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THE DISCOUNTED CASH FLOW APPROACH TO FIRM VALUATION

A STUDY WITH FOCUS ON FORECASTING

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Abstract

This thesis presents a critical discussion concerning shortcomings of the discounted cash flow (DCF) model as it is used in firm valuation. It focuses on the estimation of the future performance of a firm. The implications of the shortcomings are discussed and methods to overcome them are argued for. The thesis aims at contribute to the ever present process of improving firm valuation.

The information used to implement this thesis comes primarily from secondary data sources in the form of financial literature as well as figures from databases. The study was conducted in two parts, one theoretical and one empirical part.

In the literature study it was found that one way to improve the DCF model would be to forecaste the future sales of a firm by utilizing a causal method approach (CMA). The CMA was applied on the case company Peab AB through a multiple regression model. The empirical implications were found to, somewhat, limit the merits of the CMA.

The general conclusion of the study is that analysts should strive to make the valuation process as scientific as possible. This minimizes the valuation's exposure to subjectivity from the analyst and, hence, improve the reliability of the valuation. It could be achieved by applying the suggested CMA when transforming a qualitative strategic perspective of the firm's future development into a quantitative financial perspective. Furthermore, by explicitly stating assumptions and views, the reliability of the valuation can be assessed by the investors acting on the information. These measures will improve the DCF model as a tool in the decision-making situation.

Key-words: Valuation, discounted cash flow model, forecasting, causal forecasting model, mathematical models

Acknowledgement

This thesis has at times been a lot of hard work, but also interesting and fun. It has given us extended insight, which is an excellent complement to all our theoretical knowledge gained during our time at IFE in Graduate Business School. This thesis would never have been accomplished without the help we obtained from various people. Therefore, we would like to take this opportunity to extend a thank you all the people involved in the completion of this thesis.

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Furthermore, we would like to direct our warmest and deepest thanks to all the company and industry representatives and professors we have spoken to during this study. We appreciate the generous and positive way we always have been treated. Many thanks to you all!

Göteborg, December 2002

Karl O. Olsson Jonas Ribbing Madeleine Werner

"My interest is in the future – because I'm going to
spend the rest of my life there."

Charles Kettering

"Forecasting occupies us all for much of our lives. It begins with the speculative wagging of heads over our cradles and continuous until the prayers with which we are hopefully laid to rest. Sometimes it is an idle amusement, sometimes a matter of life and death, sometimes - and this is where the economist takes a hand - it carries rewards and punishments in the forms of profit and loss"

Sir Alec Cairncross, 1969

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INTRODUCTION AND METHODOLOGY

The first part of this thesis covers an introduction to the subject and defines the purpose of the study. Furthermore, the methodology used to carry out the thesis is discussed.

1. Introduction

1.1. Background

The activity in stock market exchanges has increased during the last decades. Consequently, so has the stock markets importance to the society. Nowadays, many institutions as well as individuals are heavily invested in the stock market. By investing poorly, large quantities of capital could be lost with quite devastating consequences for the institutions and individuals who are invested in the stock market, but also individuals indirectly dependent on the institutions could be subjected to indirect consequences. This calls for ever increasing sophistication of the tools available to estimate the value of firms on the stock markets. (Hamberg, 2000)

In order for the stock market to function, a belief in valuation techniques of individual firms is necessary. Without some sort of model to estimate value, investors would not be able to arrive at conclusions on what price to buy or sell an asset. There would be no liquidity in the stock market and, consequently, it would stop working.

When inspecting different analysts' results, of specific firm valuations, the value often differs. Looking at some recommendations on the value of Ericsson, the accuracy and usefulness of the analysts' advice can be questioned. Figure 1.1 below shows the estimated value of Ericsson made by four different investment banks as it was published in an Internet newsletter. As can be seen in the figure, there are significant differences in value between the different investment banks.

Table 1.1 Intrinsic Value of Ericsson according to different investment banks.

Investment bank	Stock Target price (1 year)	Indicated Market Capitalization
Lehman Brothers	5 SEK	76 590 200 190
Fisher Partner	15 SEK	229 770 600 570
Credit Suisse First	4,80 SEK	73 526 592 182
Morgan Stanley	3,50 SEK	53 613 140 133

Source: E-trade newsletter 2002-10-22

Why do these valuations differ? Well, either the model used to estimate these values differs a great deal or the input into this model differs between the analysts. Since the analysts have diverse views of the future this will result in different forecasts of this future and, hence, different recommended values. How do I know which of these values is the most accurate? Basically, it is not possible to determine that and this is only one of the many difficulties involved in valuation.

Marianne Nivert, former CEO of Telia Sweden's largest telephone operator and one of the participators in a seminar on whether the stock market is a break or engine in Sweden's competitiveness, went as far as stating that if it were so hard to value firms, you can question the raison d'être of the analysts (Veckans Affärer, 2002). As we can see it is vital for analysts to strengthen their customers and the publics' faith in them and to prove that they are part of a justified industry.

Thus, improvements are necessary, both in how the analysts are carrying out valuations and in how they convey their results to their customers.

1.2. Problem Discussion

It was introduced in the background that there is an ever-present need to improve the tools used by analysts when valuing firms. This thesis aims to make a contribution in this continuous process.

There are several opinions on what creates value in a firm. Therefore, there are many different approaches to estimate the value of a firm. To investigate all of these valuation approaches[1], in search of improvements, is an extensively large task. Such research would demand an extremely large quantity of reliable information and, thereby, easily lead to an overload of information to gather as well as to analyze. Therefore, to be able to make valid and reliable suggestions on how improvements could be made it is important to focus the study. This will be achieved by focusing on a specific valuation model.

[1] Hereafter, in order to avoid being overly repetitive, the words model, method, and approach will be used interchangeably with the meaning of defining a structured way of doing some sort of valuation.

This study will focus on the discounted cash flow (DCF)[2] method, which is the mostly used fundamental method in firm valuation (Perrakis et al, 1999). Consequently, the basic problem that this study is faced with is: *How can improvements to the DCF model, as it is used to value firms, be achieved?*

In order to show how analysts can improve the way they apply the DCF model, and how they report their results, thorough understanding of the DCF model and the context in which it is used is necessary. To achieve this many questions has to be answered. Firstly, *what are the pros and cons of mathematical models in general?* This has to be identified in order to establish a framework for what weaknesses and limitations of the DCF model, which is a mathematical model, could be exposed to. Secondly, *what are the weaknesses and limitations of the DCF model?* This leads to a third and even more important question: *What are the reasons behind these weaknesses?*

The answers to these questions could shed some light on the original question - how improvements to the DCF model could be achieved. By analyzing this, suggestions on how to improve firm valuation with the use of the DCF could be found. But in order to really be able to make improvements to the method, more questions have to be asked and answered.

The DCF method is a model that is created to be used in a decision-making situation. Therefore, it can be viewed as a tool designed to help decision makers reach optimal decisions and, in that case, many aspects have to be analyzed in order to improve the model. Improvement to the method can have many different shapes, for example, it can improve the accuracy of the model, make it user-friendlier, and/or make it applicable in the decision-making situation in more aspects than originally intended. Hence, more than just the immediate effects on the model in itself should be considered. *How will this suggested improvement, of the DCF model in itself, affect the role of the DCF method as a tool in the decision-making situation?* This too becomes an important question to answer.

Further, improvements solely based on theoretical reasoning tend to loose some of its usefulness when applied in real life situations. Consequently, the conclusion of such a theoretical study should be tested in reality. Moreover, in

[2] Henceforth, DCF will be used as abbreviation for: discounted cash flow.

science it is important to empirically test theoretically developed theories, this to see if the theories can be falsified or should be accepted as temporary truths (Thurén, 1998). This indicates that questions concerning how the suggested improvements work in practice are adequate. Thus, a first test of the validity of the suggested improvements should be conducted. This would at the same time provide an example of the reasoning from the more theoretical conclusion. By combining the experiences and conclusions from both an empirical application and a theoretical study, more comprehensive conclusions on how to make improvements would be made.

The DCF model rests on two inputs; the numerator, which is some sort of estimated future cash flow, and the denominator, i.e. some sort of cost of capital. The output of the model is dependent on these two inputs. The denominator and how it should be calculated is the concern of some scientific reports (Bohlin, 1995) as well as the topic of large discussions in many financial textbooks (Copeland et al., 2001, Perrakis et al., 1991 and Ross et al. 1991). On the other hand, the numerator is a much less discussed topic in scientific reports and financial textbooks. This implies that within this part of the DCF method there might be unexplored possibilities to contribute to improvements of the model.

To summarize the problem discussion; the thesis is conducted in order to find reasons behind problem areas in the DCF approach to firm valuation, as well as how improvements can be made to these areas.

This will be accomplished by conducting, (1) a literature study of related academic theories, mathematical models in general, the DCF model in particular, and forecasting models, and (2) a case study where the suggestion formed in the literature study is tried on a case company.

1.3. Purpose

The overall purpose of this study is to establish theories on improvements of the discounted cash flow method as it is used in firm valuation. This will be accomplished by a literature study and a subsequent case study whose sub-purposes are stated below.

The purpose of the literature study is to analyze the use of the discounted cash flow method as it is used in firm valuation. The aim is to expose some important weaknesses of the method and the reasons behind why they are problem areas. Further, the study will be conducted to find reasons and arguments to solutions of these problems.

The purpose of the subsequent case study is to twofold, (1) to empirically try the feasibility of the literature study's suggested solutions, and (2) to exemplify the use of the suggested solution. The aim is to expose important implications of empirical weaknesses and limitations of the suggested solution and that this, together with the suggestions from the literature study, should lead to conclusions concerning the overall purpose.

1.4. Previous Research and Potential Contribution of the Study

There are quite a lot of other studies that have been conducted on firm valuation. Some of these focus on the different methods that are used to conduct valuations. They investigate, compare and contrast, which models analysts use and how these analysts look at the models. For example, see Absiye and Diking (2001) and Carlsson (2000). Others center on how one, or a couple, of the valuation models are constructed, see Eixmann (2000), still other conduct case studies where a valuation approach, frequently the DCF model, is applied to a special case. Example of such research is Bin (2001).

This study differs from all of these in one sense or another. Firstly, the focus is on one model, the DCF model, but the whole context of the valuation process is in focus and not just the mechanics of the valuations in itself. Furthermore, the investigation is directed towards finding areas to improve within the DCF approach and ways to make improvements in these areas, this instead of just identifying problem areas as in many other studies. The study also differs from ordinary case studies since the case study in the thesis will rest upon a literature

study and the recommendations made in this. Ordinary case studies usually lead to (1) knowledge of how to apply valuation techniques, (2) developing a better understanding of an industry, and (3) developing a better understanding of a company. In addition, the approach used in this thesis will, potentially, lead to knowledge of how to apply a valuation technique as well as insight in its weaknesses and limitations and how these can be overcome. Furthermore, the knowledge obtained is more general than the knowledge developed in (1) and (2). It can be applied to all valuation situations rather than just the industry and company studied in a case study.

Some academic theories, such as uncertainty and risk, subjectivity and objectivity, and the open society, will also be introduced in the area of DCF. These are new or relatively undeveloped theories in the traditional valuation context and by introducing them the study will bring new aspects on the subject of firm valuation.

There are many scientific studies conducted on forecasting, but most of these are not in the context of firm valuation. They are usually focused on macroeconomic forecasting or short term forecasting where mostly sales volume and similar quantities are forecasted. Examples of such studies are Walker and McClelland (1991). Two articles that are relevant in the context of firm valuations are Elliott & Uphoff (1972) and Elliott (1972). These studies discuss the feasibility of using econometric models to predict a company's sales. These articles initially introduced the academic dispute on which forecast model that should be used when forecasting sales, which will be further discussed in this study. But, this thesis differs from these articles, in the sense that it covers the background to the problem in greater detail; it investigates not only the feasibility of a method but also if there is a need for the method in question.

There are also textbooks that mention different approaches to forecasting sales, among these are Copeland et al (2000), Cooley (1994), and Abrams (2001). Common for these texts is that the forecast models that can be used are only shortly explained. There is a great lack of detail in both the pros and cons of different methods as well as how to carry out a forecast with the different methods. On the other hand, this thesis will look more closely on the pros and cons of using different methods and especially on what criteria the forecast model to apply should be chosen.

Finally, we strongly believe in the open society and the power of argumentation. If this thesis leads to nothing more than a heated discussion and opposition of our claims we will still be satisfied. This since we believe that controversy of argumentation is not a bad quality. Rather, it is so that without active, engaged argumentation, ideas may stagnate and injustice will become a genuine possibility (Herrick, 1995). Thus, the greatest contribution of this thesis is that the continuous argumentation and justification process, of firm valuation theory in general and the DCF method in particular, is kept alive.

1.5. Limitations of the Study

Before progressing into the study it is important to acknowledge which areas that will not be covered or treated within the scope of the study. This discussion will be held below.

Above all, the denominator in the discounted cash flow model, i.e. the cost of capital, is not considered within the frame of this thesis. Generally, the cost of capital is a very important element when considering the value of a firm. But the practice of achieving the correct cost of capital can be the topic of a complete thesis in itself and, as mentioned in the problem discussion, there are already quite much written on this issue. Therefore, an attempt to investigate this area will not be included in the thesis.

Furthermore, the case study will focus on the recommendations of the literature study. Therefore, the other areas of the valuation process will not be carried out by thorough analysis; rather, assumptions and simplifications will be made. Consequently, the result of the valuation in the case study, i.e. the intrinsic value of the case company, will not be representative of the real world. Since it is only valid if assumptions made in the case study are valid, it should be looked upon critically.

2. Methodology

The chapter includes statements that will give the reader an insight in, how the research area was approached, why it was conducted in this way, how the work progressed, and, finally, the authors own critical opinions of the study. The intention is to introduce the reader to how the study was conducted as well as a give the opportunity to develop a personal perception concerning the trustworthiness of the study. The reader should also be able to decide whether, in his/her opinion, the study has been conducted correctly. Below is a brief description of the outline of the study, this in order to show how the study basically is structured.

2.1. Outline of the Study

In the second part of this thesis the literature study will be conducted. In order to formulate a clear picture of the DCF model approach to firm valuation a more extensive literature study was performed. The study helps to understand the core concepts and the basic theories of valuation as well as the notion of the value of a thing. This is necessary in order for the discussion to carry on in an informed manner and for valuable arguments to be presented.

The theoretical framework deals with important concepts for the understanding of the subject such as mathematical models, valuation models and the discounted free cash flow model in particular, and different approaches to forecasting. This part of the thesis is developed using theories and models based on literature studies of textbooks, scientific articles, and other theses. By using these theories we hope to give a good overview of the valuation process, problematic areas of the process, and reasons behind why these areas are problematic.

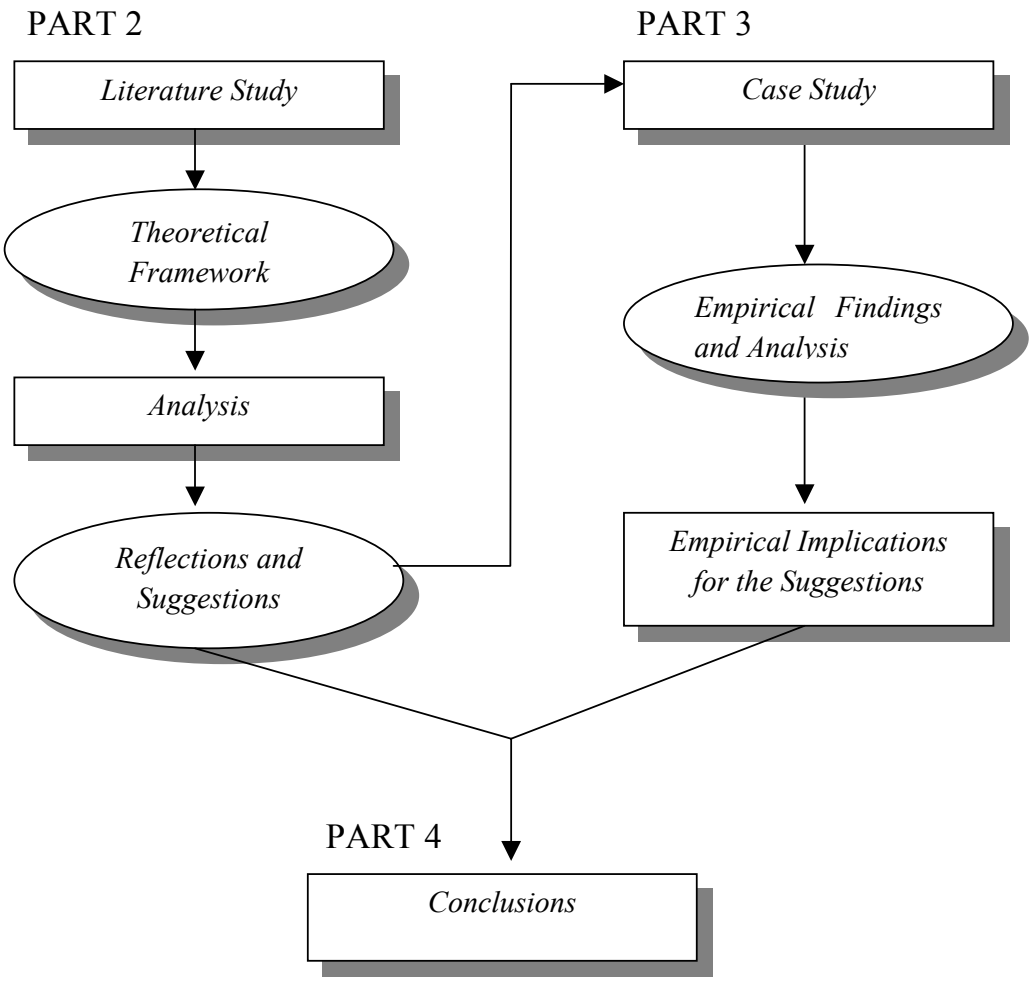
The third part of the thesis is the case study. In this we develop one of the possible solutions suggested in the literature study. A model is constructed to exemplify how to apply the approach suggested in the theory analysis. The case study is also conducted to verify the applicability of the approach. We hope to contribute to the area of valuation theory and practice by highlighting major problematic areas and presenting an attempt to solve one of these. By understanding the difficulties with valuation we hope it will be possible to

increase the accuracy of valuation and especially the forecast of key value drives in the selected valuation approach.

The fourth and final part of the thesis is concerned with our recommendations and conclusions of how the valuation process can be improved and what measures and models should be taken into consideration in order to increase the usefulness and accuracy of the forecast involved in the valuation process.

The research process described is summarized in figure 2.1 below.

Figure 2.1. The research process of the thesis



2.2. Method Approaches

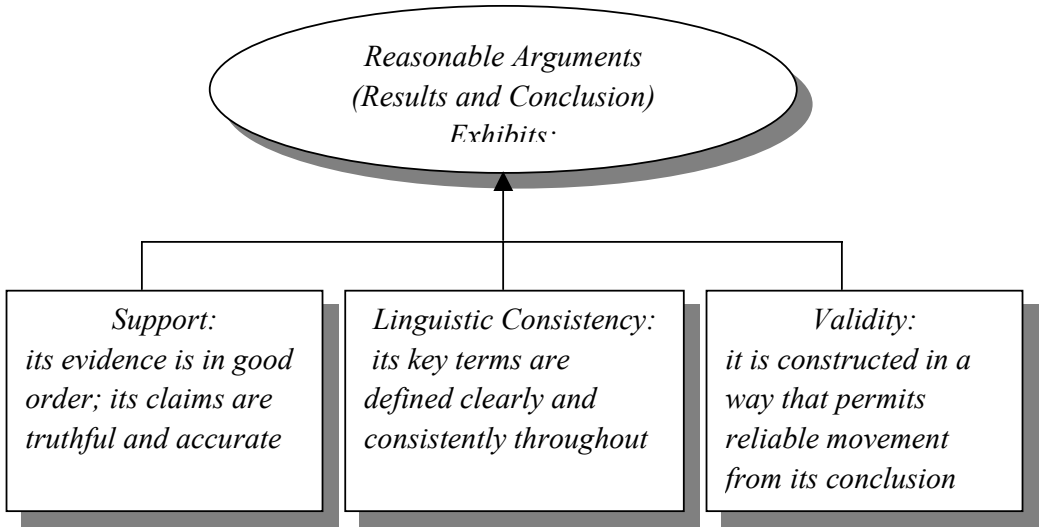
Before beginning the study is it important to consider the direction of thought. To consider the approach to the problem is a very vital aspect. This section discusses the choice between inductive and deductive approach, qualitative and quantitative approach, and, finally, a description of how the approach of this thesis was developed.

2.2.1. Inductive or Deductive Approach

There are basically two approaches to regard, the inductive approach and the hypothetical-deductive approach (Halvorsen, 2001). The inductive approach involves the practice of having no clearly defined hypotheses and a vague problem definition. In general this type of approach is used in social sciences studies due to its unpredictability. The hypothetical-deductive approach, on the other hand, involves judging the tenability of a hypothesis through essential testing of it. The purpose of the investigation is clearly settled and the retrieval of information is resolved. This approach is more suitable for studies which will use quantitative data and will reach a conclusive answer, such as "either or" – results. Another way to differentiate between the two approaches is to look at the results of the approaches. The result from a deductive reasoning is by necessity true. While a result from an inductive reasoning is probably true or has a high probability of being try (Herrick, 1995). Following this a deductive reasoning goes something like: All A are equal to B, this observation is B, thus this observation is, by necessity, equal to A. An inductive reasoning will have the following structure; A and B are similar in one situation, thus A and B probably are similar in another situation as well.

The former, induction, is the approach that will be followed in this study. A literature review and careful study will be carried out for with the intention of critically examining the literature available on how to value a company using the discount cash flow model. The results of this study will be based on sound reasoning and argumentation and have the inductive quality of being probable. For a conclusion to be reasonable it has to rest upon certain qualities. The conclusion has to have support, in the sense of credible evidence, the argumentation has to show linguistic consistency, and the chain of reasoning has to be valid (Herrick, 1995). This relationship is further explained in figure 2.2.

Figure 2.2 Qualities of a reasonable argument.



Source: Herrick, 1995 p. 65

In a scientific study, such as a thesis, there is a demand for special attention to the support and evidence that are backing up a conclusion. This will be further discussed in the section on data later in this chapter. The reasoning and arguments, in the thesis, will lend support from academic theories presented in the literature study. Linguistic consistency as well as that a valid chain of reasoning leading to the conclusions is present in the thesis, will be achieved by understanding the importance of these concepts and a thorough control from the authors, the tutor, as well as opponents.

Next, we will assess the method we will use to gather information and analyze it in order to carry out this study. There are basically two methods to utilize, the quantitative approach and the qualitative approach.

2.2.2. Quantitative and Qualitative Approach

Statistical methods can be used to solve problems of a quantitative kind (Halvorsen, 2001). When using the quantitative approach it is most common to use standardized interviews or short answer questions. The reason is that when using this method it is common to have a fairly good idea of what phenomenon the study is trying to investigate and asking appropriate questions could lead the study in the right direction.

Qualitative methods, on the other hand, can preferably be used when the study is of a more exploring kind (Halvorsen, 2001). Examples of such methods are observations and unstructured interviews. These methods cannot be quantified, but must instead be carefully accounted for in a summary written by the researcher. Qualitative methods are more suited for studies of occurrences that cannot be measured such as those common in social sciences studies.

It should also be pointed out that it is possible to use a mix of these two approaches. It is common to start by using qualitative methods to narrow the study down and find answers on how to proceed with the study and then continue by conducting the study quantitatively when enough information has been found. This is the manner in which this study will be carried out, since a case study of a multiple regression analysis will be carried out.

The thesis work will progress in the following manner: First, a literature study will be carried out to find the drawbacks and shortcomings of the discounted cash flow method which is the most common valuation method used. Secondly, we will try to come to terms with the drawbacks and attempt to discuss what can be done to lessen the effect of the shortcomings. The results from our discussion will be tested in the case study where a valuation example is carried out and the difficulties experienced will be discussed.

As is discussed in further detail in the literature study's subchapter "Subjectivity and Objectivity", all scientific work is affected by subjectivity. In order for other people to be able to interpret the quality of a scientific works conclusion there is a pressing need to explicitly (Andersen, 1997):

- Clarify the information you have when making your choice.
- Clarify your arguments for making your choice.

Document your choice and motivate it, both for yourself and those who will use your study.

Therefore, the next section will discuss why the thesis in conducted in this way. What choices were made, why these choices had to be made, and what criteria were the final decisions based on.

2.2.3. The Approach and Structure of the Study

The original approach and why it had to be changed - In the beginning the intention was to carry out a case study. We were interested in firm valuation but were not able to identify a problem area sufficient to base a thesis on. The solution would be to take proven theories on how to conduct a firm valuation and apply to a case company. But as reasoned in the problem discussion this would not achieve much more than increase our own knowledge in the field of firm valuation. We wanted to make a bigger contribution than that with our thesis. Therefore, we studied the valuation process and looked for problem areas. We were able to identify one such problem area in the forecasting process. As we understood it, it was difficult to translate subjective and mostly qualitative thoughts to objective and quantitative financial forecasts. We decided to perform a case study with the exception that we would base the sales forecast on different models. These models would be collected from different investment banks and analysts conducting valuations of the case company or of companies in the case company's industry. We also wanted to use an econometric model set up by ourselves. The different models would be tested in order to find which model was most accurate. Thereby, we hoped to gain knowledge not only on the case company but also on how such a model could and should be constructed. This is heavily neglected in the textbooks that we have studied.

This was the original approach of the thesis but as time passed we reassessed our standpoints. For once, it proved futile to get the models that different investment banks as well as analysts use. We were left with the project of setting up a forecasting model by ourselves and compare it to other forecasting techniques such as moving averages and exponential smoothing. Without the empirical information from the external sources the original approach did seem less interesting. Furthermore, it proved difficult to set up a forecasting model and conduct a detailed valuation without the help from experienced analysts. Therefore, we tried contacting analysts to collect primary information on some areas, such as important variables affecting the industry. When we were met by solid neglect from all analysts contacted we were faced with an important decision. With these limitations to the original approach was it still interesting and would the results be significant if we continued?

With this lack of first hand sources we decided that we needed to change the course of the thesis. After many discussions and further studies of textbooks and scientific articles we decided to alter the approach to the present form, which will be discussed next.

How this study will be conducted – In the following text we will describe the approach and structure that this study will have in order to answer to its purpose. Further, we will try to state what we hope to learn by following this process. After that the reasons why the study follows this approach and has this structure will be discussed.

The intention of this thesis is to make a contribution in the continuous process of improving the DCF method and, thereby, firm valuation. The DCF valuation method will be examined as it is, in theory, supposed to be used by analysts to value firms. The investigation will go from a broad perspective and gradually narrow. Firstly, models and mathematical models in general will be studied. Then, the traditional discounted cash flow model and, finally, forecasting and forecasting models will be studied. By following this structure we hope to identify (1) general strengths and weaknesses in mathematical models, (2) reasons and explanations why, and if, forecasting is one of the main problem areas within the DCF model, and (3) guidance on how to choose which forecasting model to use in a specific situation. This will provide basic knowledge of the DCF model, problem areas where improvements should and could be made and, in addition; give an indication to how improvements could be made.

Furthermore, a study on how the process of the DCF method for valuation of firms is described in finance literature will be conducted. This part is supposed to give an even greater understanding for how the valuation tool is used today. Also, this is the actual model that we hope to make improvements to. This part will mostly be based on a model described in "the valuation bible" *Valuation: Measuring and Managing the Value of Companies* by Copeland et al. (2000).

When looking for improvements, not only the DCF model in itself will be considered, but also the context in which it is used. This is done because we have a social constructionalistic view of the world. This implies that instead of a dualistic view of the reality we see the object and the reality as an inseparable relation. This can be express as in the following quote:

> There are not two independent entities, objects and subjects existing in themselves which later get to relate to each other, but the very meaning of subject implies a relationship to an object and to be an object intrinsically implies being related to subjectivity. (Giorgi, 1992, in Sjöstrand et al. 1999 p. 41)

Thus, in order to make the most out of a model we have to consider both the model in itself, the object, as well as the context in which it is used, the subjects that it relates to. Therefore, improvements both in the accuracy of the model as well as improvements in factors, such as how the results of a valuation are reported, are of interest.

Finally, a case study will be conducted. This is done to empirically test the suggestion in the literature study. Moreover, it can serve as an example to how the suggested approach can be utilized. Thus, the intention of conducting the case study is not to provide a detailed and accurate valuation; instead, the focus will be on how to make the improvement to the valuation model that is suggested. Concerning other parts of the valuation process certain assumptions will be made. This will be further discussed in the case study.

Basically this approach is structured to follow the problem solving steps, explained by Edlund, Höberg, and Leonards (1999) to be the most commonly described method, in introduction literature to research methodology, to solve problems. The following steps (in turns) were pursued:

1. The problem is identified in reality
2. The problem is defined (development of the concept)
3. A more specified model of the problem is created (model creation)
4. Data is collected and a solution is developed (model utilization)
5. The solution is applied in the real situation (implementation)

Why this approach and structure will be applied – By now it should be clear that the approach in this thesis differ somewhat from usual approaches in theses. There are many reasons for this and we believe that it is very important to explain why we have chosen the approach that we have. Therefore, the following text will further discuss our reasons.

