Master Thesis
Copenhagen Business School

M.Sc. in Finance and Strategic Management
Department of Finance
October 2008

Contrarian Investment Strategies on the Swedish Stock Market

Submitted by:

Henriette Wennicke

Supervisor:
Ole Risager

Copenhagen Business School 2008
Executive Summary

For decades academics and investment professionals have argued that value strategies outperform growth strategies. Value strategies are identified as strategies where stocks with low prices relative to earnings, cash earnings, book value and other measures of fundamental value are bought, to be able to generate abnormal returns. In general, there is almost universal agreement among researchers on the existence of the value premium in stock returns. The issue of underlying causes for the value premium is far more contentious.

The objective of this thesis is to examine whether the value-phenomenon is present on the Swedish stock market, which is the largest market in the Nordic region. Additionally the thesis explores whether value strategies yield higher returns due to increased risk or irrational behavior of market participants.

The value-phenomenon is indeed present in the Swedish stock market. Accounting and stock market data have been collected for stocks in the OMXS30 index since 1987 and onwards. Value and growth portfolios have been formed based on different sorting variables; Price-to-earnings (P/E), Price-to-cash earnings (P/C), Price-to-book (P/B) and Asset growth (ASSETG). The test and analysis of the four different strategies with either one-, two- or three-year holding periods show that the value strategy in general outperforms the growth strategy on the Swedish stock market. Thus, most of the strategies produce returns that are insignificant, which might however be a consequence of the small sample size. The value premium for the one-year value-weighted strategy is between -1.082% and 7.233%. When the stocks within the portfolios are equally-weighted, the premiums become even stronger and more significant, which might be due to small-cap effects. The same pattern is found when the holding periods were extended to two and three years.

The risk based explanation is analyzed, but it does not seem to explain the value premium. The traditional systematic risk measure beta is on average lower for value portfolios than for growth portfolios, which totally contradicts the traditional finance theory. Additionally the value strategy does not perform worse in bad states of the economy, which otherwise could have indicated that the value stocks had increased downside risk.

The irrational arguments seem to fit the existence of the value premium better. Investors are subject to several kinds of judgment biases, which originate from limited cognitive capacity. Therefore different types of heuristics are used that can limit the investors’ ability to make rational decisions. Incorrect usage of heuristics can encourage investors to extrapolate past performance too far into the future. When performing a simple extrapolation test on the Swedish stock market it is found that the net profit growth ahead of portfolio formation is slightly negative for the value portfolio, whereas net profit after formation is slightly positive. The picture is the opposite for the growth portfolio. The results indicate that markets undervalue value stocks and overvalue growth stocks, which lead to a positive performance of value stocks when the market participants realize that their view of growth stocks have been too optimistic and their view of value stocks too pessimistic.
## Table of Contents

**CHAPTER 1 INTRODUCTION** .................................................................................................................. 1

1.1 **Objective** ............................................................................................................................................. 2
   1.1.2 Problem statement ......................................................................................................................... 2

1.2 **Methodology** ........................................................................................................................................ 3
   1.2.1 Limitation ....................................................................................................................................... 3
   1.2.2 Structure ....................................................................................................................................... 4

1.3 **Theoretical foundation** .......................................................................................................................... 5

**CHAPTER 2 THEORETICAL FRAMEWORK** ............................................................................................ 6

2.1 **Standard finance theory and its limitations** .......................................................................................... 6
   2.1.1 EMH and Rational choice theory ................................................................................................. 6

2.2 **Introduction to behavioral finance theory** ........................................................................................... 9
   2.2.1 Limits to arbitrage .......................................................................................................................... 10
   2.2.2 Investor sentiment .......................................................................................................................... 12
      2.2.2.1 Decision-making and prospect theory .................................................................................... 12
      Prospect theory .................................................................................................................................... 13
      Framing matters ................................................................................................................................. 15
      Mental accounting and myopic loss aversion ...................................................................................... 15
   2.2.2.2 Heuristics and biases ................................................................................................................ 17
   2.2.2.3 Self-concept biases .................................................................................................................... 19

2.3 **Sub conclusion** .................................................................................................................................... 21

**CHAPTER 3 INVESTMENT STYLE** ......................................................................................................... 23

3.1 **Contrarian investment strategies** ......................................................................................................... 23
   3.1.1 Glamour and value stocks ............................................................................................................. 24
   3.1.2 Sorting variables and measures .................................................................................................... 25
   3.1.3 Market mean reversion ................................................................................................................ 28
   3.1.4 Empirical evidence ....................................................................................................................... 29

3.2 **Sub conclusion** .................................................................................................................................... 33

**CHAPTER 4 EMPIRICAL STUDY** ......................................................................................................... 34

4.1 **Applying the contrarian investment strategy to the Swedish market** ........................................................ 34
   4.1.1 Introduction to the Swedish market ............................................................................................... 34
   4.1.2 Description of the data applied ...................................................................................................... 36
      4.1.2.1 The variables .......................................................................................................................... 37
      4.1.2.2 Returns .................................................................................................................................. 38
      4.1.2.3 Data problems ....................................................................................................................... 40
   4.1.3 Methodological approach ............................................................................................................. 41
Chapter 1 Introduction

Contrarian investment strategies have been known for decades and have for long been a widespread investment style. Several financial studies have proved significantly superior performance of the contrarian strategies and thus the existence of the value premium. This is achieved when investors buy underpriced stocks and short overpriced stocks. The underpriced stocks are referred to as the loser or value stocks, while the overpriced stocks are often called winners or growth stocks.

Studies by (Lakonishok, Shleifer, & Vishny, 1994), (Fama & French, 1996) and (Chan & Lakonishok, 2004) provide evidence of the existence of the value premium in the US stock markets. Further do (Chan, Hamao, & Lakonishok, 1991) find superior performance of investment strategies based on value styles in Japanese stock market and (Fama & French, 1998) document persistent evidence of value premium in international stock markets including the Swedish one. Thus, there is almost universal agreement on the existence of the value premium in stock returns (Sharma, Hur, & Lee, 2008). The issue of underlying causes for the value premium is far more contentious. In a number of articles Fama and French argue that markets are efficient and that the better performance of the value investing is due to value stocks being more risky. However in the articles by Lakonishok et al. no evidence is found that value stocks are riskier than growth stocks. They use several risk measures in their documentation. Instead they argue that the value premium could be best explained by preference of investors for growth stocks over value stocks. They argue that investors are likely to suffer from cognitive biases, extrapolate past growth rates of glamour stocks and buy them at whatever price. Further growth stocks can often be justified as prudent investments in contrast to many value stocks, which appear financial distressed. Moreover they argue that the contrarian strategy is a long-term strategy, which means that the value premium is only realized in the long run, which might frighten some investors. Therefore in all researchers are in much disagreement when it comes to the reason for the value premium. Some still rely on traditional financial theories while others look for explanations in the behavior finance literature.
Chapter 1 – Introduction

1.1 Objective

The objective of this thesis is to test the contrarian investment strategies on the Swedish stock market with the methodologies developed by Lakonishok et al. (1994). The superior performance of the strategy has been proved on several markets, and therefore it will be interesting to see, whether similar results can be documented on the Swedish stock market. The Swedish stock market is the largest in the Nordic region, but no former research has been made recently on this market. On the Danish market the strategy has proved its worth and it will be interesting to see if it also can be implemented on the neighboring market in Sweden. It would be surprising if the strategy did not work on the Swedish stock market because of its success on other markets. However, if it works properly it would indicate that on the whole the Swedish stock market is very similar to the global stock market.

Some opponents of the strategy argue that the results for the value premiums are sample specific and cannot be transmitted to other markets or time periods. Therefore the overall objective is to analyze and test whether the value premium found in other markets is also present on the Swedish stock market the last 20 years. Consequently, the evidence presented in this thesis will either confirm or reject the results found in other studies on other markets in other time periods and thereby prove or disprove that the results are due to data mining.

1.1.2 Problem statement

The above introduction to former studies and the objective statement give rise to a number of questions. The overall purpose of the thesis is:

To investigate whether a consistent value premium exists on the Swedish stock market and study whether this potential premium is due to increased risk or irrational behavior of market participants.

In order to answer the above problem statement I have identified the sub questions presented in the following. Researchers disagree very much when it comes to explaining the cause of the value premium. The first research question therefore aims at comparing the traditional financial theory with the behavioral theory, so it can be determined what the problems are with the traditional explanation.
• Can the underlying assumption of investor rationality from the standard finance theory be questioned?

When both the traditional finance theory and the behavioral finance theory have been introduced briefly, the contrarian investment strategy will be introduced, outlining how it works and introducing former studies that have proved its worth.

• How do contrarian investment strategies work in practice?

After the introduction to the underlying theories an empirical study will be performed on the Swedish stock market.

• Does the Swedish stock market mean revert?
• Can the contrarian investment strategies be carried out successfully on the Swedish stock market?

Finally the results will be explained with both the traditional and behavioral finance theories.

• Can traditional risk measures explain the results obtained or do we have to search for the explanation in alternative theories like behavioral finance?

These questions will be investigated and answered thought out the paper and in the final conclusion. When differences and similarities to results presented in other studies are found they will be outlined and investigated.

1.2 Methodology

In the following the methodology used in the thesis will be presented. A more detailed discussion of the methodology and theories used in the tests and analysis will be presented in the later chapters wherever relevant.

1.2.1 Limitation

The purpose of this thesis is not to create a new theory, but rather to use the theory already developed and use this empirically on an existing but not yet investigated market. Therefore the empirical analysis is made as realistic as possible. However, taxes and transaction costs are not taken into consideration. Therefore no considerations are made whether the conclusions are
Chapter 1 – Introduction

the same in a world of taxes and transaction costs. I investigate the contrarian investment strategy on the Swedish market with reference to other former studies of other markets. No investigation is made to check whether these former analyses are made correctly and without errors.

I have chosen to investigate standard and behavioral finance in regard to the contrarian investment strategy based on stocks. Accordingly, I do not investigate other corporate finance issues like for instance irrational investor behavioral in regard to bonds, derivatives or real investments. Since traditional finance is well known and the theoretical foundation have been taught and elaborated upon for decades, the emphasis will not be on this building block. I assign one minor section to standard finance in order to clarify the contrast to behavioral finance, and put my emphasis on the behavioral finance theory. This contrast is pointed out through the thesis wherever relevant.

The thesis should not be seen as a test of the efficient market hypothesis (EMH), even though it is discussed in Chapter 2. Whether the obtained results can lead to a rejection of the hypothesis or not is not possible to answer with the test performed in the thesis. Therefore this hypothesis will not be rejected or accepted or further discussed.

The accounting variables used in the tests could be affected by changes in accounting regulations and errors in the Datastream database, but these kinds of biases will not be investigated in detail due to the limited scope of this thesis. However, a subchapter concerning data problems is included.

1.2.2 Structure

The thesis is structured with the objective of continuation between the chapters. Chapter 2 and 3 involve theories and empirical findings of others, whereas Chapter 4 involves my own study and Chapter 5 an explanation of the obtained results through the introduced theoretical framework. The sub-sections within each chapter are summarized when appropriate due to the length or complexity of the contents. Furthermore, all the chapters finish with a sub conclusion to emphasize the most important findings within each chapter. Figure 1.1 below presents the outline of the thesis.
1.3 Theoretical foundation

The theories used throughout the thesis originate mainly from literature such as articles, journals and working papers. The majority of the literature was found via the Internet through different journal databases. The huge numbers of articles on the subject expose the user to the risk of missing relevant and high-quality literature. However, after spending several hours searching and classifying the relevant literature, I am confident that I have uncovered the most important literature on the subject, often written by highly acknowledged authors. Further, most of the applied literature has been published in well-known and reliable media.
Chapter 2 Theoretical framework

The purpose of Chapter 2 is to establish a theoretical framework that can support the analysis of whether a contrarian investment strategy can be carried out successfully on the Swedish stock market. The main objective of this chapter is to outline the factors that influence and determine asset prices. First, standard finance will be introduced briefly, mainly focusing on the efficient market hypothesis and the challenges it has faced in the last thirty years. Further, the underlying assumption of full rationality of agents will be introduced, as this assumption is crucial and has formed the basis of behavioral finance. After having defined the challenges and limitations, which the old finance theory faces, the behavioral finance theory will be introduced. This will be done through an explanation of limits to arbitrage in the market and a description of dispersed psychological issues that have an impact on the decision-making process. The introduction of psychology in finance will make it possible to outline the main reasons for the irrational behavior of market participants.

