This is arguably a negotiation issue. By adjusting the argument made with Proposition 5, it appears that firms are likely to carry out adjustments with equity or short-term debt.

The capital structure adjustment behaviour is explained in the dynamic trade-off theory. Arguably, higher the costs of adjustment, the more companies allow their capital structure to shift away from the optimal level. The adjustments were relevant for all the firms` capital structure, which provides proof for this argument.

Little support can be found to the `traditional signalling theory`. The companies were highly unlevered, but at the same time also very profitable. Signalling theory claims that profitable firms should be levered. The observed relationship is opposite. This implies that growing R&D firms do not need to signal their high value to investors[83] or these firms have an alternative tool to signal their high value[84]. This study does not support

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[83] As explained by Jenter (2005, 1939-1940)

[84] As explained by the researcher. This model is explained in Chapter 5.4

the implications of the market-timing theory either. Issuing external finance in growth was not substantial in any of the case firms. It seems that the external finance issued before the growth, covers the need throughout the growth phase.

Naturally, the results are not robust in order to draw extensive generalisations – only three firms were analysed. Yet, the purpose of this study was to focus on the narrow firm type – high-growth and high R&D intensity. This is a firm type and relationship that has not been addressed in many studies. Thus, it is justifiable to apply the respective approach in this study. The study aimed to understand and find the complex causalities and facts associated with R&D firms` financial decision-making in growth.

In this respect, this study successfully explains some of the key financial characteristics of R&D firm. Yet, there are many aspect still `unrevealed`. The case data supports also theoretical arguments made in Chapter 2.5. There are strong imperceptible components in capital structure decision-making.

5.4 Growth signal theory

In this study, perhaps the most significant theoretical contribution is made with Proposition 6. The `growth signal theory` developed in Chapter 4.4 is extended with the implications of the empirical part. The growth signal theory is explained as follows:

Signalling theory suggests that firms have difficulties in conveying their high potentiality and true value to investors. The only credible way is to attain high leverage, since it is too costly for low-value companies to mimic this. This brings up a potential conflict and paradox from R&D intensive firm`s point of view. Relying on debt arguably increases the firm value, but at the same time firm`s ability to grow is hampered due to high debt service.

In terms of disclosing the true value to investors, this study argues that growth is more credible signal to investors than capital structure. In other words, growing R&D firms do not need to signal their true value with capital structure, because they are able to do it with growth. Many studies argue that growth is a signal and proxy for valuable growth opportunities, future growth and high customer acceptance. Thus, growth attracts equity investors and evicts debt investors. Equity investors search for valuable growth opportunities, whereas debt investors perceive risks and uncertainties to dominate possible future benefits.

What is a credible growth signal for investors? Arguably, investors are attracted by long-lasting and high growth. Simply short one-year growth is not enough to result a positive effect on investors` expectations. Short-term growth may be caused by numerous of reasons – not necessarily because of valuable growth opportunities. As the case data proved, growing R&D firms experience an increased market attraction

measured with P/E –indicator, trading volume% and share price. This suggests that the equity investors` attraction suddenly increases.

As Jenter (2005, 1910) explains, managers have contrarian views about the firm value in growth – market value is usually overpriced. Bearing in mind the increased attraction of equity investors, the managerial views are particularly hazardous. Companies can take an advantage of the overpricing in the financial markets. Firms analysed in this study, had rarely public offerings. On the other hand this is logical, since high growth firms have little possibilities to take advantage of overpricing, since they are already heavily unlevered. Yet, existing shareholders may also have superior information and contrarian views on the firm value.[85] Arguably, this leads to increase in company`s stock trading volume%. This observation was made in all of the case firms. Similar results were also obtained with other indicators.

Interestingly, the explanation earlier might allude, why equity investors are willing to capitalise the R&D firm before the growth – without knowing the true type of the firm. Existing equity investors reserve the right to take an advantage of potential mispricing of company value. R&D firms are highly equity capitalised, which means that they are unable to benefit from equity mispricing. The growth signal theory is modelled in Figure 7. The model is simplified, as the true value is constant. Yet, Figure 7 gives a good view of the growth signal theory.