It is our view that the method many normal theses adopt is not sufficiently critical. Many theses studies either (1) try an established and proven theory on a specific case (case study) or (2) compare established and proven theory with how this theory is used in a company. The first of these (1) do not lead to any critical examination of neither the theory applied nor the object the theory is applied to. The second (2) sort of study usually leads to critical examination of the object studied and reasons why the object differs from theory is usually provided. Given many such empirical studies the actual theory that the examination is based on can be questioned. There is a possibility that many theses will not be able to see, or believe, that the theory might be inconclusive and, hence, look for divergences within the object they study instead of critically question the actual theory.

By following the approach and structure that has been explained we believe that the study will achieve two tings: (1) a critical investigation of the DCF model and (2) a creative contribution to the theory. In our view these are very essential in scientific work, i.e. critical thinking and creativity.

Firm valuation is a huge subject and in order to limit the scope, so that the validity and reliability of the study could be sufficiently high, we decided to focus on the DCF method. As will be made clear in the theoretical framework this is the mostly used fundamental valuation method in practice. Furthermore, other valuations methods, such as the relative approaches, are simplifications of this model. Therefore, we find it interesting to thoroughly study the DCF model. Insight from this study can probably give insight in the other simplifying methods as well.

We still believed that the scope was a bit to wide to be able to have sufficiently high validity and reliability in the study. Therefore, the estimation cash flows in the DCF model was focused on and, consequently, the cost of capital were put outside the scope of the study. We chose the estimation of cash flow part of the DCF after viewing financial textbooks and scientific articles. We found that, even if it was discussed as a problem area, there was much less written on this part in the literature, which indicated that there could be improvements to be made in this area.

The literature study was built on secondary material in the form of articles and financial textbooks. Another approach would have been to gather first hand

information from practitioners and analyzed these findings. One reason why this was not done is that, as was explained earlier, analysts did not seem to be interested in participating in the study. Further, we had to study a lot of literature in order to be able to understand the valuation area and to find an interesting scientific research problem. By the time this was done there was not time to both use the theoretical framework as well as to form the right sort of questions and contact analysts. By conducting the literature study we were able to establish some thoughts on how improvements could be done to the DCF model. Instead of focusing on gathering material on how practitioners carry out their forecasts we decided to elaborate the improvement to the DCF model as it was reported in financial literature. So, the main reason why we did not gather primary data was that it was not possible to do both this and to elaborate improvements and empirically try them through a case study within the timeframe of the study. The choice to focus on making improvements and empirically test them rests on that we believe that this approach applies more critical thinking and is more creative than the other choice.

Finally, the following text will further discuss some arguments in favor of the new approach, mainly from the perspective of how the problem solving process should be organized.

If the problem is structured in a bad way you may never get beyond speculative hypotheses concerning the nature of the problem. On the other hand, if the work is focused on the creation of models, the starting-point may be a well-structured theoretical problem without being in touch with reality (Edlund et al, 1999). Hence, as with so many other things, it is important to achieve harmony when structuring the problem.

In real life decision making feelings, intuition, fantasy, and creativity should play a role. Edlund et al. (1999 p. 23) also remind us that; “We must never forget that the decision problems always have a subjective aspect." It is hard to distinguish between what is fact, values, and judgments/estimations in a decision-making situation!” It is not quite certain that the problem is identified before the solution and there is a possibility that the model will control the problem discussion. There can be a large problem present when the model controls the problem discussion. Namely, there might not be a real problem to solve. Alternatively, the actual problem is so distanced from the model that the

model is inadequate or totally irrelevant as a reliable tool in the decision making process.

With our original approach this problem could easily have been present. The econometric model and the quest for improving the forecasting process within firm valuation was based on nothing more than hunches from the literature studied. With the new approach we begun in step one of the problem solving steps discussed above. Thereby, we will actually firmly establish if the firm valuation technique discounted cash flow valuation need to be improved. Furthermore, we will see the reasons for why, and if, the forecasting part of it really is a main problem area. By conducting the subsequent case study we will also gain the perspective from practical testing. The empirical findings of this case study together with the conclusions from the literature study will then give a more comprehensive investigation of firm valuation than would have been achieved with the initial approach. Even if we believe it to be unfortunate that there are not more primary sources used, we feel that the new approach is good way to deal with this drawback. All in all, we feel that the new approach results in a scientific contribution far superior to the one, which would have been the result of the original approach.

2.3. The Case Study

A case study is a study of a scientific phenomena and it can use any method to collect information, e.g. as tests or interviews. A bounded case is chosen because it is considered interesting and important, or because it forms some kind of hypothesis, and focuses more on insight, discovery and interpretation than on hypothesis testing. The description in a case study is often rich and extensive and should include as many variables as possible and describe their interaction over a long period. (Merriam, 1988)

Accordingly, the case study is chosen depending on the nature of the research problem and questions being asked. This strategy should be the best way of answering the questions. This method is anchored in real-life situations and thus results in a rich and holistic account of the object being studied. It offers insight and enlightenment in a way that will expand the reader's knowledge. These insights can also be developed into "tentative" hypotheses that can help structure future research. (Ibid)

Since this thesis is looking at one single firm and aims to have one single understanding of the valuation process discussed in economic literature, performing a case study is believed to be the best research approach. More specifically, we want to get a picture of the valuation process discussed and analyzed in the literature study. Since the valuation process is a complex task, the theories and models can be difficult to apply in a real life situation. In addition, a case study will give more insight to the problem areas within this field. (Merriam, 1988)

2.4. Data

To be able to carry out an investigation in the first place, it is imperative to obtain relevant material to work with first. This is where the data search comes in.

There are mainly two sources of data. Firstly, there is the primary data. The primary data is all new information, which the author collects herself. New information can consist of interviews or a compilation of information made by the author herself. Secondary data, on the other hand, is all the available information already at hand (Halvorsen, 2001). Examples of secondary information would be databases, textbooks or articles.

This study was intended to be conducted with a combination using both data sources. Primary data was intended to be explored for the purpose of finding out basic information, on one hand, and to find out where to find secondary information and what secondary information would be valid. Unfortunately, as was stated in the section above, we were unable to gather this sort of data, hence, the approach with the literature study and the subsequent case study.

The main source, used in this study, for searching journals and academic works was the database JSTORE. It contains full text records of a large number of relevant journals. JSTORE was mainly used to search for articles and publications. Table 2.1 below, lists the main sources used in the literature study and in the case study to collect secondary data.

Table 2.1 Sources used in the study.

Data	Sources
Academic study	Textbooks Journals Academic papers
Case Study	Statistical databases Financial reports The Swedish building and construction industry organization Financial analyses by investment banks

2.5. Criticism of the Sources

The first part of the thesis is concerned with conducting a literature study. It is important to keep a critical state of mind as regards the data sources. The literature review has only been a study based on secondary data. This is our intuitive judging as per the nature of the study.

The proportion of books in relation to the number of articles might a bit skew. Extensive searches have been made in databases containing articles on forecasting and the ones used in this thesis have been the only ones appropriate for our purpose. Nevertheless, the thesis is believed to be founded on reliable sources which printed literature can be described as. However, it is possible that one or two aspects from the latest research have been overlooked due to the lack of data originating from published articles.

2.6. Validity and Reliability

This section will discuss the concepts of validity and reliability as measurements of the quality of the thesis. Validity implies that the study really has examined what it meant to and nothing else, whereas, reliability implies that the measurements are correctly executed and (Thurén, 1998). Furthermore and more importantly, it will discuss how the approach and process of conducting this study can have affected the validity and reliability of the study's results.

2.6.1. Validity

The term validity can also be named relevance or legality. The challenge of achieving validity is to gather relevant data suitable for the particular problem definition. It is not possible to measure the validity of a study, however, a judgment of the validity of the study can be made and arguments to support the point can be presented. Therefore, it is necessary to present the study as carefully and thoroughly as possible to make sure the reader feels that the study offers valid standpoints. (Halvorsen, 2001)

Section 2.2.3, the approach and structure if the study, describes how the study was conducted and, more importantly, why it was conducted in this way. Thereby, we hope the reader is able to assess the validity of how the study was conducted and, consequently, the validity of the study and its results. The following discussion focuses on the authors' opinions on factors affecting the validity of the study.

What was intended to be studied and what is actually studied? - As it is stated in the problem discussion this study is aimed at finding ways to improve the DCF method as it is used in firm valuation. To achieve this it is relevant to find material, i.e. data, which corresponds to this purpose. Furthermore, it is essential that the method that the data is used in, leads to fulfilling the purpose and noting else, i.e. the approach and a structure of the study have to correspond with the purpose.

As this study is of a more exploring kind a minimum of primary data will be utilized. The secondary data will consist of published literature for the literature study and figures from databases in the case study.

To achieve as high validity as possible it is important to always have a clear picture of what is to be looked for. To do that, the purpose has to be clear and in the mind at all times. We believe that we have done this in a satisfactory manner.

Next step involves finding valid secondary data to start the literature review. It is essential to find secondary data relevant for the study and make sure that it not distorted. This problem we intend to overcome by using well-known and respected published papers, reports and books. By carefully inspecting the data,

this problem is believed to be overcome. This means that the secondary data has a high degree of validity.

The danger in the interpretation of secondary data is that there is some room for interpretation errors. Another aspect is that it might be difficult in some instances to maintain an objective approach.

2.6.2. Reliability

The reliability of a study tells us how reliable the results are, that the measurements are correctly performed. In scientific work it is important that different scientists should be able to apply the same method to the same material. If these scientists arrive at the same results it shows that the scientists' personalities and own subjective views did not affect the results and, thereby, it renders the study higher reliability (Thurén, 1998). Hence, for a study to be reliable there should not be any mistakes concerning argumentation and the sources and reasons for that argumentation, as well as the data processing in the original study.

The reliability of a study might be difficult to measure when it deals with qualitative qualities or when the measured object is dependent on the perception of an individual (Halvorsen, 2001). This is the case for the literature study, which largely will be based on arguments for our standpoint. The reflections and suggestions of a second literature study could possibly differ from this first study, depending on the outlook of the author of that study and the reasoning of the same. But, we believe that a secondary study would arrive at basically similar reflections and suggestions. This since relatively large quantities of financial literature have been studied, where more or less all of them identify the problem areas described in the literature study and have similar reasoning behind why these problems are present.

Furthermore, quantitative data will not be utilized to a high degree in the literature study, which means that a large part of the study will be based on opinions and other subjective perceptions. Opinions and perceptions differ greatly from person to person and could make a study less reliable. However, we believe that the following actions, which were utilized in the study, will limit the literature study's loss of reliability due to subjectivity. These actions were:

1. By being aware of the problem of subjectivity and try to stay as objective as possible.
2. By explaining the line of thought in an explicit manner so both the reader as well as we the authors could see the possible subjective views that are affecting our arguments (which can be viewed in 2.3.3 the approach and structure of the study).
3. By carefully making arguments for our standpoints, i.e. make arguments based on ethical argumentation (how this is done was explained in 2.2.1 and in figure 2.1).

The subsequent case study should further increase the reliability of the study. There are mainly two reasons for that. (1) The suggestions based on the analysis of the theoretical framework are tested empirically and (2) the case study is conducted by means of a quantitative method. By use of statistical methods and mathematical models the suggestion of the literature study is tested. The result of such methods lends itself more easily to be compared with a secondary study. By following well-documented and empirically verified methods we believe that if someone conducted a second study they would probably reach the same results and conclusions.

Finally, we hope and believe that the thoroughness of the qualitative literature study and the empirical result of the case study render reliability to the conclusions of the study.

2nd part

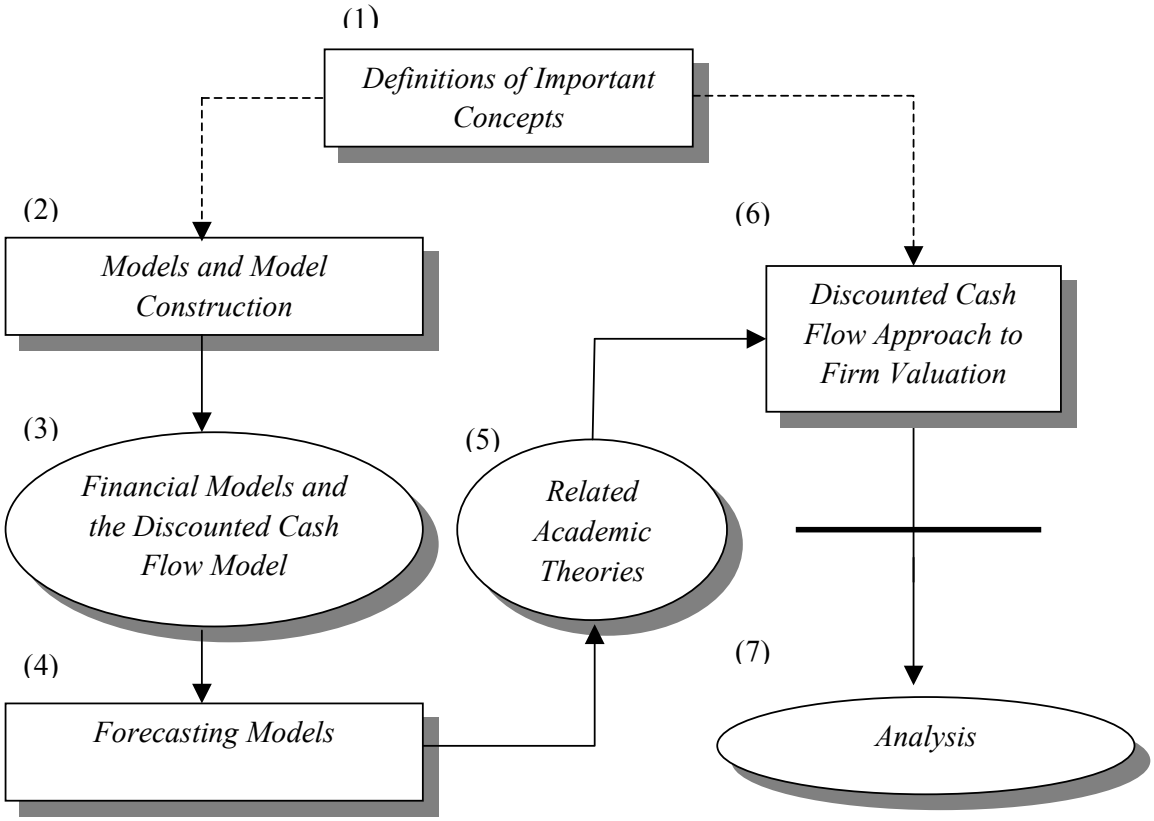
LITERATURE STUDY

This part of the thesis includes a theoretical framework of relevant theories in firm valuation and the discounted cash flow approach, an analysis, and finally reflections and suggestions. The aim of the part is to answer the second purpose stated in the introduction.

3. Theoretical Framework

In this chapter relevant theories connected to our problem discussion will be discussed. Figure 3.1 below illustrates the structure of the chapter and is constructed to help the reader to follow the reasoning in this chapter. The different steps in the progression of the literature study are explained in the text below the figure.

Figure 3.1 Progression of the literature study



The chapter begins in step (1) with definitions and discussions about some concepts that will be important when the analysis is conducted. This part includes a short description of the main theories that will be considered in the chapter. Thereafter, in step (2), basic theories of models and model construction in general are introduced. This is in order to give the reader insight in what mathematical models are and how they work. Next, step (3), narrows the perspective by focusing on financial models and especially the traditional discounted cash flow (DCF) model. This step explains the basics of the

valuation technique and reports on the most important shortcomings of the model. Then, in step (4), forecasting models are discussed. It will become evident in the discussion on the discounted cash flow model that one of its weak areas is the forecasting of the future cash flow. Therefore, this step discuss how to choose which forecasting model to use in a specific situation, explain the different qualities of different forecasting models, as well as elaborate on the special hardships with forecasting in the context of the discounted cash flow model. These four steps form a first section of the theoretical framework in the literature study. They are stepwise going from a wide perspective, with general model discussions, to a narrow perspective, where forecasting models in the context of the thesis problem discussion are discussed. The intention is to give the reader a general understanding of the problem area of mathematical models and then step for step specialize the discussion to the main area of interests.

The next step (5) introduces some, in the context of firm valuation, new or relatively undeveloped academic theories. These are relevant since they relate to some of the problems that have been discussed in the previous steps. Introducing them in the context of firm valuation possibly leads to new angles of how and why some improvements can be made. This is in line with the problem discussion, where the importance of considering how improvements to the model will affect the decision-making situation, where the model is used was stressed.

Further, step (6) introduces a modern discounted cash flow method that can be used to value firms. This step is a more comprehensive explanation on how valuation of firms, with the discounted cash flow model, should be applied. The method explained in this step is the model that, with some assumptions and shortcuts, will be used in the case study and the improvements mentioned in the problem discussion will, hopefully, be made to this model.

Finally, these steps leads to step (7) where the theories developed in this chapter will be used to make the analysis. Next, the first part of the literature study follows.

3.1. Important Concepts

This section covers important concepts that are necessary to be defined and understood in order to fundamentally grasp the contextual view of valuation developed in this thesis.

Firstly, the main theories used in the literature study are introduced and thereafter the important concepts are more in-depth discussed.

Theories in modeling (2 in figure 3.1) - In this section the basics in modeling is explained. Models are defined and problems both in how models are constructed as well as problems in how they are implemented and used in decision-making situations are discussed. The theories are intended to give the reader an overall view of the use of models in problem solving, which is important basic knowledge since firm valuation rests on the use of models. The next sections develop the framework of one such model, the discounted cash flow model.

Theories in valuation (3 and 6 in figure 3.1) - This part of the literature study focuses on one valuation approach, the discounted cash flow approach. The reason behind this is discussed earlier in the thesis. The traditional DCF model used in the valuation process is discussed in this section.

Theories in forecasting (4 in figure 3.1) - This section presents the different forecasting techniques that can be used in firm valuation. It is of outmost importance to understand the technique behind the forecast in order to evaluate the usefulness of it.

3.1.1. The Concept of Value

Valuation of firms can be done for many reasons, such as to find a fair price to offer an acquisition target, appraise an acquisition offer, or to find out the value of owning a firm. There are several different ways to look at value and, furthermore, there are several opinions on what creates value in a firm. Therefore, there are many different approaches to estimate the value of a firm. Some of the perspectives of value are discussed below.

Book Value - The book value of a firm is obtained from the balances sheet by taking the adjusted historical cost of the firm's assets and subtracting the liabilities. (Link & Boger, 1999)

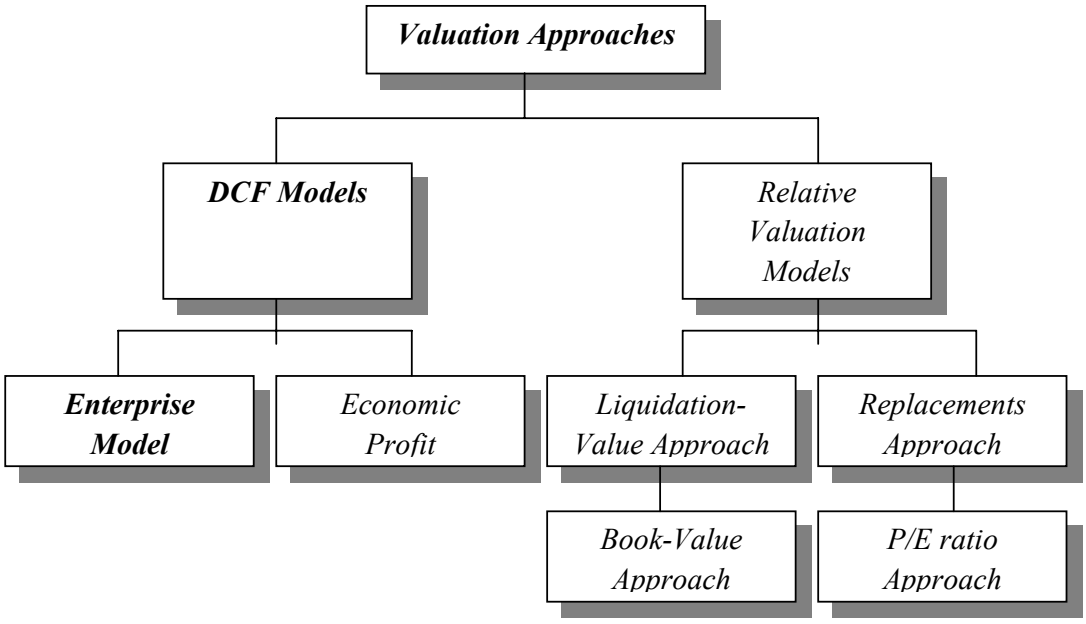
Liquidation value - It is the measure of the per share value that would be derived if the firm's assets were liquidated and the liabilities and preferred stocks were paid. (Ibid)

Fair market value - This is the price at which the property would change hands between a willing seller and a willing buyer. (Ibid)

Economic value - The economic value is the value of the expected earnings from using the item discounted at an appropriate discount rate to give the present–day value. (Copeland et al., 2000)

Due to these different perspectives of value there are many different valuation approaches. They can be classified into discounted cash flow models and relative models. This classification, and different examples of valuation approaches within each class, is illustrated in figure 3.2, where the valuation approach examined in this thesis is in bold faces.

Figure 3.2 A classification system of different valuation approaches.



Source: Modification of Bin, 2001 p.11.

3.2. Models and Model Construction

Models and model construction is a central topic of this thesis. The discounted cash flow method is a model and the forecasting procedure included in that model is a model in itself. Therefore, a thorough discussion on models in general is provided. This is followed by a more specialized exposition on economic models and the capital budgeting technique the DCF model. Finally, forecasting and different forecasting models are discussed.

3.2.1. Definition

A model is an incomplete depiction of an object, system, or idea (Edlund et al 1999). They are generalizations of the reality. There are physical, analogue, and mathematical (symbolic) models. Physical models are tangible and mathematical models are intangible. This thesis will mainly deal with mathematical models, or as they can also be referred to, quantitative models. These are intended to clarify the complex reality in a foreseeable manner and are important tools in decision-making situations. They vary in design, foremost in how exactly they are intended to depict the reality. Edlund et al (1999) define mathematical models as models that depicts the reality by use of mathematical symbols and connections between functions. Some of the most commonly used quantitative models used in decision making are presented in table 3.1.

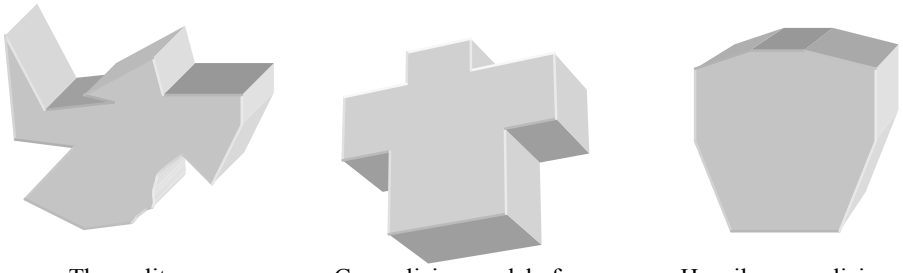
Table 3.1 Quantitative models for decision-making

Mathematical Programming	Stochastic and Probability Models	Other Mathematical Models
Linear Programming	Forecasting Models	Capital Budgeting Models
Integer Programming	Simulation	Investment Models
Nonlinear Programming	Game Theory	Financial Planning Models
Transport models	Decision Trees	Budget Models

As models intend to explain the complex reality in a foreseeable, or simplified, manner the degree of simplification, vary among the models. Figure 3.4 explains the interaction between the complexity of the model and the

generalization of the real life situation it is constructed to explain. This trade off between generalization of reality and complexity of models is important to balance in order to achieve the objective of the decision-making situation. (Andersson, 1997).

Figure 3.3 Reality and models that generalize it.



The reality | Generalizing model of the reality | Heavily generalizing model of the reality

Source: Andersson, 1997

Today models are a frequently used aid for decision-making situations in organizations. The use of quantitative models is especially widely spread within financial control. Models are used as a matter of routine to make decisions about e.g. prices, products, investments, financial alternatives, and to determine the value of stocks and firms. (Edlund et al, 1999)

The late rapid progress within Information Technology has increased the availability of quantitative models. Most people have access to computers and there are designed programs that can meet most requirements. Education about quantitative models and data are very common both in universities and as well as in companies (Edlund et al, 1999).

3.2.2. Pros and Cons with Mathematical Models

A high degree of description of the reality is positively correlated with the complexity of the model. Hence, a model that strives to depict the reality fairly exact will also be very complex and usually difficult to use. A model that generalizes heavily will, on the contrary, be simple to use and understand, but possibly the depiction of the reality may be far too generalized and, thus, to incomplete to have any practical use. To achieve the purpose, for which a model is intended to be used, there is a demand for a balance between the model's degree of generalization and the usability of the model (Andersson,

1997). This is also expressed by Vick in his book about how to pick stocks. He writes, "Too much analysis […] inevitably leads to trouble. There comes a point at which stock-picking systems [models] break down and prove futile because they are too complicated (Vick, 2001 p. 88)."

In order for a mathematical model to have any value for the decision maker it has to give a good description of the decision problems essential characteristics and relations. It has to have a high degree of validity, which means that it shows what it is designed to depict. The simplification of the real world, which was mentioned earlier is the trademark of mathematical models, is in one and the same, their strength and their weakness. A strength if the model with its approximations and mathematical connections has managed to capture something that actually happens in the real world and a weakness if it has not. As Edlund et al (1999) express, this is a reason to as far as possible test the model before putting your trust in it. By varying the variables and the parameters values and study how this affects the result, judgment can be passed on the reasonability of the models behavior.

Natenberg (1994) is another author that touches upon the subject of models. He writes that all models, if they are to be effective, require certain prior assumptions to be made about the real world. Mathematical models require the input of numbers that quantify these assumptions. If incorrect data is fed into the model, an incorrect representation of the real world can be expected. He ends the discussion with a warning, "Every model user must be aware: garbage in, garbage out" (Natenberg, 1994 p. 39).

According to Edlund et al (1999) it is getting more and more common to use mathematical models to analyze the uncertainty in a decision situation. These "what if…?" analysis, usually called sensitivity, scenario, or simulation analysis, provides valuable knowledge about which input parameters that are important for the result and, thereby, if more resources should be utilized to gain further knowledge about these parameters. This is one of the great advantages with models, it is possible to manipulate them without taking any real risks and thought this manipulation of input variables gain knowledge of how results would react to changes in the real world.

Edlund et al (1999) report some summarizing points of view on why it can be reasonable to work with mathematical models in connection to decisions making problems:

- Mathematical models force a systematic framework of reasoning. The problem has to be structured and the most important aspects have to be formulated.
- They allow a high degree of complexity concerning e.g. number of variables, restrictions and scales of measuring.
- Given that the same model is used from time to time consistency in the decisions is achieved.
- By developing a model for a decision making problem that frequently recurs it is possible to gain practical knowledge and improve the model over time.
- A decision model is a depiction of a problem that can stimulate to discussions, give ideas about lack of information, new areas of applicability, and complement/simplifications and so on.

3.2.3. Problems with applying Models

There are many models that are never put in practice or where applying the model has not given the promised result. This section will look into some of the reasons behind this.

Quite many studies have been conducted to explain the scarcity of practical use of new models. In one of these, Chris Argyris (in Edlund et al, 1999), expresses that the failure is a natural result of the fact that members of the organization perceives the model builder to be trespassing on their premises and that the model builder is conceived as a threat. Some people can feel that the space for own judgment is decreased if quantitative models are implemented, which can lead to a negative effect on self-confidence and can make the work less fun.

3.3. Financial Models

This section will deal with models used in financial purpose, such as firm valuation. It will narrow the model perspective by focusing on capital budgeting, strategic planning, and especially the discounted cash flow (DCF) model. The basics of the valuation technique will be explained and the most important shortcomings of the model will be discussed.

3.3.1. Capital Budgeting

Capital budgeting is a many-sided activity that includes searching for new and more profitable investment proposals, investigating engineering and marketing considerations to predict the consequences of accepting the investment, and making economic analyses to determine the profit potential of each investment proposal (Bierman & Smidt, 1993). In other words, capital budgeting is a decision-making process structuring the pros and cons of investing in a project. The pros and cons are measured in monetary terms and in most capital budgeting models the end result is a number indicating if the project should be carried out or not. Basically, and much simplified, the project should be carried out if the projected inflows of the project are larger than the outflows. This will be further discussed in the section 3.3.2 "Discounted Cash Flow Valuation". The next part discusses the history of capital budgeting and its distinction from strategic planning.

In "*Real Options*" Trigeorgis (1996) explains the late history of resource allocation. After the Second World War, capital budgeting and strategic planning emerged as two complementary but distinct systems for resource allocation. These two systems as can be looked upon as two cultures looking at the same problem. Capital budgeting developed into a decentralized process organized around individual or stand-alone projects based on DCF techniques. Unlike strategic planning, it focused on measurable cash flows, rather than on intangible strategic benefits that may result from developing competitive advantage, and it sought to make appropriate adjustments for the timing and riskiness of these cash flows.