2.1 Standard finance theory and its limitations

In this chapter, a few standard finance theories will be introduced. Even though traditional standard finance is not the main focus, I found it necessary to describe a couple of important theories that have created the fundamentals for the development of behavioral finance theories. In many ways, behavioral finance challenges the standard finance theories and uses the limitations of these theories to create more realistic assumptions about the rationalities of the market participants. Therefore, the efficient market hypothesis and the underlying assumption of rational choice theory will be described and discussed briefly.

2.1.1 EMH and Rational choice theory

The Efficient Market Hypothesis (EMH) has been one of the central propositions in finance for decades. The hypothesis asserts that financial markets are “informationally efficient”, meaning that all available information is fully reflected in asset prices. Accordingly, all information is public and known by all market participants and new information is immediately reflected in
Chapter 2 – Theoretical framework

the prices\(^1\). EMH states that it is impossible to constantly outperform the market by using information already known and reflected in the market, and consequently it may be due to pure luck (Brealey, Myers, & Allen, 2006). All the information reflected in the market is defined as anything that may affect the asset prices that is unknowable in the present and thus appears to be random in the future. Therefore the prices are expected to follow a random walk (Wärneryd, 2001), which means that ups and downs are equally likely to follow each other, and that the equity market has no memory. This indicates that asset prices do not follow any systematic pattern at all, as this could be utilized by arbitrageurs and would be traded away immediately. EMH states that all financial markets are fully efficient, because prices always reflect fundamental values. This implies that no investment strategy based on current public information can beat the market and earn excess return to the market return. According to EMH it is therefore optimal to passively hold the market portfolio and not use any resources for active money management, as it is a waste of money (Shleifer A., 2000).\(^2\)

The EMH is based on a number of underlying assumptions, including normal utility maximizing agents and agents with rational expectation. In finance a decision is often called rational if it is in some sense optimal, and thereby individuals and organizations are often described as rational if they tend to act optimally in pursuit of their aim. The definition of rationality has been much debated, but there is a general agreement that rational choices should at least be consistent and coherent (Tversky & Kahneman, 1981). In financial models expressions like a rational allocation or rational beliefs are often seen. In these models, the concept of rationality is frequently treated as an underlying assumption and is not subject to criticism, when the model itself is derived. Assuming human and organizational rationality implies that all behavior can be modeled and that prediction about future actions can be made. This has made the development of mathematically correct models possible, as the same results might otherwise not have been seen. Most asset pricing models uses the Rational Expectations

\(^1\) It is common to distinguish among three levels of EMH, each having different implications for how markets work: weak, where prices reflect the information contained in past prices; semi-strong, where prices reflect not only past prices but also all other published available information; and strong, where all information relevant to the firm is reflected in the price, even private information (Brealey, Myers, & Allen, 2006).

\(^2\) A market portfolio is a portfolio consisting of a weighted sum of every asset in the market, with weights in the proportions that they exist in the market. By riskless borrowing and lending investors can achieve portfolios that match their personal degree of risk aversion (Elton, Gruber, Brown, & Goetzmann, 2003).
Equilibrium framework (REE), which is based on two fundamental conditions, namely individual rationality and consistent beliefs.

The fact that individual rationality is assumed means that market participants update their beliefs correctly, when new information is received. This is done according to Bayes’ theorem, where probability is interpreted as a subjective measure of belief. Bayesian thinking allows agents to assign probabilities to unique events and it is assumed that agents revise their probabilities in accordance with new information (Wärneryd, 2001). Furthermore, according to REE the participants make choices consistent with Subjective Expected Utility (SEU), which indicates normatively acceptable choices in which the extremeness and the range of predictions are controlled by considerations of predictability or in other words; the choice should be related to an ideal standard or model (Barberis & Thaler, 2002). SEU is closely related to Expected Utility hypothesis (EU), where the utility of a risky prospect is equal to the expected utility of its outcomes, constructed by considering the utility in each possible state and constructing a weighted average. The agent must rank the different outcomes and will choose the outcome with the highest value and thereby maximize EU. Most individuals are risk averse and will therefore face a concave utility function (Tversky & Kahneman, 1981). The Expected Utility hypothesis is widely recognized in finance and has dominated the analysis of decision-making under risk, but studies of numerical prediction have showed that intuitive predictions might violate the condition (Tversky & Kahneman, 1979). Consequently the hypothesis will be challenged in Section 2.2.

Consistent beliefs mean that the beliefs of the market participant are correct. This entails that market participants use new information in a correct manner and that they have enough information about the economy that they are acting within to be able to create a correct allocation of resources and variables of interest. This will enable the participants to create correct decisions and forecast future unknown variables correctly (Barberis & Thaler, 2002).

Rationality choice theory is simply based on the fact that all the participants reach the goals in an optimal manner, by having full, correct information about all the details of a given situation and by reaching the right and most efficient conclusions in a given situation. These kinds of participants are often seen as rational agents, who always choose to act so that the expected utility is optimized from the given information and they are therefore not influenced by any emotions, personal feelings, any kind of instinct or the decision frame which the agent is acting
within, as the conclusion is based on objectives and logical thinking. Therefore the prices in markets are set by agents who completely understand Bayes’ theorem and have sensible preferences.

The very strict definition of Rational Expectations Equilibrium is used in many financial models and also assumed in EMH, but the irrationality of some investors, which is accepted to occur, is assumed to be random. Therefore the EMH can be right even if some market participants, when faced with new information, may overreact and some may underreact. The EMH only requires that all the investors react randomly and that their reactions follow a normal distribution pattern, so that the effect on the market prices cannot be exploited to earn an abnormal return. Further, to the extent that investors do make systematic errors, these are exploited in the market by arbitrageurs and therefore they eliminate the influence on market prices. This implies that one investor can be wrong, but the market and the prices are always right and consequently in an efficient market there is no free lunch. As will be discussed in the next section, behavioral finance questions these assumptions and departs from RRE by relaxing the very strict assumption of individual rationality.

EMH has been challenged by empirical findings several times, which includes some of the well-known puzzles that EMH find it hard to explain. These puzzles includes the equity premium puzzle, abnormal return due to firm size, performance of past losers and winners, bubbles and crashes etc. Even the underlying assumption of full rationality and perfect handling of information is challenged, as it has been empirically proved that not all information is reflected in stock prices immediately, some information is not all public and investors tend to demonstrate herd behavior, which may cause systematic errors (Wärneryd, 2001). These findings make it clear that EMH and the underlying assumption of full rationality face some difficulties. Therefore behavioral finance may have better explanations of reality and price determination than EMH.

2.2 Introduction to behavioral finance theory

Behavioral Finance is the study of the influence of psychology on the behavior of market participants and the following effect on the market and asset prices. Behavioral finance tries to make improvement to standard financial and economic theories and analysis by increasing the attention paid to the human behavior of financial practitioners. The assumption from standard
finance theory of rational choice is relaxed, so that market participants are not assumed to behave as perfectly as the theory otherwise predicts. Consequently the concept of bounded rationality is introduced. This concept is based on the fact that perfectly rational decisions are often not feasible in practice due to the limited computational resources available for making them. It is hard to believe that investors always find the right information relevant to a specific decision and have the intellectual capacity to interpret the information perfectly. In the behavioral finance literature it is argued that some financial phenomena can better be understood using models in which agents are not fully rational, meaning that they might fail to update their beliefs correctly and make choices that are normative questionable. Therefore behavioral finance can help explain why and how stocks might be mispriced. The behavioral finance literature is based on two building blocks, namely limits to arbitrage as well as psychology, of which psychology is a huge field covering a wide range of theories and concepts. In the following these building blocks will be elaborated upon, but as no unifying model exists in behavioral finance, a number of themes and theories will be introduced, each focusing on a potentially important economic mechanism.

2.2.1 Limits to arbitrage

Behavioral finance proponents argue that movements in stock prices away from their fundamental value occur due to the presence of traders who are not fully rational. In contrast EMH proponents claim that rational traders will quickly undo any dislocation caused by irrational traders. This argument is based on the fact that whenever a mispricing occur, an attractive investment opportunity is generated, which the rational market participants will take advantage of and consequently correct the mispricing. Behavioral finance supporters do not question the second step of which the rational participants exploit the opportunity, but take up the issue of an attractive investment opportunity. Correcting the mispricing in the market can be both risky and costly, and might therefore be highly unattractive (Barberis & Thaler, 2002).

Fundamental risk is the most obvious kind of risk that an arbitrageur will face. An arbitrageur buying a supposedly cheap asset faces the risk of the stock decreasing further in value due to bad news, which will lead to a loss. To prevent this scenario, the arbitrageur can hedge the asset by shorting a substitute security. Unfortunately reality shows that perfect substitutes rarely exist and part of the fundamental risk remains unhedged as a result. This unhedged position is unattractive as the arbitrageur according to theory is risk averse; he does not want
additional risk without additional return. The assumption of risk aversion ensures that the mispricing will not be neutralized by a single large arbitrageur taking a huge position in the mispriced asset.

In addition the obvious problem arises, namely that even if a perfect substitute asset exists, this security might be mispriced as well. Then the arbitrageur is back to basis. Likewise the mispricing of the original asset being exploited can worsen in the short run; it is known as noise trader risk. The arbitrageur will be faced with the risk that the irrational, pessimistic investors get even more pessimistic, decreasing the price even more. This could create huge losses for the investor. Noise trader risk is an important issue as it can force the arbitrageur to settle the position earlier than wanted in the first place. If a stock has lost a significant part of its value, investors tend to get nervous and therefore might settle early to avoid further losses. Moreover in real life investment a separation of brains and capital are often seen, where professional investment managers handle other people’s money (Shleifer & Vishny, 1997). This can easily create a principal-agent problem between the money manager and the investor, as managers are primarily evaluated from their performance. If an explored mispricing deepens, the investor might, due to lack of understanding of investment strategy, withdraw the funds and replace them other where as the investor get nervous that more founds will be lost by this manager. To prevent that such a situation evolves, the manager may abstain from exploiting the mispricing in the first place. Accordingly, this risk might change the incentives of the manager, so only arbitrage opportunities with short horizons are utilized instead of long runs as these opportunities seem less risky. If the risk is systematic, either fundamental or noise trader risk, the limits to arbitrage will exists in the sense that many individual arbitrageurs adding a small position of the mispriced asset to their portfolios will not effectively eliminate the mispricing (Barberis & Thaler, 2002). The different risk factors are considerable as they might restrain investors from correcting the mispricing in the market and consequently force rational investors not to act completely rationally, as the theory predicts.

Besides the discussed increased risk, which an arbitrageur is exposed to, additional costs also arise when a mispricing is tried exploited. First of all transaction costs are incurred when a trade is opened and closed, which includes bid-ask spreads, commissions etc. Moreover the arbitrage strategy often relies on a short-sale position and consequently additional costs of the short sale constraints must be considered. This can include a fee for borrowing the asset and might even include legal constraints, as many investment and mutual funds are forbidden to
short sell by law. Holding costs, including fees, opportunity costs etc. are also to be considered. Finally costs in connection with information gathering may arise, basically meaning that the investors need to use resources to find and learn about the mispricing, which may not be as easy as it sounds (Barberis & Thaler, 2002).

This is basically the arguments for the existence of limits to arbitrage and as a consequence fluctuation in prices away from the fundamental value. Arbitrageurs may be reluctant to correct the mispricing due to excess risk and additional costs, which the investment give rise to. In conclusion, the behavior of irrational investors affects the pricing in the market and the behavior of the rational investors. Therefore the EMH seems to be violated.

2.2.2 Investor sentiment

The other aspect of behavioral finance is investor sentiment, which is the theory of how real-life investors actually form beliefs, valuations and their demands for assets. In the following, various psychological concepts of behavioral finance will be discussed. Only the concepts and terms that I found relevant for the subsequent analysis will be mentioned, even thought more aspects of behavioral finance do exist. Initially, I study the reason for the existence of irrational behavior, through a discussion of the decision-making process of the investors and a following introduction to prospect theory. Additionally, an examination of the biases and mistakes, which investors tend to conduct, will be carried out, by introducing certain rules of thumb and convictions that are often followed by market participants.

2.2.2.1 Decision-making and prospect theory

Every activity that occurs during an investment process is based on information, in one sense or another, and on how the investors actually act depends on how they process this information. People receive information every day, every hour, every minute and even every second. The information technology revolution has had a huge impact on the amount of information, which we receive daily. The quantity is huge, but sometimes the quality is missing, as it has become possible to publish research and information on the Internet that will reach millions of people immediately. Therefore it has become possible to spread a message quickly and receive the latest news even as they are published. The standard finance theory argues that we are capable of sorting this information properly, so that we always base our decisions on the most relevant information. However, the decision and judgment process is
Chapter 2 – Theoretical framework

naturally complicated when asset investing involves some degree of uncertainty. The human processing of information and the problems related to it, is a natural part of cognitive psychology. The human information processing is subject to many influences that can lead to a biased output compared to the original information input. As mentioned, in general human beings posses bounded rationality, meaning that there are limits to the computational complexity that individuals are able to handle and that only smaller parts of the available information can be processed at the same time (Wärneryd, 2001). This will lead investors to focus on some aspects of the available information and disregard others, which may leave out important information. The increased amount of information has worsened the analyst capabilities of the investor, as the investor to a greater degree has to sort the valuable information from noise. Therefore the limited cognitive capacity may prevent investors from acting rationally in some situations.

