The Impact of R&D Investments on The Capital Structure of Swedish Public Life Science Companies

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2010

Uppsala University

Bachelor Thesis in Finance, 15 ECTS

Work performed at the Department of Business Studies
ACKNOWLEDGEMENTS

We are grateful to Prof. Robert Joachimsson for giving us the opportunity to conduct this study at the Department of Business Studies, Uppsala University. Many people at the unit were generous in providing us with guidelines and help to successfully complete this work.

Special thanks to Fred Nyberg, Prof. at the Department of Pharmaceutical Biosciences, Uppsala University, Henrik Stenqvist, CFO of Meda, Bengt Ågerup, Chairman of the Board of Q-Med and Weine Nejdemo, CFO of Oasmia Pharmaceuticals, for providing invaluable help and knowledge that improved our results extensively.
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ABSTRACT

Background Although the impact of R&D investments on firms’ capital structures has been the subject of extensive research, the “capital structure puzzle” still remains unsolved. Previous research is not entirely unanimous on this subject. While some studies indicate that R&D intensive firms are less levered, other studies depict the opposite.

Aim This study aims to investigate the impact of R&D investments on the capital structure of firms in the Swedish life science industry. The life science industry is especially of interest as it is characterized by fast decisions regarding the success or failure of clinical trials, approval of products by the authorities and the development of pipeline products. Such factors contribute to a fast-paced environment in which investment decisions must be made cautiously.

Methods A comparative case study analysis is conducted on five publicly listed life science companies, Meda, Q-Med, BioPhausia, Vitrolife and Biotage, trading on the Nordic OMX Stockholm Stock Exchange. Each company’s financial performance and position have been considered and analyzed during the period 2005-2009. Financial ratios relating to the R&D intensity and the capital structure of the firms have been selected in addition to other determining factors; company size, profitability, asset tangibility, non-debt tax shield, growth, income variability and dividend policy. Moreover, key informants, including CEOs/CFOs of some of the firms involved, have scrutinized our results.

Results Meda and BioPhausia were found to be the least R&D intensive firms in the sample with R&D intensities of 3 % and 1 % respectively and the highest levered with debt levels (total debt over total capital) of 53 % and 50 % respectively. Q-Med, Vitrolife and Biotage were the most R&D intensive with 19 %, 14 % and 10 % of their sales reinvested in research and development and the least levered with debt levels of 5 %, 7 % and 8 % respectively.

Conclusions Our findings show a negative relationship between the analyzed firms’ R&D intensity and their leverage level. Moreover, the three most R&D intensive firms displayed a reduction in leverage with increasing R&D intensity.
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1. INTRODUCTION

1.1 Background

The research on capital structure strives to explain the choice of mixture of firms’ securities and financing sources used to finance real investments. The optimal capital structure, i.e. the most advantageous share of debt and equity of a firm’s capital has been a central topic in corporate finance since Modigliani and Miller (MM) presented their capital structure irrelevance principle (Myers, 2001). They showed that financing does not matter in perfect capital markets. Under such circumstances, where there are no taxes, bankruptcy costs, transition costs and asymmetric information, capital structure decisions are irrelevant to firm value and to the cost of or accessibility to capital (Modigliani and Miller, 1958). The MM-theory was based on the assumption of an ideal, taxless and frictionless world, where financial innovation insures that firm value is always in equilibrium (Myers, 2001). Although the implications of these theories have become acknowledged, in practice capital structure decisions can evidently be of significance. However, many theories have been put together since Modigliani and Miller’s work, considering market inefficiencies to explain firms’ financing choices (Myers, 2001). The static tradeoff theory, the pecking order theory and the free cash flow theory are the most established theories explaining how such factors may influence capital structure choices and firms’ financing decisions. The theories suggest that a firm’s choice of capital structure depends on the aspects that determine the various costs and benefits related to debt and equity financing (Titman and Wessles, 1988). These theories of optimal balance between debt and equity financing consider market inefficiencies differently. The tradeoff theory puts emphasis on taxes, the free cash flow theory on agency costs, and the pecking order theory on asymmetric information (Myers, 2001). Further analysis in this area has been carried out by Rajan and Zingales (1995), Myers (1984) and Harris and Raviv (1991).

Development of recent approaches to examine the underlying factors determining firms’ choice of capital structure is a central issue in corporate finance. However, it is just as important to analyze existing theories and previous empirical research to assess new ideas or assumptions that might possibly increase the knowledge within this area. Capital structure decisions are vital for corporate survival and success. In many cases, wrong capital structure decisions have been described as a common reason behind corporate failure (Pike and Neale, 2009). R&D investments are clearly one of the driving forces behind pursuing an innovative competitive strategy, however those investments can be funded differently depending on each company’s particular situation and industry prospects (O’Brien, 2003). If the financial behavior of R&D intensive firms differs from those less engaged in R&D activities, there is need to examine the underlying factors behind the disparity. This thesis aims to contribute to such an understanding by investigating the relationship between firms’ R&D investments and their capital structure.
1.2 The significance of Capital Structure

In practice, most financing decisions involve choosing between debt and equity. When facing such choices, managers have to evaluate whether debt is the most suitable form of funding with respect to the firm’s particular conditions. However, capital structure is not static but changes constantly making it very difficult for financial managers to pinpoint a specific optimal proportion between debt and equity in each circumstance. The optimal relationship is likely a matter of whether the project/activity generates strong cash flows, the general marketability of the company’s assets, predictions about the industry’s outlook, the level of interest rates, regulations, social factors and the economy in general. Financial managers seeking funds for a new project, but at the same time are unwilling to reduce dividends or to make rights issues, have to evaluate and consider the debt option. However, when firms make their financing decisions to obtain the optimal capital structure, they consider the benefits of tax advantages and incentives versus the cost of default. Thus the main arguments for using debt to finance company activities rely on its relative cost. Usually, debt capital is less expensive for firms than equity since the pre-tax rate of interest is lower than the return required by shareholders. The interest on debt is tax-deductable, lowering the cost of debt relative to equity. Moreover, issuing debt involves lower administrative costs as it does not necessarily require an underwriter (Pike and Neale, 2009).

Furthermore, the choice of capital structure has a significant impact on the value of the firm. Traditionally, a small increase in the debt-to-equity ratio does not affect shareholders’ return requirements as long as the probability of financial distress remains low. Thus, the substitution of equity to debt can enhance shareholder returns and create wealth in good financial years. Consequently, it can lower the overall or weighted average cost of capital (WACC) and in turn raise the market value of the enterprise. This is based on the assumption that the rate of return required by shareholders and the interest rate remain constant. However, this positive effect on shareholder return can be observed only at relatively safe gearing levels. As debt levels grow, especially when firms’ conditions worsen, the variability in net earnings will increase which in turn may enhance the risk of default. This means that shareholders face additional financial risk that is different from the trading risk specific to the business, and will therefore seek higher return. Additionally, lenders of further debt will toughen their requirements as they perceive the prospect of default more significant. As the rate of shareholder return and the interest rate move upwards the WACC will also rise, hence reducing firm value (Pike and Neale, 2009).

Debt can be risky to company survival, hence it is of huge significance that managers carefully assess whether or not debt is the most appropriate financing choice considering the company’s actual situation. These reflections are considered in three prominent theories in the area of capital structure.
The static tradeoff theory implies that firms tend to choose the level of debt at which the tax benefits of additional debt balances the cost of default. Simply, they trade off the cost benefits of debt against the risks associated with it. According to the pecking order theory, when firms’ internal cash flows are not strong enough to finance real investments, they will most likely raise capital by selling debt rather than issuing new equity. This advocates that firms have an order of priorities when choosing different forms of funding. Initially, they rather employ internal funds to finance projects. However when internal funds are exhausted they prefer to borrow, i.e. use debt to a suitable debt/equity combination. Eventually, they consider equity by issuing new shares as a last resort. Information asymmetry is the main motive behind this order of preference. Managers have an information advantage about the firm’s performance relative to outsiders. The free cash flow theory is more relevant to mature overinvesting firms. It suggests that firms’ leverage level is dependent on the strength of their operating cash flows, indicating that high leverage will increase value, despite of the risk of financial distress (Titman and Wessle, 1988; Pike and Neale, 2009). This theory accentuates the agency cost phenomenon, which is due to the fact that managers are agents of shareholders. Shareholders neither observe the firm’s cash flow nor managements actions. This relationship creates conflicting interests, and the reason lies yet again in information asymmetry. Shareholders advocate cash payouts in order to restrain managers’ control over the free cash flow - that is the cash flow that exceeds the amount required for funding all positive net present value projects (NPV). On the contrary, managers value investments as they seek out to grow their business. Investments also increase managers’ power and perquisites even though the firm invests in negative NPV projects. Debt plays a major role in lowering these agency costs of firms, hence motivating managers and their organizations to be proficient. Dividends can be reduced in the future, thus still leaving managers with control over the free cash flow. However, introducing debt to a firm’s capital structure force managers to pay out future cash flows, otherwise debt holders have the right to take the firm to bankruptcy court if it does not meet the interest and principle payments (Jensen, 1986).

This control function has a huge impact on determining the optimal level of capital structure, however it does not necessarily apply to all types of firms. Early stage businesses are more likely to grow rapidly and have large and substantially profitable investment projects, but no or negative expected free cash flows. These organizations lean more on equity than debt financing, and have to turn frequently to capital markets to obtain capital. On the other hand, large more established businesses have low growth opportunities, but produce positive and large free cash flows. In these organizations, the risk of squandering cash flows on negative NPV project could be grave, hence shareholders may want managers to issue more debt to lower this risk (Jensen, 1986).
1.3 Problem Discussion

It has been known for a long time that firms’ investment and financing decisions interact. Strategic management theories depict that firms, in any given industry, operate under dissimilar strategies to serve the different needs of heterogeneous customers. Thus, firms within the same industry are more likely to pursue different strategies to provide their target segment with the best possible service. Competitive strategy is then the driving force behind firms’ investment decisions and as investment and financing decisions go hand in hand, different capital structures are better suited to different strategies. Firms implement different competitive strategies, i.e. innovators, adopters or followers, and will focus differently on R&D. As previous studies have shown, R&D intensity is negatively associated with leverage. The main reason for this relationship is that R&D investments form primarily intangible assets that cannot be used as collateral (O’Brien, 2003).

Recently, Bah and Dumontier (2001) examined the choice of capital structure of firms heavily engaged in R&D activities, i.e. firms that spend a large fraction of their net revenue in research and development expenditures. They showed that R&D intensive firms exhibit significantly lower debt and dividend payment levels than non-R&D firms. Further, they concluded that firms strongly involved in R&D activities demonstrate longer debt maturity and higher cash levels compared to non-R&D ones (Bah and Dumontier, 2001). Furthermore, Aghion et al. (2004) argued that the financial behavior of R&D intensive firms differ from the financial behavior of firms less involved in R&D activities. They found a nonlinear relationship between R&D intensity and leverage, defined as the ratio of total debt to total assets. Firms with positive R&D to sales ratios tend to use more debt than firms with no R&D, however in conformity with Bah and Dumontier, they found that among R&D intensive firms, the proportion of debt in their capital structure declined with increasing R&D intensity. Moreover, they argued that firms with high R&D are more likely to issue equity compared to firms with no R&D, and the application of new equity increased with R&D intensity. In their study, the negative relationship between R&D and the firms gearing level became more significant when R&D expenditures reached approximately 10% of sales, which in most cases occurred for firms in pharmaceuticals, instrument engineering and/or telecommunication equipment (Aghion et al, 2004).