Conventionally applied DCF techniques were developed to value passive investments such as bonds and stocks. Therefore, the technique is based on the implicit assumption of passive management. I.e. it does not allow flexibility to

defer, abandon, or in anyway alter a project. Due to these limitations, the DCF techniques have not gained much acceptance in strategic planning.

3.3.2. Discounted Cash Flow Valuation

Firstly, fundamentals in firm valuation are described, then, the specifics of the DCF model are explained.

The fundamentals in firm valuation - The valuation of a firm's share of stock is the same as for valuation of all types of financial instruments. The value of an asset is equal to the present value of all the future cash flows that the asset will be the origin of. The difference between, for example, valuation of bonds and valuation of stocks is that the cash flow of bonds are usually known with certainty, while future cash flows of stocks are mainly unknown. The cash flows important to the stock's value will be dependent on the firm's future profit development, which in turn is dependent on the sales growth and the firm's profit margin. Therefore, in order to value a stock, a forecast of the firm's future profit development has to be conducted. (Hagerud, 2002)

Valuation models, where all the future profits of the firm are specified, are called fundamental valuation models. Developing a reasonable forecast for the future profit development of a firm imply extensive work. Consequently, these fundamental valuation models demand much of the analyst, both concerning knowledge about the firms activities and about possible developments of the market where the firm is present. To avoid this problem a lot of simplifying has been developed. Mostly, these models use key ratios to describe the firm's financial position and value. Hence, they are often referred to as relative valuation models. (Hagerud, 2000)

There are different fundamental valuations models. The common factor is that the value of the stock is determined by the present value of the future cash flows that the firm's activities give rise to. These valuation models are usually divided into two categories, dividend discount models and discounted cash flow models. The difference is that the first discounts the dividends that the firm is expected to pay its stockholders, while the second discounts the free cash flow that the firm's activities are expected to rise. (Hagerud, 2000)

The discounted cash flow model – Today the DCF model is the most commonly used tool among financial analysts when valuing a firm. It is documented that almost fifty percent of all financial analysts use a DCF-method when valuing potential objects to acquire (Hult, 1998). In a study Absiye & Diking (2001) found that all seven of their respondents, which were analysts, use the DCF-model when they are conducting a firm valuation, the other valuation models were just used as complements to the valuation done by the DCF-method.

The discounted cash flow methodologies are developed to analyze values in the light of a business's future earnings. The theory is that the value of a business depends on the future benefits (earnings) it will provide to the owners. Traditionally, earnings are forecast from a historical performance base in some number of future years, usually five to ten years and then discounted back to present using a discount factor specifically for that business (Yegge, 2001). This method is mathematically described in equation 3.1.

$$PV = \sum_{t=1}^{\infty} \frac{CF_t}{(1+r)^t} \qquad (3.1)$$

Where $PV =$ *Present Value*
$CF =$ *Cash Flow*
$r =$ *Discount rate*

The reliability of the valuation method is depending on two factors, the reliability of the numerator – the forecast cash flow – and the reliability of the denominator – the discount factor. Unfortunately forecast values have a tendency to diverge from the real numbers. If this is true the calculated value of the firm could prove to be wrong and the valuation may be misleading. Therefore, the development of a reliable forecast model is of outmost importance to predict the cash flows used to valuate a firm (Hult, 1998). This is further developed in the next section.

3.3.3. Problem Areas

The DCF method is a model designed to depict the real world. As such it is per definition a simplification or a generalization of real world connections and context. Therefore, the model will have inherent flaws and shortcomings. The most commonly mentioned shortcomings in the financial literature that have been studied will be reported below.

Firstly, there are views on the system of basing the value of firms solely on the future. As expressed by Vick (2001) this forces the analyst to make a series of assumptions that can prove terribly wrong. The future cash flow of a firm is not a certain cash flow; hence, the uncertain future cash flows have to be estimated. In order to estimate these cash flows analyst have to make subjective forecasts, which is another related shortcoming of the DCF model. As Hamberg expresses it:

> When managers identify an investment opportunity they make biased forecasts of the information they have in hand. They can never estimate cash flows perfectly as these are uncertain by nature. The idea of risk is based on objective probability distributions, not subjective ones. Yet in investment decisions it is nothing more than subjective views of an unclear future that are the foundation for the analysis. In fact, if the probabilities of future cash flows could be objectively determined it is likely that no formal investment appraisals would be made. This is also evident in empirical studies: It is only for complex and highly uncertain projects where substantial amount of money is at stake that managers actually perform such a structured analysis that is discussed in investment literature [DCF]. This can be referred to as the *paradox of capital budgeting.* In real-life we most often use the capital budgeting techniques for those situations where they are difficult to apply. (Hamberg, 2000 p. 286)

A similar view is expressed by Benjamin Graham:

> The more dependent the valuation becomes on anticipations of the future – and the less it is tied to a figure demonstrated by past performance – the more vulnerable it becomes to possible miscalculation and serious error. A large part of the value found for a high-multiplier growth stock is derived from future projects, which differ markedly from past performance – except perhaps in the growth rate itself. Thus it may be said that security analysts today [written in 1973] find themselves compelled to become most mathematical and "scientific" in the very situations which lend themselves least auspiciously to exact treatment. (in Vick 2001 p.120)

These two views pinpoint two problem areas that the uncertainty of the future cash flows generates. First, the analysts have to predict the future by use of some sort of forecasting technique. Second, when forecasting the future a subjective element is introduced in the valuation. Hence, the result of the DCF valuation is not objective but, rather, depending on assumptions and estimations made by the analyst.

The subjectivity of the DCF model is also discussed by Vick (2001). He explains that the intrinsic value that should be the result of the DCF model is by nature dynamic and constantly changes based on economic conditions, interest rates, debt levels, and changes in the marketplace. Furthermore he writes about Warren Buffet's, one of the world's most famous investors, view of intrinsic value. He sees the intrinsic value as elusive but believes that every asset possesses a true worth that can be discovered through rigorous analysis. However, pinpointing the intrinsic value is exceedingly difficult, excruciating, and ultimately subjective. If it were easy to pinpoint intrinsic value, analysts would all be in agreement on the price a company should sell for, but such consensus almost never occurs (Vick, 2001).

Another shortcoming discussed in the financial textbooks has to do with the accuracy of the forecasted data. Hamberg (2001) states that the difficulty with company valuation is not to choose a valuation model, but to estimate the future cash flows that the company will generate. He says that regardless of which model one finally chooses the value of a company can alter substantially just by a slight change of the discount rate or the growth expectations of future cash flows. This puts emphasis on the accuracy of the cash flow forecast. This is something also mentioned in a thesis on valuation models by Absiye & Diking, where a financial analyst says that:

> Cash flow-valuation is mostly built on the forecast, since you discount the future cash flow. The most important in firm valuation is therefore to do a good forecast. The DCF-model is a mathematical model, if there is shit in there is also shit out. (Absiye & Diking, 2002 p.18)

Abrahms (2001) comes to similar conclusions in an analysis of the DCF valuation method. His bottom line conclusion is that analysts need to be most careful in forecasting growth and discount rates. This conclusion rests on the

finding that these areas have the most profound effect on the valuation. He writes that usually analysts spend the majority of their efforts forecasting cash flows and that it is tempting to some analysts to accord insufficient analytic effort to the growth forecast and/or the calculation of discount rate.

The views of these authors indicate that when conducting a valuation, forecasting is a main area to focus on. Furthermore, it is not the forecasting of cash flows, i.e. the forecasting of the pro forma income statement and the pro forma balance sheet, which should be focused on. The important area that should be in focus is the forecast of growth rates, i.e. how the annual sales revenue of the analyzed firm will develop in the future.

To summarize, this discussion on problem areas of the DCF model has identified two areas that are important when conducting a valuation, (1) How to limit the subjectivity of the assumptions and estimations behind the valuation, and, (2) How to make an accurate forecast of the future sales revenue.

There is much more literature stressing the importance of forecasting. According to Bernstein (1996), who was referred to in the important concepts' section, forecasts are one of the most important inputs managers develop to aid them in the decision-making process. Virtually every important operation decision depends to some extent on a forecast (Hanke et al, 2001). This leads to the question of how to make accurate forecasts of future sales revenue, which will be dealt with in the next section discussing forecasting models.

3.3.4. Science and Art in Valuation

Firm valuation is known as part art and part science. The discussion is held in many financial textbooks, Copeland et al (2000), Abrahms (2001), and Link & Boger (1999), which actually has the title *The Art and Science of Valuation*, implicating the importance of the discussion. The following text is a short summary of the discussion these books have on the subject. It is argued that valuation contains some elements best described as "scientific" applications and other elements best described as application of an "art." The scientific part of the valuation process is the structured part that deals with statistical procedures to arrive at conclusions, while the art is represented by judgment, understanding, and opinions. The main advantage with the scientific part is that it produces objective knowledge and the weakness is that it is not always

possible to construct models that will generate this knowledge in a desired fashion. Too time consuming and/or not enough data are some examples on circumstances that can limit the scientific part of a valuation. The main advantage of the art is that it is not limited by the same factors as the scientific part and, therefore, it can be applied when the more scientific approaches cannot. The main disadvantage is that it is a subjective approach sensitive to the views and opinions of the one making the judgment. This relates to the differences of objective and subjective forecasting techniques discussed earlier in this chapter.

3.4. Forecasting Models

A forecast is a prognosis, which usually is a prediction of an occurrence in the future. The word prognosis is originally Greek where it means prediction. Generally a forecast concerns the value of a variable at a certain point in time. The purpose of forecasts and forecast models are first and foremost to make decision-making easier and, thereby, improve the quality of the decisions made. Organizing and analyzing available knowledge so that the uncertainty in a decision-making situation decreases,achieve this. (Edlund et al, 1999)

In this section the criteria for choosing forecasting model are discussed and an introduction to different forecasting techniques will be given. Furthermore, exposition on problems in the forecasting area of the discounted cash flow model will be held.

3.4.1. How to Choose Which Model to Apply

The choice of type of model to develop to be used in a forecast involves trade-offs between time, energy, costs and desired forecast accuracy. The construction of a multi-equation model, might require large expenditures of time and money compared to a single equation model, such as exponential smoothing or moving average. The gains of choosing a more complex model might include more understanding of the relationships involved as well as the ability to make better forecasts. But these gains might be out-weighted by the costs and difficulties involved with the development of econometric model. (Pindyk & Rubenfeld, 1996)

When deciding which model to use, the demands of the forecasting situation has to be matched with the forecasting methods characteristics in the best way. Before deciding which model to use one should ask the following questions (Edlund et al, 1999):

- What is the purpose of the model – how are the results supposed to be used?
- Which variables and connections are in the system for which the forecast is conducted?
- How important is the historical development in order to predict the future development?

Some of the most important factors to consider in the choice of forecast model are according to Edlund et al (1999):

- The time horizon of the forecast
- The pattern of the data
- Costs
- Detail, the need for accuracy
- Level of details
- Access to data
- User-friendly

To summarize, these are the factors that should be balanced when deciding on which forecast method to use in a certain situation. In the analysis these will be taken into consideration when looking for ways to improve the discounted cash flow technique.

3.4.2. Introduction to Forecast Techniques

There are a number of different forecasting techniques used in practice. The determinant of deciding which technique to use depends on the data available. Often the different techniques are combined to reach the best results. The different forecasting techniques can be divided into three groups (Kinnear and Taylor, 1996). Table 3.3 is an overview of these groups with a few examples of the most common forecasting techniques.

Table 3.2 Overview of forecasting methods.

Qualitative Methods (subjective forecasting)	**Quantitative Methods (objective forecasting)**	
	Time series methods	Causal Methods
Executive opinion Sales force composites Buyer or consumer surveys Delphi method	Moving Average Exponential smoothing Mathematical models	Leading indicators Econometric forecasting (Regression models)

Source: Kinnear and Taylor (1996) and Nahmias (2001)

There are basically two different business-forecasting approaches identified in the literature study. The difference lies in what the forecast is based on, if they are based on human judgment or derived from analysis of data. The first method is commonly known as subjective forecasting method while the other one is called objective forecasting method

Qualitative forecasting techniques, also called economic judgment, are based on solely or primarily on expert opinion or judgment. Mainly there are four kinds of economic judgment; sales force composites, customer survey, a jury of executive opinion and Delphi method (Nahmias, 2001). Today they are most frequently used when no quantitative data are available. When well done by a knowledgeable expert, qualitative techniques can provide reasonably good forecasts for the short term because of the familiarity of experts with the issues and problems involved. The primary problem in using qualitative methods is identifying the appropriate employees and then getting them to agree on a common forecast. (Namvar, 2000)

Quantitative forecasting techniques, also called objective forecasting techniques, use statistical methods for projecting from historical data. Some quantitative methods involve using company data to forecast individual firm performance, but there are also numerous indices and indexes published by the government or by private forecasting firms that can be of great help. In general,

quantitative techniques are preferred when appropriate data are available. (Namvar, 2000)

Time series techniques are the most popular quantitative methods. Two major types of time-series methods are moving average and exponential smoothing. The main assumption these models rest upon is that the historical pattern will continue into the future. The information given from these patterns will then be used to find the value of the forecast variable. (Namvar, 2000 and Nahmias, 2001)

Causal forecasting techniques considers a number of variables that are related to the variable, which is going to be predicted. When these related variables have been determined, a statistical model can be built and used to forecast the variables of interest. This type of forecasting is said to be more powerful than the time series methods. Econometric models are examples of causal models. (Nahmias, 2001)

The technique often associated with this group is regression analysis. Regression analysis is an econometric tool to study the relationship among these variables. The purpose of regression analysis may be to predict, or estimate the value of one variable from known or assumed values of other variables related to it. One of the most important tasks of regression analysis is to determine which variables are important indicators, which ones carry only a little information and which seem to be redundant with other variables and are not significant to the analysis. What separates regression analysis from time series is that regression focuses on identifying variables that carry information about other variables and do not determine change from the present conditions to future ones. The correlation between two variables can leave a fairly good estimate to where future statistics might fall. Regression analysis can be used to describe the manner in which variables are related. Once this relationship is determined methods of regression analysis can be used to estimate the value of the variable of interest. (Cooley, 1994)

An econometric model does not have to include regression equations but it consists of a set equations used to describe different relationships. Econometric models allow us to account for all the interrelationships between a set of variables. Often these models consist of a set of regression equations, which after being solved individually are solved simultaneously. However, these

equations can include equations that are not estimated, such as accounting identities or behavioral rules of thumb. (Pindyk & Rubinfeld, 1991)

In the instance of a sales forecast, as is the case in the discounted cash flow model, the difference between time series forecasts and casual forecast have the following implications. Since time series techniques are estimates based on a past trend in one variable, in this case sales, they are also called trend forecasts. Trend forecasts do not account for what is expected to happen in the economy and in the company's industry. This shortcoming can be overcome with correlation forecasting, which is another phrase for causal forecasting. (Cooley, 1994)

3.4.3. Problem Areas

Forecasting is of little use to the valuation process unless it enables the analysts to make more accurate valuations than otherwise. Forecasting can by no means form a valuation by itself. Instead it serves as helpful tool in the valuation process by reducing some of the uncertainty in the environment. The uncertainty is reduced by trying to determine which variables affect the dependent variable the most.

Is the past a good predictor for the future? That is the critical question when forecasting future events on the basis of past events. An understanding of the economic environment of the business is fundamental to deciding the appropriateness of such an assumption (Link and Boger, 1990). This is usually achieved by studying the sales of the product and its determinants to be able to see which ones will affect the most. In this way it is possible to see if the past is predicting the future at all.

A simple time series analysis of the sales pattern in a firm is too uncomplicated a way to predict the sales in an unstable economy. Since macroeconomic conditions change constantly it is important to be able to predict these trend breaks. These methods are concerned with past sales and the fact that the future sales in some manner are reflected in the past sales numbers. If the past data is exhibiting a constant rise in the sales, consequently the sales forecast will always show an increase in sales even if the business cycle is declining (Hamberg, 2000). However, in a steady economy, the simple time series analysis approach might be appropriate to use. Products, such as milk, which

are less sensitive to business cycles, might be well suited for time series analysis methods. Finally, the decision to build single equation models or time series models usually occurs when little data is available about the determinants of the variable being studied and when the model is used largely for short term forecast. However, it is reasonable to construct both types of models, both single and multi-equation models, in order to compare their relative performances. (Cooley, 1994)

As stated earlier in the thesis, the forecaster needs to be aware that there are variables that can cause structural changes and therefore cause a break in the trend or relationship between past and future. The use of a more sophisticated data analysis tool than time series methods is needed to be able to forecast more accurate under these circumstances. It is important to not be satisfied with finding one variable that can foresee a break in the trends, because most likely there are a number of different variables that could cause a break in the trend. The use of an econometric model or multi regression model can be a relatively simple tool to use when analyzing the complex environment of a firm. (Hamberg, 2000)

It is important to understand that making forecasts is not only a mechanic process. A vital element in forecasting is the systematic search of the environment and the discovery of trends. Analytical and mathematical abilities are important parts of the analysis of data. This is the most time consuming and detailed activity within forecasting, however, these are of little value if the forecaster is examining inappropriate information, an irrelevant problem or has overlooked an important development beyond his normal field or expertise. Without breadth of vision and insight, attention can be focused on the wrong things and lead to ill-founded confidence of the future. (Ibid)

In addition to the above, there are sometimes difficulties in finding appropriate and accurate secondary data. This can create many pitfalls in the forecast without the knowledge of the researcher. Therefore, it is very important to bear in mind that secondary data is not perfect at all times. (Halvorsen, 2001)

Criticism of complexity - It is frequently stated that refinements in capital budgeting techniques are a waste of effort because the basic information being used is so unreliable. It is claimed that the estimation of cash flow are only guesses and that to use anything except the simplest capital budgeting

procedures is as futile as using racing forms to pick winners at the track or complicated formulas to determine which way the stock market is going to move next. (Elton and Gruber, 1995)

It has been put forward that an exaggerated belief in complex forecasting models should be handled with caution. It is also important to evaluate and investigate the variables put into models. As models become more complex, a point of diminishing returns is reached. Where this point is cannot be answered in the abstract, it is a function of the forecasting skills of the organization employing the model. (Ibid)

Vick (2001) is another author who writes on the subject of complexity in valuation models. He talks about the problem of linked errors. Because investors rely on mathematical systems, such as the DCF model, when valuing stocks they subject themselves to mathematical problems. First, they can overcomplicate things and thereby, become their own worst enemies due to the fact that the more variables you add to an investment model, the more often will it fail. Second, because the probability of errors multiply as fast as you add more layers of detail to your analysis. Therefore, Vick's advice is to avoid relying on models that use numerous variables, especially models based on future forecasts.

Defending complexity (Caveats) - It is true that in many situations reliable estimates of cash flows are difficult to make. If it is difficult to predict the outcome of an investment with certainty, and if the investment is large, the use of a careful and comprehensive analysis is justified, even if this means that the analysis will be more complicated and costly (Beirman & Smidt, 1993).

Vick is another author defending the managers who use more complex forecasting models:

> We can't fault investors from wanting to quantify their suspicions. A key element of risk management is to reduce as much uncertainty from an equation as possible. For example, if an analysis of data shows that a company's sales tend to rise by 5 percent every time interest rates drop 0.25 percent, then you have removed some uncertainty from forecasting. Armed with such information, you stand a better chance of predicting the future course of sales and earnings than an investor who lacks those data. (Vick , 2001 p.88)

The author proclaims a critical mind when using forecasting data. It is always better to be skeptical and questions the results from a forecast due to its uncertain nature.

3.5. Academic Theories Relating to the Valuation Context

The three sections below are discussing academic theories believed to be relevant and relatively undeveloped in the valuation context.

3.5.1. Risk and Uncertainty

The distinctions between certainty, risk, and uncertainty were an important part in the discussions on the DCF model above. As was explained some models are built with the assumption of certainty while the real-life situation is characterized by uncertainty. These concepts will be further discussed in this section.

Why the concept of uncertainty is essential for business - Bernstein (1996) discusses, in his book *Against the Gods – The Remarkable Story of Risk,* the imperious rule that numbers play in every important enterprise that mankind takes on. Many simple events were impossible to perform until man devised uniform standards of weights and measures and spent centuries testing and validating laws of physics. In the absence of this kind of mathematical certainty we would be living at the whims of fate. We would not be able to price a stock without first being able to quantify their economic costs and benefits. Bernstein (1996, p. 23) writes, "Without numbers, there are no odds and no probabilities. Without odds and probabilities, the only way to deal with risk is to appeal to the gods and the fates. Without numbers, risk is wholly a matter of gut."

In order to understand the importance of risk and uncertainty in firm valuation the following discussion held by Vick (2001) is of interests. He writes about fundamental investment, which is investment based on fundamental valuation techniques such as the DCF model, as a game of probabilities. In his own words: "Investors need to quantify risk, make calculations of potential return, stir up those assumptions in a pot, and produce a stock-picking strategy that works the majority of the time" (Vick 2001, p. 88). Thus, it is evident that the concept of risk and uncertainty is essential in firm valuation.

The distinction between risk and uncertainty - In economic theory there is a distinction between risk and uncertainty. This distinction was established by Frank Knight (1921), but has been used by numerous researchers and practitioners over the years (Hamberg, 2000). Knight's distinction relies on the separation of (1) knowing possible future outcomes, and (2) knowing the probability that a certain future outcome will occur. Both these two elements have to be estimated in any risk analysis. Table 3.1 is based on this separation. The table describes the different levels of uncertainty that are present and the characteristics of each level. Each level is further exemplified with real life examples.

Table 3.3 Different forms of risk and uncertainty

Level of uncertainty	Characteristics	Examples
None	Outcomes are known	Physical laws, natural science
Economic risk (Objective uncertainty)	Outcomes are identified and probabilities known	Card games, coin tossing
Economic uncertainty (Subjective uncertainty)	Outcomes are identified but probabilities are unknown	Fire, earthquake, accidents
Irreducible uncertainty	Outcomes are not fully identified and probabilities are unknown	Space exploration

Source: Hamberg, 2000 p. 99

Economic risk is present only in situations where uncertainty can be determined in an objective manner. These situations can be described as a situation where it is possible to mathematically derive the probabilities of receiving a certain outcome. If the same kind of events happens a large number of times, and it will happen again in the future then it can be empirically forecast.

In situations where *economic uncertainty* take place, pretty much is known of what the possible outcomes are, or range of the outcomes, but the probabilities of these possible outcomes are unknown. When different individuals try to estimate the same economic uncertainty, this could be characterized by subjective opinions of future outcomes and probabilities. The valuation of a quoted firm is a good example of such subjective situations. Finally,

irreducible uncertainty involves situations about which we currently have no idea. (Hamberg, 2000)

3.5.2. Subjectivity and Objectivity

One of the problems inherited in all sort of analytical work is the impact on the results that the subjective views of the analyst have. Since this thesis deal with models used to form analysis this is an important matter to discuss. It was also stated in the discussion on problem areas of the DCF model above that one of the main problems is the subjectivity that enters the model when future cash flows have to be estimated. Therefore, the next sections discuss how the problem of subjectivity should be handled in analytical work. The sources discuss scientific studies but the discussion is applicable to the DCF valuation, which, as has been explained above, incorporates both science as well as an art in the valuation process.

Holme & Solvang (1997) writes on the subject of scientific method. They state that the neutral and value free scientific research, i.e. objective, does not exist. Independent of the science areas studied, sooner or later there will be a point where the study will be based on assumptions of normative nature, i.e. have elements of subjectivity. Lack of knowledge or denial of this fact can lead researchers totally astray.

Their conclusion is thus; that what must be demanded in scientific work is honesty, both for the scientist to be honest before themselves and for the ones reading their work. In order to achieve this they have to describe their value premises, to the extent that they are consciously aware of them. They should also critically view the consequences their value premises can cause on their analysis and scientific work.

Another author, Andersen (1998), expresses similar views of how scientific studies should be reported. Since the choice of concrete procedures is a situation-based choice that depends on many conditions Andersen believes that it is important for someone conducting a study to:

- Clarify the information you have when making your choice.
- Clarify your arguments for making your choice.

Document your choice and motivate it, both for yourself and those who will use your study.

Through such documentation both the author and the user of the scientific work can judge the quality, usually measured as reliability and validity, of the results and conclusions. Reliability implies that the measurements are correctly executed and validity that the study really has examined what it meant to and nothing else (Thurén, 1998).

In the context of DCF valuation this implies that if the analysts follow the suggestions above it becomes possible for the users if the analyst's report, i.e. the investor, to see the assumptions and choices made by the analyst to make the DCF valuation. Thereby, it is possible to, at least in some extent, verify the quality of the intrinsic value that is the result of the analyst's DCF valuation.

3.5.3. The Decision-Making Situation

As was explained in the problem discussion, the DCF model is a tool that is used in the decision-making situation on whether to buy, sell, or hold on to a specific share of stock. The text above discussed how the subjectivity of the results derived from the DCF valuation should be documented, in order for the user of the valuation results to be able to form an opinion on the quality of the result. The text below further develops this thinking. Now the focus is on the decision-making situation, i.e. the context within which the DCF valuation is used, and how this process will benefit by openness and ethical thinking.

The theories presented below are of interest because they, basically, discuss how an institution and its members should approach decisions-making situations in order to optimize the quality of these decisions. The size of the institution is not what makes these theories relevant and, therefore, the theories presented below can be applied to the decision-making situation where the DCF model is used as a tool. The first part discusses the open society or, as it also can be viewed, the open method. The second part develops the virtues necessary to establish such a method.

The Open Society - In *The Open Society and Its Enemies* the Theory of Science philosopher Karl Popper (1980) discusses different regimes and their view of truth. The open society's enemies, guardian/regency regimes, claim to

possess the final truth and they force their views on others. Popper proposed another form of organization of the society, one that acknowledges that no one has, or can have, access to the final truth. He reasoned that our knowledge of the world we live in is by necessity imperfect and a perfect society is unattainable. We have to be satisfied with the second best: an imperfect society that, however, has an unlimited capability of improvement. He calls it an open society and totalitarian regimes are its enemies.

In congruence with Popper, Dahl (1989) mentions the benefits of an open society, where no one has monopoly of interpreting the truth and where the best decisions are based on discussion and argumentation. Another author touching upon this subject is James A. Herrick, who was introduced in the methodology chapter. In *Argumentation: Understanding and Shaping Arguments,* Herrick (1995 p. 47) writes, "The ability of an argument to bring about cooperation without violence or coercion has rendered the practice invaluable in free societies." He continues, "The value of argument, however, is directly proportional to advocates' willingness to argue within ethical boundaries." This last part is of great interest since it puts restrictions to the open discussion. It says that, in order to use the open method to arrive at the best decisions, the argumentation leading to the choice has to be ethical. Herrick later explains that in order to have an ethical argumentation one needs to abide certain virtues. These are discussed in the next section.

Virtues - Virtue can be defined as a quality that assists us in making ethical good choices. In argumentation virtues are habits of character that help one to frame the ethical dimensions of an argumentative situation. Some virtues relevant to argumentation ethics are discussed by Herrick (1995). Among the virtues discussed there especially four are relevant in the context of the DCF valuation. These are *honesty*, *courage*, *cooperation*, and *regard for context* and they will shortly be discussed next.

Herrick (1995) writes that *honesty* may be the most important virtue in communicating with others. *Honesty* means a loyalty to what is the case, a tendency not to willingly mislead, and a regard for what is, or what one takes to be, true. It includes qualities such as sincerity or openness, and an unwillingness to mislead or to conceal facts. *Courage* is defined as a determination to avoid "easy answers" to difficult questions and as a willingness to accept the risks associated with honest support of one's position.

Cooperation means a willingness to work toward a just resolution of the issue at hand, a commitment to make the best case possible for our own views, and a resolution to hear the arguments of the other side. Finally, regard for context is described as attempting to preserve the argumentative context. The context should be kept open for presentation of arguments.

3.6. The Discounted Cash Flow Approach to Firm Valuation

The following section will describe the basic theory behind the valuation method used in this thesis and especially in the case study. The essential parts in accordance to the approach of the thesis will be thoroughly described, in particular the part of forecasting performance. Some parts will only be vaguely illustrated in order to be able to follow the process as a whole, even though these parts are not further considered in the thesis. The main part will be further discussed in the next sub-chapter, 3.7 "Forecasting Performance".

The discounted cash flow approach is a widely used method in firm valuation. DCF methodologies are developed to analyze values in the light of a firm's future earnings. Simply described, these valuation methods consider firm earnings for a number of forecasted years into the future, quite often in practice, ten years used. These earnings are then discounted back to present value that is the value of future earnings stated in today's dollar. (Hult, 1998)

There are a number of different ways to apply this method. This thesis will be using the enterprise discounted cash flow approach and therefore this approach is the only one discussed here. The enterprise DCF model is the most widely used in practice (Copeland et al., 2000). It is also called free cash flow valuation. Free cash flow is the correct cash flow for this valuation model because it reflects the cash flow generated by a company's operations that is available to the firm's capital claimers, that is the firm's debt and equity holders. Free cash flow is defined as the firm's true operational cash flow.