**Prospect theory**

Research conducted into the decision-making processes of human beings shows that they are not capable of sorting the available information properly. The previously mentioned expected utility theory is systematically violated when people makes choices and some kind of risk is involved, due to irrational behavior and risk attitudes different from what EU state. Therefore dispersed non-expected utility theories have been developed, and one of them is prospect theory (Barberis & Thaler, 2002). Daniel Kahneman and Amos Tversky developed prospect theory in 1979 that is an attempt to reconcile theory and behavioral reality and that has become one of the most important contributions to behavioral finance. Prospect theory should be viewed as an approximate, incomplete and simplified description of the evaluation of risky prospects. The theory points the attention towards gains and losses rather than wealth, which is normally used in financial models. Further the theory assumes that subjective decision-weights replace the elsewhere used probabilities and that loss aversion rather than risk aversion is an overriding concept (Tversky & Kahneman, 1979). These fundamentals will be elaborated upon in the following.

A prospect is an outcome with some probability that involves some kind of risk. The choices involving risk, which the agents have to take, are assumed to occur in two phases, namely the editing phase and the evaluation phase. The editing phase consists of a preliminary analysis of the specific prospects in which the available options are identified, the consequences valued
and the probabilities are reviewed. This often results in a simpler representation of these prospects. In the evaluation phase the edited prospects are evaluated and the preferred prospect with the highest value is chosen. This could sound like any other utility theory, but it differs from traditional expected utility theory in a number of ways. First of all Kahneman and Tversky replace the traditional notion of utility with value, as utility is often defined in terms of wealth, which they find inappropriate. Based on a number of experiments it is illustrated that human beings focus more on gains and losses than on the final wealth. Value should be treated as a function of the asset position that serves as a reference point, which is usually the agent’s status quo, and the magnitude of the change from the reference point. In prospect theory the value of each outcome is multiplied with a decision weight that measures the impact of events on the attractiveness of prospects and not simply the supposed likelihood of these events.

Moreover prospect theory states that the value function for losses is different from the value function for gains. Experimental research has shown that agents are risk averse when choosing between gains and risk seeking when choosing between losses. This means that the utility function will be S-shaped, convex in the domain of losses and relatively steep and concave in the domain of gains and not quite so steep. This contradict the traditional EU function that states that agents are always risk averse and as a consequence the utility function is concave (Tversky & Kahneman, 1979). The figures below illustrate this difference between a standard finance utility function and the prospect theory function:

Figure 2.1 - Standard utility function (Fishar & Stahman, 1959)  
Figure 2.2 - Prospect theory function (Tversky & Kahneman, 1979)
As illustrated the value function is steeper for losses than for gains, which implies loss aversion. This basically means that losses hurt more than gains satisfy. If investors are given two positive options with equally-weighted value, one of them with certainty and the other with a probability, consequently the one with certainty will be chosen. Conversely, if the investors are faced with two negative options, the one with uncertainty will be chosen, as this provides a change of avoiding the loss.

Another aspect of prospect theory is that the transformation of probabilities is non-linear, whereas it is linear in standard finance. This non-linearity indicates that agents are more sensitive to differences in probabilities at small and high probability levels. This observation is incorporated in the decision-weight function. Prospect theory identifies a strong preference for positive outcomes that are certain relative to outcomes that are merely probable, called the certainty effect. In relation, agents tend to give zero weight to extremely small probabilities and the weight of one to very high probabilities, even thought this might not be the most optimal and rational weighting (Tversky & Kahneman, 1979) and (Barberis & Thaler, 2002).

**Framing matters**

Unlike expected utility theory, prospect theory predicts that preferences will depend on how a problem is framed, as the choice is affected by whether it is described from a positive or negative perspective. If the reference point is defined so that an outcome is viewed as a gain, then the decision-makers will tend to be risk averse. On the other hand, if the reference point is defined so that an outcome is viewed as a loss, then the decision-makers will be risk seeking. The frame is controlled partly by the formulation of the problem and by the norms, habits and personal characteristics of the decision-maker (Tversky & Kahneman, 1981). Prospect theory can accommodate the effects of framing and these effects can be extremely powerful, as there are numerous examples of shifts in preferences solely depending on the framing of the problems. Obviously this framing dependency violates the rational choice theory, since the first principle of rational choice theory is that choices should be made independently of the problem description (Barberis & Thaler, 2002).

**Mental accounting and myopic loss aversion**

Another element, closely related to prospect theory, which can be of huge importance, is the process by which agents formulate problems for themselves, called mental accounting. In
mental accounting theory, framing means that the way a person subjectively frames a transaction in their mind will determine the utility they expect to receive. This means that when information is perceived, agents form different decisions due to a dispersed perception and evaluation of the received input and will also perceive the outcome differently from one another. So besides the above-mentioned framing problem, agents also tend to form the problem differently within their minds, making it even harder to believe that we all make identical rational choices based on the available information. One feature of mental accounting is narrow framing, which is the tendency to treat individual gambles separately from the initial wealth. Indicating that when a gamble is set, we forget all about the rest of the gambles faced in the world, and thereby forget to elaborate on the total value of the merged gambles. Investors who tend to frame decisions narrowly will likely make short-term decisions, because when a gamble is evaluated individually, the effect of a loss or gain seems very strong compared to a group of gambles where some win and others lose some. Consequently investors tend to evaluate their gains and losses on a very frequent basis when framing narrowly (Thaler R. H., 1999).

An additional aspect is myopic loss aversion, which rests on two of the previously mentioned behavioral principles, namely loss aversion and mental accounting. It is the tendency to evaluate outcomes frequently and to be more sensitive to losses than to gains. In general a myopic investor can be characterized a one who tends to narrow the framing of decisions and narrow the framing of the outcomes (Thaler, Kahneman, Tversky, & Schwartz, 1997). As mentioned this will lead investors to evaluate gains and losses frequently and make short-sighted decisions that may generate irrational decisions and non-optimal investment outcomes. Thaler et al. argue that risk is affected by the myopic behavior of the investor, as the attractiveness of the risky asset depends on the time horizon. When losses hurts more than gains satisfy, myopic investors tend to experience less utility from owning stocks compared to an otherwise equally risk averse investor who is less myopic and therefore evaluates the outcome less frequently. This frequent evaluation is crucial, as the probability of observing a negative return increases with the frequency of evaluation (Thaler, Kahneman, Tversky, & Schwartz, 1997). The myopic investor may make suboptimal investment decisions that are not efficient in the long run and might even be tempted to sort out some investment strategies that are based on longer horizons. Therefore the myopia limits the investment opportunities of the investor.
The following metaphor highlights the aspects that prospect theory tries to capture:

*Individuals who face a decision problem and have a definite preference might have a different framing of the same problem, and are normally unaware of alternative frames and of their potential effects, on the attractiveness of options, and would wish their preferences to be independent of frame, but are often uncertain how to solve detected inconsistencies* (Tversky & Kahneman, 1981).

### 2.2.2.2 Heuristics and biases

In order to manage the rather difficult task of making decisions, through value determination and assessment of probabilities, Kahneman and Tversky have proposed that when judging the probability of some uncertain event investors often rely on heuristic principles. Heuristics are simply rules of thumps used for solving problems that are less than perfectly correlated with the variables that actually determine the event’s probability. Therefore heuristics can be used to reduce the number of alternative solutions and consequently reduce the complexity and time consumption of the decision-making process (Tversky & Kahneman, 1974). Even though the process gets less complex and resource demanding, it also entails that the process becomes theoretically inconsistent and can lead to significant and systematic errors, which may have severe consequences. However, the heuristics are a necessity due to limited capacity of human beings.

The heuristic principles used by individuals are imperfect, which might and often do lead human beings to be disposed to particular errors and to actually commit cognitive errors. A classic example of cognitive errors is that investors often tend to think that there is essentially no risk of losing money in the long run. They simply imagine a happy end, which is closely related to the failure of weighting probabilities correctly, as discussed in the previous section (Fisher & Statman, 1999). Yet another cognitive error frequently seen is that investors tend to extrapolate recent trends into the future. This might be a huge mistake if the market tends to mean revert; I will elaborate on this later.

Kahneman and Tversky (1974) distinguish between three heuristics that are employed when making decisions under uncertainty, namely representativeness, availability plus anchoring and adjustment. Representativeness refers to judgment based on stereotypes, simply meaning that investors look at familiar patterns when making judgments in uncertain situations. Investors
assume that the future patterns will resemble past ones, often without considering the underlying reason for this pattern. When doing so, investors do not pay any attention to the possibility that the history is generated by chance rather than the model they think exists. When using the representativeness heuristics, the probabilities are evaluated by the degree that A is a representative of B. This means that if A does resemble B, it will be assumed with a very high probability that A originates from B and on the other hand, if A does not look like B, the probability that A originates from B will assumed low. This means that investors will rely on stereotypes when judging the assets. Thus this approach of probability judgment can easily leads to errors. Some of the errors, which might occur, are insensitivity to past probability outcomes and misconception of chance (Tversky & Kahneman, 1974). In an investment decision-making process this shortcut can make it difficult for investors to analyze new information correctly. Investors may overreact to old information and underreact to newer, due to high confidence in the assumption of future performance resembling past ones. Consequently a slow reaction time to information is often seen. People simply extrapolate past trends into the future, as these fits into former patterns and convictions. Therefore all information may not be correctly reflected in the market prices, if investors tend to make representativeness errors.

The second heuristics is the availability heuristics, where an agent relies upon knowledge that is already available rather than using resources examining other alternatives. It is used in situations where a probability is estimated by the ease with which associations can be brought to mind. This heuristic approach is very useful when assessing probabilities, as instances of large and likely occurrences are usually reached more easily and even faster than less frequent occurrences. Further, the associated connection is strengthened in cases where two events easily concur. However the availability is affected by other factors than frequency and probability like imaginability, illusory correlation and retrievability of instances. This fact leads to predictable and systematic errors in the decision-making process (Tversky & Kahneman, 1974). Relying on the availability heuristics in the decision-making process, may lead to irrational decisions, due to wrong probability conclusions. It is easier to recall information recently received than older information and assets with a high level of coverage and research published might be easier recalled by an agent, than less covered assets. Consequently assets that have performed well or been positively spoken about in the past may be more available in investors’ minds and invested more into (Wärneryd, 2001).
The third and final heuristics treated here is the anchoring and adjustment heuristics, where agents tend to make an estimate by starting from an initial value that is adjusted to yield the final estimate when new information is received. This starting point depends on the formulation of the problem and/or from knowledge of historical values. This is commonly used in all kinds of forecastings, not just in investment decisions. However, using this heuristic approach implies that different starting points lead to different estimates and outcome that are often biased toward the anchor values. Therefore when using anchor values the forecast may be rather poor as the adjustments are insufficient (Tversky & Kahneman, 1974). In an investment situation agents often think of past asset prices as anchors for today’s asset prices and today’s prices as anchors for future asset prices. This process is often inadequate, because agents tend to underreact to news, which will bias the estimate. Kahneman and Tversky have proposed that the correct process according to the standard finance theory is to calculate the estimate without using anchors at all. The motivation for using this heuristic approach anyway is that it is a necessity due to the limited capacity and lack of information. The anchoring heuristics can also create overconfidence within the agents, because the agents simply believe that the estimate is very well calibrated. The fact that an initial value is chosen and the estimate is adjusted from this starting point, will make the agents more confident and make them hold on to this estimate longer than they would have reason to. Agents simply overestimate the precision of the private information signal and tend to underestimate the information signals from public information received by all (Wärneryd, 2001). Therefore anchoring can lead to overconfidence and underreaction towards news that might indeed bias the estimate.