Myers and Shyam-Sunder (1994) showed that firms within the pharmaceutical and life science industry exhibit significantly lower debt levels in their capital structure and proposed that such firms are primarily financed by equity as opposed to debt (Myers and Shyam-Sunder, 1994). Given the fiercely competitive environment of the industry, tough regulations from authorities and long R&D cycles (OTA, 1993), economically efficient R&D investments necessitates embarking on projects with positive NPV. Positive NPV projects are where the discounted value of future cash flows is positive, the rate for discounting future cash flows represents the opportunity cost of capital for investors. For
firms within the pharmaceutical and life science industry, the cost of capital is significantly dependent on the cost of equity, as such firms are primarily financed by equity. Thus, the costs of equity will become the dominant decider of the relevant cost of capital for research and development investments (Myers and Shyam-Sunder, 1994). Consequently, the determinants of the cost of equity will have a significant impact on project development processes, pricing strategies and the cost of developing and introducing new products to the market and hence on the firm’s financial decisions (Harrington, 2009).

Although the “capital structure puzzle” is not completely solved, a number of theories have attempted to explain the equity-to-debt relationship of firms. Barclay and Smith (1995) proposed that the most significant aspect of determining a firm’s capital structure is its investment prospects, which in turn rely on other factors such as agency, information asymmetry, asset substitution and uniqueness etc (Farooqi, 2008).

Firms in the same industry are more likely to apply different strategies in order to fulfill the different preferences of their customers. Firms that try to serve all different groups of customers simultaneously will most likely end up serving all of them unsuccessfully. The life science industry is one of the most R&D intensive industries. Hence, firms within this industry will differentiate their strategies from each other, in accordance with strategic management theories, in order to better meet the specific requirements of their customers. This entails engaging differently in R&D activities and as innovation, strategy and capital structure decisions are linked to each other, they will consequently differ in their capital structure choices. It would therefore be interesting to examine whether companies operating in the same R&D intensive industry differ in their choices of capital structure, and whether capital structure decisions change as R&D intensity changes. How do financing decisions vary between companies within the same industry? What impact do R&D investments have on firms’ leverage? Does the highest levered firm pursue a different innovation strategy than the less levered firms?

To be able to scrutinize this relationship, this essay will investigate the impact of R&D investments on the capital structure decisions of Swedish life science companies. The life science industry is especially interesting considering the over- and underinvestment problems and information asymmetry between outsiders and insiders, as a result of long R&D cycles and high level of confidentiality. Such factors may drive bankruptcy and agency costs higher. Through a comparative case analysis, this essay provides a confrontation between theory and data and bridges the gap between the qualitative case-oriented methodologies and quantitative variable-focused approaches. It begins with an analysis of the financial performance of the 16 life science companies that are trading on the Stockholm Stock Exchange, headquartered in Sweden, during the period 2005-2009. Consequently, cases where the different capital structure determinants occur together are selected and examined in order to assess the
potential for a relationship. This relationship is then evaluated with regard to the predictions of proposed theories.

1.4 Purpose

This thesis aims to investigate the potential effect of R&D investments on the capital structure choice of firms within the Swedish life science industry, through a qualitative comparative case analysis. The impact on financing decisions of R&D and other R&D-related variables is examined and the results are compared with previously suggested theories.

1.5 Contribution

This study provides new data of the Swedish life science and pharmaceutical industry to existing empirical research, and may be useful to assist further research within the topic. The idea is to shed light on an area that is not yet covered by empirical research. Previous studies have focused on cross industrial analysis and statistical comparisons of leverage ratios using cross sectional or regression analyses. This study aims to analyze the capital structure of a specific set of firms in a specific market, providing a complement to previous research.

The results illustrate the development of the Swedish pharmaceutical and biotechnological firms, decisions taken by their management and the symmetry of financing R&D projects. The information is of relevance to management and strategic personnel involved in financial decisions in the pharmaceutical and biotechnological industry. The study could also prove useful for debt lenders/holders as the results may be interpreted as an indication of strategic risk.
2. THEORETICAL FRAMEWORK

2.1 Strategic Financial Decisions

2.1.1 The Modigliani and Miller Contribution

The propositions made by Franco Modigliani and Merton Miller in their article on cost of capital structure from 1958 has provided a ground point for modern thinking and development of different theories and empirical research of capital structure. The work covers different aspects of the field and makes several different propositions regarding the tax effect on the firm’s capital structures. The basic theorem also named the Capital Structure Irrelevance Principle implies that firm value is not affected by the choice of financing given that it functions in an efficient market, in the absence of taxes, bankruptcy costs, transition costs, asymmetric information and that individuals and firms can borrow and lend at the rate of interest. A firm cannot create value by simply changing its capital structure given the specific surrounding conditions. Instead the value of the firm is only determined by its investment decisions (Modigliani and Miller, 1958).

The Capital Structure Irrelevance Principle was proposed under the conditions of no tax at first. From the basic theorem an extension of two propositions, I and II, was constructed. The first proposition states the value of a levered firm, \( V_L \), is equal to the value of an unlevered firm, \( V_U \), (Modigliani and Miller, 1958).

\[
V_U = V_L \quad (1)
\]

For an unlevered company, the market value is determined by discounting its earnings, \( X \), by the rate of return required by shareholders, \( Y_U \), as follows:

\[
V_U = \frac{X}{Y_U} \rightarrow V_L \quad (2)
\]

The second proposition considers the relationship between shareholders rate of return on equity and leverage. Following equation (2), the rate of return on equity for an unlevered company is defined as:

\[
Y_U = \frac{X}{V_U} \quad (3)
\]

However, the same relationship for a levered firm is given as:

\[
Y_L = \frac{X}{V_U} + \left( \frac{X}{V_U} - r \right) \frac{B_L}{S_L} = Y_U + (Y_U - r) \frac{B_L}{B_S} \quad (4)
\]
where $r$ is the interest rate, i.e. the cost of debt, $B_L$ is the market value of a levered firm’s bonds, $S_L$ is the market value of a levered firm’s shares, i.e. debt, and $\frac{B_L}{S_L}$ is the leverage. As given in equation (3), $\frac{X}{V_U}$ is the rate of return $Y_U$ for an unlevered firm. Consequently, the rate of return for a levered firm equals that of an unlevered firm, plus a risk factor, $\left( \frac{X}{V_U} - r \right) \frac{B_L}{S_L}$, which in turn depends on the degree of leverage. Considering this relationship, if $Y_U$ exceeds the cost of debt, $r$, then the cost of equity of the levered firm, $Y_L$, will rise with increasing leverage. Thus, higher leverage will increase the risk factor on equity, and hence drive the rate of return on equity upwards. The overall discount rate for a levered firm is a weighted average, whose weights reflect the relative significance of each type of fund. The weighted average cost of capital, $Y_{WACC}$, will not be affected when with the rise in leverage due to the opposite effects on the cost of equity and cost of debt (Levy and Sarnat, 1982; Pike and Neale 2009).

$$Y_{WACC} = \frac{B_L}{B_L + S_L} \cdot r + \frac{S_L}{S_L + B_L} \cdot Y_U$$

In brief, higher debt levels in a firm’s capital structure will not affect the firm value, assuming perfect markets and no taxes, but will increase the rate of return required by shareholders as they will be exposed to a higher risk (Levy and Sarnat, 1982).

The previous propositions assumed no taxes. However, Modigliani and Miller presented two other propositions which dealt with the more realistic approach where corporate income taxes exist. Without any doubt, the advantages of debt become more significant when the effect of tax is considered, as the post-tax net income and earnings per share (EPS) increase proportionally with increasing debt levels. Given that $T$ is the corporate income tax rate, the effect of taxes of the value of the firm is:

$$V_L = V_U + TB_L$$

The factor $TB_L$ depends on the tax rate and the proportion of debt in the capital structure. Thus, the value of the levered firm becomes higher than the value of the unlevered one when considering the effect of taxes. Accordingly, the relationship between rate of return on equity and leverage can be defined as:

$$Y_L = Y_U + (1 - T)(Y_U - r) \frac{B_L}{S_L}$$

Similarly to the previous proposition when taxes were not absence, the return on shareholder equity will rise with increasing debt due to higher risk on equity. $Y_{WACC}$ will be then be defined as follows:

$$Y_{WACC} = \frac{B_L}{B_L + S_L} \cdot r (1 - T) + \frac{S_L}{S_L + B_L} \cdot Y_U$$
As interest is deductible but not dividends, only the cost of debt capital is affected. This will consequently drive $Y_{WACC}$ downwards but firm value upwards, leading to the conclusion that as firms substitute equity by cheap debt, the level of gearing will increase and the firm’s optimal capital structure is when it is mainly encompassed by debt (Levy and Sarnat, 1982).

![Figure 1. The M&M propositions on the relation between the value of the firm and debt/equity combination (Levy and Sarnat, 1982).](image)

2.1.2 Modern Capital Structure Theories

2.1.2.1 The static Tradeoff Theory

The static tradeoff theory emphasizes taxes and suggests that the level of debt is predicted from the trade-off between tax advantages and the costs of default, as given in figure 1. The straight base line represents the earlier mentioned theories proposed by Modigliani and Miller. The static trade off theory has several advantages. It provides a simple and rational explanation of the benefits of introducing debt to capital structure. The proposition is well known and agreed upon by most business people- that is leverage can reduce taxes but too high levels can induce financial default. Furthermore, the theory suggest that growth firms greatly dependent on R&D have less tangible assets and are expected to borrow less than mature firms with low investment opportunities but with rather high free cash flows. It also supports research on the market reactions to announcements related to security issues or exchanges. All these arguments strengthen the fact that the tradeoff theory is of huge significance practically (Myers, 1989).
However, Myers (1989) argues that special or random events are not explained by the simple static tradeoff theory. Asset disposals and anticipated good operating revenues can reduce a firm’s leverage below the optimum level. Conversely, an unexpected downturn in revenues might leave a firm above its optimal leverage ratio. As such events occur, we expect firms to issue debt or equity and achieve the optimal capital structure, i.e. firms with a higher than optimal leverage ratio would move left and firms with a lower than the optimal value would move rightwards in figure 3. In both cases managers would seek to achieve the optimal capital structure in order to maximize firm value. Moreover, the relationship between profitability and leverage is probably the most important argument against the tradeoff theory. In practice, firms with high profitability tend to borrow less, whereas firms with low profitability borrow more. Yet the tradeoff theory would envisage the opposite, suggesting that highly profitable firms have more income to put out on debt issuing and to protect from tax payments. However, none of these arguments deny the impact of the static tradeoff theory on firms’ determination of the optimal level of capital structure (Myers, 1989).