The framework of the approach developed in this chapter is based on Copeland et al's (2000) approach described in the book *Valuation: Measuring and Managing the Value of Companies.* In the next part, 3.7 "Forecasting Performance", Copeland et al (2000) provide the basics but since this area is in focus it is also further developed. Otherwise most of the parts are based more

or less entirely on Copeland et al (2000) and, therefore the approach will henceforth be referred to as the Copeland model.

The valuation process includes four important steps before a value can be estimated (Copeland et al, 2000):

1. Analyzing historical performance
2. Forecasting performance
3. Estimating cost of capital
4. Estimating continuing value

Each of these steps will be briefly discussed below.

3.6.1. Analyzing Historical Performance

The first issue in valuing a firm is to analyze its historical performance. A sound understanding of the firm's past performance provides an essential perspective for developing and evaluating forecasts of future performance. This assumes that the firm has a history, which is not always the case. Historical performance analysis should focus on the key value drivers within the firm. The different key value drivers will in this thesis be tested as variables in the model developed to forecast sales. To estimate whether the firm is generating or consuming money the firm's free cash flow is estimated.

3.6.2. Forecasting Performance

In this section the forecast of future performance will be discussed. The key here is to develop a point of view on how the company will perform in the future on the most important value drivers. In this thesis sales are considered to be the key value driver of the firm and therefore the focus will be on how the firm's sales are developing in the future. As mentioned before, the future cannot be predicted, but a careful analysis can yield insights into how it may develop in the future. The developments of the forecast techniques are explained in further detail in the section 3.7. "Forecasting Performance".

3.6.3. Cost of Capital and Continuing Value

The following sections will briefly introduce two important issues in the valuation process that will not be considered to a great extent in this thesis. That is estimation of the cost of capital, the denominator of the DCF equation and the estimation of the continuing value, or terminal value as it also is called. Both these are really complex to calculate and they are both issues for a wealth of discussions in financial literature.

Estimating cost of capital - The investors expect to be compensated for the opportunity cost of investing in one particular firm instead of other firms with similar risk. The DCF method uses the weighted average cost of capital (WACC) as the discount rate to convert the expected future free cash flow into present value. The WACC is the average cost the firm is expected to pay its debt and equity holders.

Estimating continuous value – The DCF approach values the firm by discounting the free cash flows that the firm will be generating. A forecast is done to estimate future free cash flow, but it is difficult to make accurate long-term forecasts. The valuation method therefore divides the firm's expected free cash flow into to separate free cash flows. The cash flows are generated in two different periods and is defined as (Copeland et al, 2000 p 267):

$$\text{Value} = \begin{array}{l}\text{Present value of}\\ \text{free cash flow}\\ \textit{during}\ \text{explicit}\\ \text{forecast period}\end{array} + \begin{array}{l}\text{Present value of}\\ \text{free cash flow}\\ \textit{after}\ \text{explicit}\\ \text{forecast period}\end{array}$$

The second term of this formula is the continuing or terminal value. It is defined as the value of the firm's expected free cash flow beyond the explicit forecast period.

3.7. Forecasting Performance

As mentioned before one of the most important stages in a valuation is the forecast of the firm's financial statement. In order to be able to carry out the financial statement the firm's future performance need to be forecast. This is one of the crucial parts in the valuation process, because no one can predict the future. However, careful analysis can yield insights into how the firm's future performance may develop. This should also be the objective of the forecast. The thesis will be organized around the basic steps that are needed to develop a financial forecast (Copeland et al., 2000 p.233):

1. Determine the length and level of detail for the forecast.
2. Develop a strategic perspective on future company performance.
3. Translate the strategic perspective into financial forecasts. Create the income statement, balance sheet, free cash flow, and key value drivers.
4. Develop alternative performance scenarios to the base case developed in steps 2 and 3.
5. Check the overall forecast for internal consistency and alignment with your strategic perspective.

These five steps are explained in greater detail in the next sections. This part of the Copeland model is further developed and explained by use of other sources as well. This since this part of the valuation process is the point of focus in the analysis and will be further developed in the subsequent case study.

3.7.1. Determine the Length and Level of Detail

Forecasting deals with the future. The greater the distance of the forecast period from the period which was used to construct the forecasting model, the greater the difficulty in making the forecast and the greater the risk that the actual result differs from the forecast. Forecasts are typically divided into three time frames, long, medium and short range.

Short-range forecasts typically cover the immediate future and are used to deal with issues of daily or weekly operations of a business. Typically, a short-range forecast would cover a period of one or two months.

A medium-range forecast usually covers the period from one to two months to a year and is generally related to something like a yearly production plan.
A long-range forecast would be for more than one or two years and is used to plan for the production for new products or the expansion of production capacity, or in the consideration of long-term financing.

It is, recommended (Copeland et al., 2000 and Hanke et al 2001), to use a forecast period of five to fifteen years when conducting a valuation. The forecast should be long enough so that the projecting growth of the firm when estimating continuing value is close to the rate of growth in the surrounding economy, that is the growth in GDP. Using a short forecast period, say three to five years, will typically result in an under-valuation of the firm. Since the accuracy of the forecast is diminishing with time, the forecast is often divided into two periods.

3.7.2. Strategic Perspective

To find estimates of the future free cash flow the analyst should perform a fundamental analysis. This analysis is about finding the strengths and weaknesses of the firm's operations and to relate this to the firm value. The analysis consists of a combination of a strategic analysis and a financial analysis. The strategic analysis aims at creating an understanding of how the firm will interact with stakeholders and industry competitors in the future. The financial analysis is based on historical figures of earlier performance. These figures will then be extended into the future to determine the expected free cash flow. (Hamberg, 2001)

It is almost impossible to conduct a good financial analysis without strategic analysis. This since the historical cash flows have to be understood in the light of the historical competitive environment, and future changes in that environment are what will cause changes in future free cash flows. The financial analysis should result in knowledge of; (1) the key success factors for the business and (2) how they, and potential changes in them, are measured. (Ibid)

Strategic analysis - Copeland et al (2000) discuss how to make a strategic analysis and how it should result in a strategic perspective for a company. They say that to develop such a strategic perspective for a company essentially

means crafting a plausible story about the company's future performance. This story should be based on a thorough strategic analysis of the company and its industry. Furthermore, it is brought to attention that what drives the company's value is whether, and for how long, a company can earn returns in excess of its opportunity cost of capital. In order to achieve this, companies must have and make use of a competitive advantage. This since the lack of a competitive advantage would force all the companies in the industry to earn no more than their cost of capital. This story is of a qualitative quality but in order to be used in a quantitative model, such as the DCF, it has to be transformed into quantitative data. The next section will deal with this transformation and the process of the financial analysis.

3.7.3. Financial Forecasts

After conducting the strategic analysis it should be translated into a financial forecast. The process of translating the strategic analysis into a financial forecast is called the financial analysis. The next step in the valuation process is to create the financial forecast. The mix of the strategic and the financial analysis should later result in a forecast of the future free cash flows. Firstly, sales will be discussed, as one of the key value drivers in a firm. Furthermore the development of a financial forecast is described and the approach used to estimated the final value of the firm.

Sales - Sales or as it is also called, sales revenue, net sales, net revenue or just revenue, is the income from sales of goods and services, minus the cost associated with sales, such as cost of goods sold.

Sales are the (primary) key driver of value because, without costumers and sales, no value can be added in operations. Much of our knowledge of the firm- its products, its marketing, its Research and Developments, to name a few factors- is applied to sales. And as every basic economics course teaches, "dollar sales is sales price multiplied by quantity sold" (Penman, 2001). As a result of this, sales are the key element in the valuation process of a firm. A reliable measure of sales is fundamental in order to achieve a fair value of a firm (Cooley, 1994).

Forecasting future sales is the key and starting point for financial planning models (financial forecasting) because sales affect the size of all other financial

variables. A sales increase affects both sides of the balance sheet and it also affects all items in the income statement. If sales are forecast higher than they turn out to be, money will be tied up in assets that will not generate financial returns. If sales are forecast lower than they turn out to be, the firm will miss out on opportunities to make profitable sales and may lose market share. So in addition to predicting sales, it is important to predict how likely it is that the sales forecast will be wrong by a large magnitude. This part of the forecasting process is called sensitivity analysis and simulation analysis and is discussed in section 3.6.4. (Cooley, 1994)

The sales forecast can be based on an internal or external analysis. The problem with an internal analysis performed by firm managers is that they tend to overlook significant trends in the economy and within the industry. With an external approach, economic analysts make forecasts of the economy and of industry sales for several years to come. They may use regression analysis to estimate the association between industry sales and the economy in general (Cooley, 1994). A sales forecast should involve information about the firm, macroeconomic trends, the market etc in order to be as accurate as possible. Next follows a list of the information that is needed to forecast sales in the best possible manner (Damodaran, 2002):

1. Firm-specific information that is public.
2. Macroeconomic information that may impact on the sales.
3. Information revealed by competitors on future prospects.
4. Private information about the firm.

Determinants of sales - Before a forecasting technique can be established to perform the sales forecast the determinants of sales must be found. If a variable is changing and this change causes a change in the sales it is said to be a determinant of sales. Two main areas are mentioned where independent variables explaining sales can be found; (1) general indicators, such as GDP and inflation, and (2) industry and firms specific indicators, such as price index for the product and its supplement products (Abrahms, 2000). Much of the literature is focusing on smaller firms where just one product's future sales revenue is forecasted. In these cases the multiple regression models usually consist of around three independent variables. There tend to be mixes of GDP, marketing expenditure, population series, and so on. Since there are many more factors which can affect sales in large firms with many products and markets

the independent variables explaining sales is more difficult to define. (Copeland et al., 2000)

A useful tool, or the starting point of finding the determinants of sales, is to create an economic model over the environment of the firm. This model will of course be incomplete but it is a tool that will help the analyst to find the factors that are affecting the outcome of the sales in the firm. (Hymans, 2002)

Conducting the financial forecast - The financial statements report many items that explain how firms produce earnings and cash flow. The income statement gives sales and expenses necessary to make the sales, the cash flow statements gives the sources of cash flow. The balance sheet lists the assets employed to generate earnings and cash. Therefore, the financial statement is the "jargon" of valuation analysis; giving the drivers of earnings and cash flows.

Forecasting financial statement is called pro forma analysis because it involves preparing pro forma financial statements for the future. Current financial statements are information for forecasting, so they are analyzed with the purpose of forecasting future financial statements. The way is to use financial ratios according to its historical accounting statement. Firm and industry changes should be incorporated into the projections of the future financial performance.

After conducting the forecast of the firm's future performance (sales), it should be translated into a financial forecast. To begin a pro forma income statement and balance sheet are derived from the forecast. The free cash flow forecast can then be derived from the income statement and balance sheet. This thesis works with a sales-driven forecast. A sales-driven forecast starts with sales. Most other variables are driven off the sales forecast. Such a forecast can have the following structure (Ross et al, 2001):

1. Construct the sales forecast
2. Forecast operational items
3. Forecast non-operational items
4. Project the equity accounts.
5. Use the cash and/or debt accounts to balance the balance sheet

The next sections will consider the definition and development of the pro-formas financial statements.

The pro-forma income statement - Using the sales forecast, a five-year pro forma income statement is projected. The pro forma income statement is similar to a historical income statement, except that it projects the future instead of describing the past. One standard approach in constructing pro formas is to identify which components of the income statement are related to sales, which are constant, and which are simply calculated from other elements. For example, cost of goods sold might be expressed as a percentage of sales, depreciation might be constant, and total interest might be a linear function of time. Since sales are the key driver all other items in the incomes statement and balance sheet are derived from sales. For the purpose of the valuation it will be necessary to prepare the first year's projected income statement in detail.

The pro-forma balance sheet - The balance sheet projections are constructed in a manner similar to the income statements. The balance sheet will be a statement of the source of funds for the business in terms of loans, equity participation and retained profit and how these have been allocated. The allocation of the funds will be broken down according to investment in fixed assets of plant and equipment, and also current assets, which are defined as working capital. The balance sheet is a tabulation of pure numbers and there is no identification of the nature of the individual creditors, sources of loans and equity, or the type of fixed assets, which have been purchased.

There are many different approaches to create a pro forma income statement and balance sheet. Elliott and Uphoff (1972) develop an equation for every single item in the income statement. This is probably the most appropriate way to project the pro formas but also very time-consuming and complex.

Percentage of sales approach - When the sales of a company are changing the investments in assets are changing as well. For example if sales are increasing, to maintain and satisfy the increased number of costumers, additional investments, in e.g. inventories, are needed. If the increase is large additional investments in the fixed assets might be required. These investments must be financed either by an increase of debt or equity. Armed with a reliable forecast that sales are increasing, the task is to estimate the increase of total assets and

the financing for the increase. This method of constructing the pro-forma is called the percentage of sales method. (Cooley, 1994)

The underlying logic is that most of the costs shown on the income statement, most of the assets shown on the balance sheet, and at least one or two categories of liabilities on the balance sheet should be proportional to the level of sales. In other words, it is based on the idea that relationships that have held consistently in the past will continue to hold in the future (not always a reasonable assumption). (Ibid)

The free cash flow - A firm's free cash flow is defined as the true operating cash flow. It is the total after tax cash flow generated by the firm that is available to all providers of the firm's capital. Free cash flow is before financing and is, therefore, not affected by the financial structure of the firm. It is essential to define free cash flow properly in order to maintain consistency between the free cash flow and discount rate used in the valuation. To simplify, free cash flow equals NOPLAT less net investment, where net investment is the change in invested capital. A further description of how the free cash flow statement is calculated is presented in Appendix 1. Copeland et al (2000) and Kaplan & Ruback (1996) are examples of authors that use this denomination of the free cash flow.

Converting the projected financial performance into value - After constructing the pro-forma financial statement, the projected cash flow has been predicted. However, as discussed earlier, the firm does not stop to exist after the predicted periods of cash flow. Therefore, the firm's ability to generate cash flow to its claimants after that period must be considered. This is done by estimating the terminal value or continuing value of the last predicted cash flow. Discounting, at the WACC, the projected free cash flows gives the value as a whole- the value of the firm's assets.

3.7.4. Alternative Performance Scenarios

One of the great limitations with forecasting is that they are based on the assumption that past data can be extended into the future. The problem is that the economic environment is characterized by a high degree of uncertainty, which can cause inaccuracy in the forecasts. In order to increase the ability of using forecasts as a tool in such of environment, a sensitivity analysis or

simulation can be conducted. This is one of the advantages with the construction of a multivariable model: different scenarios that are likely to happened can be simulated, to examine the affects on the forecasted variable.

Sensitivity analysis - A sensitivity analysis is an investigation how the projected value varies along with changes in the key assumptions on which the valuation is based. In this thesis, this kind of analysis examines how change in underlying assumptions changes the outcome of the forecast sales and thereafter the change in firm value. This can involve the analysis of the effects of changes in sales, costs, cost of capital and so on, on the firm value or an analysis of the effects of changes in sales determinants on sales. A sensitivity analysis locates the variables that have the greatest impact on the validity of the valuation. It shows where to focus attention and also what variables to monitor more carefully. By using this method the possibility of different outcomes can be examined and the variables with the most impact on e.g. firm value or sales can be identified. The method is applicable to any DCF measure to check the sensitivity to changes in input. (Ross et al., 1999)

The advantage of conducting a sensitivity analysis is that it shows when the forecast or valuation should be trusted and it gives an interval of different outcomes. It reduces the "false sense of security" that may arise with the use of a complicated forecasting model and it also shows where more information is needed. (Ibid)

Simulation or scenario analysis - An extension of the sensitivity analysis is to perform a simulation or scenario analysis to minimize the drawbacks of the sensitivity analysis. Simulation of a model might be performed for a number of reasons, such as model testing and evaluation, historical policy analysis and forecasting. The simulation will enable the user of the model to see how variations in the forecast assumptions will affect the result of the forecast and following that the result of the valuation. Using a simulation, series of possible scenarios can be examined and the affects on sales forecast or value can be estimated. The effect of a change in one variable might cause a change in another variable. This depends on the correlation between the variables Whereas a sensitivity analysis is focusing sequentially on changes in one variable at the time, holding the other constant, the scenario analysis examines the impact on the value of simultaneous changes in a number of variables in the model. (Cooley, 1994)

In a simulation or scenario analysis, the possible results of a valuation are tested before it is accepted to be significant. The testing itself is based on a model coupled with probabilistic information about the different variables. Probability distributions are assigned to each of the variables usually based on management assessment of the probable outcomes. Note, that likewise there is a risk included in the scenario analysis since the probable outcomes are based on a manager's knowledge. Once the probability distribution is determined a simulation can be carried out to see the result of a valuation under the different outcomes. (Horne & Wachowicz, 1995)

3.7.5. Check for Consistency and Alignment

Finally, the results need to be checked for consistency and alignment. The forecast should be evaluated in the same way as historical performance can be analyzed. It is necessary to check the forecast so that there are no deviations from what can be reasonable. Questions such as, "Is the company's performance on the value drivers consistent with the company's economics and the industry competitive dynamics?" should be asked (Copeland et al., 2000 p. 245).

4. Analysis

As stated in the problem discussion, the discounted cash flow approach to firm valuation is a model or tool used in a decision-making situation. Therefore, this analysis will deal with both the DCF model in itself and how it affects the decision-making situation where it is applied. The different theories in the theoretical framework will be considered in order to reach the purpose of the thesis. Firstly, the analysis of the literature study will begin with a conceptual discussion of the theoretical framework. This section also describes how the analysis is disposed.

4.1. Conceptual Discussion

This section will summarize the major points of the theories presented in the theoretical framework. Furthermore, some interesting observations made while reading the literature will be reported. The literature study is focusing on models and their weaknesses, both in their assumptions and limitations and in how the models can be applied as tools in decision-making situations.

The main weaknesses of mathematical models are identified as (1) their dependency on the assumptions made about the reality and (2) how these assumptions are quantified. This can be exemplified with the quote: “[G]arbage in, garbage out” (Natenberg, 1994 p.39).

Instead of focusing on different models of firm valuation we focused on the most commonly used one in practice, the discounted cash flow (DCF) method. With focusing on just one approach we could identify the main problem areas and work from that point. Since the DCF model is a mathematical model it has the weaknesses described above. The model consists of a numerator, estimated future cash flows, and a denominator, cost of capital. The latter of these are thoroughly discussed in many textbooks while the former is, mainly, briefly explained. This is an interesting notion since, both in textbooks and in the above mentioned interview, the main weakness, or difficulty or area where faults are most easily made, with the DCF model mostly was said to be the estimation of the future cash flow, and especially the forecast of future sales were implied to be important. Consequently, this raises the question why there is not more information on this part of the valuation process. If distinguishing

between textbooks focused on capital budgeting and valuation and textbooks with a focus on financial planning there is frequently more information on the forecasting procedure in the books on financial planning.

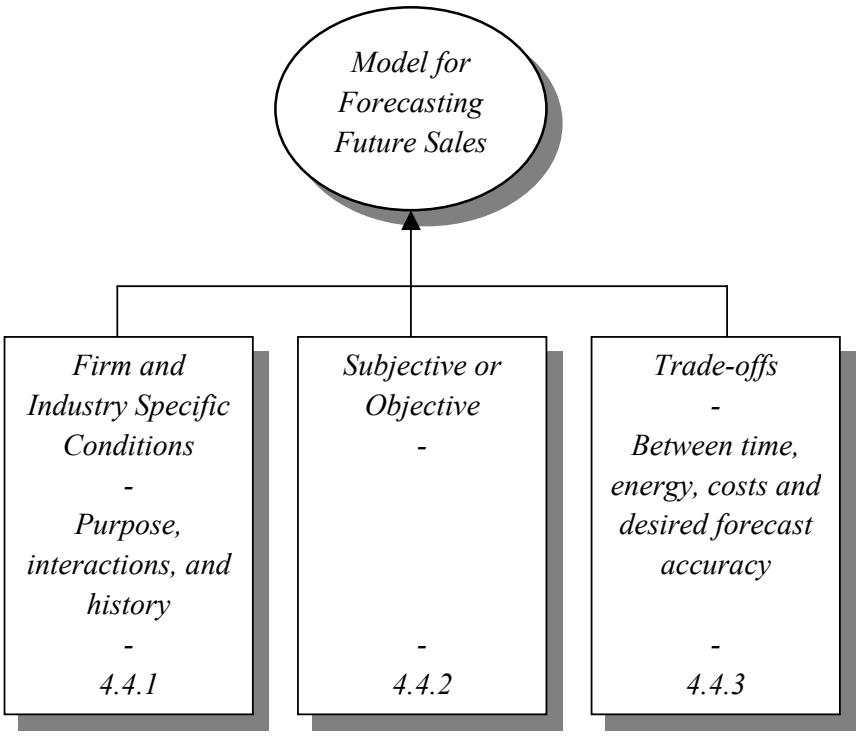
Having established that the main problem area of the traditional DCF model is the estimation of future sales, the literature study focuses on forecasting models that can be used to estimate these future sales. The main findings here are (1) the capabilities of different forecasting models and (2) how to choose which models to use in a certain situation. The implications of the theories reported on these issues will be further discussed in section 4.4 “Development of a Forecasting Model”.

In the second part of the literature study the DCF method for firm valuation, as it is reported in modern literature, is explained. Basically this process will be followed in the subsequent case study. However, the forecasting part will be further discussed and developed in the analysis. One observation of interest is that the method described, from now on in this thesis called the Copeland model, seems to be an attempt to overcome the weakness the traditional DCF model had when it came to estimating future and uncertain cash flow. The Copeland model is a hybrid between, what was expressed in Trigeorgis (1996) as two cousins’ approaches to valuation, the capital budgeting approach and the strategic planning approach. The latter of these cousins is only briefly discussed in this study.

The analysis will reason and argue further on this notion and try to suggest improvements on this hybrid approach. The arguments developed there will mostly rest on interpretations on the initial theories presented in the beginning of the literature study. Where concepts such as the importance of (1) explicitly stating assumptions and views when conducting analysis, (2) the open society/method as the best approach to good decisions, (3) and ethical argumentation based on virtues are essential.

The text on valuation as a science versus an art and how this relates to the other concepts discussed above is also further discussed in the analysis. Figure 4.1. below illustrates the main problem area identified in the DCF method, the process to estimate future sales, and the different variables that the literature study imply are important to concider when trying to improve this problem area. Further, the sections where these variables are discussed are shown.

Figure 4.1. Variables to consider in a model to forecast future sales



4.2. Models and Model Construction in General

In this section we will analyze why the theory provided on models and model construction in general is applicable and should be considered when investigating the problem areas of the discounted cash flow (DCF) model and when making arguments for how to improve the model.

Since the discounted cash flow model is depicting the reality by use of mathematical symbols and connections between functions it is, by the definition in the literature study, a mathematical model. Accordingly, it should have the strengths, weaknesses, and other features that were asserted mathematical models in the literature study. When investigating the DCF model in the literature study it becomes evident that this is the case. For example, the general conclusion on mathematical models is that if the in-data is of low quality then the out-data also be of low quality and, consequently, it is evident, both in textbooks and expressed by practitioners, that the quality of the DCF model results are dependent on the in-data. Furthermore, there are discussions, in the studied theory, on the level of detail that should be pursued when gathering the in-data and how this affects the quality of the results. These too, are common problems for mathematical models. Thus, we see that the

DCF model is a mathematical model and, more importantly, that it probably will have the same strengths, weaknesses, and other features generally inherited in mathematical models.

If the DCF model is a mathematical model, the overall theoretical reasoning concerning mathematical models that is held in the literature study, should be applicable to use. Since we have established that the DCF model is a mathematical model the conclusion above should be valid and, thereby, it will be applicable to use those theories when looking for areas to improve and to use as reasons for suggested improvements.

4.3. The Discounted Cash Flow Model

Analyzing the theoretical texts on the traditional DCF method lead us to conclude that the main problems with the model is the quality of its in-data, estimated future cash flow and estimated cost of capital. As was mentioned both in the introduction as well as in the conceptual discussion the process of estimating the cost of capital is a thoroughly investigated area and is, therefore, not included in the scope of this thesis. Instead the focus is on the less discussed estimation of the future cash flow.

The original DCF model developed to value bonds assumes that the future cash flows are certain, but when applied to value a firm the cash flow is uncertain (Hagerud, 2002). In order to find the future cash flow these have to be predicted by the use of some sort of forecasting model. Thereby, a subjective element is introduced in the valuation. Hence, the result of the DCF valuation is not objective but, rather, depending on assumptions and estimations made by the analyst.

In order for the results of the DCF valuation to have high quality the valuation process has to have high validity and reliability. By applying the scientific standards of the concepts the quality of the valuations can be assessed, or at least the user of the valuation can form an opinion of how valid and reliable the valuation is. Validity should be achieved by following the DCF method as it was explained in the Copeland model. Reliability, to execute the measuring in a correct and as objective as possible manner, can be achieved by applying a forecasting model that is superior to other forecasting models in the specific situation, and that limits the subjectivity of the forecast. How such a forecasting

model is identified was discussed in the literature study, in section 3.4.1, and this approach will be applied to the DCF model later in the analysis.

The reasoning behind this is that forecasting the future cash flow in the DCF model is an area that can and should be improved. By discussing which model should be used we have a basis for the discussion on how to improve the DCF model.

4.4. Development of a Forecasting Model

Firstly, we begin by looking at the questions suggested by Edlund et al. (1999) in the literature discussion. Then, a discussion on whether a subjective or objective forecasting model suits the situation best is held. Thereafter, the different factors that need to be balanced in a forecasting model are view. These sections give the arguments and reasons for suggesting a forecasting model, which is done in the end of the third section. Finally, a discussion on when the suggested forecasting model works best is held.

4.4.1. Identifying Questions

What is the purpose of the model – how are the results supposed to be used? - The purpose of developing a forecasting model is to estimate future cash flow as accurate as possible. That is to say, to reduce as much as possible of the uncertainty in the future outcome. The results are supposed to be input data in the DCF valuation model, which in turn will result in an intrinsic or true value of a firm. This value will be used as a guide, or tool, in a decision-making situation of whether to buy or sell shares of a specific firm.

Which variables and interactions are in the system for which the forecast is conducted? - Rephrased to this special situation we ask: Which variables and interactions are affecting the future cash flow earned by a firm? These variables and interactions are mostly specific for specific industries and specific firms. What they do have in common is that there are many variables and many connections between these variables that affect a firm's future cash flow, which lead to a higher degree of uncertainty in the future cash flow earned by a firm. In order to produce good forecasts the forecasting model

should therefore strive to reduce as much of this uncertainty as possible, i.e. transform the uncertainty to risk.

How important is the historical development in order to predict the future development for a firm? - This is also different for different firms. The less dependent the future development of a firm is on its historical development, the less are the possibilities of transforming the uncertain future cash flows into quantified risk measures. Consequently, it is more difficult to gain quality in the in-data of such a company than it is in a more stable company where the past is a good indicator of the future.

By answering these three questions we can see that the purpose and how the results are to be used are similar for valuations of different firms, while the variables affecting and the importance of the past is different for different companies. This makes it hard to pinpoint one forecasting model that is best no matter what firm is valued. But since there are some common factors in these areas we will argue for a specific forecasting model applicable in most valuations. It is our belief that, in most situations, this model matches the demands the DCF method puts on its forecasting model better than other models.

The model we will argue for is an objective forecasting model. Consequently, we will begin with stating the reasons for preferring an objective forecasting model before a subjective one. Then, we will continue and further discuss what sort of objective forecasting model we suggest and why we believe in this model.

4.4.2. Subjective or Objective Forecasting Model

The use of an objective forecasting method has many advantages and we will be getting back to some of them later in the analysis. Basically, the objective model is supposed to statistically interpret how the competitive environment influenced the historical cash flows and thereby avoiding some of the subjectivity that a qualitative study is affected by. By constructing an objective, or mathematical, forecast model the decision makers are forced to formalize their view of the connections between different variables, and these connections can be statistically tested. Objective forecasting techniques are divided into time series models and causal models.

The use of an objective forecasting technique gives a value on the uncertainty of the estimation, accordingly risk is created. Furthermore, as we will see later, if it is a causal model it is also possible to conduct sensitivity analyses for different values on the dependent variables. The prediction becomes less personal, i.e. subjective, and can in principle be conducted by anyone.

As we can see from the reasoning above the main advantages of using an objective model lies in the fact that it is a mathematical model and, thereby, the summarizing points of view on why it can be reasonable to work with mathematical models in connection to decision-making problems, presented in the literature study, provides reasons for choosing this approach. These points of view were (Edlund et al., 1999):

- Mathematical models force a systematic framework of reasoning. The problem has to be structured and the most important aspects have to be formulated.
- They allow a high degree of complexity concerning e.g. number of variables, restrictions and scales of measuring.
- Given that the same model is used from time to time consistency in the decisions is achieved.
- By developing a model for a decision making problem that frequently recurs it is possible to gain practical knowledge and improve the model over time.
- A decision model is a depiction of a problem that can stimulate to the occurrence of discussions, give ideas about lack of information, new areas of applicability, and complement/simplifications and so on.