2.2.2.3 Self-concept biases

Behavioral finance proponents argue that emotions and feelings are important factors for the decision-making process. Even though they are hard to measure, there is much for us to learn from the knowledge concerning emotions and feelings, when analyzing the behavior of investors (Wärneryd, 2001). Feelings and emotions are often perceived as irrational noise in the decision-making process affecting the outcome that is then based on irrational arguments. The sentiments, which will be elaborated upon in the following, are all identified as having an impact on the behavior of an investor.
The fact that agents tend to take some wrong decisions now and then often stem from overconfidence. Agents simply often think that they know more than they actually do, compared to the market. Behavioral research has found that overconfidence causes agents to overestimate their knowledge, underestimate the risk and overstate their skills to control occurrences (Montier, 2002). This originates from misbelieves, as agents often think they are smarter than the average, can predict the future better than the average and that the outcome is only based on the skills of the agent and not due to pure luck. Constructing a portfolio of assets is a difficult task with many considerations and it is precisely for this kind of task that agents tend to demonstrate overconfidence. The main reason for this is that when a task is complicated, agents tend to think that they are better at solving it due to their excess knowledge and abilities. There are two main implications of investor overconfidence. Firstly agents make bad investments because of lack of realization; they are at an informational disadvantage. Secondly agents trade too frequently, which leads to excessive trading volume (Shefrin, 2002). Excessive trading is costly and might even be irrational (Barber & Odean, 2000). One of the main problems for many investors is themselves. The investor basically has so much overconfidence, that the frequent trading makes the portfolio bad and costly to hold. This excess trading will make overconfident traders earn lower returns due to transaction costs.

One reason for overconfidence may have to do with hindsight bias that is a tendency to misremember things. An agent tends to think that he would have known actual events were coming before they happened, if there had been a reason to pay attention to these events. Simply because the agent believe so much in own abilities. This means that the hindsight bias encourages a view of the world as being more predictable than it is. This can be related to the previously mentioned availability heuristics, where the event that did occur is more salient in the mind of the agent than the one that did not.

The feeling of regret can also be part of the explanation of why agents tend to trade so and even too frequently. Imagine an agent who makes a decision that turns out badly and engages in self-recrimination for not having done the right thing. Here the hindsight bias may set in. It will look obvious that this would happen and the investor will probably feel like a fool and experience the pain of wishing to have done things differently (Shefrin, 2002). Therefore regret is an emotional dislike for past acts and behaviors or lack thereof. The pain associated with feeling responsible for the loss is the worst thing for an agent, as this indicates a lack of knowhow. Therefore the tolerance of regret is reflected in the risk profile of the agent, as very
risk averse agents are less inclined to regret. To try to prevent that the feeling of regret steps in or because former regression of not buying steps in, agents trade frequently chasing positive returns.

Another bias affecting the decision-making process is the confirmation bias. This bias occurs because agents tend to ignore information that is in conflict with their beliefs and simultaneously look for information in the market that confirms their beliefs. This means that agents overlook information that contradicts existing views and thereby respond too conservatively to some new piece of information. As mentioned, agents stick to their view, which creates underreaction to new information (Montier, 2002).

The demonstrated heuristics and biases have large and systematic effects on the decision-making process of the investors, but they are more necessary than anything else due to the limited cognitive capacity of human beings. The lack of appropriate coding explains why agents usually do not detect the biases of their judgments. This leads to systematic errors in the decision-making process that cannot be explained by the traditional finance theory. However the heuristics and biases are not universal, as every investor is unique and perceives the income and outcome differently. Agents are for example highly influenced by the social environment in which they act. They often follow the norms of the environment in which they are acting, because it seems easier and less risky if the investment turns out bad. Herd behavior is a well-known phenomenon, which affects all human beings.

2.3 Sub conclusion

When introducing the efficient market hypothesis and the underlying assumption of full rationality of all agents, the weaknesses of the price determination of standard finance theory was outlined. The theory assumes that all agents are capable of making the right choices at all times, based on the correct set of information. Further should the agent be capable of updating his beliefs correctly when new information is received. This makes it possible that prices always reflect their fundamental values. In real life these assumptions seem very strict and unrealistic and the doubt on this matter is brought up by the behavioral finance proponents. They find it hard to believe that perfectly rational decisions are feasible at all times due to the limited computational resources available for agents. It is hard to believe that investors always find the right information relevant to a specific decision and have the intellectual capacities to
interpret the information perfectly. Moreover there are limits to arbitrage arguably due to the fact that a correction of the mispricing in the market is both risky and costly, and might therefore be highly unattractive. Therefore arbitrageurs might be reluctant to correct the mispricing in markets. Since irrational traders consequently seem to have a significant impact on asset prices, the psychological part of behavioral finance becomes highly relevant.

Investors have limited cognitive capacity, which may prevent them from handling information in a rational manner in the decision-making process. Prospect theory is an attempt to reconcile theory and behavioral reality and has become one of the most important contributions to behavioral finance. One of the cornerstones of prospect theory is that the framing of the problem and decision matters, which conflicts with the assumption of individual rationality. Investors simply form different decisions depending on whether the problem is framed as a gain or loss. To compensate further for their limited cognitive capacity, agents often use heuristics. This use may lead to cognitive errors, since relevant information may be neglected and investors may underreact or overreact to information. Investors may also be subject to judgment biases due to self-concept, like overconfidence, regret and the hindsight bias. Moreover herd behavior is a well-known phenomenon, because agents often follow the herd as this seems easier. All these biases and errors may lead to suboptimal conclusions and irrational behavior of market participants.

In the next chapter I will focus on investment strategies that can utilize the fact that investors seem to act irrationally and that prices not always reflect the fundamental value.
Chapter 3 – Investment style

Chapter 3 Investment style

Investing in stocks has been a growing and more common activity for both private and institutional investors seen over a long period of time. As a consequence more investors are examining and analyzing the market to identify lucrative investment opportunities. In continuation of the previously discussion of EHM and the challenges which has been presented to the very passive investment strategy of holding the market portfolio, other investment strategies may be more appropriate. Dispersed investment styles and strategies are applied to the market by investors with various beliefs in the market and the tendencies which may apply to it. Some investors believe in very active and dynamic strategies, such as constant mix strategies or constant proposition strategies, where the portfolio is constantly adjusted to the currently market conditions others make use of passive strategies, where a simple buy and hold principle is followed. Which strategy is the best for the investor depends on the risk tolerance of the investors and the wanted exposure (Sharpe & Perold, 1995). When a wanted investment strategy is decided upon the choice of which kind of stocks to invest in remains unsolved. Investors can chose to invest in small cap stocks, large cap stocks, value or growth stocks or a combination of the categories. Despite the individual preferences, which need to be taken into account in the decision process, many studies have found that an buy and hold investment strategy with a long horizon, consistent of a long position in value stocks and a short position in growth stocks has yielded superior returns. This strategy is called a contrarian investment strategy. The strategy tries to utilize the fact that investor act irrational and force prices away from the fundamental value. This is done by investing in loser stocks and shorting winner stocks. In the following the principles of such an investment strategy will be discussed and elaborated upon.

3.1 Contrarian investment strategies

Several empirical studies have shown that it is actually possible for one group of stocks to outperform another group. This has caused frustration for the proponents of the rational paradigm, because rational models are unable to explain this tendency. In this chapter a very widely discussed strategy, the contrarian investment strategy, will be discussed. For many
years researchers have argued that this strategy can outperform the market in the long run. Contrarian investment strategies work, because investors do not know their limitations as forecasters. As long as market participants believe that they can predict the future of favored and unfavored stocks, it is possible to make good returns on contrarian investment strategies (Dreman, 1998).

A contrarian investor attempts to make a profit by investing differently from the conventional manner, when it is believed that the consensus opinion appears to be wrong. Therefore a contrarian investor believes that certain herd behavior from other market participants can lead to exploitable mispricings in the market. As previously mentioned contrarian investment strategies are based on long positions in value assets that will appear undervalued and additionally short positions in growth assets that will appear overvalued to the contrarian (Lakonishok, Shleifer, & Vishny, 1994). Widespread pessimism about a stock will for example lead the stock price down and as a consequence overstate the risk of the company and understate the likelihood of returning to profitability. The contrarian seeks opportunities to buy and sell assets when the herd of the market participants appears to do the opposite, to the point where the investment has become mispriced. One of the most famous contrarians, Warren Buffet believes that the best time to invest in an asset is when short-sightedness of the market has beaten down the price. This may indicate a possibility of long-term profitability. In the following glamour and value stocks are defined and the variables used to identify these stocks are classified. Further the tendency towards mean reversion will be introduced, as this is a fundamental condition for the strategy to be successful. Finally some results from other worldwide studies are presented.

3.1.1 Glamour and value stocks

To be able to implement the contrarian investment strategy successfully, it is important to understand, what factors classify the assets. Lakonishok et al. (1994) make the following identification of growth and value stocks:

- Glamour stocks are stocks that 1) have performed well in the past, and 2) are expected by the market to perform well in the future.
- Value stocks are stocks that 1) have performed poorly in the past and 2) are expected to continue to perform poorly.
These definitions indicate that the glamour stocks tend to be favored by the market, as the market is in general optimistic about future performance. These stocks are often also sighted as growth stocks, which is defined as stocks that have a significant growth in sales, earning and/or assets. In the following both definitions will be used synonymously. Contrary to this, value stocks tend to be disliked by the market, because the market is generally pessimistic about the future performance of these stocks. The market generally expect stocks with high past growth to continue to deliver, which can be a huge mistake, as it seems unlikely that companies can maintain a very high growth level forever. This behavior will cause the prices to deviate from the fundamental values. Consequently the contrarian investment strategy tries to take advantage of these characteristics and beliefs from the market, to make an abnormal profit.

### 3.1.2 Sorting variables and measures

The identification process of value and glamour stocks is of course important. Several variables can be used, but I will focus my attention on the market to book (M/B), asset growth (ASSETG), price-to-cash flow (P/C) and price-earnings (P/E) values. These variables are expected to proxy for past performance and in continuation of the previously discussion, as an indication of the market expectations of future performance. The past growth is captured in the ASSETG and M/B variables, and the future growth is measured by P/C and P/E, since these are multiples of profitability (Lakonishok, Shleifer, & Vishny, 1994). The variables can be sorted in relation to value and growth stocks. The ratios in the below table may characterize value and growth stocks:

<table>
<thead>
<tr>
<th>Growth stocks</th>
<th>Value stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>High M/B</td>
<td>Low M/B</td>
</tr>
<tr>
<td>High P/C</td>
<td>Low P/C</td>
</tr>
<tr>
<td>High P/E</td>
<td>Low P/E</td>
</tr>
<tr>
<td>High ASSETG</td>
<td>Low ASSETG</td>
</tr>
</tbody>
</table>

Source: Based on Lakonishok et al. (1994)

The M/B variable looks at the market value of equity to book value of equity. Stocks with a high M/B are defined as growth stocks and stocks with low M/B as value stocks. When looking for growth stocks within the market, it is assumed that a high M/B value reflects growth opportunities that have reached the market price but not the book price. The idea is that
companies with a high M/B have often had a high growth rate in the past and might therefore be described as overvalued and subsequently fail to meet expectations. On the other hand, stocks with a low M/B ratio reflect the fact that growth opportunities have not yet reached the market price, as agents tend to extrapolate the past poor performance into the future. However, the M/B ratio is not entirely clear and can reflect other aspects than the growth of the company. A high ratio could reflect that the specific company has a lot of intangible assets such as intellectual capital, which is not reflected in the accounting book value or that the company only experience high temporary profits. Likewise, a low M/B ratio could indicate that the company is in some kind of distress, indicating that it is more risky. These facts may lead to a misclassification of the stocks in the allocation process. However, the point is that even though the M/B variable is not the best measure, as lots of things can be reflected within the variable, but it is still useable as long as the analyst is aware of these pitfalls (Lakonishok, Shleifer, & Vishny, 1994).

Another method used to classify value and growth stocks is the price-to-cash flow (P/C) ratio. This measure may reflect the expected future rate of growth in cash flows. Therefore low P/C stocks are identified with value stocks, because their growth rate of cash flow is expected to be low or put differently, their prices are low per dollar of cash flow. Conversely, high P/C stocks are glamour stocks, which reflect high current savings and high expected future cash flow growth. The price-earnings (P/E) ratio is very similar to the P/C in the sense that the ratio is also used as a proxy for future expected growth. The cash flow is simply replaced with earnings in general in the measure. Likewise the P/C ratio is the P/E ratio used as an approximation for the market’s expectations of future growth and still a low P/E ratio indicates a low expected growth rate of earnings and a high P/E indicates the opposite, hence a growth stock. However, a high P/E ratio may also indicate temporary depressed earnings and thereby not a glamour stock (Lakonishok, Shleifer, & Vishny, 1994). The idea behind the notation is based on the Gordon’s growth model (Brealey, Myers, & Allen, 2006):

\[ P_t = \frac{D_t (1 + g)}{r - g} \]  

(3.1)

where \( D_t (1 + g) \) represents next period dividend, \( P_t \) is the current stock price, \( r \) is the required rate of return and \( g \) is the expected growth rate of dividends. When expressed in terms of earnings then:

\[ D_t = K \times E_t \]  

(3.2)
where $K$ is the payout ratio, which is a constant fraction of earnings paid out as dividends. We can now write:

$$\frac{P_t}{E_t} = \frac{K(1 + g)}{r - g}$$

From this equation it is clear that if we hold $r$ and $K$ constant, a high P/E company has a high expected future growth rate of earnings, while a low P/E company has a low expected growth rate of earnings. Even though the assumptions behind Gordon’s growth model of a constant growth rate and strict proportionality between earnings and dividends are very restrictive, the intuition is still useable and general. Differences in P/E ratios across stocks can very well be used as an approximation for differences in expected growth rates (Lakonishok, Shleifer, & Vishny, 1994).