2.1.2.2 The Pecking Order Theory
The pecking order theory proposes that under circumstances of information asymmetry between the markets and the managers of the firm, different R&D projects are orderly financed. First internally generated funds are utilized, then by issuing safe and risky debt and last off by issuing new equity (Myers 1984).

Opposite to the tradeoff theory, the appeal to tax shields and the cost of financial default is of second-importance according to the pecking order theory. Instead, leverage change with regard to changes in internal cash flows, dividend payments, or investment opportunities. Moreover, this theory gives a direct clarification to the above stated negative relationship between profitability and leverage. Given that firms generally involve in novel investments to sustain good growth, and that dividends are

![Figure 3. The static tradeoff theory of capital structure (Myers, 1989).](image-url)
considered to be less favorable according to information asymmetry, the least profitable firm will end up issuing more debt to be able to fund its investments (Myers, 1989).

The pecking order theory considers issues derived by information asymmetry between managers and outside investors. Simply, this phenomenon suggests that managers of a firm know more about their business than investors and is a type of signaling behavior of the firm to its investors. When managers issue new equity it is generally an indication to investors that the company is overvalued. However, investors are aware of this information asymmetry and will react negatively to issuing announcements, making them less keen on financing new equity without price reductions. Consequently, this will drive managers either towards missing out on positive NPV investments or issuing excessively high debt levels that may threaten the future of the company. These contradictions lead the following arguments. First, internal funds in form of retained earnings are more favorable than external equity. Second, financial slack, i.e. disposal of real assets, cash or marketable securities, is possible. Lastly, debt is more attractive than equity, simply because it is cheaper and less risky (Myers, 1989; Talberg et al., 2008).

2.1.2.3 The Free Cash Flow Theory

The free cash flow problem proposed by Jensen (1986) relies on the principal agency theory and the analysis of conflicts between managers and shareholders. The agency problem is associated with imperfect and asymmetric information; managers are the agents of shareholders, however this relationship is fraught with contradictory interests. It states that management tends to act in a way that is more inclined to serve its own interests rather than the shareholders. The choice of capital structure and dividend policy creates major conflicts that might influence the way in which firms are operated (Jensen, 1986; Myers, 1989).

Agency costs are divided into two categories, agency costs of equity and agency costs of debt. The agency costs of equity are based on the fact that while managers bear the responsibility and costs of a performed activity, they are not able to profit from the entire gain. Hence, they will become more inclined to obtain perquisites and transferring the firm’s assets into personal benefits than managing the firm the optimal way (Pike & Neale 2009). Dividend payouts reduce the free cash flow under management’s control, hence mitigating the risk of wasting that cash flow on negative NPV projects. Free cash flow is the cash flow beyond what is required to finance all projects that have positive NPV. Conversely, managers are more interested in investing in projects, despite their NPV, to grow their firms. Jensen argues that growth enhances managers’ power as it puts more resources under their control. Further, growth increases managers’ perquisites, since compensations are usually associated with growth. Usually, this problem is more palpable when organizations generate large free cash flows. The issue lies in how to embolden manager’s to apply this cash flow efficiently. The influence of agency costs on capital structure will thereby become more significant for such organization, as
introducing debt to capital structure will replace dividend payouts but alleviate the agency problem by reducing the resources under managers’ control. Debt is more effective than dividend payouts in reducing agency costs. The payout of cash to shareholders and dividend promises are not static but can alter in the future. However, when issuing debt, managers are forced to pay interest and principals in a way that cannot be changed, otherwise the cost of default will increase, hence threatening the future of the organization. Issuing more debt to repurchase stock is also an effective way in encouraging managers to make better use of the free cash flow. However, increased leverage will affect firm value and consequently increase the cost of financial distress (Jensen, 1986).

Another problem that may occur is the second category of agency costs, i.e. the agency costs of debt. The agency costs of debt focuses on the relationship between shareholders, bondholders and managers ways of obtaining personal interests. When debt increases in the firm’s capital structure it transfers default risk on bondholders while managers and shareholders carry the company’s investment decisions. The problems occur when managers start to act in a way that benefits themselves or shareholders, on the behalf of bondholders. However, bondholders are aware of such contradictory and can put some restrictions on the use of their money to mitigate the potential for financial default. (Riahi-Belkaoui, 1999).

Introducing debt to the firm’s capital structure to control management is called by Jensen (1986) the “control hypothesis”. However, it is not necessarily applicable in all types of organizations. It is more important in large mature firms that have large free cash flows but low growth prospects or investments with positive NPV. For such organizations, the effect of agency costs could be very stern (Jensen, 1986).

2.2 Governance in relation to R&D

Investments in research and development projects provide a platform for pursuing complete strategies and help to put up new capabilities that may boost firms’ performances. Continuous involvement in R&D programs is crucial for the accumulation, amalgamation and adaptation of new knowledge, hence building up strong competitive advantage. However, financing those investments, i.e. either by debt or equity, is subject to significant trade hazards. Whatever type of funding firms choose to finance their R&D projects with, financers want some kind of safeguard ensuring that their investments will generate pleasing returns, on the other hand managers are more likely to require safeguards that persuade them to make “riskier” investments to ensure firm growth. Debt and equity provide different governance strategies for protecting the invested capital, thus reducing the potential for contradictions between investors and managers; however it is highly dependent on the firm’s particular situation and the type of industry it operates in (Parthiban et al., 2008).
The choice of financing and thus governance direction can be affected by four types of perils: underinvestment, uncertainty/asset substitution, asset specificity and information asymmetry (Bah and Dumontier, 2001; Parthiban et al., 2008).

**The underinvestment problem:** firms’ growth prospects are determined by the future value of its R&D investments. However, levered firms will have to consider the value of future investments and the value of debt payments, and therefore will employ investments, for which their value exceed the value of the debt. This may drive firms to avoid investing in positive NPV R&D projects, as their expected future cash flows equals the reimbursement of the debt. Hence, they will disregard a positive investment opportunity, increasing the risk on debt holders. Consequently, debt holders will demand higher payments, which in turn will raise the firm’s financial risk and may lead to greater variability in income. This underinvestment problem suggests that shareholders of R&D intensive firms favor equity financing to reduce the cost requirements of debt holders. Further, it proposes that if firms have to utilize debt, shareholders will rather focus on short term debt contracts (Bah and Dumontier, 2001).

**The uncertainty/asset substitution problem:** it deals with the substitution process from low risk assets to high risk investments in a firm. Consequently, this situation expropriates value from the firm’s bondholders, as it increases the risk of bankruptcy, without giving them any additional advantages. Clearly, the effectiveness of R&D investments is complicated to evaluate, mainly due to the time lag between investments and return. This time difference is especially significant for life science/pharmaceutical companies, due to long R&D cycles compared to other industries. However, it suggests that when managers obtain financing for their projects, they may act in a way that transfers risk to lenders. Financing R&D through debt may therefore evoke agency costs as a result of managers’ tendency to involve in high risk investments. Riskier investments can in turn increase the stock profits and please the shareholders of the company while the bondholders who carry a fixed interest return suffer the higher risk of default without any additional benefits. R&D investments are also proven to be harder to oversee, hence giving managers an extra freedom to invest according to their own interest. The asset substitution to more risky investments and the transfer of value leads to dissatisfaction of the firm’s bondholders. Consequently, they will either be disinclined to issue debt or request an increased premium to cover the general risk associated. According to the asset substitution hypothesis R&D intensive firms are more inclined to use equity financing than debt (Bah and Dumontier, 2001; Parthiban et al., 2008).

**Asset specificity:** R&D investments add more knowledge-based intangible and specific assets to firm’s total assets. According to the asset specificity problem, it states that firms with low level of specific assets should be more leveraged given that these assets can be used as collateral. Further, debt usually entails lower transaction costs and less complicated governance mechanisms than equity.
Shareholders are more involved in firms’ strategic decisions than debt holders, however debt contracts force managers to pay out future cash flows, and in the case of default debt holders have the right to cause the firms liquidation, while shareholders have no such claims as dividends can be altered in the future. According to this hypothesis, assets are specific as long as they are not redeployable, hence value of such assets are higher for the firm than others. Consequently, the liquidation value of such assets is ambiguous, and as monitoring them is much harder, debt holders will request higher risk premiums. Thereby, equity is more preferred when firms have more specific assets, i.e. involve more in R&D activities, as debt will increase the transition costs significantly. Moreover, firms with specific assets employ a workforce with specific knowledge/experience and they offer their customers specific products/services, hence the liquidation cost of such firms will be much higher as staff cannot easily find other workplaces that suit their job-specific proficiencies, or neither can customers find substitutable products (Bah and Dumontier, 2001; Parthiban et al., 2008).

**Information asymmetry:** The information asymmetry phenomenon is more significant for intensive R&D firms. Bah and Dumontier (2001) discuss two reasons for this relationship. First traditional conventional products appeal more to outsiders as they are not familiar with the advanced characteristics of specific firms’ products. Second, Research and development projects are often surrounded by confidentiality to not disclose sensitive information to competitors, due to a high level of secrecy in a highly competitive business. Such firms will consequently have less access to security markets and are less keen on using external funding to lower the risk of exposing sensitive information that could be used by competitors. Thereby, they are expected to exhibit lower payouts to shareholders compared to firms less engaged in R&D (Bah and Dumontier, 2001).

These hazards associated with R&D intensity imply that R&D firms should rely more on equity than debt financing. However, Parthiban et al. (2008) argue that debt is heterogeneous and categorized into transactional and relational debt. Transactional debt includes bonds and commercial papers issued to individuals or institutions where the duration of the debt is unchanging. Transactional debt holders consider only the direct returns from the debt, they are not involved in employing forbearance when firms’ are struggling but will cause a firm’s liquidity instantly in case of default. Further, they rely on high-powered inducements, i.e. bankruptcy, to make borrowers adapt to changing environments and utilize uncomplicated monitoring systems to evaluate debt contracts. In contrast, relational debt constitutes of loans between the borrower and financial institutions such as banks or insurance companies. Accordingly, this type of debt entails long-term relationships between both parts, where the loan holders also offer other services to the borrower. Relational debt holders are more inclined to employ forbearance and to help the borrowers when bad conditions arise. In contrast to transactional debt holders, relational lenders primarily utilize bankruptcy as a threat to renegotiate the debt contracts and enforce more administrative control. Furthermore, banks are more involved in collecting information on client firms, hence they make use of more administratively complicated monitoring
systems to evaluate the projects of the firm. However, this process starts before the issuing the debt, during the issuance period, as well as afterwards, hence more subjective detailed information are gathered compared to transactional debt. These two different types of debt describe Williamson’s (1988) different governance systems that help parties involved in transactions to get through inaccuracies and inefficiencies usually exist. In contrast to previous research, Parthiban et al. (2008) showed that debt, of relational type, could enhance the performance of R&D intensive firms. Moreover, they argue that there is a positive relationship between R&D and relational debt.