The only time that it would be better with a subjective model is when the reality cannot be accurately depicted in an objective model. This would be the case if there would not be any access to relevant data or if the assumptions in the objective models did not allow for an accurate picture of the reality. When developing a financial forecast for a firm there might actually be some problems here. But we believe that initially it is best to conduct an objective forecast. Then, the results of the forecast as well as the variables and their estimates have to be considered and evaluated by a subjective study. This is a combination of the objective and subjective method that would, hopefully, help

in eliminating both approaches' individual weaknesses and limitations. The approach argued for below should, accordingly, not be viewed as an alternative to the strategic analysis discussed in the literature study. Rather, it should be viewed as a complement, trying to improve the difficult part of transforming a strategic and qualitative perspective into a financial and quantitative forecast.

The next section will state the reasons and arguments for our belief that a certain objective forecasting model should be used in most valuations. We will discuss some of the important factors to consider in a forecast model as they were discussed in the literature study as well as reasons based on the new, or relatively undeveloped, academic theories introduced in the literature study. As was stated in the problem discussion we will both discuss reasons contributing to more accurate forecasts, i.e. improvements of the DCF model in itself, as well as arguments for why the approach improves the context where the DCF model is to be used. Furthermore, we will discuss in which situations the approach works best.

4.4.3. Factors that Need to be Balanced

First, we will analyze how the different factors that should be balanced affect the choice of forecasting model to be used in the DCF model. Then, this will, together with the analysis of the three questions above, be the base of an argument for the use of a specific forecasting model when applying firm valuation with the DCF model. The different factors considered were mentioned in the literature study (Edlund et al., 1999) as important factors to consider and balance when deciding which forecasting model to use in a special situation.

The time horizon of the forecast - As was discussed in the literature study the time frame for the detailed forecast should be somewhere between five and ten years. This is considered to be a long-term forecasting horizon and, therefore, the forecasting model has to be able to handle long-term forecasting.

The pattern of the data - The pattern of the data, annual sales revenue, usually show a trend but there are also often trend breaks in the pattern. This differs for different firms since they are more or less dependent on external factors. For example cyclical companies are highly dependent on the business cycle and the

sales figures are, consequently, subject to breaks in the trend whenever the business cycle is changing.

Costs - The direct costs of using a model mostly depends on how much data that needs to be collected and how time-consuming this gathering as well as interpretation of the data is. On the other hand, the indirect costs of using a model, or rather the alternative cost of not applying a more accurate model, can possibly largely outweigh the gain in lower direct costs. Furthermore, as indicated by Edlund et al. (1999) in 3.2.1 "Definition", the cost of gathering data and the time consumed in analyzing should be decreasing with the aid of new IT technique and better statistical software programs as well as better trained analysts.

Detail, the need for accuracy - As we have seen over and over again a mathematical model's result is only as good as the data put into the model. Therefore, there is a great need for accuracy in the forecasts. As Hamberg (2001) put it, reported in 3.3.3. Problem Areas, the value of a company can alter substantially just by a slight change of the discount rate or the growth expectations, i.e. the forecast, of future cash flows. This puts emphasis on the accuracy of the cash flow forecast.

More complex models, such as causal models, involve more variables in their approaches to generalize the reality. More variables increase the possibility to detect trend breaks in the economic environment. And a firm in an economic environment is affected by a great deal of variables. By making an economic environment analysis, as discussed in section 3.5.5 "Financial Forecast", the different variables that are affecting the firm can be identified. These variables can then be used to investigate their interaction with the value of the firm. This is an important ingredient in the firm valuation process. The use of a model that includes different variables gives the opportunity to conduct further analysis of the value. A sensitivity analysis with different variables is made possible and also a scenario analysis or simulation is possible to perform.

Level of details - The level of detail that is needed in the forecast for future cash flow is something that varies from each case. This could involve whether to use quarterly or yearly data in the forecast. For long range forecast it might be enough using yearly data but in a short range forecast monthly or weekly data is required.

Access to data - The access to data is crucial when deciding which model to use. In order to use sophisticated models more data has to be collected and, thus, the demand for access to such data is larger.

User-friendly - This feature of the model should not be too important in this context. The analysts using the DCF method for valuation should be highly trained in the use of mathematical models and statistical data, otherwise it is doubtful that they can apply the DCF method at all. Furthermore, as mentioned above under costs, the knowledge of mathematical approach and statistics is getting better and better. So the analysts of tomorrow should not have any trouble handling sophisticated forecasting techniques. It is even so that if a more sophisticated model leads to better valuations then the analysts choosing not to use them because they believe the models to be to hard to understand and use will be out-competed by analysts using the more accurate and sophisticated forecasting model as a competitive advantage. Thus, the user-friendly feature is not important when considering which forecasting model that should be used in the DCF model.

To summarize this discussion, the most important factors to consider, when deciding which forecasting model to use in the DCF analysis, are (in no specific order):

- The time horizon of the forecast
- The pattern of the data
- The need for accuracy
- Access to data

Based on the analysis above we believe that the best forecasting model to be used in the DCF model is a causal model. Thus, our recommendation is that this model should be used in most cases when a firm is valued with the DCF model. The arguments and reasons behind our belief in the causal model approach (CMA) to forecasting sales will be discussed next.

First, the need for a long-term forecast that is required in a DCF valuation immediately excludes some forecasting models. The time series models moving averages as well as exponential smoothing have great difficulties in

performing long range forecasts, leaving only some sort of simple regressions or average growth rate as a possible time series approach.

Second, the pattern of the data indicates a need for a model that can foresee trend breaks. Time series models can detect linear trends and seasonalties but lack the ability to find trend breaks. The reason for this is that the only variable the forecast is depending on, besides the actual sales, is the time factor. Hence, breaks in the trend are impossible to forecast. Causal models, on the other hand, use more than one independent variable to estimate the dependent variable. Thus according to theory, assuming that correct variables are used, causal forecasting models stand a better chance to foresee trend-breaks in the environment that affects a firm's sales and, hence, give more accurate forecasts.

Third, the demand for the forecasting model to perform forecasts with high accuracy also favors a CMA. This follows from the discussion on trend breaks above. It is crucial that the forecasting model is as accurate as possible and since the CMA approach is the only mathematical model discussed that can properly forecast with trend breaks it follows that this model approach will lead to more accurate forecasts, assuming that the in-data is correct. Furthermore, the sales figures are as previously mentioned highly uncertain. The forecasting process is one way of trying to change this uncertainty into risk measures.

Fourth, the access to data should not be an obstacle for the CMA. Since it is a sophisticated forecasting model with many independent or at least more independent variables than a time series model, it needs a lot of data. But in the society of today, with more and more information available through increased Information Technology coverage this should not present a problem.

This last point leads to the question of costs. As was stated above, the costs for gathering and analyzing the data needed for a forecasting model should not outweighs the benefits of achieving more accurate forecasts. Also, if the procedure of the CMA becomes routine the statistical analysis of the data will take less and less time, due to increasing productivity by learning.

4.4.4. When the CMA Works Best

As with all mathematical forecasting models the CMA works best when the past is a good predictor of the future for a company. If the strategic analysis gives indications that this is not the case for the company the valuation is conducted on, more of the forecasting has to be carried out by qualitative forecasting. Consequently, valuation in such cases will be subject to more subjectivity on the analyst's part. Thus, the need to follow a scientific method in both how the analysis is conducted as well as reported becomes increasingly important. This procedure will limit the subjectivity and provide the user of the analysis with means to assess the quality by having the opportunity to view the process and assumption in an explicitly stated form.

Furthermore, it should be easier to apply the CMA to companies whose sales are not exposed to many factors. It is difficult to forecast sales growth for a large firm that has many products and operates on many markets and with the CMA there will be a lot of different variables that have to be tried as independent variables.

By this reasoning CMA is more applicable in small and medium sized business, since these tend to be more dependent on their past performance and have less variables that affect their sales and these also tend to have a more direct relationship with the dependent variable.

Another notion is that the CMA might be even more applicable for internal forecasting. The procedure of forecasting sales and setting up pro formas is not only used for external valuation of firms, the procedure is also followed in internal financial planning. The complexity as well as the advantages of the CMA might be better suited for internal forecasting. Thereby, both plenty of macro- and micro- can be added to explain sales. Furthermore, the CMA can be applied to different profit centers or subsidiaries, which would limit the problem, mentioned above concerning the difficulty if a firm has many products and operate on many markets.

To conclude the text so far on the CMA we believe that the model should be used as a primary indicator and not as a final and absolute result. The power of the regression model approach to forecast sales revenue is not just its accuracy, rather, it is its ability to test the sensitivity of the results and the possibility to

construct simulations where different inputs are used in the independent variables. Through such analysis knowledge of which variables affect the sales the most are attainable. This knowledge is useful since it indicates which variables should be extra scrutinized, if these are changing so will the intrinsic value of the firm. Thereby, the analysts and the investor will have an indication on which macroeconomic variables should be followed closely and which one they can play less attention to.

4.5. The New Academic Theories and the CMA

The text above has mostly been the reasoning for the CMA on the basis of its forecasting abilities; however, there are more merits to the approach. Next, the new or relatively undeveloped academic theories in the context of valuation, discussed in the theoretical framework, will be applied to find reasons and arguments for how improvements can be made in the valuation process. How the CMA can be used in this process will be discussed, as well as how the incorporation of these thoughts in the valuation process could make the decision-making situation in itself better. The purpose of using these theories is to hopefully gain new aspects of the valuation and forecasting areas in order to be able to improve these areas.

4.5.1. Science versus Art in the Valuation

In the literature study the view on valuation as an art or as a science was introduced. The valuation process contains elements from both these areas. We believe that a good way of expressing it is that valuation is an art that rests on top of a science. A good analyst has to be a good artist. However, the art of valuation without the scientific element in forecasting is nothing but reckless fortune telling.

It is our belief that the valuation process should be as scientific as possible. That is, it should strive to structure the gathering of input data, the use of the input data, and how the analysis is reported in a scientific way. With scientific we mean to follow the systematization and structuring that take place in the development of scientific theory and through the scientific methodological tools. By following theory of science and scientific method the analysis will be as objective as possible. Furthermore, if the valuation process, with the assumptions and estimations, is explicitly reported the user of the analysis, i.e.

the investor who uses the valuation as a tool in the decision on whether to sell, buy, or wait, can form his own view on the validity and reliability of the analysis and its results. In short, by structuring the analysis in a scientific way the problem of subjectivity will be limited. This is achieved by using forecasting methods that are less subjective and by explicitly stating the subjective views used in the analysis.

This goes hand in hand with the reasoning about the open society and the open method. By making the valuation subject to scientific method a contribution to an open discussion is made and, as was discussed in the literature study, it is through open discussions that we are able to make the best decisions.

4.5.2. Ethical Argumentation

CMA could be used in order to build confidence in the valuation process. This belief is based on the following reasoning. As seen in the literature study, ethical argumentation is based on the virtues of the ones making the arguments. Analysts have to show that they possess the virtues relevant to creating ethical arguments in order to gain the publics, and above all investors', faith in their argumentation, i.e. their analysis.

The CMA would contribute with a model that more openly shows the analysts assumptions of the future, i.e. contributing to the virtue of honesty and openness about one's support and evidence for the conclusion being argued for. It would also express a willingness to cooperate, which was another virtue mentioned in the literature study, and, thereby, show that they are trying to contribute to an ethical argumentation. By showing their assumptions behind the intrinsic value they report; the discounted cash flow value, they are also sticking their neck out. They would be displaying the virtue of courage. Furthermore, they would have to be willing to make divergent arguments, i.e. be willing to report DCF values that are different from others as well as the current price on the stock market. This would contribute even further to restore the belief in analysts making ethical arguments.

If analysts follow the virtue of honesty and openness another advantage of the CMA will be readily available. It will provide the analysts with an incentive to sharpen their knowledge and in-put data. If their views, estimations, and assumptions are explicitly stated in their reports, it will put pressure on the

analysts to continuously increase their performance. If not, the scrutinizing eyes of the investors using their analysis will see that they are not as good as other analysts. So by opening up the valuation process it becomes easier for the consumers of the analysis to assess the quality of the analysts recommendations and, at the same time, it will serve as an incentive for the analysts to make good analysis.

To organize a decision-making situation in accordance with the rules of the open society was, in the literature study, argued for as giving opportunity for making the best decisions. Both the discussion on scientific versus artful valuation approach as well as about ethical argumentation rests on this argument. We believe the CMA approach to forecast in the DCF model can contribute to these areas and, consequently, improve the context where the DCF model is used.

In the next part of the analysis we will discuss how the CMA fits in the Copeland method of valuing firms.

4.5.3. The Copeland Model and the CMA

As was noted in the conceptual discussion the Copeland model, to value firms is an attempt to limit the shortcomings of the traditional DCF method. By introducing strategic planning in the valuation process he tries to solve the problem of the fact of in reality having uncertain cash flows, while the DCF assumes that these are certain. The Copeland method is in a way a hybrid method with some part resting on strategic planning, a qualitative method, and capital budgeting, a quantitative method. By adding the element of strategic planning Copeland perceives that the forecast of the future cash flow will be better. This might be true but it also increases the valuation methods exposure to subjectivity. Therefore, if conducting a valuation with the Copeland method, it becomes increasingly important to try to limit subjectivity in other parts of the valuation process. It also makes it increasingly important to explicitly state the decisions and assumptions that can be subject to subjectivity. Thereby, even if the subjectivity in itself is not limited, the investor using the analysis stands a chance of evaluating the support and evidence that the analysis results rest upon.

The above observation gives further support for the use of the CMA. This conclusion is based on the qualities of the approach previously discussed. Above all that the approach is less subjective than most other approaches and that it is easy to report on the assumptions and estimations that the result of the forecast rests upon. As has been mentioned before the CMA is a complement to the Copeland approach. It is even suggested in the Copeland approach that the analyst should base the sales forecast on some sort of multiple regression model. In this way it might sound like we are trying to kick-in an open door when discussing the use of the CMA, but as we see it there is not enough emphasis put on (1) why such an approach should be pursued, as well as, (2) how such an approach should be carried out. Furthermore, there are reasons why applying the CMA could improve not just the correctness of the valuation in itself, but also make improvements to the whole decision making situation and we believe that the merit of the CMA lies as much in these, as far as we understand, unnoticed factors. Finally, the CMA lends itself easily to sensitivity, scenario, and simulation analysis. These are a part of the Copeland method and, consequently, if using the CMA this procedure will be both easily made and above all be more thorough than if other forecasting models are used when estimating future sales.

4.5.4. Further Reflections

Finally, some further reflections mainly on how the CMA can be used and problems that can arise on the implementation of the model are discussed. In the end a short discussion on the otherwise neglected part of the DCF model, i.e. cost of capital, is held.

More than one forecasting model – It has to be said that more than one forecasting model can be used. In the classical strategy masterpiece *The Art of War*, Sun Tzu (1988) writes that the general, who makes the most calculations before a battle, is the general who is most probable to win the battle. The same thinking should be applicable concerning firm valuation. The more different forecasting models, and hence the more calculations that an analyst uses the better the understanding for the past and future development of the firm will be. Of course there is a point of diminishing returns where more time spent on analysis will not be in balance with the contribution to better understanding.

Therefore, the suggested CMA could be used as a complement to other forecasting models. One suggestion could be to initially use an average growth rate of sales. Then, to apply the CMA, followed by valuing the firm according to the target growth rates of the firm (usually reported in the annual reports). Finally, the current market price can be backtracked so that the average annual growth that this current price implies can be found. If executing all these forecasts a more thorough understanding of the firm will be developed and a better valuation could hopefully be conducted.

Implementation of the CMA - The usefulness of the suggested CMA will further be investigated in the case study. But even if this empirical test on the feasibility of the CMA shows that the method works this might not be enough to convince analysts to use the CMA when applying DCF valuations of firms. As reported in the theoretical framework many mathematical models experience problems in the implementation phase. The CMA transforms some of the subjective and qualitative know-how possessed by analysts into objective statistical methods. Analysts can view this as a threat to their expertise in the area. If so, the merits of the CMA have to be thoroughly presented and proven in order to convince analysts to fully adopt the suggestion.

Cost of capital – The main problem discussed in this analysis have concerned the uncertainty of the future cash flow, and since these usually are derived from the future sales the focus has especially been on how to forecast the future sales. Even if cost of capital is not considered in the scope of this study some things can be said. First, the uncertainty of the future cash flow is in some ways dealt with in the cost of capital. This is done through adjusting the discount rate to the riskiness of the business. The uncertainty of the future is in this case transformed to risk through calculating a beta value derived from the fluctuation of the market price of the firm. One thought that occurred while conducting this thesis is whether it would be better to apply a risk adjusted discount rate based on the fluctuation of the sales rather than the market value. Market value is a tricky concept since it is merely based on what the aggregated individuals on the market perceive that the right price is for a firm. This value, as it has been argued in this thesis, should be based in the future performance of the firms. If then the value is calculated by the use of former perceptions of the value a moment of circular thinking is formed. It might be better to apply past sales data to assess the risk of the business, in this way subjectivity of the aggregated investors is not just to value the company, rather,

objective past data is applied. It has to be emphasized that these are only thoughts that have occurred while conducting the study and that there are neither academic theories nor empirical proof behind the reasoning. Nevertheless, it is in our opinion an interesting notion that could be the topic of a study focusing on the cost of capital.

5. Reflections and Suggestions

The purpose of the literature study was to analyze the use of the discounted cash flow method as it is used in firm valuation. The aim is to expose some important weaknesses of the method and the reasons behind why they are problem areas. Further, the study will be conducted to find reasons and arguments to solutions of these problems.

The main problem area in all mathematical models is the quality of the input data. In the DCF model these are estimations of cost of capital and estimations of future cash flows. As was mentioned in the problem discussion the first of these were not further investigated. The estimation of future cash flows was, on the other hand, further investigated. It was found that it was the forecast of the growth rate, i.e. the sales future development that was the main problem and not the process where the pro forma statements are forecasted. The reason for this was found to be that errors in the growth rate affected the valuation the most.

The future sales of a firm are uncertain. When estimating these two problems arise (1) the forecast will be affected by the subjective views of the analyst and (2) the accuracy of the valuation will be partly dependent on the accuracy of the forecast.

Next, the study focused on how to make improvements in this problem area. After analyzing the situation where the forecast was supposed to be applied it was found that the forecast of future sales would be best done with the application of a causal forecasting model, which was referred to as a causal model approach (CMA).

This model was found to be the best model for the situation, since it showed the features that were found to be important for a sales forecasting model that should be used in the DCF method. The best model should:

- Be able to translate economic uncertainty into economic risk. This is by definition made by quantifying the possibilities of different outcomes.

- Be constructed in an objective view. This can never be totally fulfilled but if it is possible to test the model mathematically or statistically others can judge the subjectivity of the forecast.
- Show openness about all assumptions and judgment made that underlies the forecast. This gives the opportunity to discuss these assumptions and judgments and make own judgments about the accuracy of the model.
- Balance the most important factor to consider (in no specific order) when choosing among forecasting models
    - The time horizon of the forecast
    - The pattern of the data
    - The need for accuracy
    - Access to data

The CMA, if conducted appropriate, has the ability to fulfill these requirements when applied to forecasting a firm's future sales. It is also easy to conduct sensitivity and simulations analyses with a causal forecasting model. Thereby, the use of the CMA could be a better tool for handling the uncertainty of the future cash flow than most other techniques. Another merit of the CMA is that the extrapolation would be based on external factors and thereby has a chance of detecting breaks in trends, which was mentioned by Hamberg (2001) as the most important thing for an extrapolation to do.

Furthermore, concerning how this suggested improvement of the DCF model in itself, affect the role of the DCF method as a tool in the decision-making situation was discussed. The main finding was that it is important to structure the whole valuation process according to scientific methods. By this the element of subjectivity can be limited and, above all, if explicitly explaining the method and assumptions applied to conduct the valuation, the user of the valuation, i.e. the investor, can, in some sense, assess the quality of the valuation. The main contribution of the CMA, in this context, is that the assumptions of the forecast easily can be explicitly stated.

In short, we believe that analysts should strive to make the valuation process as scientific as possible, i.e. structured according to theory of science. This would include:

- Strive to make as reasonable and ethical arguments as possible and to explicitly state their assumptions and subjective views.
- Use a causal model approach (CMA) as a guide when translating the strategic perspective to the financial forecast.

Based on these reflections and suggestions a case study will be conducted, where a causal forecasting model for a specific firm is constructed. This will serve as an example of how such a model can be developed and used in firm valuation, as well as, trying out the empirical validity of the CMA.

3rd part

CASE STUDY

This third part of the thesis is an empirical attempt to apply the suggested CMA. The aim is to fulfill the third purpose.

6. Case Study Introduction

In the literature study it was concluded that there are shortcomings when applying the discounted cash flow method in practice. Furthermore, it was suggested that by applying a causal model approach (CMA) to the forecasting process in the discounted cash flow model one of the major shortcomings would be less severe.

The intention of conducting the case study is not to provide a detailed and accurate valuation but, rather, to empirically test the feasibility of the suggested CMA and give an example of how to apply the suggested approach. By doing this we hope to gain new insights on the suggested CMA that, combined with the conclusions of the literature study, will result in overall conclusions on how the DCF model can be improved.

In this case study an attempt to construct a forecasting model that can be used in a DCF valuation to forecast sales will be made. The model will be constructed for a case company, namely Peab AB. As concluded earlier, sales is the main value driver in a discounted cash flow valuation, therefore, a number of variables which affect sales will be chosen and their individual effect on sales will be estimated. Figure 6.1 shows the steps of the valuation process and is described below the figure.

Figure 6.1 The valuation model

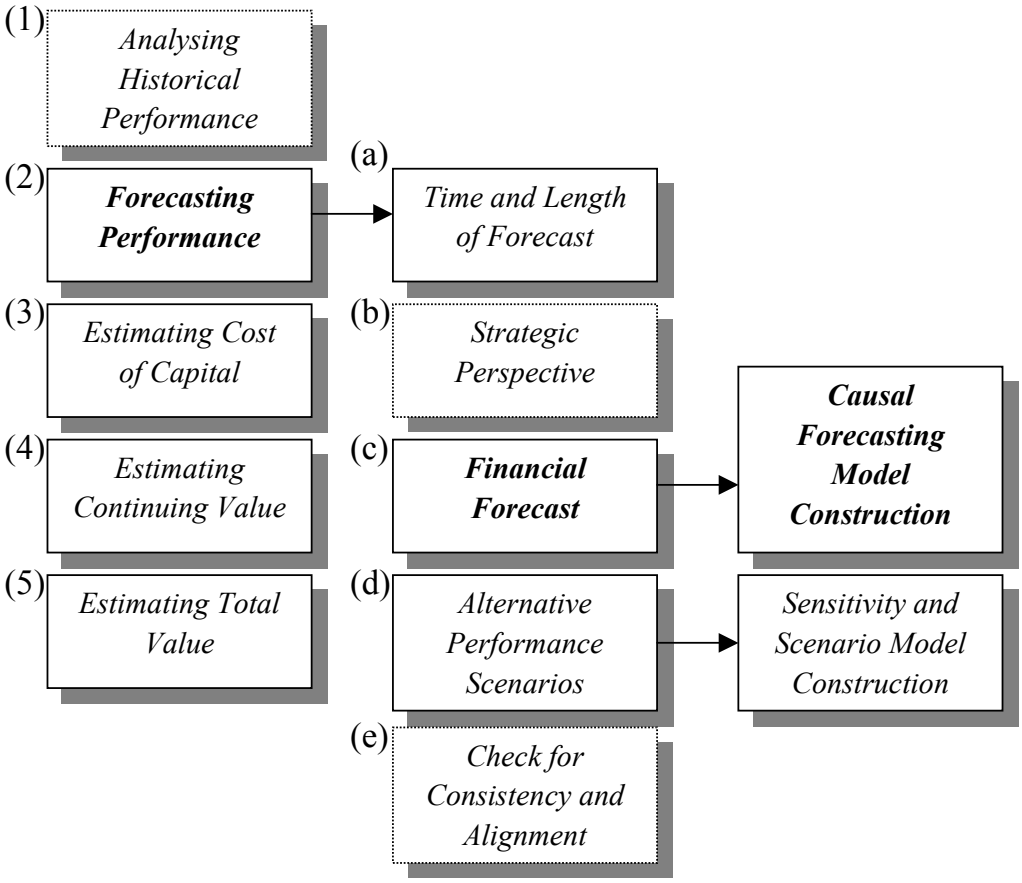


Figure 6.1 describes the valuation process as described in the literature study. It is called the Copeland model. This process will basically be followed in the case study, but there are some areas where assumptions will be made instead of a complete analysis. These areas are dotted in the figure. The areas that are in bold text are the focus of the case study. Step (2), forecasting performance, will be developed further in the steps (a) to (e). Foremost, the part (c), financial forecast, will be done in detail. This part includes developing the causal forecasting model that was recommended in the literature study's conclusion. Step (d), alternative performance scenarios, will also be conducted and a scenario model will be constructed. The areas that are neither dotted nor bold, i.e. (3), (4), and (5), are steps that will be carried out in order to complete the valuation but they will be conducted in a simplified manner.

6.1. Outline of the Case Study

In order for the reader to be able to easier follow the authors' line of reasoning, this outline has been formulated. Primarily, an introduction of the company as well as the methods used will be presented. The data regarding the dependent variable of sales will be depicted as well as the independent variables, which are believed to affect sales. As a result, the assumptions made concerning the choice of independent variables will be stated.

Consequently, the focus will turn to the significant variables, which will be found out through essential testing of the data. It will be done by the use of regression models and the parameters for each variable will be estimated. In addition, further tests on the model specification will be conducted in order to test the validity of the model. Depending on the result, a transformation of the data will be made to fit the result.

This model will then be used to carry out a valuation of the selected case company. Finally, an analysis of the generated data will be made and as a result of those, conclusions will be drawn.

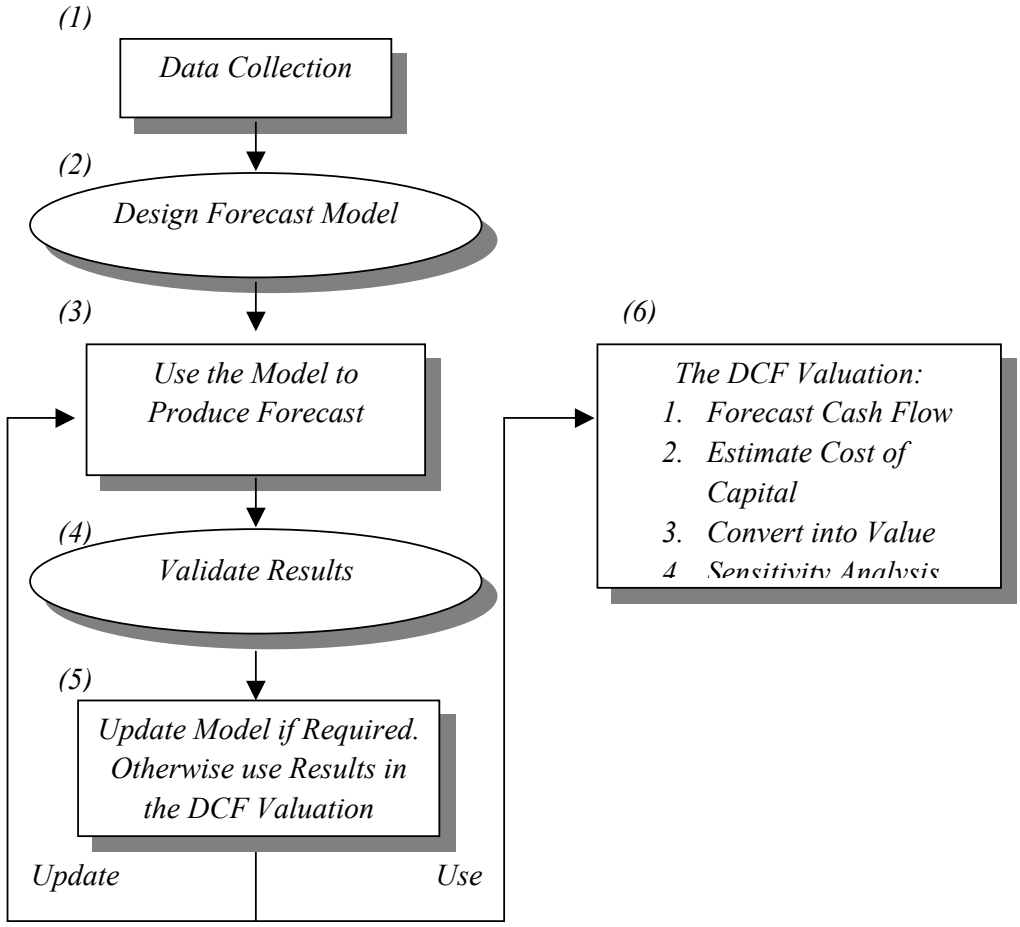
6.2. Methodology

In order for the reader to be able to follow the author's line of reasoning and have an easier time reading and understanding the case study, the methods used and the thoughts behind the choices made will be examined in the following part.