The asset growth (ASSETG) is another ratio recently introduced for the purpose of classifying glamour and value stocks. This ratio measures the past growth instead of the expectations for future growth and may naturally reflect some volatility in assets. The asset growth measure is recently introduced by Cooper et al. (2007), as an alternative to the traditional variables. They investigate the cross-sectional relation between company asset growth and subsequent stock returns, by using the percentage change in total assets, year-on-year. ASSETG is defined as follows:

$$ASSETG = \frac{(assets_t - assets_{t-1})}{assets_{t-1}}$$

Cooper et al. argue that when comparing the measure with other previously documented determinants, annual asset growth emerges as an economically and statistically significant predictor of future stock returns in the US. As previously mentioned one of the main functions of capital markets is the efficient pricing of real investment. As companies acquire and dispose of assets, economic efficiency demands that the market appropriately capitalize such transactions. However growing evidence shows that the market is not totally capable of doing so. Findings suggest that corporate events associated with asset expansion tend to be followed by periods of abnormally low returns, whereas events associated with asset contraction tend to be followed by periods of abnormally high returns (Cooper, Gulen, & Schill, 2007). This trend is the ASSETG measure seeking capturing and exploiting.
As the paper has just recently been published, the measure has not yet been tested on that many markets. Therefore it would be interesting to see whether the US results can be supported by the results from the Swedish market, and the measure consequently be added to the literature on the Contrarian Investment Strategy, as a new interesting feature.

The mentioned variables and measures can be used to sort the stocks into categories and one may use these when performing investment strategies. However, the ratios are not all unbiased and as a consequence they may reflect other aspects than an undervalued or overvalued stock, and thus the stock might become miscategorised.

Further, it is hard to determine exactly what can be considered a high ratio and a low ratio of the dispersed measures. Therefore a ranking is needed in the ascending order based on the M/B, P/C, P/E or ASSETG values and then an investment in the top 50% or the bottom 50% depending on the measure and strategy (Dreman, 1998).

### 3.1.3 Market mean reversion

For the contrarian investment strategy to work it is necessary that the market is mean reverting as it is based on investment in former loser stocks and short sale of former winners. Mean reversion is a mathematical methodology often used when asset investing and is based on the idea that both an asset’s high and low prices are temporary and that a stock’s price will tend to have an average price over time. Therefore when the current market price is less than the average price, the stock is attractive for purchase due to the expectation of an increased price over time. And vice verse when the current market price is above the average price, due to the expectations of reversion towards the average.

Many empirical studies have been performed in this field, and researchers do not completely agree whether the market is acting according to mean reversion or random walk. Poterba and Summers (1998) have tested the US stock market and some other countries world wide. They find that the US market show negative serial correlation, mean reversion at long horizons and positive serial correlation, momentum at short horizons. Furthermore, even though they find high possibilities of type II errors, random walk is rejected at low levels of p-values. Further they find the same tendency, and even stronger, for 14 out of 17 examined countries besides the US. They argue that this is related to mean reversion being more apparent in less broad-based and less sophisticated equity markets. Fama (1995, 1997) and other researcher tend to
believe that this is not the reality. They argue that the random walk hypothesis holds, meaning that the stock prices cannot be predicted, due to the efficiency of the market. The market efficiency survives as underreaction is just as common as overreaction and post-event continuation of pre-event abnormal returns is about as frequent as post-event reversal. They admit that although successive price changes may not be strictly independent, the actual amount of dependence may be so small as to be unimportant.

However, as just argued in the previous chapter, it is hard to believe that the market is fully efficient due to the irrational behavior of market participants. Based on all the psychological arguments presented, we must assume that agents tend to extrapolate past trends and believe more in personal information and thinking than publicly available information that indicate that prices must be related from period to period. Therefore it is my persuasion that markets tend to mean revert, due to herd behavior and overreaction from market participants. I will test this hypothesis on the Swedish stock market in following chapter.

Concerning the Nordic equity markets research, Risager (1998) tested the Danish stock market in the period 1922-1995 and found evidence of mean reversion. The evidence for mean reversion is significant at 2-year horizons. Frennberg and Hansson (1993) tested the Swedish stock market and their results suggest that Swedish stock prices did not follow a random walk in the period 1919-1990. For short horizons they found strong evidence of positively autocorrelated returns indicating momentum effect. For longer horizons, two years or more, an indication of negative autocorrelation was found, meaning that a mean reversion takes place. The two studies even found stronger evidence towards mean reversion, than in the US. This evidence is in line with the research and arguments presented by Poterba and Summers (1998), stating that mean reversion is more pronounced in less broad-based and less sophisticated markets.

3.1.4 Empirical evidence

To support my view of the excellence of the contrarian investment strategy, I will present some empirical evidence of its usability. A large number of studies have been performed on different markets, but only the ones I found highly relevant will be presented here. The paper by Lakonishok et al. will be outlined in some detail, because this paper will form the basis for the test and analysis performed in the following chapter.
One of the most remarkable observations concerning this strategy is that it continued to earn abnormal returns long after researchers started to write about it. One of the first researchers to publish an analysis on this subject was Sanjoy Basu (1977), who determined empirically the relationship between investment performance of equities and their P/E’s. The result showed that the average annual returns increases as one moves from high P/E’s to low P/E’s. Therefore low P/E stocks provide superior returns and are less risky, according to the analysis, than high P/E stocks. Basu interpreted these results as a rejection of the EMH, because the hypothesis denies the possibility of earning an excess return (Basu, 1977). After the publishing of Basu’s research, many other papers have followed on this subject and one of the most famous papers in the field is the one by Lakonishok et al. (1994) that studies the US market. Lakonishok, Schleifer and Vishny made an empirical test in the period 1963-1990. They formed portfolios every years starting in 1968, since some of the formation strategies they used required five years of past accounting data. The subsequent performance of these portfolios for up to five years after formation was then investigated, indicating a long run performance examination. One of the main differences of this research and that of others is that Lakonishok et al. studied more variables in order to improve the test of whether value stocks outperformed glamour stocks. The variables used are in line with the ones described previously except ASSETG, which made it possible to test for both past performance and expectation of future performance.

At the end of April each year in the testing period, ten portfolios were formed in ascending order based on the different measures. They showed that investments in long-run value stocks, based on classifications of companies with both one and later two fundamental value measures, yielded significantly higher returns than investments in glamour stocks. The average returns, when using one variable is shown below in Table 3.2:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value stocks</th>
<th>Glamour stocks</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/M</td>
<td>19.8%</td>
<td>9.3%</td>
<td>10.5%</td>
</tr>
<tr>
<td>C/P</td>
<td>20.1%</td>
<td>9.1%</td>
<td>11.0%</td>
</tr>
<tr>
<td>E/P</td>
<td>19.0%</td>
<td>11.4%</td>
<td>7.6%</td>
</tr>
<tr>
<td>GS</td>
<td>19.5%</td>
<td>12.7%</td>
<td>6.8%</td>
</tr>
</tbody>
</table>

Table 3.2 - Average returns based on one variable

Source: Based on Lakonishok et al. (1994)
The results in the table clearly show that employing any of the measures as basis for a value strategy provides superior returns. Lakonishok et al. show that the value stocks start outperforming glamour stocks after one year and that this outperformance deepens further with time. As mentioned they also constructed portfolios based on two ratios simultaneously, using both past growth and expected future growth. This means that a value stock is now classified as one with low past growth and low expected growth. The purpose was to reduce the mentioned misclassification bias of stocks and the method actually improves the performance of value stocks. When for example both E/P and GS is used to indentify a value portfolio, then stocks with depressed earnings which are expected to recover and the true growth stocks do not finish in the same classification. The average returns of this allocation process are shown in Appendix 1.

Lakonishok et al. found that traditional risk measures such as betas and standard deviation were not able to explain this phenomenon. They also looked at the frequency of superior performance of value strategies and their performance in bad states of the world, but with these tests they found only little, if any, support for the view that value strategies are fundamentally riskier. Therefore Lakonishok et al. turned to the behavioral finance theory trying to find an explanation. In compliance with the overreaction hypothesis they found that the value strategy succeeded, because it exploited the fact that naive investors made judgment errors and extrapolated past growth rates too far into the future. Interestingly, the results showed that investors correctly anticipated higher growth rates in cash earnings and earnings for glamour stocks in the short run, but they also grossly overestimated the persistence of these higher growth rates.

When looking for an explanation, why investors and especial professional investors did not exploit this opportunity of abnormal profit, Lakonishok et al. argued that institutional investors were not likely to do so, because it would require long horizons to materialize. Therefore, they tend to hold glamour stocks, because they do not want to fall short of the short horizon benchmarks. When no or only a few institutional investors trade against the naive strategy, the return difference between glamour and value stocks will remain and is never eliminated. Therefore the superior return to contrarian strategies could continue, according to the authors.

Fama and French (1998) have also investigated the US market and markets outside the US, testing if the values premium found in past US returns were sample specific. Their findings for
non-US markets were similar to those presented previously for the US. In twelve out of thirteen markets value stocks outperformed glamour stocks, in the period 1975-1995. Included in the sample was Sweden, which this paper is analyzing, and the results from this market are given below in Table 3.3:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value stocks</th>
<th>Glamour stocks</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{B}{M} )</td>
<td>20.61%</td>
<td>12.59%</td>
<td>8.02%</td>
</tr>
<tr>
<td>( \frac{C}{P} )</td>
<td>17.08%</td>
<td>12.50%</td>
<td>4.58%</td>
</tr>
<tr>
<td>( \frac{E}{P} )</td>
<td>20.61%</td>
<td>12.42%</td>
<td>8.19%</td>
</tr>
<tr>
<td>( \frac{D}{P} )</td>
<td>16.15%</td>
<td>11.32%</td>
<td>4.83%</td>
</tr>
</tbody>
</table>

Source: Based on Fama & French (1998)

The table shows that the value premium definitely exists in the Swedish market in the period 1975-1995. Fama and French argue that the higher returns on value stocks cannot be explained by a traditional international CAPM, but can be explained in a two-factor model that includes a risk factor for relative distress (Fama & French, 1998). Consequently they argue that the value premium is a risk premium, as also stated earlier in this thesis by Fama.

Chin et al. (2002) have tested the contrarian investment strategy on the New Zealand equity market. They analyzed the hypothesis that a relative illiquid stock market like that of New Zealand could be less competitive than the US market, which could influence the usability of the strategy. They argued that the contrarian strategy could require longer investment horizons to pay off on an imperfect market, due to the fact that more noise traders were present and had a greater impact on the market. This could also be the scenario on the Swedish market tested in the next chapter. Consequently they found portfolio consisting of glamour stocks outperformed value stocks portfolios in the first year after the formation, but in the second post-formation year value portfolios outperformed glamour portfolios significantly (Chin, Prevost, & Gottesmann, 2002).

Recently a research paper was presented by Risager (2008) on the value premium on the Danish stock market. He shows that there is also a value premium on the Danish stock market though the premium is not a simple constant, as the premium displays considerable volatility, even across decades. The average annual premium ranges between 4.2% and 5.7% in the rather long sample period 1950-2004. The only factor found which could support the risk explanation is the value portfolio’s higher standard deviation, but this appears to explain only 20% of the
premium. Further, it is argued that growth stocks’ earnings disappointment is a more important factor, when trying to explain the premium, and thereby indicating that the explanation should be found in the behavioral finance argumentation (Risager, 2008).

In general there is a tendency towards acceptance of the superior performance of value stocks, but there is some disagreement as to why this significantly higher return occurs. Some still rely on the traditional risk measures, while others believe in psychological explanations. In the following chapters both explanations will be challenged and used, when trying to explain the tendencies in the Swedish equity market.