2.3 Theoretical Summary and Problem Issues

<table>
<thead>
<tr>
<th>Problems</th>
<th>Impact on financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underinvestment problem</td>
<td>R&amp;D intensive firms focus more on equity financing and in case of debt financing, they focus rather on short term debt</td>
</tr>
<tr>
<td>Asset substitution problem</td>
<td>R&amp;D intensive firms are more inclined to use equity financing</td>
</tr>
<tr>
<td>Asset specificity problem</td>
<td>R&amp;D intensive firms have more intangible assets, which makes it harder to issue debt, hence they should have more equity in their capital structure</td>
</tr>
<tr>
<td>Information asymmetry</td>
<td>R&amp;D intensive firms should rely more on equity than debt financing</td>
</tr>
<tr>
<td>Debt heterogeneity</td>
<td>Relational debt (Bank loans) is positively related to R&amp;D intensity</td>
</tr>
</tbody>
</table>

Clearly, a firm’s R&D investments have a significant impact on its capital structure. However, previous studies are not entirely unanimous on the relationship between R&D and the mix of debt and equity. While some studies show a negative relationship between R&D and leverage, due to the impact of different hazards on firms’ financing and governance directions, other studies advocate the opposite, claiming that debt is not homogenous. It is argued that debt is composed by relational and transactional debt, and that firms’ R&D intensity is positively correlated to the level of relational debt. Through a comparative case study analysis, this paper will investigate the impact of R&D investments on the capital structure of firms within the Swedish life science industry. It aims to contribute to such an understanding by answering the following questions:

**Question 1:** How do firms finance their R&D investments and how does their capital structures differ?

**Question 2:** Why is there a relationship between R&D and capital structure?

**Question 3:** How do other factors related to R&D influence a firm’s choice of financing?
3. METHODOLOGY

3.1 Methodological Framework

Yin (1994) argues that case studies provide a thorough investigation of a contemporary phenomenon within its real-life context by answering “how” and “why” types of questions (Yin, 1994). Our study aims to investigate the impact of R&D investments on the capital structure of firms within the Swedish life science industry. Hence, the case is the relationship between R&D and capital structure and the context is the Swedish life science industry. However, to facilitate the investigation of the impact of R&D on capital structure within its context, 5 firms are being analyzed. This ensures that our phenomenon is not investigated solely through one lens, but rather a number of lenses. Consequently, this will increase our understanding of the relationship and allow us to determine its underlying factors (Baxter and Jack, 2008). As we have identified what is being investigated, we formulated three questions aimed to be answered throughout the scope of this study. One major drawback of case study analysis is that the research question tends to be too broad, hence providing too much information of the investigated phenomenon. In order to evade such difficulties from occurring, it is of particular significance to set clear borders on the case.

Our analysis started with analyzing the financial statements of all firms listed on the Stockholm Stock Exchange, “OMX Stockholm Pharma, Biotech&LifeS_PI”, headquartered in Sweden, during the period 2005-2009. However, in order to investigate the potential for an association between R&D and leverage, only units where both R&D and leverage are present are of relevance. Consequently, our selection was limited to five firms. Moreover, previous research has shown that R&D investments are related to other factors, such as growth and asset structure, which in turn may affect firms’ financial decisions and hence leads to misinterpretation of the results. Therefore, we included seven other factors, i.e. firm size, profitability, non-debt tax shields, growth, income variability, asset tangibility and dividend policy in our analysis to investigate their impact. In brief, our analysis is based on 5 companies during the period 2005-2009, and intends to investigate the effect of R&D and other R&D related factors on leverage.

Furthermore, Yin (1994) argues that the case study approach can take several forms. However, if the study include more than a single case, a multiple case study is essential in order to understand the similarities and disparities between the cases. Our study is of a multiple type, as a variety of firms are investigated, however it applies a holistic approach, as we aim to consider one context.
3.2 Research Strategy

Every study has its specific research strategy that depends on the type of study and the questions being asked. Hence, different strategies are suitable for different purposes. Previous empirical research has mainly focused on applying quantitative regression analysis in order to verify the relationship between leverage and the theoretical determinants of capital structure. Titman and Wessels (1988) discuss a number of disadvantages with this approach. They argue that due to the large number of measures existing for a particular attribute, those that fulfill the statistical criteria might have been specifically selected, thus leading to a misrepresentation of the results. Further, they claim that it is difficult to find proxies for a certain attribute that do not interfere with other attributes of significance. Finally, as the measured proxies are flawed depictions of the attributes they are assumed to determine, their use in regression analysis may create errors-in-variable troubles (Titman and Wessels, 1988).

In this study we aim to investigate the impact of R&D intensity on the capital structure of Swedish Life Science companies by applying a qualitative case study approach. This type of approach can take several forms. A study is defined as deductive if it involves an empirical study that can be based on theory. Conversely, if a study contains facts that are self-explanatory and not readily related to any theory, then it is defined as inductive (Halvorsen, 1992). This study employs a combination of both approaches. To reach the goal of this study, we intend to utilize a descriptive type of research strategy. This approach is suitable as information regarding the issue is reasonably existent. Existing theory of the problem area is then described at the same time as the issue is thoroughly assessed (Patel and Davidson, 1994).

3.3 Collection of data

The data contain all Swedish life science companies, headquartered in Sweden, and listed on the Stockholm Stock Exchange, “OMX Stockholm Pharma, Biotech&LifeS_PI”, over the period 2005-2009. There are totally 19 companies trading on the exchange. However, AstraZeneca and EpiCept were not included in the study as they are not based in Sweden. Further, LinkMed, a life science venture capitalist firm was not either considered, because it is an investment firm rather than an operating life science firm. Consequently, our financial analysis consisted of 16 operating life science firms based in Sweden, giving a data set of 960 firm-year observations, incorporating 12 financial ratios for 16 firms over a five year period. 4 financial ratios were used to determine the leverage level, i.e., dependent variables, and 8 proxies were utilized for measuring R&D and R&D related factors, i.e. independent variables, as shown in table 3.1. Mean values of key ratios for the whole sample over the five years are given in table 1 and 2, appendix 1.
The data was mainly collected from firms’ annual reports over the five year period. Furthermore, financial information about the firms was also gathered from financial databases such as the Stockholm Stock Exchange database, Retriever and Factivo, as a supplement to the companies’ financial reports. The latest annual reports were used to take into account adjusted financial figures confirmed after the reporting period. Consequently, a template for analyzing the financial statements was built up and utilized for the whole sample. The standardized fiscal year-end was December; firms that deviated from this criterion were calendarized.

The ratios produced were used to select companies for conducting the multiple case study analysis. The case study was based on a sample of 5 companies selected according to the following criteria:

**Criteria 1:** Subjects must have measurable leverage values.
**Criteria 2:** Leverage values must be consistent over the entire period.
**Criteria 3:** Subjects must have R&D expenditures equal to or less than sales.

Consequently, the study analyzed the relationship between R&D and leverage for the following companies: Meda, Q-Med, Biophausia, Vitrolife and Biotage. Only those five companies followed the above stated criteria out of the 16 companies analyzed. All five firms have different R&D strategies; hence they differ in their R&D intensity.

The results of the multiple case study analysis were discussed with financial managers of companies analyzed. The intention was to evaluate the results and provide an explanation of the observed trends. Abnormal factors related to the companies or the economy in general that may impact our results could be exposed throughout this evaluation, hence reducing the risk of misinterpretation of the results. This served as a complement to our theoretical explanations of the results.

### 3.4 Explanatory Variables

#### 3.4.1 Measures of Gearing

There are two main ways to determine the level of gearing of a firm, capital gearing and income gearing. Capital gearing is the relationship between the level of debt in the firms’ capital structure and its capital (Pike and Neale, 2009). However the capital factor in this relationship can be expressed differently, depending on the type of the analysis and the desired outcome. Rajan and Zingales (1995) discuss the advantages and drawbacks of several ratios applied to measure the level of gearing. Leverage can be measured either by debt ratios i.e. debt over assets, or by capital ratios, i.e. debt over capital. Further, they argue that the relationship between total debt to capital is appropriate for retrospective studies aimed to measure financial decisions of the past. The advantages are that the ratio
is not affected by trade credit or other external factors to finance. Since accounts payable and untaxed reserves are left out of the factors total debt over capital, the risk of overstating leverage is minimized. The conclusion is that the ratio serves as an adequate measure of leverage of past decisions. Two leverage measures are used in this study, total debt, TD, over total capital, TC, and total debt over total shareholder equity, TE (Rajan and Zingales 1995).

\[
\text{Leverage 1} = \frac{TD}{TC} \quad (9)
\]

\[
\text{Leverage 2} = \frac{TD}{TE} \quad (10)
\]

Income gearing measures the firm’s ability to cover its interest payments, i.e. interest coverage, and is given by the relation of income, expressed as earnings before interests and tax, EBIT, to interest charges. It provides a quick look of how many times the interest could be paid by the companies generated EBIT. An interest coverage ratio of 1 means that the company’s operating income equals its interest charges. Generally, if the value falls below 1, it indicates that the company has no longer sufficient operating income to cover its interest payments. The disadvantage of applying EBIT over interest expenses is the assumptions it makes regarding short term liabilities. The effect of short term liabilities is more or less excluded from the ratio, which could be proven incorrect if the firm faces occasions of economic distress. The coverage ratio suffers from an additional drawback, that is due to its high sensitivity regarding income variations the ratio can give errors in measured leverage. The measure of interest coverage used in this study is EBIT over interest expenses, IE, (Rajan and Zingales 1995).

\[
\text{Interest coverage} = \frac{EBIT}{IE} \quad (11)
\]

Bah and Dumontier (2001) argue that firms with strong R&D investments should focus on equity financing rather than debt, however in case of debt financing, they should exhibit higher portions of short term debt. This study investigates this effect by measuring the ratio of short term and current portion of long term debt, STD, over total debt, TD (Bah and Dumontier, 2001).

\[
\text{Proportion of short term debt} = \frac{STD}{TD} \quad (12)
\]

3.4.2 Determinants of Capital Structure

3.4.2.1 R&D Intensity
R&D expenditures over sales is used as a proxy for measuring firms’ R&D intensity (Bah and Dumontier, 2001). We define firms with ratios over 5% as R&D intensive.
3.4.2.2 Firm Size
Rajan & Zingales (1995) proposed that large firms are less leveraged since they prefer to issue new equity. Large firms generally have less informational asymmetry and therefore less trouble issuing equity at more favorable terms than smaller firms. Further, large firms have higher level of transparency which lowers the costs of equity and increases the probability of financing investments with equity. They proposed that the size of the company is negatively correlated with leverage (Rajan and Zingales, 1995).

Moreover, Titman and Wessels (1988) implied that leverage increases with firm size and that the correlation between firm debt levels and size is positive. As firms grow larger diversification generally increases, which in turn minimizes the risk of default. The costs of bankruptcy would therefore be higher for smaller firms than larger and would have a direct effect on leverage decisions (Titman and Wessels, 1988). Moreover, Firms that are larger may also draw advantages from their reputation and have a superior access to debt markets resulting in higher leverage (Nguyen and Shekhar, 2007).