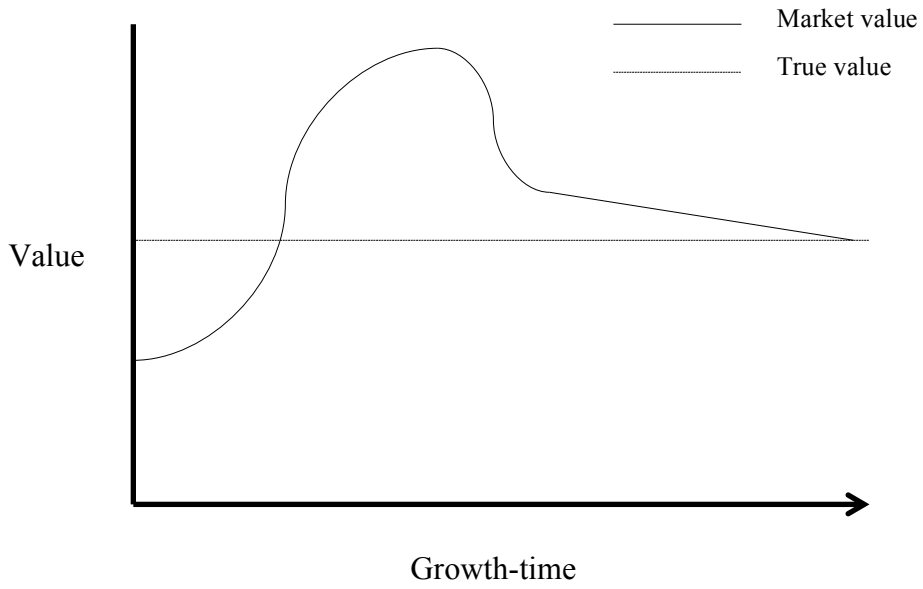

Figure 7. Model of growth signal theory

[85] Bear in mind that existing shareholders may also be managers – as stated earlier, the companies established option programs for their managers

The model illustrates that equity investors have difficulties in perceiving the true type and value of the firm. Thus, before the company starts to grow there is strong asymmetric information between insiders and outsiders that leads to market under-pricing. As the growth continues there is a `dramatic` positive shift in market value as external investors are able to perceive the true type of firm. However, the increase is excessive. However, managers and inside-investors are able to take an advantage of this overpricing. As growth continues further markets perceive the overpricing, which leads to balance of market value and true value eventually.

6 FINAL REMARKS

6.1 Summary

The purpose of this this study was to examine firms` growth impact on capital structure of an R&D intensive firm. The relationship between strategically important R&D and finance has been examined in numerous of scientific studies that have applied either theoretical or empirical discipline. Corporate finance theories provide many explanations for R&D finance, but the empirical evidence has been somewhat ambiguous. As growth is a fundamental econometric outcome of R&D, it is feasible to examine its impact on financial decision-making. The study employed an objectivist research approach with a nomothetic methodology. In addition, the study develops propositions based on theoretical implications and tests them with empirical data.

There is a clear process from the first implications of the modern capital structure theory or MM theorem to the recently developed theories – primarily the trade-off theory and pecking order theory. Modigliani and Miller (1958) presented their classic argument that capital structure is completely irrelevant to firm`s value. This is because of the perfect market assumption. Since market imperfections prevail in the real world, the academics were able to explain why capital structure matters. The trade-off theory is a clear extension of the MM theorem. Because of taxes, agency costs and financial distress costs, there is optimal balance of debt versus equity that maximises shareholder value. The pecking order theory explains that capital structure is a second-hand issue. The financial decisions derive from the financial need. There is asymmetric information between a company and investors, which increases the price of external finance. This further implies that there is a hierarchy of funds – internal funds are used first, then debt and as a last resort equity.