3.2 Sub conclusion

The contrarian investment strategy is based on the fact that a mispricing across stock categories takes place. A contrarian investor attempts to utilize the situation to make an abnormal profit by investing differently from the conventional manner. The strategy, which is based on long positions in value assets and short positions in growth assets, has proved to yield a superior return. Dispersed measures can be used, but most importantly they have to capture both the past performance and the expectations of the future performance. One fundamental factor, which has to be fulfilled for the strategy to work, is that the market is mean reverting. This means that when a stock is categorized as a value stock, this undervaluation is only temporary, and an abnormally high profit may be earned over time.

The contrarian strategy has been proven on several markets, including the US and Swedish market. Based on the evidence presented previously, it is fair to believe that the contrarian investment strategy can outperform a growth strategy. The underlying reason for this outperformance is somewhat more controversial and much less consensus exists among the former researchers. Both the traditional finance theory and the risk measures presented from here, and the behavioral finance theory and the limited cognitive capacities of human beings, are used as an argumentation for the results. In the following chapter an empirical analysis and test of the Swedish stock market will be performed and similarities and differences of the results found in other markets will be presented. An interpretation of the results is given in Chapter 5.
Chapter 4 Empirical study

In this chapter contrarian investment strategies are tested on the Swedish stock market. Even though a huge amount of evidence for the superior performance of the strategy is present for different markets, the Swedish equity market has not been tested recently. Therefore I found it relevant to perform a simple test of whether mean reversion is present at all on the market, as this is one fundamental criterion for the contrarian investment strategy to work. After this test I will categorize the stocks in the OMXS30 index, according to the described variables, making it possible to carry out a test and analysis of the performance of the strategy ex post. These tests will substantiate the further analysis of the Swedish stock market. Yet, the chapter will begin with a description of the Swedish stock market and the methodology applied in the tests. This will include a short description of the data applied.

4.1 Applying the contrarian investment strategy to the Swedish market

I have found no recent evidence of how well or bad the contrarian investment strategy works on the Swedish stock market. Evidence supporting the strategy has been presented on a number of other markets, which easily can be compared to the Swedish market, but nobody has recently tested the Swedish market for the usability of the strategy. Therefore this market is chosen for the analysis. In the following a few characteristics of the market will be presented.

4.1.1 Introduction to the Swedish market

The Stockholm Stock Exchange is the place in Sweden were securities are listed and traded. It was founded in 1863 and is the primary securities exchange of the Nordic countries. It was acquired by OMX in 1998 and recently NASDAQ and OMX have merged and are now The NASDAQ OMX Group. The Swedish stock market can be characterized as the Nordic industrial giant. The industrial sector in Sweden is very dominating in the Nordic region.

In 2006 the Nordic Marketplace was created. The OMX Group listed companies from Sweden, Denmark and Finland on the same market place in order to make it more attractive for investors. This meant that common rules were created for the whole market, the trading hours were extended and an improved trading system was introduced at the joint market. The Nordic
Chapter 4 – Empirical study

Exchange offers access to around 80% of the stocks trading on these markets. Since 1990 trading on the Stockholm Stock Exchange has been fully automated, meaning that the floor trading is history.

The Nordic region’s best known and most widely used index, the OMX Stockholm 30, consists of the 30 most traded stocks on the Stockholm Stock Exchange. The limited amount of stocks included in the index guarantees that all the underlying stocks included have excellent liquidity and valuable (by market value). The index has only been calculated since September 1986 starting with a basis value of 125, which might not be long enough to guarantee significant results, but it is nevertheless the index used in this paper. The index is reviewed twice a year, on the first trading day in January and July respectively and it is a market value-weighted index, like most other indexes, meaning that the constituent stocks’ share of the index is determined by the actual market capitalization of each company. OMXS30 has been constructed to develop like OMX Stockholm All-Share Index, thus the index displays the general movements in the stock market. This means that the index is easy to use, clear and resistant to changes in individual stocks simultaneously.

In general the Swedish stock market structure is more developed than for example the Danish one, which is due to a lighter taxation on stocks, but also due to the fact that the Swedes have never had the same tradition for investing in bonds that Danes have. The turnover on the Swedish market is much higher than the turnover on the Danish market. For example the total share trading value was DKK 4621.3 billions from July 2007 to June 2008 in Stockholm compared to only DKK 1236.0 in Copenhagen. The total number of trades was about three times as high at the Stockholm exchange compared to Copenhagen in the same period, indicating that the Stockholm Stock Exchange is by far the largest one in the Nordic region. These facts make the market interesting to investigate.

The Swedish Stock Market is today dominated by Ericsson, which is a leading provider of telecommunication and data communication systems, and related services covering a range of technologies. The joint Scandinavian Bank Nordea follows and the clothing retail chain Hennes & Mauritz takes third place on the Swedish stock market. The Swedish market is the most diversified when it comes to various sectors on the Nordic market, even though the

3 Source: www.omxnordicexchange.com
4 Source: June Statistics report from the OMX Nordic Exchange
Chapter 4 – Empirical study

industrial sector is the most dominating. The sector representation of OMXS30 today is illustrated in the chart below.

Figure 4.1 sector representation of OMXS30

4.1.2 Description of the data applied

The stock returns and the other measures needed and used in this paper are all collected from the Thomson Datastream database, available at CBS. Thomson Datastream is the world largest and most respected financial, statistical database. It contains more than two million financial instruments, securities and indicators for over 175 countries in 60 markets. The OMXS30 index is the investment universe chosen, which is due to the fact that liquidity and size are two common features required by many investors. Liquidity is required to guarantee that a disinvestment is possible at all times and the size is required so large transactions only affect the price in a minor way. This is obtained when the sample only includes the largest and most liquid shares that are traded on an exchange, like OMXS30 in Sweden. It is however arguable that the 30 largest stocks in a market, represent a very narrow sample and thereby definition of the true investment universe, but if the contrarian investment strategy can be successfully implemented on this index, which only includes the largest, most observed and maybe best priced stocks, the results are probably applicable for the whole market.

When analyzing the index, it is of course important to get an overview of all the stocks that have been included in the index in the past and the ones included now. When trying to redraw the data from Datastream, only the stocks that are included now appear. If this data set is used, the results would be subject to survivor bias, because only the current traded companies would

---

5 Source: www.omxnordicexchange.com
6 Source: www.datastream.com
be considered. This is of course not optimal and therefore I found it necessary to manually construct the index year-by-year from the original index composition from September 1986 to July 2008. Datastream has an important advantage relative to this subject, because it includes historical data for companies that disappear. Therefore it has been possible to find almost all the historical data needed to reconstruct the index. The original OMXS30 index composition and changes applied to it throughout the years are to be found in Appendix 2. A huge amount of stocks were removed and added to the index during the first year of its existence. Therefore I choose to start the formation of the portfolios almost one year after its establishment, namely after July 1987. After a year of holding, the portfolio was then rebalanced, as many new stocks were added and others removed from the index during the year. It may be argued that it would have been more appropriate to rebalance the portfolios every time a stock as added or removed from the index. However, the strategy tested in this paper is a simple buy and hold strategy, where no transactions are performed through the holding period; therefore I found it suitable to just rebalance at the end of the holding period, every year.

Therefore the sample period used is the 21-year period from July 1987 to July 2008. The strategy is tested throughout these years, by means of the sorting variables mentioned in the previous chapter, namely P/E, P/C, P/B and ASSETG. All primary shares included in OMXS30 index and found in Datastream from July 1987 to July 2008 constitute the sample. A share is therefore included in the sample if it has made it to the index and had been capable of staying in the index by the end of the formation period. This means that shares which have been included in the index for only a very short time before leaving the index again, are not included in the sample. These smaller shares have not passed the liquidity and size requirements, as they could only meet them for a very limited time, and I therefore found it inappropriate to include them in the sample.

4.1.2.1 The variables

Yearly observations of the Return-index (RI), Price-to-Book value (PTBV), Price/cash earnings ratio (PC), Price/earnings ratio (PE), Market Value (MV) and Total Assets (DWTA) are all obtained from Datastream for all companies in the sample. The Datastream exact determinations of the variables are found in Appendix 3. If a company disappears from the sample, the daily observations are obtained for the specific company for the specific year, so it is possible to identify the last trading day.
Chapter 4 – Empirical study

The PE ratio is defined in Datastream as the price divided by the earnings rate per share at the required date. Earnings per share is the latest rate that reflects the last financial year. Risager (2008) argues that you need to consider both current and trailing PE multiples, to avoid the look-ahead bias. This is due to the fact that the current PE is defined as end-of-year price relative to reported earnings over the year, and thereby assumes that we are able to make forecast for fourth quarter earnings, because the earning at year-ends are only known for the first nine months. However, in this study I have chosen to run the sample from July 1987 to July 2008 and it can therefore be argued that the obtained data are free of this bias, as the annual report will be available for all companies at this time. The same argumentation can be presented for the PC ratio, which is defined in Datastream as the share price divided by the cash earnings per share for the appropriate financial period. While PTBV is defined as the share price divided by the book value per share.

Total Assets represent the sum of total current assets, long-term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets. From the fiscal period 2002, the items are populated from the quarterly, semi-annual and trimester time series based on the availability of the underlying data. When trailing twelve month data is unavailable or for values before the fiscal period 2002, the data is based on a trailing twelve-month period if applicable and represents the sum of the relevant item reported in the last twelve months.

The last variable used is the Market Value, which in Datastream is the share price multiplied by the number of ordinary shares in issue. The amount in issue is updated whenever new tranches of stock are issued or after a capital change, which should ensure the robustness of the data.

4.1.2.2 Returns

The Return Index is calculated from a price index based on adjusted closing prices. The index shows the theoretical growth in the value of a share holding over a specific period, assuming that dividends are reinvested to purchase additional units of equity at the closing price applicable on the ex-dividend date. For Sweden detailed dividend payment data is only available on Datastream from 1988 onwards, but as this is actually the first year of return calculation in this analysis, we can ignore this bias. The Return Index is calculated as shown below; as the availability of detailed dividend payment data enables a realistic method to be
used in which the discrete quantity of dividend paid is added to the price on the ex-date of the payment. Then:

\[
RI_t = RI_{t-1} \times \frac{P_t}{P_{t-1}}
\]  

except when \( t = \) ex-date of the dividend payment \( D_t \) then:

\[
RI_t = RI_{t-1} \times \frac{P_t + D_t}{P_{t-1}}
\]  

where, \( P_t \) is the price on ex-date and \( P_{t-1} \) is the price on the previous day. Likewise \( D_t \) is the dividend payment associated with ex-date \( t \).

For all the individual shares \( j \) in the sample, the simple net return \( R_j \) is calculated using continuously compounded returns from the Return Index observations, using the following formula (Benninga, 2000):

\[
R_{jt} (k) = \ln \left( \frac{RI_{jt}}{RI_{jt-k}} \right)
\]

This is the return for share \( j \) between time \( t-k \) and \( t \). \( k \) is the length of the holding period. For every one of the shares in the sample and on each relevant portfolio formation date, the necessary buy-and-hold returns are calculated.

The returns on the formatted portfolios from the OMXS30 index are calculated annually with the standard formula from (Benninga, 2000):

\[
R_p = \Gamma^T \times (R)
\]

\( \Gamma^T \) is the column vector of the relevant portfolio weights and \((R)\) is the row vector of the relevant asset returns. This multiplication is simple to perform in Excel and the returns on the formed portfolios are returned. To be able to evaluate these returns, it is practical and common to create an average, which investors can expect to earn with the strategy in the particular year. The arithmetic average is the most commonly used average when analyzing multiyear returns (e.g. Lakonishok et al.. 1994). Therefore this average will also be used here, to make the results comparable with results from former studies on other markets.
4.1.2.3 Data problems

Datastream, which is the database used for generating the needed data in this study, is one of the most used, comprehensive and credible publicly available equity market databases. The confidence in the database is demonstrated by consistent reference to it in mainstream financial press like Financial Times. However, this does not guarantee that this database is totally free from errors and biases. Therefore some care has to be taken when the results are presented and elaborated upon. In the following some of the documented data problems will be presented, but there might be other problems and errors that have not yet proved to be of great importance.

Even though Datastream claims that they hold up to 50 years of history throughout 60 markets and that they provide access to over 100 million time series, it is not possible to obtain more than 21 years of data for the Swedish market, when we need consistency in the reporting. This makes it difficult to make significant tests on the data, as more data might be required. Therefore the reader will have to consider the rather short sample period when the reported results are interpreted.

The share prices reported in Datastream and used to calculate the return index are all the adjusted closing prices. A minor assumption of closing price being used at settled price at all times is therefore taken. This might not be realistic as a bid-ask spread is present in the market. This spread raises the cost of trading, which will not be reflected in the closing prices used in the share prices reported by Datastream. Even though the strategy tested in this study is not transaction intense, as it is a buy-and-hold strategy over longer horizons, some transactions do take place at the formation period and these may therefore be affected by the bid-ask spread. Therefore the returns used in this study might be a bit upward biased and consequently the true return might be a bit smaller than the ones reported. However, this bias will also apply to other strategies and even harder to more transaction intense strategies. The effect of the bid-ask spread is also minimized by using annual returns, as these returns hide the day-to-day fluctuation in the bid-ask spreads.