Purely opportunistic reasons can also be a factor that lies behind firms’ choices of capital structure. Talberg et al. (2008) proposed that the costs of debt and equity are not constant over time but alter depending on the surrounding economical environment. At some times the market may favor equity financing, proving to be superior to debt, while at other times debt is more financially favorable (Talberg et al., 2008). The natural logarithm of sales, S, is used as a measure of firm size (Titman and Wessels, 1988).

\[
Size = \ln S \tag{14}
\]

3.4.2.3 Profitability
Firms rather raise capital first from retained earnings, second from debt and third from issuing new equity, according to the pecking order theory. Therefore, the profitability of a firm is an important determinant of its capital structure, as it will decide the level of earnings obtainable to retaining. Operating income, EBIT, over sales, S, serves as an indicator of the profitability attribute (Titman and Wessels, 1988).

\[
Profitability = \frac{EBIT}{S} \tag{15}
\]

3.4.2.4 Non-Debt Tax Shields
Tax shields provide a way of utilizing leverage to make a reduction in a firm’s income tax. The firm can reduce tax on its income if it takes on more debt, as debt interest is tax deductible. Modigliani and Miller (1958) stated that the tax shield increases the firm’s willingness to take on leverage. Also an
increase in income tax rate will generally have a positive effect on firm’s debt level, according to the trade-off model. Non debt tax shields function as a substitute for the tax benefits of debt. Depreciation and tax credits are examples of non debt tax shields that affect leverage (De Angelo and Masulis 1980).

According to Wanzenried (2002), when an increase in the firms non debt tax shield occur the benefits of leverage diminish. Firms that carry more non-debt tax shields would be expected to have less debt as they do not need to benefit from the tax shields provided by debt. The relationship between non-debt tax shields and leverage is hence a negative correlation. The measurement of non debt tax shields, NDTS, in this study will be performed by using depreciation, D, over total assets, TA (Titman and Wessels, 1988).

\[
NDTS = \frac{D}{TA} \quad (16)
\]

3.4.2.5 Growth
Market-to-book ratios are indicators of investment opportunities. High such values predict growth (Myers, 1977). The indicator of the growth, G, attribute applied in this study is the market-to-book value of assets, \( \frac{M}{B_{\text{assets}}} \), defined as the book value of assets, \( B_{\text{assets}} \), less the book value of equity, \( B_{\text{equity}} \), plus the market value of equity \( M_{\text{equity}} \), and over the book value of assets \( B_{\text{assets}} \) (Rajan and Zingales, 1995).

\[
G = \frac{M}{B_{\text{assets}}} = \frac{B_{\text{assets}} - B_{\text{equity}} + M_{\text{equity}}}{B_{\text{assets}}} \quad (17)
\]

3.4.2.6 Income Variability
The factor income variability is a measure of the variance in income and an indicator of the business risk firms are exposed to. If the income variability is high, the differences between the firm’s earnings are high, which is associated with higher risk of financial default. Thus, firms with high income variability will have lower leverage. The level of income variability is therefore negatively associated with leverage. The used measurement of income variability, \( V \), will be the standard deviation of the change in operating income, EBIT, from year \( t-1 \) to year \( t \) (Titman and Wessels, 1988).

\[
V = \text{std.} \left [ \frac{EBIT_t - EBIT_{t-1}}{EBIT_{t-1}} \right ] \quad (18)
\]

3.4.2.7 Asset Tangibility
Asset tangibility refers to the character of the firms’ assets or the level of tangibility (materiality) of the company’s asset structure. When a firm defaults, a liquidation of its assets is performed to repay investors. Tangible or material assets are usually considered as better collateral as the risk of mispricing in liquidation of intangible assets is higher. Debt lenders are more willing to provide financials when the liquidation value of the company’s assets is high as with tangible assets (Rajan & Zingales, 1995).
According to Scott (1977), if debt is secured through tangible assets, the firm is able to borrow at a lower interest rate. The level of debt is therefore positively correlated with the level of tangibility of the firm’s assets. Hence, asset tangibility may play a significant role in specifying the capital structure of firms. The ratio of fixed assets, FA, over total assets, TA, is used as a proxy for measuring the level of tangibility, tang, (Titman and Wessels, 1988).

\[ \text{tang} = \frac{\text{FA}}{\text{TA}} \]  

(19)

3.4.2.8 Dividend Payout

The preference of a firm to utilize internal funding, in line with the pecking order theory, is connected with the restrictive approach towards giving out dividends. Consequently R&D intensive firms are less inclined to hand out dividends when they favor internally generated funds first before utilizing external. The dividend payout ratio, PAYOUT, given by dividends per share, DPS, over earnings per share, before extraordinary items, EPS, serves as an indicator of the dividend attribute (Bah and Dumontier, 2001).

\[ \text{PAYOUT} = \frac{\text{DPS}}{\text{EPS}} \]  

(20)

Table 3.1. Summary of the explanatory variables

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total capital ratio</td>
<td>Total debt/Total capital</td>
</tr>
<tr>
<td>Total equity ratio</td>
<td>Total debt/Total shareholder equity</td>
</tr>
<tr>
<td>Interest coverage</td>
<td>EBIT/Interest expenses</td>
</tr>
<tr>
<td>Proportion short term debt</td>
<td>Short term &amp; current portion of long term debt, debt/Total debt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D intensity</td>
<td>R&amp;D expenditures/Sales</td>
</tr>
<tr>
<td>Firm size</td>
<td>Natural logarithm of total sales</td>
</tr>
<tr>
<td>Profitability</td>
<td>EBIT/Sales</td>
</tr>
<tr>
<td>Non-debt tax shields</td>
<td>Depreciation/Sales</td>
</tr>
<tr>
<td>Growth</td>
<td>(Book value of assets-Book value of equity+Market value of equity)/Book value of assets</td>
</tr>
<tr>
<td>Income variability</td>
<td>Standard deviation of the change in EBIT from t₁ to t</td>
</tr>
<tr>
<td>Asset tangibility</td>
<td>Fixed assets/Total assets</td>
</tr>
<tr>
<td>Dividend payout</td>
<td>Dividends per share/Earnings per share before extraordinary items</td>
</tr>
</tbody>
</table>

3.5 Methodological Issues

3.5.1 Validity

Criticism has been directed towards conductors of case studies, claiming that they often tend to be subjective in their data collection and thus threaten the validity of the study (Yin, 1994). This study utilized multiple sources of evidence in order to maximize the validity. Particularly, we used annual
reports, interviews and finance theories proposed by pioneers within the area to gather data. Moreover, we made sure to use the latest possible annual reports, taking into consideration any adjustments made by firms after the reporting date for any specific year. Secondly, a template was established for the data collection and utilized for the whole sample. Thirdly, key informants, including CEOs/CFOs of the firms involved, have scrutinized our results.

While internal validity is an issue for this type of case studies, this thesis deals with this issue well by closely referring to the theoretical framework throughout the analysis. Yin (1994) claims that the internal validity of a case study is threatened when a relationship between two variables is assumed, without recognizing any other factors that may have influenced the relationship (Yin, 1994). We intended to minimize this threat by selecting the most significant and relevant factors that are related to a firm’s R&D investments and may have affected leverage.

External validity is related to whether or not the results from a scientific study can be generalized beyond the sample, and is particularly problematic for case studies. Typically, the results of a case study cannot be generalized in a similar manner as a quantitative analysis can be. Yin (1994) advocates that while surveys use statistics to generalize beyond a sample to a population, case studies use in-depth analysis to apply a set of results to broader theoretical framework (Yin, 1994). In this study, we have used multiple cases to prevent external validity issues. In particular, we have chosen a sample of 5 companies to evaluate. This sample is characterized by a wide range of leverage and R&D values.

3.5.2 Reliability
Reliability refers to errors and biases in the study. A reliable study is one that obtains the same results if conducted repeatedly by different researchers (Yin, 1994). To maximize the reliability of our study, we have closely evaluated any collected data and information from different sources and scrutinized our findings with key informants. Our informants have been high profile decision makers that are highly knowledgeable of their firms’ financial performance, ensuring that we obtain reliability of our results.

3.5.3 Ethics
The applied research approach in this paper is a multiple case study analysis where 5 companies have been selected out of a sample consisting of 16 companies, to investigate the relationship between R&D intensity and leverage. Ethical problems related to our approach may occur if an association between selected factors is present for the companies, but not for those not included in the study. While our results could confirm some of the described theories, they are not representative of the entire industry leading to a misinterpretation of the studied phenomenon. To avoid such problems, the selection of the companies included in the case analysis was based on the criteria stated in chapter 3.3,
and the companies that followed the criteria were incorporated. Furthermore, the explanatory variables chosen to determine firms’ capital structures could also lead to similar problems. Defining suitable measures of firms’ performances, especially measures of leverage, is not always a simple task. Different measures have been used in previous research depending on the type of the analysis and the desired outcome. However, the measures used in this study are taken from prestigious journals and pioneering studies within the area of corporate finance. Moreover, the results were evaluated and discussed with key decision makers of the companies studied to provide a practical explanation of the results.

3.6 Delimitations

The research is limited to Swedish life science companies that are listed on the Stockholm Stock Exchange, “OMX Stockholm Pharma, Biotech&LifeS_PI”. Five companies were selected out of the total sample consisting of 19 companies to conduct the comparative case analysis. Further delimitations occurred by restricting the time frame to the period 2005-2009.

The life science industry is affected by the state of the world economy. The financial crisis has restricted the extent to which firms can raise capital from investors either in the form of debt or equity. The economic environment also affects banks and long term lenders who would be under more financial distress and are unable to issue debt as rigorously. Moreover, considerable care should be taken when evaluating abnormal factors such as earnings from non-recurring events, i.e. asset disposals, restructuring programs and discontinued operations. These factors affect the outcome of the analysis, as financial ratios under the influence of such events may deviate significantly from otherwise. However, this study attempts to even out the risk of these effects by evaluating multiple years and maximize the reliability of the results. Further, an attempt was made to distinguish core or sustainable earnings from transitory parts in order to lower the potential for interfering factors. The study was built upon the same financial analysis model for the whole sample in order to achieve consistency and provide more reliable results.

Additionally, factors related to the life science industry specifically, such as stricter requirements from authorities, refusal of pipeline products and reports of adverse events / medical errors are also relevant to the outcome. These factors could for instance have an impact on the information asymmetry between outsiders and insiders and also agency costs, and may result in different financial structure choices from what is predicted by the proposed theories.
4. EMPIRICAL RESULTS

Table 4.1. Mean financial ratios of the 5 firms included in the multiple case study analysis over the period 2005-2009.