6.2.1. Method Disposition

The focus of the case study is on developing the forecasting model that was discussed in the literature study, and to apply it in a DCF valuation. The process in which this will be achieved is divided into six steps. These are illustrated in figure 6.1 and explained below the figure.

Figure 6.2. Developing a forecasting model and using it in a DCF valuation.



Source: Modification of Thomas, 1997 p. 257

The first element, in the case study process, is the collection and analysis of relevant data. The second and continuing to the fifth step, includes the different elements included in the process of developing a valid forecasting model. This will be achieved by developing the specific CMA applicable and valid for the case company.

The sixth and final step is the DCF valuation of the case company, which includes the creation of pro formas to derive the future cash flows, estimation of WACC, and finally an implementation of these in the valuation equation in order to arrive at a value. A sensitivity analysis will also be conducted to see the implications for the final value when changing one independent variable, holding all else constant.

6.2.2. Case Study Company

The company chosen was Peab AB. The reason for choosing Peab AB as the case study company for this thesis is that the company has shown a stable and progressive growth. In recent years the company has also started to focus its operation to the core competence area, which is the construction part of the business. Hereby, it is possible to forecast this area of the company. Another reason is that the company is based in Sweden with basic operations in Sweden, which makes the influence from outside less, meaning that the number of variables affecting sales are limited and the regression will be easier to carry out and in light of the time limit of this study this is appropriate.

6.2.3. Data

Due to the statistical nature of this case study it is important to find data, which will fit the purpose. The section is divided into three parts where data sources, sample size, independent variables and missing values are discussed.

Data Sources - The operation started with investigating search engines and web pages on the Internet. Fortunately, there are many high quality data information pages to find, but as we discovered, they often report different values on the income statements and balance sheets. One such example is the Swedish Central Statistical Agency web page, which has an online database to search. Inflation, GDP and interest rate information was there to find, mostly quarterly information.

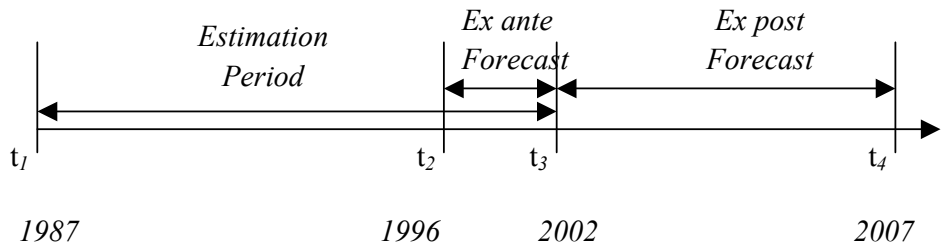
Other data used in the sample are collected from the databases EcoWin, Six Trust and Amadeus, which was accessed through the Economic Library in the School of Economics and Commercial Law. Also the homepage of Peab AB was a big help for gathering the data. The primary search in the latter databases concerned individual firm and industry information, such as numbers on sales revenue and stock indexes and some macroeconomic variables. To summarize, the following databases were used in order to collect the data:

- Ecowin, a database with statistics from countries and organizations, such as EU, OECD etcetera. Contains macro- and microeconomic variables and stock-exchange rates.
- Amadeus, a database with extensive information about companies in Europe

- Six Trust. This database contains extensive information about companies, including their balance sheet and income statement. It also contains information about different markets and micro variables. It is used to search for firm specific data, such as historical income statements and balance sheet

Sample size and time horizon of the data - The problem of finding the appropriate data is evident in the collection of firm specific data. Statistically a sample of at least thirty-forty observations for each variable is good enough to make significant estimations. This will not be obtained in this study due to lack of especially firm specific data. The estimation period is therefore set to six years, meaning twenty-four observations using quarterly data. Then an ex ante period is used to test the constructed forecasting model. Forecasting involves an estimation of the model forward in time beyond the estimation and ex ante period. Before the forecast can be estimated values for the independent variables must be covered for the entire forecast period (Pindyk & Rybenfeld, 1991). The actual forecast period, or the ex post forecast, will range over six years. In the ex post forecast the year 2002 is the first year.

Figure 6.3 Estimations periods in the forecasting process



In perfect conditions the estimation period and the ex ante, or out of sample period, should not be overlapped. Due to data constraints this is not possible in our case. This might have the effect that the forecast model is producing better results in the out of sample test than if this was not the case.

Independent variables - To be able to forecast sales the different variables that are affecting the sales of the firm must be identified. To get an overview over different factors, an economic model was created. This model presents both external and internal variables that might affect the value of sales. The external factors are factors that the firm does not have the control over and internal variables are defined to be variables that the firm can control, such as

marketing expenses or capital investments. All identified variables are then tested in the model.

Missing observations - The empirical work of a study is often complicated by the fact that some observations for variables might be missing, or for some variables quarterly data is available but for some variables only annual data is available. An example in a regression model is when there are N observations for the dependent variable but only N-M observations available for one or more independent variables. In literature, there is no common best approach for dealing with this problem. But there are some general suggestions that are used when this problem occurs. These general suggestions will be discussed below.

Firstly, within in a multivariable model the missing observations might be replaced by the variable means. This approach does not change the slope or variance if it is applied in a two variable model. But, if applied to a multivariable model this procedure might yield a different slope estimator. (Pindyk & Rubinfeld, 1991)

Then, a basic solution to this problem in a time series would be to replace the missing observations with proxy observations obtained by regressing the known values of the independent variable on time and by replacing the missing observations by the fitted values of the regression. This procedure is one way in which missing variables can be replaced through interpolation of the independent variables. (Ibid)

Finally, one approach is to use own judgment to fill in the missing observations. The validity of this approach can surely be discussed, however, if the judgment can be justified and argued for, it can be construed as valid, all the same. (Ibid)

6.2.4. Model Construction

As the literature study concludes a forecasting model built with a causal model approach, in this case a multiple regression analysis, will be constructed. Therefore, the construction of a multiple regression model is discussed below.

The Multiple Regression Model - The multiple regression approach is a statistical method to investigate the relationship between one dependent

variable and one or more independent variables. The regression analysis can be divided into a number of steps that should be processed in a specific order. The result and empirical findings of each step is reported in the next chapter (Pindyk & Rubinfeld, 1991):

1. The choices of variables to test in the model.
2. Create scatter diagram between the dependent variable and for each independent variable (see Appendix 2).
3. Create a hypothesis of the model specification
4. Test the hypothesis

After the collection of data and independent variables is finished a hypothesis of the model specification can be created. The original model's specification is referred to the formula of the general multiple regression model. It looks as the following equation. (6.1)

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon \qquad (6.1)$$

Where β_n = is the change in the dependent variables
Y= the dependent variable
X_n = the independent variables
ε = *the error term*

Once a model hypothesis is constructed the model specification can be tested. This usually ends up in one or more independent variables that significantly explain the dependent variable. But, the model constructed can be a subject to various statistical problems, such as spurious regression, autocorrelation etcetera. The model needs to be tested for those problems in order to achieve a reliable model that can explain the dependent variable. For those readers that are not familiar with the multiple regression analysis, further explanations about significant testing and model specification testing can be found in Appendix 3.

6.2.5. Valuation of the Firm

The multiple regression model accomplished will be used to forecast sales. When the sales forecast are completed the discounted cash flow valuation can be completed using the free cash flow analysis.

The sales forecast will be used to create a pro forma financial statement. The percentage of sales approach is the method used to create the financial statement. As discussed earlier, this might not be the most accurate method but it is easy to use and is based on the forecast sales which is the main focus in this case study.

7. Empirical Findings and Analysis

This section of the case study includes empirical findings made in the case study and an interpretation of those findings. The complete valuation process of Peab AB is reviewed here.

7.1. Company Presentation, Peab AB

Next follows a short presentation of the company that is the subject to this case study and the industry it is operating in.

7.1.1. The company

Peab AB is a Swedish company founded in 1959 by two brothers, Erik and Mats Paulsson. The business at that point consisted of garbage collection and clean keeping for farmers. In 1967 the first office was established in Förslöv and the brothers started working constructing larger contracs. In 1969 the growth of the small house market took off with larger profits as a consequence. Peab AB also expanded into the field of road improvements. 1970 readily made houses were constructed and sold for the first time. During the 1970s Peab expanded through acquisitions of companies in fields related to construction. In 1992 the company changed names to Tre Byggare only to change it back to Peab AB in 1993. In 1995 it was established that the company should be committed to concentrating on the core business, which is construction. By the year of 2000 the company had reached large volumes and the Business had been divided into four competence areas;

- Construction
- Industry
- Management
- Businesses under divestment

During 2000 a more pure version of Peab AB has been developed where the company is to be focused on its core competences. There are currently 11,000 employees. Sweden is still the main market even though there are operations to a small extent in Norway, Finland and Latvia. Operations in foreign countries should, according to Peab AB's strategy, proceed with caution and only be

undertaken when the profitability of the expansion surely will be stable and good. The trend for the foreseeable future will be characterized by increased housing construction with a subsequent downturn in commercial construction.

7.1.2. The industry

This brief section will give the reader an understanding of the characteristics of the building and construction industry that Peab AB is operating in.

The building trade is a major part of Sweden's economic development and historically investments in buildings have represented 50 % of the gross investments in Sweden. Investments in buildings and constructions lead to a demand on other products and services in other business areas in the economy.

The building business area is a vital area for the national economy as a whole and is one of the largest business area in the country. The total investments include new and re-investments in real estate and investments in roads and constructions. The total amount of investments were in the year 2000 almost 126 MSEK. This makes it is one of the largest business areas in Sweden. The number of employees directly linked to the business area is close to 225,000. Another 130,000 are employed in businesses that is related or dependent on the building companies, such as transportation and manufacturing of building equipment. Totally, the building industry is employing almost 450,000 or 10% of Sweden's total workforce. (www.bygg.org/byggmarknaden, 2002-10-23)

The market is characterized by a few large companies, such as NCC, Skanska, JM, and Peab, and a large number of small firms. The competition is often limited to regional markets and the operations are very sensitive to cyclic changes in the economy. The business area is said to follow a cyclic pattern. In times of prosperity the business area seems to have a lack of a educated work force and materials and in times of recessions the business area struggles with lack of profitability and the unemployment of construction workers becomes a problem. One characteristic of the building business area is that it has been subject to government regulations and subsidies. The system is created to fulfill some political goals that all citizens should have a place to live for a reasonable cost. Another characteristic is that the integration in the business area is very high. A lot of the larger firms are cooperating with, or own, the supplier of materials. (Ibid)

7.2. Forecasting Sales

This section will cover the development of a forecasting model. It will include the complete process involving identifying independent variables, the multiple regression, an interpretation of the model specification and finally some comments and critiques of the model.

7.2.1. Forecasting Model

The initial intent was to interview analysts for the construction industry and through the interviews be able to isolate a number of variables affecting sales. Due to the difficulties in getting in touch with the right people as well as the lack of time only one analyst had the opportunity to give information to us.

Both internal and external variables will be examined to seek any explanation of sales. An analysis of Peab AB's economic environment was carried out in order to identify possible variables that are affecting sales. A model of this analysis is presented in Appendix 4.

The initial equation to explain sales in Peab AB is shown in equation (7.1).

$$SALES = f(VAR_1, VAR_2 \ldots. VAR_n) \qquad (7.1)$$

The first step was to try to identify the variables, which might influence the sales of Peab AB. One such variable was the *GDP* variable. It is considered a measure of the overall growth of an economy and should therefore be considered a determinant of sales. If the economy as a whole is growing it can be assumed that the sales of a construction company should follow as well. Other variables of interest were, for example, *population growth, inflation, the general stock index (AFGX), short and long term interest rate, Swedish labor cost index, construction index,* and *the price of the Peab share*. The whole list of all variables considered at the first stage in the model development is summarized in Appendix 5. The *population growth* variable should be considered at least in the long run since a population increase should lead to a larger demand of housing. The population increase will not show immediately however, which makes the reaction in sales a bit delayed. The *inflation* should also be a self-explanatory determinant of sales, especially when considering housing. In times of relatively high inflation and with an accompanying low real interest rate it is more attractive for people to lend money and buy a house

since the real interest they pay is not that high due to high inflation. The *general stock index* in a country tells us about the future outlook on the economy. If the stock index is high it is fair to assume a great trust in the future and the opposite when it comes to a low stock index. The *construction specific industry index* tells us about the development of the construction industry and can be used as an indication of how much investment will be made in housing. *Swedish labor costs* were incorporated since they also influence the housing industry due to it being a large part of the overall cost of construction. The *share price of Peab* might also influence building indirectly since it determines how many funds there are to invest. Another theoretically important variable for sales revenue in the construction industry is the interest rate. It was also included to determine its impact on sales. According to Sveriges Byggindustrier, available for a short telephone interview, agreed that these variables were the most important ones to consider in this context (see Appendix 5).

7.2.2. Model Development

In following section, the line of reasoning can be followed to achieve a clearer picture of how the process has progressed.

Due to the lack of appropriate data and difficulties to find information from analysts the number of variables was reduced to a sample of 9 with 20 observations on each for the first run. The other variables considered were not included due to lack of data. Also sales was concerned with lack of data since it was only possible to find annual data until 1990 and semi-annual data after that until 1995. The quarterly data available was decided to be enough to try our first run.

The results from this simulation were found to be inconclusive in the sense that all the independent variables were found to be insignificant. A correlation matrix was constructed to detect any collinearity between any of the variables. The complete correlation matrix can be found in Appendix 6. Collinearity exists when there is an almost linear relationship between two or more variables. Signs of the existence of collinearity were found. There was an almost linear relationship found between the *construction index* and the *population*, *GDP,* and the *Swedish labor cost index*, and between *long and short-term interest rate*. There are simply two ways to deal with collinearity

and it is to either eliminate one of the variables or increase the number of observations. The second alternative was not possible for us at this stage so we eliminated a few of the variables. At this point only five were left; *inflation*, *GDP*, *population growth*, *AFGX* and the *index specific to construction*. This regression showed that GDP was the only significant variable in the model.

The next step was then to expand the observations in some way. There were two possible ways to solve the problem of missing values in sales. A regression was made since it seemed to be able to produce the right numbers for our purpose. It turned out that the regression equation to be used to arrive at new sales numbers produced too high numbers for the first part of the observation span. The reason is that sales have increased a great deal over time. The regression captures the trend very well but it was not possible to use the produced number in the beginning periods.

To make sure that the assumption about steady growth of sales during the year is not completely invalid it is important to test it against something. As a basis of comparison it was decided to make a regression analysis of the same variables but from annual data. This should then produce close to the same forecast numbers as the ones based on quarterly information. The result showed that there was a slight difference, but not a large one. The coefficients are a bit more uncertain in the run with the annual numbers, however, it is most likely a result from the few observations.

Therefore, it was decided that quarterly data could be produced using the annual data by taking the arithmetic average of the annual sales number. Hence, an assumption of a smooth upward curve in sales was taken with equal sales each quarter. With those numbers in place instead the sample was expanded to 54 observations, which statistically should be enough to produce a satisfactory regression model. To achieve a conclusive result this time it was decided to exclude one more variable. *AFGX* was chosen as the variable to be excluded since it contains the same information as construction index with the distinction of construction index being more specific in regards to the industry considered.

With data on the four independent variables, *inflation*, *GDP*, *population* and *Construction Index*, coupled with data on sales a regression analysis was carried out through Excel. Five hypotheses were formulated to be able to test

the data collected. All five independent variables in the sample were assumed to differ significantly from zero. They were all tested simultaneously in the regression analysis using a t-test.

Table 7.1 Hypotheses to be tested in the multiple regression analysis

H_0: $\beta_0=0$	H_0: $\beta_1=0$	H_0: $\beta_2=0$	H_0: $\beta_3=0$	H_0: $\beta_4=0$
H_1: $\beta_0\neq0$	H_1: $\beta_1\neq0$	H_1: $\beta_2\neq0$	H_1: $\beta_3\neq0$	H_1: $\beta_4\neq0$

Our null hypothesis was that each of the variables was equal to zero. For the null hypothesis to be true, the t-statistic received from the regression must be compared to a critical t-value. If our t-statistic is above the critical value it means that the null hypothesis is rejected in favor of the alternative hypothesis. If it is not, then we do not reject the null hypothesis. Not rejecting the null hypothesis does not mean that the coefficient for that variable necessarily is zero, but rather not significantly different from zero. The variable can, however, not be included in the regression equation.

The regression showed that the significant variables were *inflation*, *GDP* and *population*. There was only one insignificant variable found in this run and it was the construction index variable. In this case the null hypothesis was not rejected. Again, it does not mean the coefficient is zero; just that it is not significantly different from zero. To investigate the general stock index significance, a new regression with the general stock index variable replacing the construction index variable was carried out. The results, however, were the same.

A joint hypothesis in the form of an F-test was also performed. A joint hypothesis means that the whole equation with all variables is tested simultaneously. The null hypothesis, in this instance, is that all the coefficients are zero and the alternative hypothesis is formulated as at least one of the variables differs significantly from zero. Which variable, or if there in fact are more variables significantly differing from zero, the hypothesis says nothing of. The F-test showed that the null hypothesis can be rejected, leaving the knowledge that at least one of the variables are significant. This is in accordance with the previous result. The table below summarizes the process of the model development.

Table 7.2 Summary of the model development

	1	2	3
Assumptions and Variables included.	Include all variables in the model.	Include all variables found for the estimation period with at least 20 observations.	Include missing values on variables that are likely to be significant in the model according to the results with the first assumptions
Number of variables.	20	9	4
Observations in estimation period per variable.	Observations for all variables were not available.	20	54
Results.	A regression, using all variables was not possible to be carried out.	No significant variables	Three significant variables that affect sales were identified.

After the final estimation of the regression model, tests of the model were conducted. Residual plots were also produced for every variable to examine the possibility of heteroskedasticity. No obvious indications of such computation error were found. The risk for collinearity between the different independent variables exists and was discussed earlier in this section.

Another way of estimating a sales forecast is to utilize the time series analysis approach. In this approach, past values of sales are used to generate future sales figures, whereas a multiple regression model makes use of explanatory variables to predict the value of a dependent variable. The example of time series analysis is carried out to show that it is possible to employ another method than the one previously mentioned.

The first thing to make sure of, however, is that the sales data does not incorporate a trend. The data should hence be tested for stationarity. Stationary data has the same mean and variance over time, whereas non-stationary data has not. The econometric consequence of non stationary time series can be

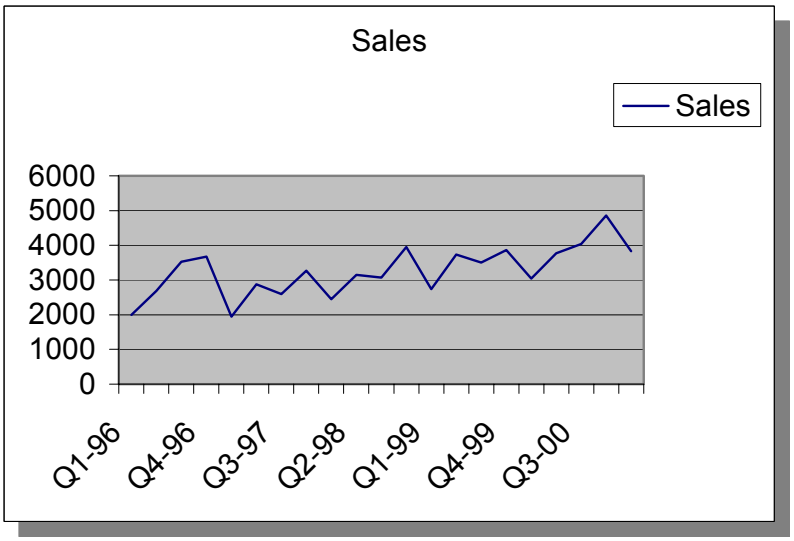
quite severe, leading to the least square estimators, test statistics and predictors being insignificant despite a significant result. Therefore, it is of outmost importance to test the data for stationarity.

The reason for the suspicion of non-stationary data arose from the observation that the population variable exhibited a significant relationship with sales. The intuition here would be to assume a lag of approximately 20 years before any increase in the population reaches a level, which affects the sales of a construction company. It is assumed that this is an example of spurious regressions, which means that the relationship between two variables does not exist, it only appears that way. Hence, a test of the stationarity of the data will be carried out.

The test will be carried out using only the first 21 observations, which were available in the first run (Q1-96 to Q2-01). The reason is that the assumption concerning the quarterly data derived from annual data will not fit well with taking the first difference. One observation will be lost in order to test stationarity. Speculatively, this will have an effect on the significant variables, since the sample is so small.

As can be seen from the figure 7.1 below, a trend can be spotted in the observations of sales.

Figure 7.1 Graphical presentation of sales from 1996-2001



This is a problem when using a time series model, since it can give rise to spurious regression. It means that the model will indicate the existence of a correlation between variables when, in fact, there is none. This can be an explanation for the strong bond between sales and population, for instance. The possible existence of non-stationary data can be detected using a Dickey-Fuller test, also known as unit root test. The test statistic is called τ (tau) and it has to be compared to a critical value (in this instance 5% is used with a critical value of -2.48) to determine whether the data is stationary or not (Hull, 2001). The hypothesis formulated looks as follows;

Table 7.3 Hypothesis formulated for γ

H_0: $\gamma=0$
H_1: $\gamma<1$

The τ has to be much larger and negative for the null hypothesis to be rejected in favor of the alternative hypothesis. When testing our sales data for stationarity it was found that the data is stationary ($\gamma = -5$). It turns out that the null hypothesis can be rejected in favor of the alternative hypothesis i.e. that γ is less than 1.

In order to obtain more correct results when absence of stationarity is found, one can transform the time series by taking the first difference. The gain from this transformation is that the trend will be removed and hence, we will obtain a stationary time series. The stationary time series can then be used in further attempts to create an accurate valuation. The same procedure was used when obtaining the first difference to the independent variables for the purpose of carrying out a multiple regression using the trend-adjusted values.

In summary, after carrying out a time series analysis, the only significant variable was found to be the GDP as was the result from the previous test with 20 observations. The difference in this instance is that the sales figures are adjusted for the trend.

In order to be certain that the method chosen for estimating future sales is the right one to use in the particular situation, an evaluation can be made. The method used is compared to other possible methods, such as moving average,

exponential smoothing or single regression models, by creating error measures from previous sales. This is usually called an out-of-sample test. Our model serves merely as an example of how a causal model can be created and will, hence, not be tested against any of the other methods to forecasting.

Following the discussion on the model development it was decided, due to the objectives of the case study, to choose the regression model which includes three independent variables to explain and forecast the sales for Peab AB.

7.2.3. Model Specification

The forecasting model indicates that sales should be predicted by equation (7.2).

$$SALES = f(INF, GDP, POP) \qquad (7.2)$$

Where *INF = inflation*
GDP = gross domestic product (value)
POP = the population on the Swedish market

The model specifications are as follows.

Table 7.4 Variables tested and statistics

Variable	**β**	**t-statistical**
y = sales	-	
β_0=constant	-94243,7	-4,807201804
β_1= inflation	-45,09904	-3,195034003
β_2= GDP	0,01026	4,119185764
β_3= population	0,01180	4,504308156
Total model	**R^2**	**R^2 adjusted**
	0,9151	0,9082
F-test		132,01869
Observations		54

Thus, giving a final model specification of Peab's sales as equation (7.3).

$$y = -94243{,}666 - 45{,}099\beta_1 + 0{,}01026\beta_2 + 0{,}0118\beta_3 \qquad (7.3)$$

7.2.4. The Interpretation of the Model

The intercept in the model is a large negative number, which tells us that both *GDP* and the *population* must be very high in order for the model to produce any sales at all. However, *GDP* and *population* are essentially high, which should be in accordance with the results. The inflation coefficient is also negative which indicates that when the inflation is high the sales of PEAB are declining. This is fairly intuitive since if there currently is high inflation the price will be very high for a large expense such as a house. The reasoning of the house investor might be to postpone the idea of buying the house and buy it later in times of low inflation. The coefficient -45.099 means that when inflation rises by one point, sales decrease by 45.099.

The relation between sales of PEAB and the development of *GDP* is positive which was also assumed. For each unit increase in *GDP* a 0.01 increase in sales is noted. The same goes for an increase in the *population*. However, the *population* variable for instance, can be assumed to have impact on sales much later than when the population really rises. If the increase in population comes from more babies being born it is only natural that the house demand will rise in 20 years time instead of right away. On the other hand, increase immigration could boost the population increase more than usual in which case the increased housing demand will be immediate.

The data outputs give us more information on the model than just concerning the variable coefficients. The R^2 is a measure of how much the significant variables explain the changes in sales given our sample. That is, it is important not to confuse it with being universal for every sample. The R^2 is rather high for our sample, 0.915. It means that sales can be explained to 91.5 % by the significant variables from our sample. Another 8.5 % of the development of sales remains unexplained by our model. This indicates that we have not found all the significant variables, which is an almost impossible task due to the fact that there are several small variables, too small to consider, and sometimes non-quantifiable ones determining sales. A word of caution should be issued in association with a high R^2. It is often a sign of collinearity and the correlation matrix constructed for this example shows this as well.

7.2.5. Criticism of Model and Data

The expectation is not that this study has found all relevant determinants of sales, in fact it is most likely many factors have been overlooked or not considered at all. The reason is that a company operating in an ever-changing environment is bound to have many factors that influence it, however, not on a large scale. There are also factors that are not quantifiable that affect the company. Therefore, the authors make no claim to have performed a flawless study in any way. The awareness inherited and vulnerability of the study is present and has been considered. The sources of the firm data can also be discussed, not in the least the accountancy data. Since it is sales figures from the annual data and semi-annual statements which have been used, it is important to consider the accountancy principals which are the foundation of any number in the statement. This comes into play when this valuation is compared to other studies with the same purpose. If this study considers one type of data based on one accountancy principle, and it is compared to another study based on a other accountancy principles, the results of that comparison will be wrong.

Another aspect concerning data is the source of data. When conducting this search for appropriate numbers it was discovered that the revenue was a different number in different databases. This fact puzzled us greatly and it was very difficult to know how to proceed. We decided ultimately to use the numbers found from Six Trust and trust that they were the right ones.

Another problem we faced was how to treat the independent variable interest rate. It seems rather intuitive to include this variable considering that it should have an impact on the sales of houses since it is common to borrow money when these large investments are considered. In one of the regression analyses the interest rate, in the shape of the central bank's lending rate, was considered. The analysis returned that all variables were insignificant in determining the sales of Peab AB. This puzzled us quite a lot due to the fact that in the case of considering the theoretically most important variable, interest rate, the whole analysis was not valid. The likely explanation for this was that the sample was too small. This had to be considered carefully and finally it was decided that the interest rate could not be included due to the small number of observations.

One more consideration has to be addressed. The variables tested are all macroeconomic variables i.e. variables which cannot be affected by Peab AB.

The data problems met have contributed to limited testing of microeconomic variables. The results from using microeconomic variables to a greater extent should be significantly different.

7.2.6. Forecasting Independent Variables in the Model

To perform the forecast it is necessary to have numbers or forecasts of all the variables as well. They can be estimated through a regression analysis or estimated through a percentage of the past value being carried over to the next period. To make a valuation of Peab AB and to empirically test the forecasting model it is essential to forecast the variables included in the regression model for estimating sales. The variables incorporated are GDP, inflation and population growth. Therefore, it is necessary to obtain forecast numbers of these variables. The basic forecasts of these variables were found at an institution called SME direkt. These forecasts reached only a few years ahead and, hence, own forecasts had to be conducted on the following years. A trend analysis was carried out where the relationship between the time period and the specific variable was estimated. Furthermore, the forecast of sales was implemented through the use of our estimated model.

In Appendix 7 the forecasted sales figures and the forecasted variables affecting sales can be seen. From investigating the forecast numbers it can be discovered that there is a trend in the numbers. This is expected since the regression analysis builds on the fact that there is a trend. Caution should be taken if the forecast sales exhibit larger deviations in sales between periods, however, the forecast sales numbers have been considered to be well in accordance with the previous numbers, which means that the forecast sales numbers are accepted.

7.3. Valuation

The next section concerns the valuation process. The forecast will be achieved as well as the discount rate which will be used.

7.3.1. Forecasting the Free Cash Flow of Peab AB

Sales were forecast quarterly due to be consistent with the development of the model. However, the free cash flow will be estimated yearly, due to the fact that the historical balance sheets and income statements are reported yearly (see Appendix 8). Therefore, the quarterly forecast sales are aggregated to create a yearly forecast of sales. The complete sales forecast is presented in Appendix 7.

The free cash flow is estimated using the approach described in theoretical framework. The pro forma financial forecast that works as a basis for the free cash flow is presented in Appendix 9.

Table 7.5 Free cash flows annually (MSEK)

Year	2002	2003	2004	2005	2006	2007
Free Cash Flow	232	558	650	881	607	658

The large increase in free cash flow the first year of the forecast is dependent of the estimations of items such as working capital and capital expenditures. These variables were larger than for the rest of the forecast. This difference can be explained by the use of the percentages of sales approach that assumes that the relationships are constant over time. Working capital and capital expenditures were unusually low respectively high in 2001, which makes the free cash flow sufficiently smaller then during the rest of the free cash flow analysis. The drop in free cash flow in 2006 indicates that a trend break is identified. This trend break is probably caused by the changes in forecast from using SME Directs forecasts during 2002-2004 and own regression forecasts 2005-2007. But this event strengthens the use of a CMA, since it shows that it can identify possible trend breaks in the economy.