In addition the reported return index show the theoretical growth in the value of a share, assuming that dividends are reinvested to purchase additional units of equity at the closing price applicable on the ex-dividend date. This means that all transaction costs associated with this are ignored and the reinvested amount might consequently be overestimated. However, it can be argued that the transaction costs associated with this reinvestment are rather low today,
as it has become very easy and inexpensive to perform simple trades online, when no further research is needed. Nevertheless the reported returns are likely to be upward biased, but no adjustments are made to oblige this as the bias will be found no matter what strategy performed.

4.1.3 Methodological approach

The first action taken was to form the portfolios in each of the test years. When running the constitution list of equities in the OMXS30 through Datastream, the only stocks included are the current stocks in the index. For this reason I found it necessary to construct the portfolios of stocks in the OMXS30 manually year-by-year from 1987 and onwards. The relevant data was then obtained through Datastream, but for some of the stocks in the index no data were available. This excluded the no-data stocks from the sample. Even thought this approach can be criticized as being inappropriate and misleading, the limited scope of this paper made it impossible to create a whole database of missing data. Therefore the reader should take this fact into consideration when interpreting the results, as some of the portfolios contains less than 30 stocks.

Having identified the relevant companies that had to be included in the two portfolios, a value and a growth portfolio, the companies were sorted in increasing order. The value portfolio was identified as the 50% lowest measurement ratio stocks, while the growth portfolio contained the 50% highest.

The holding periods used in this study are one, two and three years. Some of the empirical evidence presented for other markets also analyses five-years holding periods, but due to the limited amount of annual data, I do not find this period appropriate for this study. The holding periods are to be interpreted as simple buy-and-hold periods, which means that the returns for the two and three year holding periods are calculated as the natural logarithm of the return index at the end of the period divided by the return index in the formation year. No rebalance or adjustments are made doing the periods and therefore the fluctuations in the index during the holding period are not taken into account. This is due to the fact that the strategy tested is not transaction heavy and the only important feature is the return when the portfolio is sold at the end of the holding period.
Returns are calculated by assuming that investors weight their portfolios according to the stocks’ individual market values. The value-weighted returns ensure that a potential size effect does not occur. I also report the returns assuming that investors invest equally in all stocks, as this approach is used in many former studies, e.g. Chin et al. (2002). This method is of course very convenient to work with, but might not be so realistic. However, the advantage of this method is that it implicitly assumes that all stocks have the same expected return and consequently should have the same portfolio weight. As both the value-weighted and equally-weighted approach is reported, the two can be compared and the real influence of the choice can be investigated.

During the holding period some stocks disappear from the stock market for different reasons. At the time of the portfolio formation it is not clear, which stocks will survive or disappear. Therefore some action must be taken during the holding period if a stock disappears from the sample, depending on the reason. With mergers, takeovers and acquisitions it is assumed that the funds invested in the company are reinvested in the overtaking company. A company that simply is omitted the OMXS30 index due to reduced share turnover, is removed from the portfolio after the holding period is finished and replaced by the newly added share. If a company disappears due to bankruptcy, which is very rare in a leading market index, the return of that company is of course minus 100% in the portfolio return.

To be able to make conclusions from the results obtained, it is necessary to make a statistically significant test. The most common way to do this is by using a t-test, which tests whether the difference in returns between the two strategies is equal to zero. A t-test is any statistical hypothesis test in which the test statistic has a Student's t distribution if the null hypothesis is true. It is used when sample sizes are small enough that using an assumption of normality and the associated z-test leads to incorrect inference. The return differences are tested by a paired two sample for means t-test. This analysis tool and its formula perform a paired two-sample student's t-test to determine whether a sample's means is distinct. This t-test form does not assume that the variances of both populations are equal. This test pairs the return from the value strategy with the return for the growth strategy in each year. The purpose of this testing method is to see whether the variation in the return from year-to-year is the same for each strategy. This will make it possible to get an insight into whether the level of return is the same for both strategies.
The null hypothesis for the comparison of the two populations is that the level of the returns is the same for both strategies:

$$H_0 : \mu_{value} - \mu_{growth} = 0$$

This null hypothesis has no direction and is two-sided, whereas the alternative hypothesis has a direction and is one-sided. The alternative hypothesis states that the difference in the returns is larger than zero, indicating that the value strategy by definition earns a higher return than the growth strategy:

$$H_A : \mu_{value} - \mu_{growth} > 0$$

The t-statistics are calculated from the following equation (Pindyck & Rubinfeld, 1998):

$$T_D = \frac{\bar{D} \sqrt{n}}{S_D}$$

where $\bar{D}$ represents the mean return difference between the two tested strategies, $n$ is the number of observations and $S_D$ is the standard variance, which is calculated from the return differences. $T_D$ is t-distributed with $n-1$ degrees of freedom. The test performed in Excel through the Data Analysis function is testing the null hypothesis and thus is two sided. Therefore the critical value that the t-test value has to exceed for each test performed is 1.960 for $n \Rightarrow \infty$.

It is worth mentioning that the t-test originally is based on a number of very strict assumptions, which it might be hard to fulfill. The assumption that the returns on the value strategy and the growth strategy should be independent and identically normally distributed, may be violated, as some financial literature indicates that the returns are driven partly by the exposure to a common pricing factor. However, the explanatory power of this common pricing factor seems pretty low and therefore it seems reasonable to overlook this minor violation.

### 4.2 Mean reversion

Before performing the contrarian investment strategy on the Swedish stocks market, I found it relevant to study the time series pattern in the data applied and test whether sign of mean reversion is present in the Swedish stock market.
Chapter 4 – Empirical study

In the last chapter I mentioned that investor overreaction and herd behavior often cause asset prices to deviate systematically from their fundamental values and later exhibit mean reversion. Investors tend to drive asset prices away from their fundamental values and after some time a correction takes place in the market. In theory this means that high asset returns are often followed by low returns and vice versa. This tendency creates an opportunity for investors who have an understanding of the psychology and mechanism that create these fluctuations in the market. Therefore if mean reversion is present in the Swedish stock market, an indication of support towards the contrarian investment strategy is found. The tendency in a mean reverting and non-mean reverting market is illustrated in the figure below, which clearly demonstrates how different the fluctuations in the market can be.

Figure 4.2 – Mean reversion tendencies

If the market return is independent or random over time, stocks are as risky in the long run as in the short run. This means that long and short run investors should have the same proposition of stocks. This also indicates that investors cannot use historical information for anything, as price changes from one year to the other are independent. Conversely, if the market return is mean reverting, negative serial correlation is experienced in the market, and stocks therefore become less risky in the long run compared to the short run. Long-term investors should have a higher proposition of stocks than short-term investors. When you invest for a short period of time, there is always a risk of a large fall in stock prices and a risk of having to sell stocks with a big loss. In contrast, when you have a long investment horizon and stock prices mean revert, you could go through periods of recession and booms in the market, but the long trend is almost certainly an increase in value. Conversely, if prices follow a random walk, the time horizon does not matter.

4.2.1 Return pattern

First, to get an impression of whether mean reversion is present in the Swedish stock market, a graph of the one-year return series is presented. As mentioned high returns will often be
followed by low returns and vice versa, if mean reversion takes place. Figure 4.4 presented below shows the movements in the OMXS30 index in the period 1986 to 2008.

The graph actually shows a tendency towards mean reversion, as a year with positive return is often followed by a year with a negative return. However, some periods do not follow this tendency and it might be argued that a conclusion of mean reversion in a market based on 21 years of data is far too extreme. However, the graph should give the reader an indication of the tendency in the market in the period tested. A more precise test of mean reversion and random walk is carried out in the following.

4.2.2 Ljung-Box test

In statistics there are a large number of test of randomness. Out of the many tests which can be used to test for mean reversion in a more precise manner, I chose to use the Ljung-Box test, as this test is very useable for small samples. Further the Ljung-Box test is in general very often used due to the high level of precision in the estimates. The Ljung-Box test is a type of statistical test of whether any of a group of autocorrelations of a time series is different from zero. Instead of testing randomness at each distinct lag, it tests the "overall" randomness based on a number of lags. This means that the test is based on the autocorrelation coefficient, which tells us how much correlation and resulting also interdependency there is between neighboring data points in the return series. If the autocorrelation coefficient is zero or close to, this implies that the returns follow a random walk (Pindyck & Rubinfeld, 1998).

The sample autocorrelation and the Ljung-Box test statistic are defined as follows (Ljung & Box, 1978):

$$\hat{\rho}_k = \frac{\text{Cov}(r_t, r_{t+k})}{\text{Var}(r_t)}$$  \hspace{1cm} (4.6)
The Ljung-Box statistic is approximately distributed as chi square with m degrees of freedom. Thus, if the calculated value of $Q'_m$ is greater than, say, the critical 5 % level of the chi square distribution, we can be 95 % sure that the true autocorrelation coefficients are not all zero (Pindyck & Rubinfeld, 1998). Firstly, I test whether there are a first-order autocorrelation in the return series. This test checks whether errors in one time period is correlated directly with errors in the subsequent period. Therefore the following hypothesis is tested:

$H_0 = \text{RW, no first order autocorrelation, } \rho_1 = 0$

$H_1 = \text{Not RW, first order autocorrelation, } \rho_1 \neq 0$

These hypotheses are tested using the general equations presented above:

$$\hat{\rho}_1 = \frac{Cov(r_t, r_{t+1})}{Var(r_t)}$$

$$Q'_1 = T(T + 2) \frac{\rho_1^2}{T - 1}$$

To be able to see whether the $H_0$ hypothesis of no-first-order autocorrelation can be rejected or accepted, the calculated value of $Q'_1$ is compared with the critical value of the chi square distribution at a 5 % significant level with 1 degree of freedom.

Secondly, the joint hypothesis of first- and second-order autocorrelation is tested, to see whether there is a correlation between errors in time period t and errors further back in time.

$H_0 = \text{RW, no first and second order autocorrelation, } \rho_1 = \rho_2 = 0$

$H_1 = \text{Not RW, first and second order autocorrelation, } \rho_1 = \rho_2 \neq 0$

The Ljung-Box tests are performed on both daily and yearly observations to be able to identify both long-term patterns and short-term patterns.

### 4.2.1.1 Daily observations

The calculations and results of $\hat{\rho}_1$ and the Ljung-Box statistics are presented in the box below:
The critical value of the chi square distribution at a 5 % significant level and with 1 degree of freedom is 3.84. The $Q'_1$ value calculated is 10.1942, which is of course higher than the critical value. This implies that the null hypothesis of random walk is rejected for the time period 1986-2008, when daily observations are used. We can be 95 % sure that the true autocorrelation coefficient is not zero and therefore that there is first order autocorrelation in the data. Further, since the autocorrelation coefficient is positive (0.0417), it indicates that a momentum effect is present in the daily market. This means that there is a short-run tendency towards momentum, for stock prices to continue moving in the same direction.

Below is the result of the second-order autocorrelation test is presented. Further the test is also carried out with three and four lags, so it is possible to see if a pattern is created during a trading week.

The coefficient for the second lag is also different from zero, which also implies that the null hypothesis of random walk can be rejected. Moreover the coefficient is negative, which indicates that the Swedish stock returns did mean revert over the sample period. Both the third and fourth lag coefficients are also statistically significantly different from zero. The third lag is negative and the fourth lag is positive. These results based on daily observations clearly reject the null hypothesis of no autocorrelation and therefore it seems clear that the returns do not follow a random walk.
4.2.1.2 Yearly observations

The same calculations are performed on yearly returns in the period July 1986 to July 2008. This is done to be able to identify a long term pattern in the data. However, it is arguable that the sample size becomes too small to perform a randomness test in general, but this is one of the reasons for the choice of the Ljung-Box test as it is preferred on small samples. The calculations and results of $\rho_1$ and the Ljung-Box statistics are presented in the box below:

<table>
<thead>
<tr>
<th>$\sum (r(t) - \bar{r})(r(t+1) - \bar{r})$</th>
<th>$\sum (r(t) - \bar{r})^2$</th>
<th>$\text{Cov}(r(t) : r(t+1))$</th>
<th>$\text{Var}(r(t))$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.07261231</td>
<td>1.4570941739</td>
<td>0.00315706</td>
<td>0.063351921</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$T$</th>
<th>$T + 2$</th>
<th>$T - 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>25</td>
<td>22</td>
</tr>
</tbody>
</table>

The autocorrelation coefficient is slightly negative for the yearly observations, which could indicate that the stock returns did mean revert in the Swedish market over the period 1987 to 2008. However, since the statistic is far below the significance level, we can accept the null hypothesis and conclude that there is indication of a random walk. The returns are not sufficiently correlated in order to establish a pattern and therefore the development in the returns seem random. Nevertheless, this result is highly influenced by the small sample size, as 23 observations might be too few observations to make usable, robust conclusions. Unfortunately the Ljung-Box test has a bias in favor of accepting the random walk hypothesis in small samples. To minimize this bias in the test around 200 or more observations are needed. Therefore the reader is encouraged to consider is when the yearly observations are interpreted.