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLES*</th>
<th>INDEPENDENT VARIABLES*</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVERAGE¹</td>
<td>LEVERAGE¹</td>
</tr>
<tr>
<td>Meda</td>
<td>0.53</td>
</tr>
<tr>
<td>Q-Med</td>
<td>0.05</td>
</tr>
<tr>
<td>BioPhausia</td>
<td>0.50</td>
</tr>
<tr>
<td>Vitrolife</td>
<td>0.07</td>
</tr>
<tr>
<td>Biotage</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Table 4.1 shows the empirical results of the multiple case study analysis. Financial ratios relating to firms’ capital structures and R&D-intensity are given, in addition to other R&D-related factors. Meda and BioPhausia are clearly the most levered and least R&D intensive firms in the sample. Q-Med is the most R&D intensive firm with highest growth opportunities, lowest leverage level and level of tangible assets in the sample. BioPhausia has the highest income variability in the sample. Q-Med exhibits the highest dividend payout ratio compared to peers, and together with Meda, they are the most profitable companies.
Figure 4.1. Development of the R&D Intensity of companies included in the multiple case study over the period 2005-2009

Figure 4.1 show firms’ R&D intensity over the five-year period. Q-Med displays highest ratios over the entire period followed by Vitrolife and Biotage. The firm’s R&D intensities have been relatively stable, except for Biotage that shows a small reduction during the first three years of the analysis period. Meda and BioPhausia demonstrate the lowest ratios, however a decrease in the R&D intensity of BioPhausia is seen throughout the period.

Figure 4.2. Development of the firms’ leverage levels, expressed as total debt over total capital, over the period 2005-2009
Firms’ leverage levels over the five-year period are shown in figure 4.2 and 4.3. The figures show a clear difference between the analyzed firms’ capital structures. Meda and BioPhausia exhibit the highest ratios, meaning that they rely on debt rather than equity financing, whereas Q-Med, Vitrolife and Biotage demonstrate lowest leverage levels with Q-Med being the least levered company in the sample. However, both Meda and BioPhausia show a decrease in leverage during 2007, 2008 and 2009.

Mean financial ratios for the entire sample are further provided by table 8.1 and 8.2, appendix 8.1. Moreover, the development of other R&D related variables of firms included in the case study analysis are given in figure 8.1, 8.2 and 8.3, appendix 8.2. CEO/CFO-evaluations of the results are provided in appendix 8.3.
5. CASE ANALYSIS

5.1 Case 1: Meda

Meda is a Sweden-based specialty pharma company, one of the largest in Sweden with a market cap of MSEK 19,495 at the end of fiscal period 2009. It is mainly involved in sales, marketing and late-stage product development, i.e. drug development in late clinical and registration stages, hence desisting from early research, usually associated with high capital intensity and risk. The company is fully represented in Europe and Northern America, with proprietary sales organizations in 50 countries. In other countries where the company is not represented, its products are sold by agents and other pharmaceutical companies. Consequently, the company’s products are sold in about 120 countries. The company has four main business functions, sales and marketing, development, manufacturing and administration, where sales and marketing is the largest one. Meda’s strategy is focused on expanding its business through: (1) the development of its own products and (2) by collaboration, licensing and acquisitions of products and technology, with efforts oriented mainly towards the latter. Meda’s product development strategy focuses on established drug substances, hence on improving the characteristics of those substances either by the development of new delivery methods, combination with other successful substances or the discovery of new indications. This strategy helps the company to evade costs and risks from early stage pharmaceutical research (Meda, 2010). Generally, pharmaceutical R&D is a risky investment due to long R&D cycles resulting in a long lag time between investment and return. Moreover, changes in government regulations may have an effect on the cost, uncertainty and returns of the investments, hence impacting the investment patterns within the industry significantly (OTA, 1993).

As shown in table 4.1, Meda is one of the most levered companies in the sample, with a mean total debt over total capital ratio of 0.53 and a mean total debt over total shareholder equity of 1.16, over the period 2005-2009. The debt-to-equity ratio shows that the firm has more debt than equity in its capital structure. Moreover the firm is considered as one of the less R&D intensive firms, reinvesting 3% of its sales in drug development. Figure 4.1 show the development of firms’ R&D intensity over the period. The R&D intensity of Meda has been stable thorough the entire period. However, the figure clearly shows that Meda is less engaged in R&D activities compared to peers. Figure 4.2 and 4.3 show that Meda’s leverage is high, especially compared to firms with strong R&D intensity. These values confirm the underinvestment and asset substitution problems depicting that firms’ level of leverage and R&D intensity are negatively related to each other. However, the company has reduced its debt levels during the last three years of the analysis. The low level of tangible assets provides low non-debt tax shield, hence the firm is trading off the benefits of debt, in accordance with the static
trade off theory. However, debt levels have been decreasing to ensure an optimal capital structure where firm value is maximized.

Furthermore, examining Meda’s debt proportions, it displayed a relatively low mean value of 12% short term debt compared to the other companies analyzed, indicating that the company has more long term debt in its capital structure, hence confirming the conclusion of Bah and Dumontier (2001), that R&D and proportion short term debt are positively correlated to each other. The relationship between long term and short term debt is expressed in figure 8.1, appendix 8.2. The firm’s mean interest coverage ratio was 3.96, though lower than almost all firms analyzed, except for BioPhausia (figure 8.2), the company still demonstrates a good capability of paying the interest charges on its debt. In brief, Meda is more levered but has lower R&D intensity than the other firms included in the study. It has more long term than short term debt in its capital structure, however the company’s ability to cover its interest payments is relatively good, despite the high leverage level.

The firm’s asset structure is mainly consisting of intangible assets, which is very interesting due to low R&D and high leverage. The mean value of the asset tangibility ratio was 0.04. This observation is not confirming previous theories on the relationship between leverage and level of tangibility. The asset substitution problem suggests that firms with high level of intangible assets may prefer equity as intangible assets cannot be used as collateral. As mentioned earlier, Meda’s strategy is focused on collaboration, acquisitions and licensing, hence they do not need to invest a lot in equipment, gross plant, and other tangible facilities, evaluation of Henrik Stenqvist, CFO of Meda, Appendix 8.3. The mean value of EBIT over sales is 0.21, indicating high profitability compared to the sample. This may be related to the high level of debt. High profitability generates strong cash flow and hence high debt capacity. Such firms are less risky to debt holders. Therefore, they will have less troubles issuing debt than firms with low profitability. The income variability ratio is an indicator of business risk, the higher the ratio is the riskier the business. The standard deviation of change in operating income of Meda was 1.27. This may reflect back to our findings on profitability. Though Meda has increased its sales during the analysis period, its profitability has been stable without higher fluctuations. Our findings confirm the suggestions of theories related to agency and bankruptcy costs. Meda has had stable earnings and low income variability over the period. This lowers the potential of financial default and makes it easier for the firm to issue debt. Furthermore, the correlation between high leverage and intangible assets may be derived from the free cash flow theory. Managers do want their firm to grow as growth is associated with higher level of perquisites. However, the risk that managers may consume more than the optimal level of perquisites may lead to the negative relation between tangibility and leverage. Meda’s intangible assets are harder to monitor by debt holders, hence the cost of bankruptcy become higher than for firms with more tangible assets. The increased threat of
bankruptcy may in turn reduce managers’ tendency of consuming high levels of perquisites. Thus, debt is used as a control mechanism to restrict managers’ consumption of perquisites.

Meda is not considered as the largest company. In contrast, it displays low ratios on firm size compared to the sample. This is an interesting observation, because previous research, such as the study made by Titman and Wessles (1988), depict that large firms should be more levered, hence size and leverage are positively correlated. Conversely, Rajan and Zingales (1995) argue that large firms should have less debt, as they are less exposed to the information asymmetry problem than smaller firms and hence have less trouble issuing equity. Consequently, our study confirms their suggestions. However, Meda has much lower R&D intensity than for instance Q-Med or Biotage, as demonstrated in figure 4.1. In general, R&D intensive firms are more exposed to the information asymmetry problem due to high confidentiality to not reveal information for competitors. Thus, Meda’s choice of financing should not be impacted by this hazard to the same extent. Yet they still exhibit smaller size, higher debt and lower R&D intensity. In general, all firms studied exhibit low non-debt tax shields. High Non-debt tax shields can offset the tax benefits of debt, hence the relationship is negative. Our results show that Meda has low levels of NDTS, however as shown in figure 8.2, other companies demonstrate similar values, despite debt levels.

Market-to-book ratios are used to predict growth, as they are indicators of investments opportunities. High values are usually associated with low leverage. Considering that, firms with large number of growth opportunities are expected to be less levered. Figure 8.4 shows market-to-book values of firms’ assets. Our results confirm this relationship, as Meda has relative low M/B values of assets but high leverage. Q-Med, on the other hand, exhibits the opposite, with the highest M/B values and lowest leverage in our sample. The dividend payment level of Meda has decreased throughout the period. Firms with low R&D intensity tend to pay out high dividends to its shareholders, due to the information asymmetry problem. However, this relationship is also dependent on the firm’s growth opportunities. Biophausia, for instance, is a relative young company with high growth opportunities, which can be reflected on their income that exhibits high variability. However, the firm pays no dividends to shareholders which may be expected. Interestingly, Q-Med which engages strongly in R&D pays extremely high dividend to shareholders, although they have decreased over the period (figure 8.4).
5.2 Case 2: Q-Med

Q-Med is a Swedish medical device company listed on the Mid Cap segment of NASDAQ OMX Nordic. The company has focused its business on developing, producing, and marketing medical implants based on the company’s own patented NASHA™ technology. The company has operations in close to 20 countries and employs about 650 people. In 2009 the revenue reached MSEK 1 364 and the market cap had a value of MSEK 4 790. Q-Meds focuses on injectable solutions and products developed for beauty and esthetic treatments. Q-Meds’ success in the area of product development is a result of extensive in-house development and strategic partnerships. The primary customer group has been physicians in the esthetic line of work e.g. dermatologists and plastic surgeons when the products are mostly used on the skin, head and body. The company is considering increasing and focusing its marketing strategy towards direct consumers to increase brand awareness and sales. Additionally Q-Med has intension of increasing its presence internationally in emerging and developing markets. (Q-Med, 2010)

Q-Med has a relatively low proportion of debt in its capital structure in relation to its industry peers as shown in table 4.2 and 4.3, indicating equity dominant capital structure. Regarding the R&D intensity, Q-Med has been comparably stable over the five-year period reaching a mean value of 0.19 as indicated in figure 4.1 and table 4.1. Compared with its peers the company is considered being the most R&D intensive. The high R&D intensity and the low levels of leverage is in line with the underinvestment and asset substitution problems, depicting that firm’s debt and R&D intensity are negatively correlated. According to the pecking order theory, equity should be used as a last resort due to information asymmetry between managers and the market. However, this problem may be of minor significance in the case of Q-Med, as main owner of the firm is also the founder and former CEO, appendix 8.3.