7.3.2. Estimating WACC

The weighted average cost of capital (WACC) is a weighting of a firm's cost of equity and costs of debt. The general principle when developing the WACC is that it must be consistent with the overall valuation approach. To be consistent with the free cash flow approach, the estimate of cost of capital must comprise a weighted average of the costs of all sources of capital, meaning long term debt, short term debt, equity etcetera, since the free cash flow represents cash available to all providers of capital within the firm. It must be computed after corporate taxes since the free cash flow is stated after taxes. The discount rate will change with time as interest rates, inflation, and other factors affecting the environment the company operates in, are changing. Therefore, the assumption that it will remain the same for the entire forecasting period is not realistic.

Table 7.6 WACC-table

Ingredients of the WACC		
Balance sheet proportion between debt and equity		(The mean of the last five years)
Debt (Proportion, %)	75%	
Equity (Proportion, %)	25%	
Mean interest rate paid on debt	5,1% (2001)	(According to the annual report)
Cost of equity	15%	(According to the objectives of Peab AB)
Tax Rate	28%	(According to Swedish tax laws, FAR)

This estimation of the WACC is based upon book values. Another alternative is to analyze the market values of these figures. This might result in a more accurate estimation of the WACC. But as mentioned before, the WACC was not the focus of this thesis and the book values were easily accessible, therefore these numbers were used.

No distinction between long-term debt and short-term debt is made in this case. According to the balance sheet the percentage of debt has stabilized the last five years to be around 75%.

When calculating the weighted average cost of capital (WACC) mostly information from the PEAB home page was used in order to achieve the best possible number. The WACC was found to be 6.5 %. This might seem a bit low but there are many plausible explanations for this number.

First of all, the fraction of loans is big. 75 % of the capital in PEAB comes from loans. Loans are usually a more affordable way of financing operations than equity, since the creditors are the first to be paid should the company go belly up. This means that the risk premium incorporated in the interest rate is lower for loan than for equity.

The average cost of loans is 5.1 %, which also might appear low. The answer to this low rate might be that a company in construction such as PEAB has to borrow funds to a great extent to finance huge projects. This can lead to lower interest rates in the form of interest rate discounts on these enormous quantities of money.

The interest rate paid for loans taken are also subject to a tax shield. The tax shield equals the interest rate times the tax rate and appears as a saving in the income statement. This factor also contributes to the low WACC.

7.3.3. Converting the Financial Performance into Value

The value of the operations equals the discounted value of expected future free cash flow. As mentioned earlier the value is divided into two periods, during and after the explicit forecasting period. The total value of the firm equals the sum of these values. Equation (7.4) is the formula for deriving the value of the explicit forecasting period.

$$Value1 = PV = \frac{\sum_{t=1}^{n} FCF_t}{(1+WACC)^t} \qquad (7.4)$$

Where n = *the ex post forecast period.*

The estimations of *value*1 can be found in Appendix 10.

The value after the ex post forecast period, called the continuing value (CV), is estimated by equation (7.5).

$$Value2 = CV = \frac{FCF_{t+1}}{(WACC - g)} \qquad (7.5)$$

As indicated earlier the annual growth rate (g) of a firm within the building and construction industry is thought be, in the long run, equal to the growth of the gross domestic product in Sweden. The total value of Peab AB to its claimants is as shown in table 7.6.

Table 7.7 Estimation of the total value of Peab AB.

		(MSEK)
Value 1	Total FCF (6 years)	2826,10
Value 2	Continuing Value	7718,41
Total value		10544,51

The problem in this process of the valuation is the continuing value. The continuing value counts for almost 75 % of the total value of Peab AB. This value includes the most uncertainty in the whole valuation process. If this could be forecast more accurate the value would probably be lower and stand for a lower share of the whole estimated value. Also, if the pro forma financial forecast were made further, say ten years, this would also decrease the uncertainty of the value. It should be noted that the value is very sensitive to changes in the growth rate used to estimate continuing value, see further in the sensitivity analysis.

Further, with the projected capital structure the values to Peab AB's different claimants are:

Table 7.8 Capital structure (MSEK)

Claimants	Capital Structure	Value to claimant
Debt holders (Debt Value)	75%	7 908,38
Total (Enterprise Value)	100 %	10 544,51
Equity holders (Equity Value)	25%	2 636,13

The value estimated with the free cash flow analysis and other cash flow, from for example excess cash and non-operating assets gives the total value of the enterprise in subject. That is, the reason it is called the enterprise model, see section 3.1.1. Those kinds of cash flow are not present in our simplified valuation. Further, the equity value is estimated subtracting the value of debt (preferably the market value), hybrid securities, minority interests and other claims. The rest is said to the value of debt (Copeland et al., 2000). The value of equity seems a little low compared with today's market value, which is around 4 121 MSEK (www.avanza.se, 2002-11-25). One of the explanations to this difference is the forecast of the growth rate. The growth rate is assumed to be close to the growth in GDP, but Peab AB is indicating another growth rate to the stock market, their objective growth rate, which is substantially higher than the GDP. Using their forecast of the growth rate in the valuation, the total value of Peab AB would be projected to be higher and consequently, the value of equity would be higher.

7.3.4. Sensitivity Analysis

The sensitivity analysis is conducted to see how changes in the variables affect the sales of Peab AB. The variables forecasts are varied both upward and downward in order to see what happens with sales if the variables were forecast wrong in the first case. This gives the analysts some safety interval in the estimations.

All the changes have been made by only changing one variable at a time, hence holding the other ones constant. The change resulting from the change in each variable and its effect on the value of the company can be spotted in the table below. All changes are assumed to occur at the end of 2002, only for illustrative purposes. The changes are made as one percent change compared to the expected value of the respective variable.

Table 7.9 Sensitivity analyzis.

Variable	Change	Affect on value		Change	Affect on value	
		%	MSEK		%	MSEK
Inflation	1%	0,0025	26,65	-1%	-0,0025	-27,16
GDP	1%	-0,0013	-13,27	-1%	0,0013	13,19
Population	1%	-0,0101	-106,08	-1%	0,0101	106,02
Cost of equity	1%	-0,0102	-108,08	-1%	0,0104	109,63
Interest rate, k_D	1%	-0,0085	-89,21	-1%	0,0076	80,29
Growth rate, g	1%	0,0050	48,47	-1%	-0,0050	-48,478

The population variable is not likely to change too much over time but it is still included in the sensitivity analysis in order see how it affects the value. The sensitivity of the different variables in the cost of capital could also be tested. This would reflect how the value is affected by changes in interest rates, cost of equity and growth rate.

Changes in economic variables tend to be dependent of each other. Therefore, it is unlikely that only one variable, as in the sensitivity analysis, will change. Thus, it is of interest to construct likely, or at least possible scenarios, where simultaneous changes in different variables and their effect on sales are calculated. After estimating the value for each scenario, several checks to test the logic of the result should be performed, in order to minimize the possibility of errors and ensure that you have a good understanding of the key value drivers in the valuation. The sensitivity analysis and scenario analysis could be seen as an investigation of how much the underlying variables in the valuation could change without changing your decision. This provides a sense of the margin for error in the estimations. (Copeland et al., 2000)

7.4. Summary of the Empirical Findings and Analysis

7.4.1. Assumptions Limiting the Valuation

The model developed in the case study includes three variables that proved to affect sales at Peab AB. This model was then used to forecast future sales of Peab AB, sales that is the main driver in the free cash flow analysis. The case study includes a lot of assumptions that are further analyzed below. If these assumptions would prove to be wrong the value of Peab AB would differ from the one estimated in this case study. Consequently, the value estimated on Peab AB should not be considered as an exact or truthful value in reality, only in a world where our assumptions are relevant will the value derived be exact and true.

Assumptions about the following items have been applied in the case study:

1. In order to be able to accomplish the sales forecast a lot of missing values of both sales and independent variables were constructed.
2. The forecast of independent variables is a study in itself and therefore it was simplified in our case study. Firstly, a forecast institute, SME Direkt, supplied forecasts for the years 2002-2004. We had to forecast the remaining years and this forecast was based solely on a regression analysis of the previous years. Hence, the forecast for 2002-2004 should be considered more reliable than the forecast for the remaining years.
3. The construction of pro forma financial statements was carried out using the percentage of sales approach. This is an easy way of constructing pro formas but it also suffers from drawbacks due to its simplicity.
4. The sensitivity analysis only includes changes in one variable at the time. There are probably interactions between the variables in the forecasting model, as discussed in the section about simulations and scenario analysis, therefore they would be likely to change simultaneously. An analysis like that would make it easier to se how unexpected changes in the environment would affect sales.
5. The measure of continuing value is uncertain due to the assumption of the growth rate and that this assumes that the company exists perpetually.

Improvements in the valuation process applied in the case study can be made in conducting the pro formas. The percentage of sales approach, that was used, is not a perfect method to use when projecting the pro forma financial statements. An econometric model can be developed to forecast the different posts in the pro forma balance sheets and income statements. However, since it not in the scope of the case study to provide such detailed forecasts on the cash flows this is an unnecessarily complicated procedure[3].

As mentioned in the literature study the denominator in the discounted cash flow method the cost of capital is not in the scope of this study. Therefore, this study's approach to this problem can be improved. One such improvement could be to see whether market values would give a different discount rate.

The last subject to be considered is the strategic analysis. A strategic analysis is not conducted on the case company. The financial analysis described in the theoretical framework is conducted as the research before and during the discounted cash flow approach is carried out, including the sales forecast. The strategic analysis is important for the analysts in order to be able to make correct assumptions in the financial forecast. The strategic analysis can enable the analysts to identify competitive advantages that might affect future earnings. Therefore it is important to conduct a thorough strategic analysis in order to conduct a good financial forecast that could be used to carry out a fair valuation of a firm. But, as explained, this too is outside the scope of the case study.

7.4.2. The Developed CMA Model

The purpose with conducting the case study was to see if the reflections and suggestions from the literature study could, somewhat, be confirmed and exemplified with real numbers and to see the result of the suggested improvements from the literature study. The forecasting model developed in the case study fulfils the following suggestions made in the literature study:

[3] See Eliot & Uphoff (1972) for further information of how to develop such an econometric model.

1. It is constructed, through the scenario analysis, so that uncertainty can be translated to risk.
2. It is constructed so that the subjectivity of the forecast is minimized, i.e. it is as close to an objective forecast as possible.
3. It is open about the assumptions, i.e., which forecast numbers are used to derive the sales forecast.
4. It balances the factors that need to be considered in a good way.

Furthermore, the model is very sensitive to the data that is put into the model. The quote by Natenberg (1994, p.34) "garbage in, garbage out" can be assumed to be applied to our model. As indicated in section 3.2.2, one of the hardest parts of the model development in the case study was collecting relevant data. Next, more on the problems encountered when the suggested forecasting technique CMA was applied is discussed.

7.4.3. Empirically Exposed Problems with the CMA

In the sales forecast only macroeconomic variables have been considered since they were the only ones found significant in determining sales for Peab AB. Firm-specific variables have been excluded due to insignificance or lack of data availability. It is important, in this context, to emphasize that macroeconomic variables affect *all* firms, however, not in the exact same manner as it affects Peab AB. Therefore, it is most likely that sales are affected by a much larger number, and more firm-specific variables than those found in this study. Our sample size, as well as the difficulty in getting in touch with analysts responsible for the construction industry, has limited this aspect of the study. However, it is important to consider and be aware of and this is yet another example of a difficulty when making a valuation.

The main problems that were identified when conducting the case study were:

- It is difficult to find sufficiently large numbers of observations.
- It is difficult to find the appropriate data, especially internal data.

These findings limit the usefulness of the CMA. It is hard to make a statistically significant model with less than 40 observations. To find 40 numbers of observations for a firm indicates using their sales figures for the last 40 years. Many firms have not existed for 40 years and most firms where so

significantly different then that sales figure from those firms does not say much of the present firm. Generally, about 10 years back is used to find sales growth and this will not lead to statistically significant causal models. An alternative is to use quarterly figures and make quarterly forecasts using ten years. But also this approach is incorporated with difficulties of, for example, finding quarterly data of independent variables and converting quarterly figures in to annual figures in the financial forecast. Furthermore, it was found that it is hard to find appropriate data even for the last 10 years, which makes the CMA even more limited. However, this will probably change since more and more statistical data is stored and will be available in the future.

Based on this it might be better to employ some sort of time-series forecasting model. Two reasons speak in favor of this, (1) such a model is less sensitive to lack of data and number of observations, (2) at least time-series models are objective models and the use of such a model would also limit the subjectivity of the forecast. However, the use of time series analysis should be looked upon as a complement, or as a comparison tool, to the CMA approach in any cases.

Furthermore, the CMA was found to be complex to construct, since it demanded knowledge of both statistics as well as thorough knowledge of the industry. As stated in the theoretical framework by Andersson (1997), there is a demand for balance between the degree of generalization and the usability of the model. The model developed in the case study is quite complex, just as the environment it tries to generalize. However, it is our belief that it is not too complex to use in a real life situation, even though it might need some modifications. Edlund et al (1999) also claim that the complexity of a model should be as low as possible in order to make an application successful. The model created is quite complex, but the argument stated by Edlund et al is rejected due to, as analyzed in the literature study, the complexity in the model should not be an obstacle to a successful implementation, because there are educated personnel that should be able to handle these kinds of models. Further, once the model have been developed it is not difficult to manage, improve, and use the model. Therefore, the complexity of the approach is believed to be a minor problem.

8. Empirical Implications

The purpose of the subsequent case study was twofold, (1) to empirically try the feasibility of the literature study's suggested solution, and (2) to exemplify the use of the suggested solution. Furthermore, the aim was to expose important implications of empirical weaknesses and limitations of the suggested solution and that this, together with the suggestions from the literature study, should lead to conclusions concerning the overall purpose.

In short, the empirical and practical application of the CMA indicates that the CMA is a possible approach to forecast sales. Further, the empirical study showed that the CMA actually has the potential of identifying trend breaks in the economy and to consider these in the forecast, which was discussed in the literature study as a possible merit of the model. However, some factors limiting the applicability of the approach were found. Mainly it was found to be difficult to find sufficiently large numbers of observations and to find the appropriate data, especially internal data. The implication of this is that it is hard to construct a statistically significant causal model for a firm's sales and, hence, a time-series forecasting model could in some cases be a better approach.

These empirical implications of the CMA will be considered, together with the reflections and suggestions from the literature study, in the conclusion.

4th part

CONCLUSIONS

This fourth part of the thesis is the conclusions of the analysis of both the theoretical suggestions and the empirical implications to these suggestions. The aim is to fulfill the first and main purpose of the study.

9. Conclusions

The overall purpose of this study was to establish theories on improvements of the discounted cash flow method as it is used in firm valuation. This was accomplished by conducting a literature study and a subsequent case study. The conclusions of these studies are reported below.

The conclusion is based on the analysis and, foremost, the notions discussed in chapter 5 “Reflections and Suggestions” and chapter 8 “Empirical Implications”, where chapter 5 basically accounts the questions stated in the problem discussion and chapter 8 adds empirical implications to these answers and findings.

In order for a mathematical model, as the DCF model, to have high quality in its results the quality of the in-data is important. The in-data discussed in the study was the future cash flow, and especially the future sales since they are the most influential factor to derive the future cash flows. The future sales and the future cash flows were identified as uncertain. Therefore, they have to be estimated. When estimating the future sales there are two difficulties to overcome (1) a subjective element enters the valuation and (2) the accuracy of the forecast highly affects the accuracy of the valuation.

To improve the DCF model the implication of these difficulties should be accounted for. To overcome the subjectivity of the valuations analysts should strive to make their valuations as scientific as possible. We argue that this could be made by implementing quantitative methods to achieve objective forecasts and by applying the scientific method in how the analysis is conducted and above all how the results are reported. This implies that there should be a structure in the analysis process resting on scientific method.

The scientific part of using quantitative models should be focused on implementation and refining of simulation models. This in order to quantify the risks of inaccurate assumptions and estimations and to gain further knowledge about the factors that affect our results and also on how they are interconnected among themselves.
If we acknowledge that we, by necessity, cannot have certain results, or final truths, the second best is to create an approach that has unlimited capabilities of

improvement. This is achieved by applying the theory of the open society to the DCF method and the valuation process. This can be achieved by making analysts abide to ethical argumentation that rests on reasonable arguments. Their analysis should openly show validity, linguistic consistency, and the evidence that the arguments conclusion rests upon. In order to do that they have to incorporate the virtues of candor, honor, courage, cooperation, and regard for context.

The best way of achieving all this might be through the suggested CMA. The reasons supporting this conclusion are that the model lends itself easily to simulation, and the structure of the model makes it easy to explicitly state estimations and how the valuation is affected by changes in the environment. These reasons were established in the literature study. The case study partly supports the conclusion about the CMA. It establishes that the CMA is a possible approach, but indicates that it has important limitations. Above all there are practical problems in finding enough numbers of observations to conduct a statistically significant CMA and, further, if there are enough numbers found these might stretch so far back in time that they are not representative for the firm for which the forecast should be used. But, even if the results of the CMA, due to too few numbers of observations, are not statistically significant, we still believe that it is of interest to apply the approach. This since the approach gives an understanding of how the environment affects the sales that can be valuable when conducting other forecasts and because the approach is easily applied to sensitivity analysis. However, these limitations indicate that the application of another forecasting model, such as a time-series model, should be implemented as well. By applying forecasting model with different weaknesses more comprehensive conclusions concerning the probable future of a firm can be formed.

Thus, the main conclusion is that, in order to improve the DCF method, analysts should strive to make the valuation process as scientific as possible, i.e. structured according to theory of science. This would include:

- Strive to make as reasonable and ethical arguments as possible and to explicitly state their assumptions and subjective views.
- Use a causal model approach (CMA) as a guide when translating the strategic perspective to the financial forecast. This should be done with awareness of the approach's empirical limitations and, therefore,
- We suggest that more than one forecasting model is applied.

Finally, even if it might be to kick-in open doors to suggest the causal method approach for forecasting future sales, we feel that we have made a contribution to the continuous process of improvement of the discounted cash flow method. We have established arguments and reasons for why such a model should be used and we have also shown how such a model could be developed and used. Furthermore, we have introduced some new or relatively undeveloped theories in the context of valuation, which have lead to new aspects of how the DCF method should be carried out to optimize the decisions-making situation where it is used.

As mentioned in the problem discussion we believe that we have made a contribution to the DCF method whether the reader chooses to accept our view or not. By making the argument we contribute to an active and engaged argumentation that, if nothing else, serves to keep the idea, the DCF method, from stagnation. If the reader finds our conclusions to be unjustified this is in itself an indication that we have not succeeded in falsifying the present DCF method. Hence, the contribution of the thesis is that the present DCF method can, for the period being, be viewed as a temporary truth.

In time, whether by us or someone else, the present methods will be modified and improved. Old truths will eventually give in to new interpretations. Through active, engaged, and ethical argumentation the ideals of the open society will make science and the scientists strive to gain further knowledge, which in time will lead to progress. It is as Shakespeare once wrote:

"Ignorance is the curse of God,
Knowledge the wing wherewith we fly to heaven."

William Shakespeare, 2 Henry VI IV, 7

Further research - While conducting the study we have developed ideas on further research that could be interesting in the context. These thoughts will be discussed below.

In terms of the model developed in this thesis, one suggestion for further research is to conduct a more empirical exploration, where the validity and the application of the model is tested and thoroughly examined. The empirical evidence can then be used to further strengthen the conclusion reached in this thesis. Furthermore, there are other valuation techniques that can be developed and investigated in the same manner as the discounted cash flow method, which was the topic for this particular thesis. One such suggestion would be to make an evaluation concerning the drawbacks and limitations of the real option theory. This method is a rather recent development in valuation theory and it would certainly make an interesting subject. Another suggestion is to extend the analysis and the case study to incorporate more variables, perhaps even an international perspective. This would accomplish a deeper and more complex forecasting model with other aspects to examine. In addition to this, forecasting models of the independent variables can be constructed to incorporate that characteristic of valuation as well. In addition, the case study develops the pro forma financial statement relatively simply. Elliott and Uphoff (1972) forecast pro formas using complex equations on every item in the income statement. This is a method that could improve the free cash flow analysis. It is a complex and time-consuming operation that could be the subject of a study. However, as we see it, the most interesting area for further research is simulation. By constructing simulation models applicable to the DCF method and the causal forecasting model approach a great improvement of the valuation technique would be achieved.

References

Articles

DeAngelo, L.E. "Equity Valuation and Corporate Control. *The Accounting Review,* Vol. 64, Issue 1, 1990

Eliott, J. W. "Forecasting and Analysis of Corporate Financial Performance with an Econometric Model of the Firm", *The Journal of Financial and Quantitative Analysis,* Vol.7, Issue 2, pp.1499-1526, 197

Elliott, J. W. & Uphoff, H.L. "Predicting the near term profit and loss statement with an econometric mode: A feasibility study", *Journal of accounting research*, vol.10, no. 2, pp.259-274. 1972

Kaplan, S.N. & Ruback, R.S. "The valuation of cash flow forecasts: An empirical analysis", *Journal of Finance*, Vol 50, Issue 4. 1995

Penman, S.H. & Sougiannis, T. "A Comparison of Dividends, Cash Flows and Earnings Approaches to Equity Valuation", *Contemporary Accounting Research*, vol. 15, no. 3, 1998

Sandén, W. "Direktörerna Blåste också Börsbubblan", *Veckans affärer,* no. 47, 18 Nov. 2002

Walker, K. B. & McClelland, L. A. "Management Forecasts and Statistical Prediction Forecasts in corporate Budgeting", *Journal of Accounting Research,* vol.29, Issue 2, pp. 371-381, 1991

Books

Aaker, D. *Strategic Market Management,* 5th Edition*,* New York, John Wiley & Sons, 1998

Abraham J. B., *Quantitative Business Forecasting,* New York, McGraw-Hill, 2001

Andersen, I. *Den Uppenbara Verkligheten,* Lund, Studentlitteratur, 1998

Andersson, G. *Kalkyler som beslutsunderlag,* Lund, Studentlitteratur, 1997

Bierman, H. Jr. & Smidt, S. *The Capital Budgeting Decision,* 8th Edition, New Jersey*,* Prentice Hall, New Jersey, 1993

Bohlin, E. *Economics and Management of Investments,* Discertation, Department of Industrial Management and Economics, Chalmers University of Technology, Göteborg, 1995

Bruner, R.F. *Case studies in finance: managing for corporate value.* 4th edition, New York: The McGraw-Hill Inc, 1999

Cooley, P. L. *Business Financial Management,* 3rd Edition, Fort Worth, Dryden Press, 1994

Copeland, T. et al. *Valuation: Measuring and Managing the Value of Companies*. New York, John Wiley & Sons, 2000

Dahl, R. A. *Democracy and Its Critics,* Stockholm, Ordfront Förlag, 1989

Damodaran, A. *Investment Valuation, Tools and Techniques for Determining the Value of Any Asset*, 2nd edition, New York: John Wiley & Sons Inc, 2002

Edlund, P-O. et al. *Beslutsmodeller – redskap för ekonomisk argumentation,* Lund*,* Studentlitteratur, 1999

Elton, E. & Gruber, M. *Modern Portfolio Theory and Investment Analysis,* 5th Editi*o*n, New York: John Wiley & Sons, 1995

Freund, R. J. & Minton, Paul D. *Regression Methods: A Tool for Data Analysis,* New York, Dekker, 1979

Hamberg, M. *Strategic Financial Decisions*, Malmö*,* Liber, 2001

Hanke, J. E. et al. *Business Forecasting,* Upper Saddle River, Prentice Hall, 2001

Herrick, J. A. *Argumentation: Understanding and Shaping Arguments.* Boston, Allyn and Bacon, 1995

Hill, C.R. et al. *Undergraduate Econometrics 2nd ed.* John Wiley & Sons, New York, 2001

Holme, I. M. & Solvang, B. *Forskningsmetodik: om Kvalitativa och Kvantitiva Metoder,* Lund, Studentlitteratur, 1997

Hult, M. *Värdering av Företag,* Stockholm, Liber Ekonomi, 1998

Kinnear T. C. &Taylor J. R. *Marketing Research: an Applied Approach,* New York, McGraw-Hill, 1996

Knight, F. *Risk, Uncertainty, and Profit*, Boston, Houghton Mifflin Company, 1921

Link, A. N. & Boger, M. B. *The Art and Science of Business Valuation,* Westport, 1999

Merriam, S. B. *Qualitative Research and Case Study Application in Education*, San Fransisco, Jossey-Bass, 1988

Nahmias, S. *Production and Operations Analysis,* 4th edition, Boston, McGraw-Hill, 2001

Natenberg, S. *Option Volatility & Pricing,* Burr Ridge, Irwin, 1994

Perrakis, R. et al. *Investment Analysis,* New York, McGraw Hill, 2000

Pindyck, R. S. & Rubinfeld, Daniel L. *Econometric Models and Economic Forecasts,* Boston, McGraw-Hill, 1991

Popper, K. *The Open Society and its Enemies*. Stockholm, Akademilitteratur, 1980

Ross, S. et al. *Corporate Finance,* Chicago, Irwin, 1996

Sandelin, B. et al. *Det ekonomiska tänkandets historia,* Stockholm, SNS Förlag, Stockholm, 1998

Simon, B. & Sarig, O. H. *Corporate Finance: A Valuation Approach,* New York, McGraw-Hill, 1997

Teitelbaum, H. *How to Write a Thesis,* New York, Macmillan, 1994

Thomas, R. *Quantitative methods for Business studies,* London, Prentice Hall Europe, 1997

Thurén, T. *Vetenskapsteori för nybörjare.* Stockholm, Liber AB, 1998

Trigeorgis, L. *Real Options; managerial flexibility and strategy in resource allocation*. MIT Press, Cambridge, Mass, 1996

Tzu, S., *The Art of War*, New York: Bantan Doubleday Dell Publishing Group, Inc. 1983

Van Horne, J. & Wachowicz, J. M. *Fundamentals of Financial Management,* Englewood Cliffs, Prentice Hall, 1995

Vick, T. *How to Pick Stocks Like Warren Buffett,* New York, McGraw-Hill, 2001

Yegge, W. M. *A Basic Guide for Valuing a Company,* New York, John Wiley and Sons, 2001

Theses

Absiye, K. & Diking, J. ”Värdering av Unga Tillväxtbolag – Risker, Värderingsmodeller och Värdegrundande Egenskaper”, Unpublished Master Thesis, Kostnads- och intäktsanalys, Handelshögskolan vid Göteborgs Universitet., 2001

Bin, H. “Company Valuation in Mergers and Acquisitions: A Study of AT&T/McCaw”, Unpublished Master Thesis, Graduate Business School, Handelshögskolan vid Göteborgs Universitet, 2001

Carlsson, M. & Dahlström, H. *Company Valuation; a Case Study of Sandvik: Cash is King,* Unpublished Bachelor’s Thesis, Handelshögskolan vid universitetet I Göteborg, 2000

Eixmann, L. & Österberg, J. *Företagsvärdering med hjälp av Substansvärde, Kassaflöden och CAPM; en jämförelse av Modellernas Olika Egenskaper*, Unpublished Master Thesis, Handelshögskolan vid Universitetet i Göteborg, 2000

Other Published Sources

Hymans, S. H. “Forecasting and Econometric Models”, 2002, downloaded from <http://www.econlib.org/library/Enc/ForecastingandEconometricModels.html> , 2002-09-12

Namvar, B. “Economic forecasting, how pros predicts the future”, 2001, <http://gbr.pepperdine.edu/001/forecast.html> 2002-09-12

Internet Sources

Statistiska Central Byrån <www.scb.se>

Riksbanken <www.riksbanken.se>

Sveriges Byggindustrier (BI) <www.bygg.org/byggmarknden>

Peab AB <www.peab.se>

Avanza <www.avanza.se> 2002-11-25

E-trade newsletter 2002-10-22

Appendix

Appendix 1. Free Cash Flow Analysis.

The method used in this thesis divides the free cash flow into two parts, gross cash flow and gross investments.

Free cash flow	
Gross Cash Flow	Earnings before Interests and Taxes (EBIT)
	(Taxes on EBIT)
	Changes in deferred taxes
=	NOPLAT
	Depreciation
=	Gross Cash Flow

NOPLAT can also be calculated by first estimate the operating profit, also called operating income, as the net sales less total cost of goods sold. To obtain NOPLAT, the taxes on the operating income is deducted. Note that this does not have to be the same amount of taxes that is stated in the income statement.