Other corporate finance theories also explain the financial decision-making. The dynamic trade-off theory explains that because of adjustment costs, firms will let their leverage move from the optimal level. The companies rebalance when benefits of adjustment outweigh the costs of adjustment. Thus, there is optimal zone or region of leverage. The market timing theory suggests that capital structure is a consequence of managers trying to time equity markets by issuing shares at high market prices and repurchasing shares or issuing debt at low market prices. The signalling theory explains that capital structure is determined by `firm value`. High-value firms exhibit high leverage in order to distinguish from low-value companies – this lowers information asymmetries. Recently, many studies have assumed an approach that emphasises behavioural finance. It questions the human rationality that seems to be the `backbone` of other capital structure theories.

This study recognises that R&D activity is associated with strong strategic importance. R&D enhances competitive advantages of companies assuming different strategies – this is empirically observed. R&D has also positive impact in operational level. An essential benefit is `knowledge spill overs` generated by R&D. More importantly, investing in R&D appears to lead to increase in profitability. From financial point of view, R&D is often described as a strategic intangible investment that is also highly uncertain, costly and lengthy. The uncertainties relate to the high technical and commercial risks. The intangible nature of R&D indicates that the prime input and output are intangible – knowledge, skills, experiences etc. Additionally, options are an important element in R&D. R&D investments can be expanded, abandoned and modified throughout the process – there is high degree of growth options as well.

Empirical literature shows that growth is a particularly meaningful econometric outcome of R&D. This is especially the case among firms that are investing substantially in R&D. In general, growth rates are higher in R&D firms than in non-R&D firms. The commercialization seems to lead to short-lived and immediate growth.

According to the literature review, the capital structure decisions in companies investing substantially in R&D are different from other types of companies. Characteristically, R&D intensive firms rely heavily on internal finance – this phenomenon is confirmed by looking at both small and large firms. The firms are also highly unlevered and prefer `special funding arrangements`. The latter includes public grants and subsidies, venture capital and joint ventures.

There are many reasons for the observed financing patterns. Many studies explain that there are severe information asymmetries between R&D firms and investors who have difficulties in understanding the nature of R&D. Firms may also be reluctant to reveal their investment information outside the company. These reasons make firms prefer internal finance. Debt is unsuitable in financing R&D. Innovative firms have abilities to perform wealth-shifting actions and R&D cannot be used as collateral. This implies high agency costs of debt and costs of financial distress. Debt could also lead to severe underinvestment problems – financial slack is essential for innovative firms.

Financing growth has many similarities with financing of R&D. Growth has a negative impact on debt finance. Growth is related to increased agency costs and excessive use of debt may in fact hamper firms` growth. Firms should prefer equity or short-term debt. Theoretically argued, growing firms are subject to external finance compared to non-growth companies. This is because firms have to finance the growth. Also, some models argue that information asymmetries increase in growth. The researcher argued that growth attracts investors. Thus, in long-term, high growth firms should issue more equity finance.

The empirical part in this study included three R&D intensive companies that operate in ICT- or IT-industry. These firms were F-Secure Oyj, Teleste Oyj and Tekla Oyj,

which were publicly listed firms during the analysis period. The data was gathered from 2003 to 2008. The firms experienced high growth during the period.

The empirical part successfully explained some of the key patterns in growing R&D firms` financial decision-making. The firms seemed to prefer internal finance during the growth – although, external finance might be a catalyst for growth. Firms strongly prefer equity financing. In growth, the use of equity per capital either increases or stays in a constant level. The firms were often associated to equity related transactions and short-term debt. Short-term debt was used as a substitute of long-term debt and equity. The case firms also adjusted their capital structure – these adjustments were carried out with short-term debt or equity.

The case data also provided implications for the growth signal theory that was developed in this study. Measured with few econometric indicators, equity investors were `attracted` to growing R&D firms. Arguably, this is because growth helps investors to perceive the true type of firm.

6.2 Implications for further research

There are numerous of ways to deepen the knowledge in R&D firms` growth finance. An obvious implication for future research would be to examine the research topic by looking at a larger sample. The generalizability of the findings of this study could be improved. The sample could also consist of companies with different sizes, ownership structures and industries.

It would also be interesting to investigate the growth signal theory further. The theory lacks a solid theoretical foundation. Also, how the theory should be tested requires still further studying.

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