The proportion of short term debt, seen in Figure 8.1, has increased over the five-year study period when the company reduced its long-term debt, and has been more inclined to focus on short-term debt. According to the underinvestment problem, R&D intensive firms primarily focus on equity but in the case of debt financing, they show higher levels of short-term debt. The mean value of proportion of short term debt of Q-Med is 0.40 which is considerably higher in comparison with e.g. the less R&D intensive firm Meda, thus validating the stated correlation. The mean interest coverage ratio of 176.50 is compared with the peers extremely high. The company's ability to cover its interest costs is the highest of the companies in the sample over the five year period. Figure 8.2 indicates that the values for all years except 2008 are given as NA due to the extremely large values generated in interest coverage these years. This specific year the company deviated from the period values and exhibited lower profitability which in turn my have affected the ratio.
The firm’s asset structure had a high and stable level of fixed assets compared with its industrial peers over the period, Figure 8.3. Q-Med develops its own products; hence they invest more in manufacturing facilities than Meda or BioPhausia. Figure 8.3 indicates that Q-Med has kept a constant level of size over the five-year period. The company is also, according to this ratio, the largest company in the studied population followed by Vitrolife. The negative correlation between the low levels of debt Q-Med is carrying on and the large size of the company, as with the case of Vitrolife, is in line with the theory of information asymmetry. Q-med has a mean profitability of 0.25 that is the highest out of the firms in the sample as indicated in Figure 8.3. High profitability indicates high level of retained earnings that can be used to finance new projects according to the pecking order theory.

Over the analyzed five-year period the profitability has steadily increased although as stated before, the year 2008 had a significant drop in profitability, which affected the level of income variability. The increase in income variability due to the drop in profitability 2008 increased the firm’s level of business risk, placing it in second place after BioPhausia, with 6.22. The case of Q-Med follows the propositions of Titman and Wessles (1988) that firms with high-income variability will have lower debt levels in their capital structure. Although the income variability is high it would be due to the variable level of profitability and not necessarily an implication of a higher risk of financial default.

Q-Med shows the same level of NDTS as Vitrolife. Q-Med exhibit a higher level of tangible assets compared to pews, hence the higher NDTS. This confirms the previous research by Wanzenried (2002), stating a negative correlation between non-debt tax shields and leverage. In brief, firms as Q-Med and Vitrolife with higher levels of non-debt tax shields are expected to have lower levels of leverage when they do not need to drawing benefit from the tax shields provided by debt. The mean market-to-book ratio of Q-Med is the highest in the sample as shown in figure 8.4. Q-med confirms the predictions that firms with high growth opportunities have less debt in their capital structure, thus the negative correlation between growth and leverage.

Q-med is an interesting case regarding the dividend payout measure. The company is the most R&D intensive in the sample and the previous theory states that R&D intensive firms are less keen on handing out dividends when they favor internally generated funds primarily before utilizing external financing. Q-Med on the other hand exhibits the highest dividend payout ratio as seen in figure 8.4. The dividend payout has decreased over the analyzed years, yet still the mean value is as high as 0.52 compared with the non R&D intensive firm Meda that has a value of 0.24. The signaling hypothesis could serve as a possible explanation to this anomaly. High quality firms are keener on handing out larger dividends for two reasons that are related to increased investment possibilities. First it could serve as an indication to the market that the firm is still operating as a high quality firm. The second reason is to minimize information asymmetries between the firm’s managers and the investors (Easterbrook, 1984).
5.3 Case 3: BioPhausia

BioPhausia is a Swedish specialty pharma company with over 100 employees operating in Sweden, Poland, the Netherlands, Denmark and Finland. The company’s products are distributed to approximately ten different countries with the largest market currently in the Nordic countries. In the year 2009 the market cap reached MSEK 558 which was a five year high for the company. Since BioPhausia does not actively perform any early stage R&D, the company is more inclined to performing marketing and sales on acquired product lines. The research and development that occurs is focused on developing and improving existing products gathered from other companies’ early stage research. This enables the company to cut down costs and the risks associated with this type of R&D and focus on sales and marketing of products. BioPhausia focuses its business operations on three core fields, parallel-imported products, licensed products and its own products. However, the success of BioPhausia has lied in the extensive level of cooperation the company has had with many of the leading pharmaceutical companies in the world (Biophausia, 2010).

BioPhausia and Meda are the most levered companies in the study. The results from figure 4.1 show that the company is the less R&D intensive firms, with a mean value as low as 0.01. This indicates that only 1% of sales are reinvested in R&D which is considerably low compared with peers in the sample. The negative correlation between the low R&D intensity and the high level of debt verifies the theories of the underinvestment and asset substitution problem as seen in figure 4.2 and 4.3. Furthermore, BioPhausia has a relatively low level of short term debt over the years 2005 – 2009, although in 2005 the level of short term debt reached 0.90, raising the mean for the whole period. The mean interest coverage ratio was lower than approximately all firms in the study with a value of 2.16, though still high enough to indicate a reasonable capability of paying the interest charges on its debt.

BioPhausia has a very low level of tangible assets in its asset structure, table 4.1. The firm relies most likely on parallel-import and licensing, hence do not need to invest a lot in manufacturing facilities. This observation is very interesting, especially due to the firm’s high debt levels and low profitability. While Meda’s high leverage could be explained by the high profitability, low business risk and the free cash flow theory, BioPhausia’s could not. The mean value of profitability is 0.07. The value is relatively low compared to the other companies studied. However, figure 8.3 shows that the profitability has increased progressively throughout the period, which is also shown by the high income variability the firm is exhibiting. The change in operating income calculated over the five-year period is highest for BioPhausia among all other companies in the sample. The value of income variability that serves as an indicator of business risk was 53.53, and is considerably larger than Q-Med’s which is the company with the second largest value of 6.22. These values indicate that the firm is a “growth firm”. Additionally, BioPhausia exhibits, although not so high but relatively stable B/B values, indicating a stable cash flow generation over the period. As indicated in figure 8.3,
BioPhausia has been comparably constant and is relatively large in size compared with the firms in the sample. In contrast to Meda, BioPhausia is proving to be in line with the theory of Titman and Wessles (1988), that there exists a positive correlation with size and leverage. The Non-debt tax shield indicator has a mean of 0.02 which is considerably less than peers. The relatively high leverage confirms the negative correlation between NDTS and debt.

The mean market-to-book ratio of 1.21 shown in table 4.1, indicates a relatively low growth compared with the sample. BioPhausia has not actively been handing out dividends to its shareholders during the covered five-year period. It is expected that less R&D intensive firms pay out more dividends to its shareholders, due to the information asymmetry problem. Thus the case of BioPhausia disproves this relation. However, the dividend policy is also dependent on the firm’s profitability and growth opportunities and as BioPhausia’s operating income still not has reached stable levels, this may be expected.

5.4 Case 4: Vitrolife

Vitrolife is a global biotechnology/medical device company based in Sweden and listed on the OMX Nordic Stockholm Exchange, with a market cap at the end of 2009 of MSEK 680. The company is engaged in the development, production and marketing of products used in the preparation, cultivation and preservation of human cells, tissues and organs. However, the company focuses mainly on three product areas represented by fertility, transplantation and stem cell cultivation. The company is represented in different parts of the world by its nine subsidiaries, however it is mainly active in Europe, US, Australia and Japan. The company’s R&D strategy is mainly concentrated on external partnerships and acquisitions of technology, where Vitrolife seeks collaborations to access new expertise and technology. The products are then further developed by the company’s internal R&D department (Vitrolife, 2010).

The mean values of both leverage measures were 0.07 over the period, much lower than Meda and BioPhausia but similar to those of Q-Med and Biotage. However, the firm has decreased its debt levels significantly over the period. Vitrolife is one of the most R&D intensive in our sample, as shown in figure 4.1. In accordance with the previous cases, this relationship confirms the underinvestment and asset substitution hazards on the impact of R&D on capital structure. Furthermore, the firm’s mean debt proportion ratio was 0.31, which is higher than that of Meda, but lower than Q-Med’s. This corroborates the debt maturity hypothesis, arguing that R&D intensive firms are more inclined to issue short term debt to lower the impact of the under-investment risk. However, BioPhausia, the less R&D intensive firm in our sample, exhibited a significantly higher mean value of short term debt than Vitrolife. This is most likely due to BioPhausia’s high ratio in 2005 as demonstrated in figure 8.1, which could depend on the owner structure. Vitrolife has high interest coverage (figure 8.2), especially
compared to BioPhausia, and the interest coverage ratio has decreased over the 5 year period, which is connected to the reduction in leverage.

The firm exhibited a mean value of asset tangibility of 30%. Moreover, Vitrolife exhibited similar size ratios as the sample, except for Meda. The mean value of Ln(Sales) over the period was 12.15. The firm’s profitability has been relatively stable, with a mean EBIT/sales of 0.11. This is also shown in the income variability diagram (figure 8.3), where Vitrolife displays the lowest standard deviation of the change in operating income, 0.30. Vitrolife has lower profitability than Meda, which may be due to the fact that Vitrolife spends 14% of its sales on R&D, compared to the 3% of Meda. Consequently, Meda’s high profitability makes it easier to issue debt compared to Vitrolife, which could confirm the disparities in leverage levels between the two companies. Interestingly, Vitrolife exhibits the highest level of NDT in the sample, confirming what previous research has suggested. Vitrolife has low debt levels, hence missing the tax advantages of debt, according to the static tradeoff theory. However, non-debt tax shield can balance this affect. The M/B ratio of Vitrolife is similar to Meda’s, but higher than those of Biotage and BioPhausia, and lower than Q-Med’s. High M/B values mean low leverage. A weak relationship between leverage and M/B ratios is shown in figure 8.4, where Q-Med with the highest M/B is the less levered as opposed to BioPhausia.

Figure 8.4 shows the dividend payout ratios of the firms over the period. Vitrolife handed out no dividends in 2005, 2006 and 2007. However, they started paying out dividends first in 2008 and has done that 2009 as well. This is an interesting observation as it could have many explanations. First, the company has had relative stable earnings over the period, which in turn may generate a strong cash flow. According to the free cash flow theory and the “control hypothesis” by Jensen (1986), dividend payouts decrease managers’ control over the firm’s free cash flow, hence lowering the risk of investing in negative NPV projects. Managers are on the other hand more inclined to investing as they want their firm to grow, and growth is positively related to their perquisites. This could be a possible explanation. However, dividends are generally paid out in mature firms with low growth opportunities. This may lead us to question Vitrolife’s growth opportunities and whether the firm has reached its peak.
5.5 Case 5: Biotage

Biotage is a global supplier of instruments and consumables for medicinal and analytical chemists. It develops, manufactures and markets its products and services within the area of biotechnology/life science. Biotage’s shares are listed on the Nasdaq OMX Stockholm Small Cap List, with a market cap of MSEK 628 at the end of 2009. The company’s client base consists primarily of pharmaceutical companies, academic institutions and organizations engaged in analytical chemistry. The company’s R&D strategy focuses mainly on developing its own products through well defined and established R&D processes. Moreover, the company has focused on research rather than development of products during the last period, with efforts oriented towards technologies and platforms that can be utilized to further develop the company’s products in the next coming years.