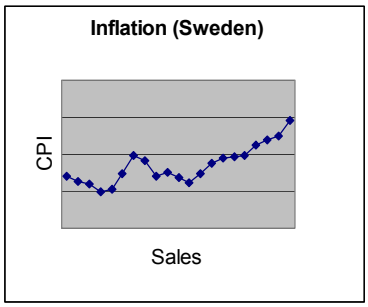
Free cash flow (continued)	
Gross Investment	Increase in operating working capital
	Capital expenditures
	Investments in Goodwill
	Increase in Net Other Assets

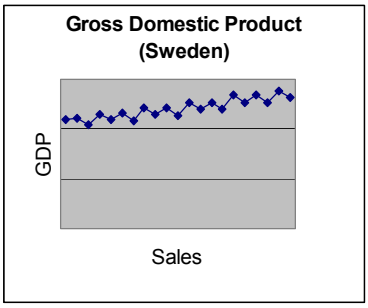
The free cash flow is then estimated as:

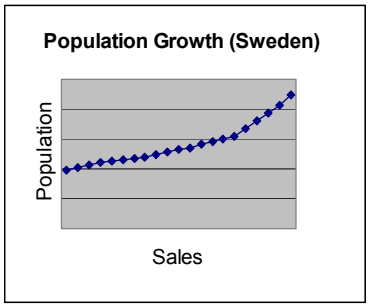
Free cash flow (continued)
Gross Cash Flow
(Gross Investment)
Free Cash Flow

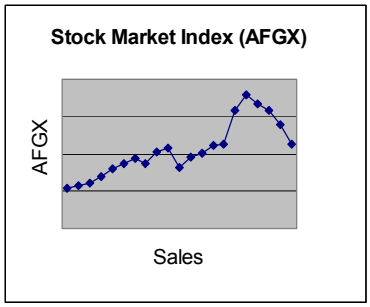
Appendix 2. Scatter Diagrams

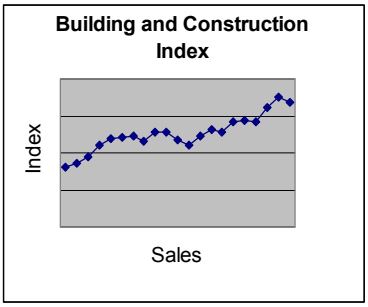
Below are all Scatter diagrams made. The purpose is to see if there are any kind of relationship between the dependent and the independent variables. The first nine diagrams shows the first test made with 20 observations with each variable. As can be seen relationships exists between some of the variables and sales. These were further tested. Due to insignificant and lack of data variables were excluded and the model were finally tested with four variables. The scatter diagrams for these are presented at the next page.

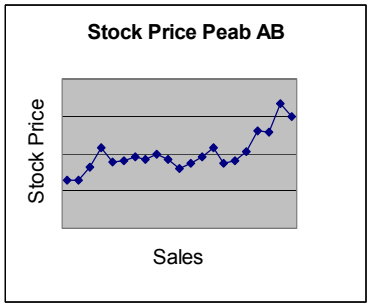


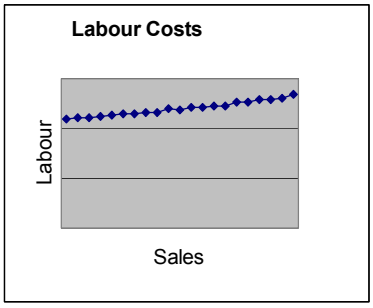


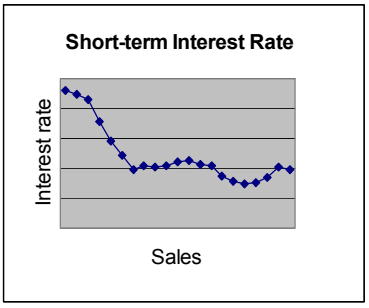


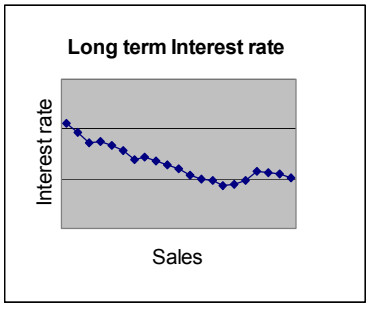




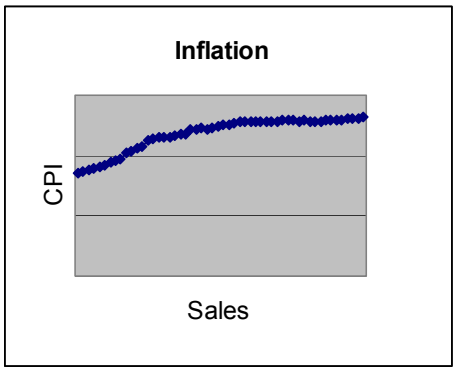


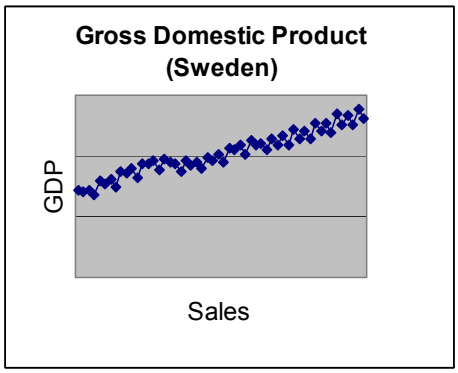


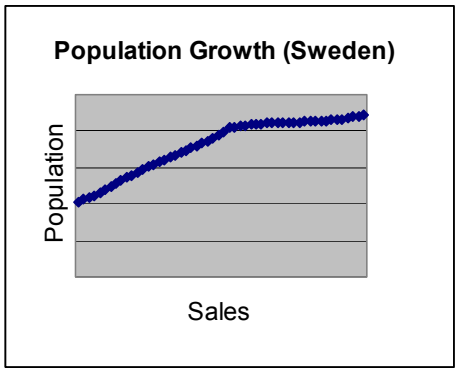


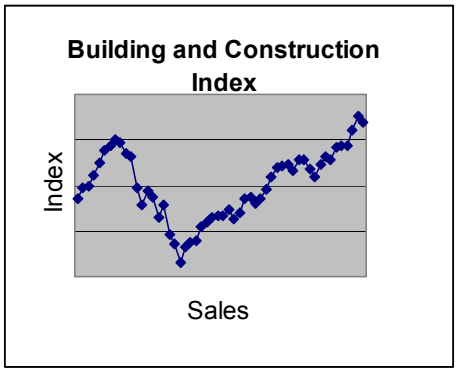


Scatter diagrams for the variables included in the final model specification with four variables and 54 observation on each variable.









Appendix 3. Multiple Regression Analysis

This appendix is created to give an understanding of the multiple regression analysis used to create the forecasting model for Sales at Peab AB. The regression analysis is a statistical tool that is investigating the relationship between one dependent variable and one or more quantitative independent variables.

From the assumed relationships between the variables a hypothesis about the model specification can be constructed. To be able to investigate whether the hypothesis can be rejected or not a number of model specification tests must be considered. Below is a gross outline of what tests that has to be considered in order to guarantee the validity of the model.

R^2 and R^2 adjusted

Since the objective with the regression is to explain the fluctuations in the dependent variable, sales, the coefficient of determination, R^2, should be maximized, assumed that all variables included are statistically significant.. The problem here is, when including more variables the R^2 is increasing. This implies that whenever you include one more variable in the model this is improving the explanation of the independent variable, which might be misleading. Instead the adjusted R square must be analyzed. If this value is decreasing when adding a new variable is included that variable should be excluded from the model.

To achieve the maximum R^2 the independent variables significance must be tested. This is done by comparing the t-statistics of each variable with the selected significance level.

Test of significant

Regarding sales revenue, it is often of great interest to find out whether demand is elastic or inelastic in terms of one of the independent variables. Hence, it is attainable to formulate a null hypothesis (i.e. demand is unit or inelastic) to be tested against another hypothesis (i.e. demand is elastic). Mathematically it looks as follows;

H_0:β_2=0
H_1:β_2≠0

To arrive at a test statistic we assume that the null hypothesis is an equality: H_0:β_2=0. A t-statistic must then be found from the equation

$$t = \frac{b_k}{se(b_k)} \sim t_{(T-K)}$$

If the null hypothesis is true, the rejection region of the sample data consists of values of the t-distribution that are unlikely to happen. In general, unlikely is defined as a significance level of 5%, i.e. $P\left[t_{(T-K)} \le t_c\right] = 0{,}05$

Hence, the null hypothesis is rejected if $t \le t_c$. If t is lower, it is assumed that H_1 is more compatible with the data set.

F-test

There is also a possibility to test the entire model significance. In those cases a *joint* null hypothesis is assumed, i.e. all coefficients are 0, and to be able to test it an F-distribution is necessary. The null hypothesis will be assumed to be true and by making this assumption, constraints are put on the model, since the parameters can only take a certain numbers and the sum of squared errors increase. If these sums of squared errors are substantially different then the model does not fit the data well and thus the null hypothesis is not supported. If there is little change from the sum of squared errors the null hypothesis is accepted and assumed to be true.

The sum of squared errors in the restricted model is called SSE_R and in the unrestricted model SSE_U. SSE_R is always bigger than SSE_U. The F-statistic looks as follows:

$$F = \frac{(SSE_R - SSE_U)/J}{SSE_U/(T-K)}$$

where J is the number of hypotheses. The hypothesis is rejected should the F-statistic becomes too large. The F-value is compared to a critical F-value to be able to decide what is too large. A single hypothesis can also be tested using the F-statistic. The outcome of a t-test as opposed to an F-test will be the same with the distinction that the F-test cannot be utilized when the hypothesis to be

tested require an inequality. Both t- and f-tests can be used for the purpose of economic hypothesis testing.

Diagnostic tests

This section will deal with some of the test for the model specification where the researcher test the specified model with the available data in search for evidence of model shortfalls. In the following text the possible statistical problems that might arise will be presented and discussed as well as manners to avoid and change the model to make it more accurate.

Heteroskedasticity

One of the basic assumptions for the least square model is that the error terms are constant, i.e. σ^2 is constant. Sometimes, however, reality does not look like this. For example, the amount of money a family spends on food might vary to a great extent depending on the income. One might suggest that a family who has a more modest income might be forced to buy certain kinds of food, which the rich family does not have to do. However, it does not mean that the rich family will not buy the affordable food; in fact, they might prefer the more affordable food. This will make the food spending habits of the rich family more unpredictable and more varying than that of the poor family. From this reasoning it is easy to see that the uncertainty of the dependent variable, food expenditure, is harder to predict for the family with more money. It means that the variance is not constant. When the variances of all the observations are not the same, *heteroskedasticity* exists.

What are then the consequences for the least squares estimator when heteroskedasticity is present? The estimators are still linear and unbiased but they are no longer the best ones. Furthermore, the standard errors are incorrect and interval and hypothesis testing should not be pursued. There are, however, ways to overcome the impact of heteroskedasticity. The estimators are changed to recognize and incorporate this fact.

So how can we detect heteroskedasticity? There are two ways to do this: residual plots and the Goldfeldt-Quandt test. The residual errors can be depicted in a graph and if it looks like the errors move in a systematic way, or

that there is a pattern; it is safe to assume heteroskedasticity. The GQ-test will not be covered since it will not be performed.

Autocorrelation

Autocorrelation exists when the errors are related to each other in some way. When the data consists of time related information it is very common with autocorrelation between observations, i.e. the zero-covariance assumption does not hold.

For a set of data, which can be assumed to entail auto correlated errors, it is possible to change the error term to recognize the presence of correlation. It is called a first order autoregressive model or AR(1).

If we were to ignore the correlation of errors the estimators will no longer be the best ones and the formulas for the standard errors are no longer correct and confidence intervals will be misleading. The standard errors, when calculating them considering autocorrelation, have a larger span. To make the estimation more reliable a generalized least squares estimation is carried out for the AR(1) model.

The first test for signs of autocorrelation can be conducted by the use of a graph to plot the residuals. Graphically it is easy to detect any patterns that might prevail. If it looks like there is autocorrelation among the observations another, more exact test can be carried out, called the Durbin-Watson test. The d-statistic should be around 2.

Spurious regression

Sometimes there is evidence of a highly significant relationship between a dependent and an independent variable even when β_2 is 0. The occurrence is called spurious regressions. It can be detected by a low Durbin-Watson statistic.

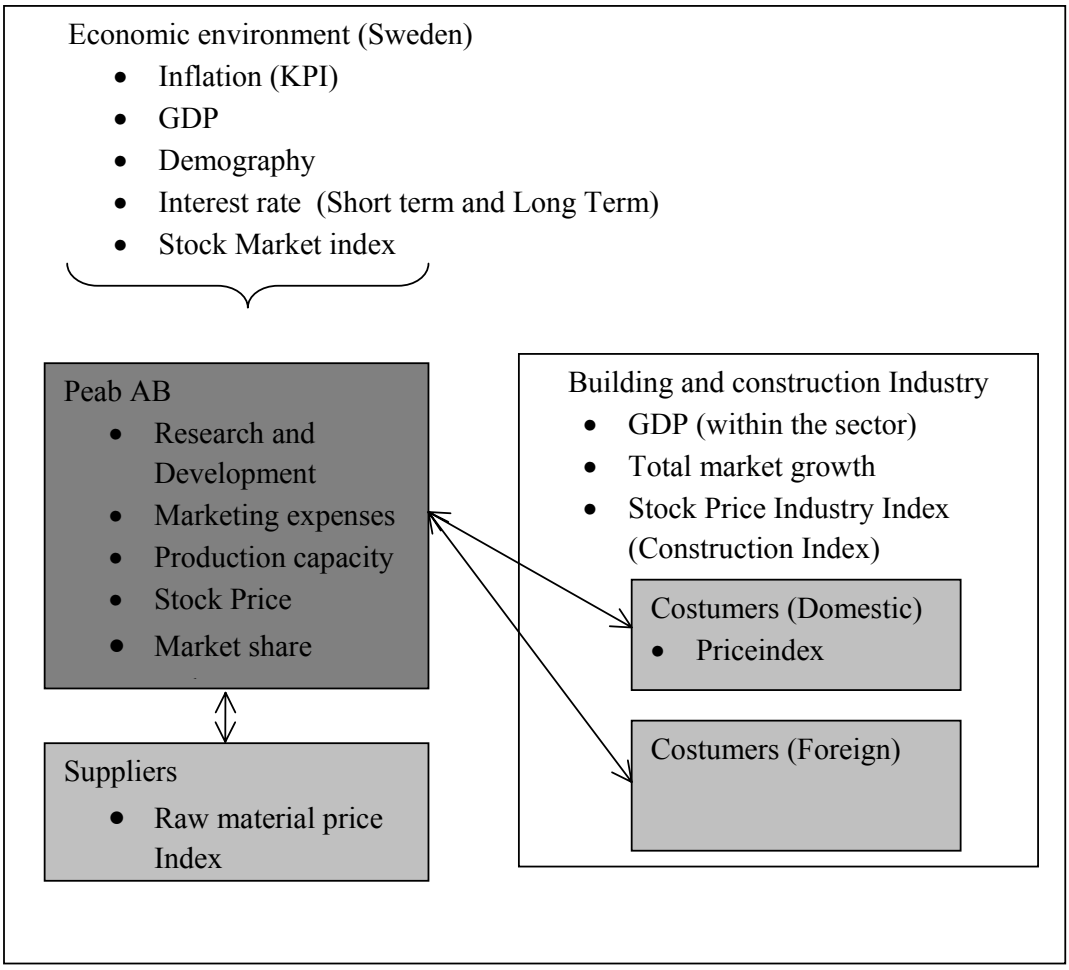
Multicollinearity

The problem of multicollinearity arises when there is a linear or almost linear relationship between one or more independent variables. The easiest way to

detect multicollinearity is to construct a correlation matrix. The matrix will show the movement of one variable given a movement of another variable. If the correlation coefficient is 0.8 and higher, the correlation between variables is considered to be high. The solution to the multicollinearity problem is to eliminate one or more variables with high correlation with other variables. Another way to decrease the effect of multicollinearity is to increase the number of observations in such a way, that the correlation is decreased.

Appendix 4. The Economic Environment of PEAB AB

To find the factors that might be affecting sales in Peab AB, an economic model was created. This model enables us to investigate the economic environment that Peab AB is operating in and also to analyze of what factors that Peab AB is controlling. The factors are divided into two groups, internal and external factors.



Appendix 5. Variables from Peab AB´s Economic Analysis.

	Variables	Definition	Assumption or relationship of variables
(1)	Population	Population in Sweden	The growth is assumed to constant over the year.
(2)	Market size	The market size of the building and construction area in Sweden	
(3)	Market share	Peab AB's market share of the building and construction area	(2)/(3)*100
(4)	Market growth	The annual growth of the building and construction area.	The percentage growth of total market size over one period
(5)	Annual Sales	Net sales of Peab AB	According to Peab AB's annual reports
(6)	Quarterly sales	Net sales of Peab AB for each financial quarter	According to Peab AB´s interim report
(7)	Stock market index	The Swedish stock market index, AFGX	
(8)	Peab AB B	The share price of Peab AB B	
(9)	Labour Cost	The labour costs, blue collar within the building and construction area	The change in labour costs is represented in a index
(10)	Construction index	The aggregate industry index for the building and construction area	
(11)	Raw Material price index	The price index of the major raw materials	
(12)	House price index	The price index for the Swedish real estate industry	Only house prices are included
(13)	Inflation	The Swedish consumer price index	The increase in percentage over one period
(14)	Short term interest rate	The interest rate on Swedish treasury bills, 3-months	The change in percentage over one period
(15)	Long term Interest rate	The interest rate on Swedish treasury bonds, 10-years	The change in percentage over one period
(16)	Marketing expenses	Total annual marketing expenses	Not Available
(17)	Investment expenses	Total annual investments, includes both research and development and production capacity investments	According to Peab AB's historical balance sheet
(18)	GDP	The Swedish gross domestic product	Measured in value

Appendix 6. Correlation Matrix

The table below shows the first correlation try in the model development. All variables where enough data is found is included.

	Sales	Inflation	GDP	Population	AFGX	Construction Index	Share Price Peab AB	Sweden Labour Cost Index	Short term interest rate	Long term interest rate
Sales	1									
Inflation	0,550	1								
GDP	0,752	0,718	1							
Population	0,690	0,891	0,834	1						
AFGX	0,506	0,687	0,796	0,762	1					
Construction Index	0,622	0,832	0,793	0,918	0,796	1				
Share Price Peab AB	0,689	0,768	0,721	0,869	0,591	0,887	1			
Sweden Labour Cost Index	0,677	0,840	0,901	0,965	0,849	0,901	0,779	1		
Short term interest rate	-0,386	-0,593	-0,680	-0,629	-0,794	-0,774	-0,510	-0,751	1	
Long term interest rate	-0,562	-0,580	-0,741	-0,701	-0,759	-0,733	-0,487	-0,827	0,886	1

Appendix 7. Forecasting Sales.

Period	Population	Inflation	GDP	Forecast using quarterly data	Forecast aggregated to yearly data
				(MSEK)	(MSEK)
Q1-02	9009537,517	274,8875 [1]	563348,104[1]	5486,940027	
Q2-02	9018214,199	275,275547[1]	570590,427[1]	5646,172813	
Q3-02	9026890,88	275,664142[1]	577925,857[1]	5806,33628	
Q4-02	9035567,561	276,05[1]	584799,3[1]	5961,882618	**22901,33174**
Q1-03	9044244,243	277,6025[1]	588702,825[1]	6034,339498	
Q2-03	9052920,924	279,163731[1]	592632,406[1]	6106,669976	
Q3-03	9061597,606	280,733743[1]	596588,217[1]	6178,873619	
Q4-03	9070274,287	282,26[1]	600413,4[1]	6251,710141	**24571,59323**
Q1-04	9078950,969	283,9325[1]	604105,95[1]	6316,590273	
Q2-04	9087627,65	285,61491[1]	607821,209[1]	6381,256489	
Q3-04	9096304,332	287,307289[1]	611559,317[1]	6445,707574	
Q4-04	9104981,013	288,95[1]	6151803,6[1]	6511,23067	**25654,78501**
Q1-05	9113657,695	305,531832	615214,69	5866,143199	
Q2-05	9122334,376	307,051721	619754,459	5946,599452	
Q3-05	9131011,057	308,57161	624294,227	6027,055704	
Q4-05	9139687,739	308,57161	628833,995	6176,05748	**24015,85583**
Q1-06	9148364,42	310,091499	633373,763	6256,513732	
Q2-06	9157041,102	311,611387	637913,531	6336,969985	
Q3-06	9165717,783	313,131276	642453,299	6417,426238	
Q4-06	9174394,465	314,651165	642453,299	6451,298856	**25462,20881**
Q1-07	9183071,146	316,171054	651532,835	6578,338744	
Q2-07	9191747,828	317,690943	656072,603	6658,794996	
Q3-07	9200424,509	319,210832	660612,371	6739,251249	
Q4-07	9209101,191	320,730721	665152,139	6819,707502	**26796,09249**

[1] Forecasts obtained from the institute SME Direkt online. From these the quarterly data has been extracted by assuming a constant development during the year. All other forecasts are made by the authors by making a regression with time as the independent variable and inflation, GDP or population as the dependent variable.

Appendix 8. Historical Income Statements and Balance Sheets for Peab AB

Historical Balance Sheet for Peab AB, 1987-1991.

Year	1987	1988	1989	1990	1991
(MSEK)					
Assets					
Cash	160	139	255	327,3	334,1
Accounts Recievable	210	360	511	646	631
Inventories	260,7	420,1	644,8	1034	1307,6
Total Current Assets	630	920	1412	2007	2272
Total fixed Assets	61	86	91	130	136
Depreciation	N/A	N/A	N/A	N/A	N/A
Total Assets	**692**	**1006**	**1503**	**2137**	**2409**
Liabilities and Shareholder Equity					
Short term debt including accounts payable	469	733	1185	1759	1895
Long term debt	75	104	91	107	204
Total Liabilities	544	837	1276	1866	2099
Untaxed Reserves	58	76	121	163	187
Minorit Interests	1,9	1,9	2,1	1,9	2
Common Stock	67	67	67	67	67
Retained earnings	21,5	23,8	37	39,8	54
Total Shareholders Equity	88	90	104	106	120
Total Liabilites and Share holder Equity	**692**	**1006**	**1503**	**2137**	**2409**

Historical Balance Sheet continued, 1992-1996.

Year	1992	1993	1994	1995	1996
(MSEK)					
Assets					
Cash	510	390	403	247	242
Accounts Recievable	1379	1161	1985	2339	2669
Inventories	4673	479	418	103	108
Total Current Assets	6562	2030	2806	2689	3019
Total fixed Assets	763	1393	1478	1791	1842
Depreciation	N/A	N/A	N/A	109	103
Total Assets	**7325**	**3424**	**4284**	**4480**	**4861**
Liabilities and Shareholder Equity					
Short term debt including accounts payable	5674	1883	2483	2773	2639
Long term debt	968	1205	1056	905	1112
Total Liabilities	6642	3088	3539	3678	3751
Untaxed Reserves	0	0	0	0	0
Minorit Interests	188	1	13	18	18
Common Stock	423	348	777	704	964
Retained earnings	73	-14	-45	80	128
Total Shareholders Equity	496	335	731	784	1092
Total Liabilites and Share holder Equity	**7325**	**3424**	**4284**	**4480**	**4861**

Historical Balance Sheet continued, 1997-2001.

Year	1997	1998	1999	2000	2001
(MSEK)					
Assets					
Cash	272	50	99	254	296
Accounts Recievable	3044	3334	2965	4656	5921
Inventories	174	335	366	1048	1181
Total Current Assets	3490	3719	3430	5958	7398
Total fixed Assets	2061	2873	3145	2253	2440
Depreciation	101	152	216	216	261
Total Assets	**5551**	**6592**	**6575**	**8211**	**9838**
Liabilities and Shareholder Equity					
Short term debt including accounts payable	3043	3009	2834	3445	5237
Long term debt	1142	1990	2048	2476	2063
Total Liabilities	4185	4999	4882	5921	7300
Untaxed Reserves	0	0	0	0	0
Minorit Interests	20	23	6	10	8
Common Stock	1095	920	994	1291	1390
Retained earnings	110	402	520	813	1044
Total Shareholders Equity	1205	1322	1514	2104	2434
Total Liabilites and Share holder Equity	**5551**	**6592**	**6575**	**8211**	**9838**

Historical Income Statement, 1992-1996.

Year	**1992**	**1993**	**1994**	**1995**	**1996**
(MSEK)					
Sales	6376	6657	8414	9984	10580
COGS				-9732	-9731
Other Incomes and Expenses				-105	-704
Operating Income	**425**	**-121**	**114**	**147**	**145**
Financial Incomes and Expenses				-84	-77
Income before tax				**63**	**68**
Taxes				-1	-21
Minority interests				0	
Income after tax	**10**	**-99**	**22**	**62**	**47**

Historical Income Statement for Peab AB, 1997-2001.

Year	**1997**	**1998**	**1999**	**2000**	**2001**
(MSEK)					
Sales	10679	12616	13841	15704	18721
COGS	-9808	-11555	-12815	-14059	-16902
Other Incomes and Expenses	-699	-781	-780	-981	-1164
Operating Income	**172**	**280**	**246**	**664**	**655**
Financial Incomes and Expenses	-70	-66	-84	-22	-78
Income before tax	**105**	**211**	**162**	**642**	**577**
Taxes	-13	-64	43	-218	-79
Minority interests	13	-2	28	0	4
Income after tax	**105**	**145**	**233**	**424**	**502**

Appendix 9. Pro-forma Financial Statement of Peab AB

The table presents the pro forma income statement of Peab AB.

Year	2002	2003	2004	2005	2006	2007
(MSEK)						
Forecasted Sales	22901	24572	25655	24016	25462	26796
COGS	17922	19229	20077	18794	19926	20970
Other Incomes and Expenses	1227	1316	1374	1286	1364	1435
Operating Income	481	516	539	504	535	563
Financial Incomes and Expenses	100	108	113	105	112	118
Income before tax	381	409	427	399	423	446
Taxes	45	49	51	48	51	53
Minority interests	17	18	19	17	18	19
Income after tax	315	338	353	331	351	369

Some remarks on the pro forma financial statements.

All assets are assumed to vary proportional with sales. This is the practice in using the percentage of sales approach to pro forma income statements.

The items in the balance sheet are also based on the percentage of sales. Usually, the long term debts and common stock do not vary with sales, instead these items usually remain constant. But in PEAB AB's case these items seems to vary with sales.

Retained earnings equals last years retained earnings plus projected earnings after taxes less dividends paid. Peab AB seems to have a stable dividends policy that is proportional to earnings, thus it is also proportional to sales.

Accounts payable is often used as a plug factor in a financial forecast to balance the balance sheet, which is not necessary in this case where sales works as a basis for all items.

Since the asset side of the balance sheet is growing proportionally to sales, the liabilities and equity must grow with the same rate. This means that Peab must raise capital in some way every year sales is growing.

The table below presents the pro forma balance sheet of Peab AB.

Year	2002	2003	2004	2005	2006	2007
(MSEK)						
Cash	299	321	335	314	333	350
Accounts Receivable	5328	5717	5969	5587	5924	6234
Inventories	685	735	767	718	761	801
Total Current Assets	6312	6772	7071	6619	7018	7385
Total fixed Assets	3585	3847	4016	3760	3986	4195
Depreciation	244	262	273	256	271	285
Total Assets	9897	10619	11087	10379	11004	11580
Short term debt including accounts payable	4831	5184	5412	5067	5372	5653
Long term debt	2570	2758	2879	2695	2858	3007
Total Liabilities	7402	7941	8291	7762	8229	8660
Minorit Interests	23	24	25	24	25	26
Common Stock	1619	1737	1814	1698	1800	1894
Retained earnings	652	700	731	684	725	763
Total Shareholders Equity	2271	2437	2544	2382	2525	2657
Total Liabilites and Share holder Equity	9897	10619	11087	10379	11004	11580

Remarks, see previous page.

Appendix 10. Present Value of Free Cash Flow.

Year	2002	2003	2004	2005	2006	2007
Free Cash Flow	232	558	650	881	607	658
Discount rate	1,0650	1,1343	1,2081	1,2867	1,3703	1,4595
Present value	217,64	491,74	538,15	684,44	443,08	451,04

The disount rate is the WACC estimated as 6,50% in section 6.5.9. The free cash flows are estimated at the end of the finacial year. The year 2002 is the first year in the free cash flow analysis.

Year	2002	2003	2004	2005	2006	2007
(MSEK)						
EBIT	481	516	539	504	535	563
Taxes	-45	-49	-51	-48	-51	-53
NOPLAT	**436**	**467**	**488**	**457**	**484**	**510**
Depreciations	244	262	273	256	271	285
Gross Cash Flow	**680**	**729**	**761**	**713**	**755**	**795**
Increase in operating working capital	-680	-108	-70	106	-94	-86
Capital expenditures	1128	279	181	-274	242	223
Investments in Goodwill	-(1)					
Increase in Net Other Assets	-(2)					
(Gross Investments)	**448**	**171**	**111**	**-168**	**148**	**137**
Free Cash Flow	**232**	**558**	**650**	**881**	**607**	**658**

(1) assumed to be zero or included in net fixed assets, depreciation also includes both these items

(2) assumed to be zero