Considering figure 4.2 and 4.3, the company has low leverage compared to Meda and BioPhausia, however somewhat higher than Q-Med and Vitrolife. It exhibited a mean value of total debt/capital of 0.08, and total debt/equity of 0.08, indicating that the firm is mainly financed by equity. However, figure 4.2 and 4.3 also show that the firm has reduced its debt levels over the analyzed period. The company invests around 10% of its total sales on R&D, expressed as the mean value over the period.

Figure 4.1 shows the development of the firms R&D, the company has reduced its R&D investments, which could be due to the fact that the development work has been supplemented by a larger degree research. However, our findings on Biotage strengthen previous research on the negative relationship between R&D and leverage. The firm’s proportion of short term debt has increased as shown in figure 8.1, with highest values in 2008 and 2009. Furthermore, the companies operating income was negative in 2005, and low in 2006, hence indicating an incapability of paying its interests, which is shown as NA in figure 8.2. However, the income increased in 2007 and 2008, giving better ratios of interest coverage, but decreased again in 2009. These variations in operating income between the years increase the company’s business risk and consequently the cost of bankruptcy, making it tougher for the firm to issue debt. The firms mean EBIT/sales over the period was 0.01, and the standard deviation of the change in EBIT was 2.83.

The firm’s asset structure is low due to high R&D, though it decreased significantly during the last years. The mean value of the asset tangibility ratio was 0.08. Furthermore, Biotage exhibited analogous size measures (13.5) to the other firms except for Meda. The firm has significantly lower debt levels and larger size than Meda, hence strengthening Ranjan and Zingales (1995) on this. Similar to Vitrolife, Biotage has higher NDTS than the other firms; however figure 8.3 shows that the firm’s NDTS declined in the last two years of the analysis period, which is most likely related to the reduction in the level of fixed assets. What is interesting here is the relationship between the M/B ratio and leverage. While the firm’s leverage has decreased as mentioned above, the M/B ratio has acted similarly, hence not confirming previous arguments. However, the firm has had high variability in
operating income and low interest coverage values which could be the explanation behind the decrease in leverage. Moreover, the firm has been focusing more on research than development in order to discover new technologies that can be applied to the firm’s products in the future. The reduction in the development work may have affected the M/B ratio. Furthermore, high growth is usually associated with greater information disparities between outsiders and managers, therefore firms with high growth may take on more debt to certify high quality to outsiders. Thus years with low growth may entail lower debt levels.

However, the second interesting finding is the development of the dividend payout ratio as shown in figure 6. The firm started handing out dividends to its shareholders in 2008 and 2009. As discussed earlier, the firm exhibited lower M/B ratios during these years, i.e. expected fewer investment opportunities. This could confirm the free cash flow theory proposition on the impact of agency costs, claiming that when the firm has few investment opportunities, shareholders require higher dividends in order to prevent managers from overinvesting. Firms with low growth opportunities will pay higher dividends rather than taking on negative NPV projects.
6. CONCLUSION

This study aimed to investigate the impact of R&D investments on the capital structures of firms within the Swedish life science industry by giving answer to the following questions:

Question 1: How do firms finance their R&D investments and how does their capital structures differ?
Question 2: Why is there a relationship between R&D and capital structure?
Question 3: How do other factors related to R&D influence a firm’s choice of financing?

In investigating the problem issue, a multiple case study analysis was set up, in accordance with Yin (1994). The financial performance of the sixteen Sweden-based life science companies listed on the Nasdaq OMX Stockholm Stock Exchange was analyzed over the period 2005-2009. Consequently, five companies; Meda, Q-Med, BioPhausia, Vitrolife and Biotage were selected for conducting the case analysis. The companies were chosen based on the following two criteria:

Criteria 1: Subjects must have measureable leverage values.
Criteria 2: Leverage values must be consistent over the entire period
Criteria 3: Subjects must have R&D expenditures equal to or less than sales.

Our findings show clear differences between the analyzed firms’ capital structures. Meda and BioPhausia were the least R&D intensive firms with mean R&D over sales ratios of 0.03 and 0.01 respectively. However, they exhibited highest leverage levels expressed as total debt over total capital, with means of 0.53 and 0.50 respectively. Further, they displayed mean values of total debt over total equity ratios of 1.16 and 1.03, respectively, clearly indicating that they are financed by more debt than equity. Q-Med, Vitrolife and Biotage were the most R&D intensive firms with mean R&D over sales of 0.19, 0.14, and 0.10 respectively, as given in table 8.1 and 8.2, appendix 8.1. Those firms were also the less levered, with total mean debt over capital of 0.05, 0.07 and 0.08 respectively, and with mean total debt over equity of 0.05, 0.07, and 0.08, hence indicating more equity than debt in their capital structure. Furthermore, our results are aligned with the findings of Aghion et. al (2004), on the relationship between R&D intensity and capital structure. The level of leverage decreases with increasing R&D intensity, however only for the most R&D intensive firms, as Meda and BioPhausia did not exhibit the similar.

The relationship between R&D and capital structure may be driven by the different strategies the firms pursue. The analyzed firms have different strategies and differ in their R&D intensity, and may therefore choose different capital structures. The strategy of Meda and BioPhausia is mainly focused
on licensing and acquisition of products, hence they do not engage heavily in R&D or production, and do not need to invest in manufacturing facilities, which explains the low level of tangible assets. However, in contrast to previous research, those firms were the most levered, despite the low level of tangible assets that can be used as collateral. Q-Med, Vitrolife and Biotage focus more on in-house product development, thereby the higher level of fixed assets. However, they exhibited low leverage but higher dividends.

The study also investigated the effect of other R&D related factors on leverage. Our most interesting finding was the relationship between R&D, growth, and dividend payouts of Q-Med. Theory usually suggests a negative relationship between growth and dividend payouts, most likely due to agency costs. Moreover, R&D and dividend is also suggested to be negatively correlated to each other, because of the information asymmetry problem. Q-Med, as shown in figure 8.4, exhibited the highest growth, R&D and dividend payout ratios amongst the others, hence depicting a positive relationship in contrast to previous theories. The positive relationship between growth and dividend payout could be explained by the “signaling hypothesis”, claiming that firms with high investment opportunities may be inclined to paying out high dividends in order to signal their high quality to the market (Easterbrook, 1984). Further, the high dividends could be related to the firm’s owner structure. Founder and former CEO Bengt Ågerup has been the main owner during the 15 years the company has been operating. Throughout this period, the company has tried to refrain from external funding whether in the form of bank loans or venture capital.

It is clear that a firm’s capital structure decision is a complicated topic, which theory alone cannot always explain. Utilizing a multiple case study approach, this paper has provided an in-depth analysis of the capital structure of five publicly traded firms within the Swedish Life science industry by applying both theory and empirical research. A limitation to our study is that we have only considered the life science industry. We hope that future research will be able to examine these problem issues for other R&D intensive industries, such as instrument engineering and/or telecommunication equipment and provide a cross-industrial comparison within this area.
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### Key Ratios for the Period 2005-2009

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<td>0.18</td>
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</table>

* Mean values for financial ratios during the period 2005-2009

1) Leverage defined as total debt to total capital
2) Leverage defined as total debt to total shareholder equity

Table 8.1. Mean financial ratios for the industry over 2005-2009.
### Table 8.2

Mean financial ratios for the industry over 2005-2009.

<table>
<thead>
<tr>
<th>Company</th>
<th>Leverage 1</th>
<th>Leverage 2</th>
<th>Intrest Coverage</th>
<th>Debt Maturity</th>
<th>R&amp;D Intensity</th>
<th>Asset Structure</th>
<th>Dividend Policy</th>
<th>Growth</th>
<th>Income Variability</th>
<th>NDS</th>
<th>Profitability</th>
<th>Size</th>
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<td>0.30</td>
<td>0.04</td>
<td>0.11</td>
<td>12.15</td>
</tr>
</tbody>
</table>

* Mean values for financial ratios during the period 2005-2009

1) Leverage defined as total debt to total capital
2) Leverage defined as total debt to total shareholder equity
8.2 Appendix 2: Figures

**Proportion of short term debt**

![Proportion of short term debt](image)

*Figure 8.1. Development of the firms’ type of debt over the period 2005-2009*

**Interest Coverage**

![Interest Coverage](image)

*Figure 8.2. Development of the firms’ interest coverage over the period 2005-2009*
Figure 8.3. Development of the firms’ asset tangibility, NDTs, profitability and income variability over the period 2005-2009.
The Impact of R&D Investments on The Capital Structure of Swedish Public Life Science Companies

Figure 8.4. Development of the firms’ growth, size and dividend payout ratios over the period 2005-2009

NA – No dividends have been paid out by the firms
8.3 Appendix 3: CEO/CFO Evaluation

Henrik Stenqvist's, CFO of Meda, evaluated our results as follows: Meda differs a lot from the other companies included. The company refrains from early R&D costs by focusing on acquisitions of products and patents for further development and marketing. As some of the other companies studied are pure development companies, they may engage more in early stage R&D and hence have higher research intensity. Meda does not need to invest a lot in manufacturing facilities and other tangible assets in relation to the level of intellectual property as products and patents. Regarding the dividend policy, Meda is one of the few companies in the study that pays dividends. This indicates a stable profitability, but also low R&D levels, since these two are most likely connected. The dividend rate has declined somewhat over the years at the same time as the debt levels have been reduced significantly.

Bengt Ågerup, former CEO and current Chairman of The Board of Q-Med evaluated these findings as follows: Throughout the fifteen-year period the company has been active, it has focused on optimizing the long-term development by refraining from external funds, in form of bank loans or venture capital, hence the low leverage. The capitalization is stable as we have sold the rights of our aesthetical products in the U.S. Furthermore, the licensing of our hospital products to partners has generated sufficient earnings as well, displayed in figure 8.3. This has consequently raised the market value of the firm. The firm’s ability to perform strategic acquisitions is adequate due to the low leverage. However, the industry’s current situation is mainly due to the lack of financially reliable acquisitions, and a good portfolio of internal projects.

Weine Nejdemo, current CFO of Oasmia Pharmaceuticals and previously Co-Founder of BioPhausia, evaluated the study as follows: Basically, Oasmia and firms similar to Oasmia, i.e. innovative firms that primarily focus on research and development have mainly three available instruments of financing: issuing new equity, debt or licensing depending on the firms’ economical situation and the current market attributes. Licensing could have an impact on firms’ R&D intensity, due to stage or milestones payments. These payments do not occur on a yearly basis, hence increasing the turnover of years for which they occur, which may in turn lower the firms’ R&D intensity or increase the variation between years. Over the period of the study the turnover has also been affected by the company’s choice of entering a new field of business, parallel import of pharmaceutical products. This may have influenced the firm’s R&D intensity, asset structure and leverage as well. The firm exhibits low debt ratios as given in table 8.1 and 8.2, mainly due to low level of fixed assets that can be used as collateral. The level of intangible assets has increased. The firm’s NDTS has decreased, due to increasing level of tangible assets and the entrance into a new business area, which affects both total assets and working capital as well. Furthermore, the firm’s proportion of short term debt has increased due to the high level of debt received from principal owners.