The results of the second lag show the same tendency, as the coefficient for the second lag is slightly negative as well, but the statistic is far below the significant level. Therefore the indication of random walk in the data series is maintained.
I have not found it appropriate to perform the Ljung-Box test based on yearly observations for further lags, due to the limited number of observations. If more lags were considered, the results would have become too arbitrary.

4.2.3 Discussion

The main result of the performed analysis of whether mean reversion is present in the Swedish stock market is that there seems to be a mean reversion when we look at the return pattern in the illustrated graph. This is also supported by the results obtained by the Ljung-Box test based on daily observations. These results clearly reject the null hypothesis of random walk. However, when the same test is performed on yearly data the conclusion becomes muddy. These last results show a tendency towards random walk due to very low statistics, but these results might be biased by the small sample size.

The Ljung-Box test based on daily observations showed both momentum and mean reversion tendencies. This means that on the second day the market seems to follow the tendency from the first day, but on the third day the market mean revert. This pattern indicates that if a stock’s returns have been high for some period of time, it is more likely that it will fall than continue the high level. This is the reverse situation of a random walk for which it is impossible to predict whether a fall or rise will take place in the next period. The fact that the market seems predictable to some extent may signal inefficiency in the Swedish stock market. Yet, an efficient market does not imply random walk, as an element of predictability may be feasible and consistent with efficiency if this reflects risk, but if the market is easy and highly predictable, this might indicate inefficiency.

These results are basically in line with the results presented by Frennberg and Hansson in 1993, who found that Swedish stock prices have not followed a random walk from 1919-1990. For short investment horizons they found strong evidence of positively autocorrelated returns and for longer horizons indications of negatively autocorrelation. Both theirs and my results give support to the further analysis of the contrarian investment strategies in the Swedish stock market, since these are long-term strategies powered by investor behavior and mean reversion in stock prices.
4.3 Contrarian investment strategies on the Swedish market

In the following the results from the contrarian investment strategies performed on the Swedish stock market will be presented. But, a few things have to be noted first. Primarily, most other studies on this subject use market-adjusted excess returns or excess returns against the risk free rate, which ensures that the return and thereby also the contrarian profit can be interpreted as the abnormal return/profit on the strategy. However, this methodology is not used here. The tables that follow all report the raw return differences between value and growth strategies. This increases the transparency of the results, as different levels of risk free rates at dispersed points in time could affect the results. Further, the objective of this analysis is to see whether a profit could be earned on the Swedish market if invested in value shares over growth shares.

The same portfolio formation model is used for all the strategies presented below. Stocks are ranked in ascending order conditional on their measure value, which is either M/B, P/C, P/E or ASSETG. This means that the 50% of the stocks with the lowest measure value are categorized as value stocks and the remaining 50% of the stocks are categorized as growth stocks. Other studies categorize the stocks into three or more groups, but due to the rather small sample size, 30 stocks, I have chosen to rank the stocks into either the value or growth portfolio. The stocks are classified in each relevant portfolio formation year in the sample period starting in July 1987. This date is chosen, as it is one year after the first formation of the OMXS30 index and I therefore believe that after one year of survival, the index is more stable. July is chosen as it is assumed that the companies’ financial statements are all available within six month after the financial year-end.

After the categorization the stocks are market value-weighted and equally-weighted respectively into the two portfolios. Finally the portfolio returns are achieved through a multiplication of the portfolio weights and the returns. The reported figures below are the return difference between the value strategies over the growth strategies.

For the strategies based on P/C and P/E ratios, only the companies with positive earnings or cash earnings are considered. The companies with negative earnings also have negative P/C and P/E ratios and therefore these cannot be interpreted as expected growth companies. Further, Datastream reports these negative ratios as zero and therefore it is impossible to include these companies in the analysis. It is arguable that the average return of the stocks will
be upward biased, when the negative-earnings companies are excluded. However, the negative earnings are based on the reporting in the financial year prior to formation and it is unclear why these companies should have lower returns than other companies in the coming year. Therefore I choose to overlook this minor dilemma. Due to the fact that some companies from the OMXS30 index are not included, the portfolios from year-by-year do not contain the same number of stocks.

The results that follow are divided into three groups; the results from the one-, two- and three year strategy. Firstly, the one-year strategy based on value-weighted returns will be reported followed by the equally-weighted results.

### 4.3.1 Results of the one-year strategy

Table 4.1 below shows the output of the performed value-weighted one-year strategies. In the first column the formation year is shown and in the following the different measure values for the specific year is presented. At the bottom of the table, the arithmetic mean and the respective t-statistics are given.

<table>
<thead>
<tr>
<th>Year-by-Year Returns: Value minus Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One-year strategy</strong></td>
</tr>
<tr>
<td><strong>Formation year</strong></td>
</tr>
<tr>
<td>1987</td>
</tr>
<tr>
<td>1988</td>
</tr>
<tr>
<td>1989</td>
</tr>
<tr>
<td>1990</td>
</tr>
<tr>
<td>1991</td>
</tr>
<tr>
<td>1992</td>
</tr>
<tr>
<td>1993</td>
</tr>
<tr>
<td>1994</td>
</tr>
<tr>
<td>1995</td>
</tr>
<tr>
<td>1996</td>
</tr>
<tr>
<td>1997</td>
</tr>
<tr>
<td>1998</td>
</tr>
<tr>
<td>1999</td>
</tr>
<tr>
<td>2000</td>
</tr>
<tr>
<td>2001</td>
</tr>
<tr>
<td>2002</td>
</tr>
<tr>
<td>2003</td>
</tr>
<tr>
<td>2004</td>
</tr>
<tr>
<td>2005</td>
</tr>
<tr>
<td>2006</td>
</tr>
<tr>
<td>2007</td>
</tr>
<tr>
<td><strong>Arithmetic mean</strong></td>
</tr>
<tr>
<td>0.0456</td>
</tr>
<tr>
<td><strong>%age</strong></td>
</tr>
<tr>
<td><strong>4.559%</strong></td>
</tr>
<tr>
<td><strong>T-stat</strong></td>
</tr>
<tr>
<td>0.7643</td>
</tr>
</tbody>
</table>
In general it is clear that the one-year strategy is a good strategy. Both the P/E, P/B and ASSETG variables have a positive mean, but not enough to conclude that the one-year value return is significantly higher than the one-year growth return, given that the t-statistics are all below the critical value of 1.960.

The results range from -1.082% to 7.233% depending on the measure chosen, which is a large interval. However, the average value premium found for three of the reported ratios are relatively close to one another (4.559%, 7.233%, 3.937%) and also close to the average value premium found in other markets. Therefore the results do not seem surprising.

Moreover, Fama and French (1998) have calculated the value premium on a yearly basis on a number of markets, including the Swedish market, and they found that the value stocks outperformed the growth stocks around the world. On the Swedish market Fama and French (1998) found the value premium to be between 4.58% - 8.19%. They found that the highest premium could be realized when the data were sorted by E/P (8.19) or B/M (8.02). This is fully in line with the results which I report. When the data are sorted by the price-to-book ratio the highest value premium is obtained, namely 7.233% and when sorted by price earnings a value premium of 4.559% is earned. When the data set is sorted by the ratio price to cash earnings, a negative value premium is reported, namely -1.082%. Fama and French (1998) also reported the lowest premium from this measure on the Swedish stock market. Therefore in general the results obtained are fully in line with what could have been expected.

The P/E values reported are very mixed, half of them are positive and the other half negative, but all together the mean is 4.559% positive. The P/E ratio is commonly used when testing for the value premium in different markets. This is due to the fact that the ratio is the oldest and best documented measure of all the contrarian strategies and therefore has become a very robust and strong measure.

The result from the Swedish market can be compared to the recently published data on another Scandinavian stock market, the Danish stock market, where the average annual premium is between 4.2% - 5.7%, based on the P/E ratio as well (Risager, 2008). The strategy yields almost identical average returns on the two markets, even though the Danish results are based on a very large sample including 54 years of observations and the one performed in this analysis only on 21 years. This fact support the reliability of the data set presented here as the two data sets are expected to be very alike due to the many similarities in the two markets. Yet,
it does not rule out data problems, as we do not know what the results of a test based on a larger sample on the Swedish market would be. However, if I calculate the correlation between the OMXS30 and the OMXC20 indexes from 1990 - 2008, I find a very high correlation of 0.9084, which means that the two indexes have an increasingly linear relationship. This indicates that the results obtained in the tests presented here are pretty strong, as they are in line with the large, robust tests performed on the Danish market. Further I find many similarities when comparing the yearly results. In the Danish evidence, the P/E ratio also performs negative returns during the last few years, 2006-2007, like on the Swedish market. This could indicate that an international or maybe just Nordic tendency is found.

As mentioned, the results sorted by the P/C ratio are the only average value premium that turns out negatively. It is worth mentioning that one of the reasons for this very poor result is that the premiums for the years 1994 to 1999 all turned out negative. In the 1980s and 2000s a positive value premium is earned with this strategy, but the six years in row with negative premiums is of course destroying for the strategy. The fact that the results obtained when sorted by the P/C measure turn out negatively is surprising. The P/C ratio is not that much different from the P/E ratio when defined. Cash earning refers to the elements of a company's profit and loss statement, which can be considered to have been earned or paid in cash. It typically excludes items like depreciation and amortization, which are non-cash charges that would reduce reported net profit. Extraordinary or exceptional items (which may boost or reduce net profit) are often also excluded in calculating cash earnings. This means that cash earnings differ from earnings in the sense that it does not include non-cash expenses. Therefore we would expect the results from the P/C measure to be in line with the results from the P/E measure. However, as this is not the case I realize that there is some uncertainty about the results.

The companies included in the value portfolio when sorted by P/C are very different from the ones included when sorted by P/E. This could indicate that for some companies in the Swedish stock market depreciation and amortization have a huge impact on how the stock is categorized. It can be argued that growth stocks have a higher depreciation than value stocks, because when the past performance of a company have been good, many become too optimistic and increase investments and expansions dramatically, which of course increases depreciation. As cash earnings are calculated without taking depreciation into account, the stock becomes more attractive from a contrarian point of view when sorted by P/C compared to by P/E.
Therefore the company can become wrongly categorized depending on how the expansion is perceived. Further, it could be that some companies try to boost or reduce net profits by including or excluding some exceptional expenses to shape the company result. It troubles me that companies to some extent can affect the categorization by manipulation the net profit, as it would have been preferred that the results was free of categorization biases.

The P/B strategy is by far the best strategy based on one-year returns; it yields in average 7.233%, but still the result is not statistically significant. One of the reasons for this could be that the returns are negative from 1993 to 1999, which again has a huge impact on the overall average. However, due to very high returns in the last 1980s and beginning of the 2000s, the strategy actually turns out very good. Still, it is worth emphasizing that the returns are very volatile and that the strategy could for some years give negative outcomes, but will on average yield positive returns. It will be interesting to see how this strategy performs on longer horizons in the following sub-chapters.

Finally, the results for the new measure for value premium testing, namely ASSETG recently introduced by Cooper et al. (2007), is presented. I will discuss this measure a bit more that the others, as it has only been used for contrarian testing a few times before.

Based on the asset growth measure the average value premium for the strategy when is 3.937%. This is in line with former research. Cooper et al. (2007) found a strong negative correlation between company asset growth and subsequent company abnormal returns. When sorted by previous year company asset growth they found that the raw value-weighted portfolio annualized returns for companies in the lowest growth decile on average were 18%, while they were 5% for companies in the highest growth decile. They also found that the returns of low-asset growth stocks exceeded that of high-asset growth stocks in 71% of the years. The test performed in this paper is not as significant as the one presented by Cooper et al. (2007). The year-by-year returns are very mixed, some negative and some positive, but this could be due to the small sample size.

Cooper et al. (2007) argue that the asset growth rate is by far the strongest determinant of future returns, with t-statistics of more than twice those obtained by other predictors of the cross-section. Further they argue that because the ASSETG is the sum of the subcomponents of growth from the left and right hand side of the balance sheet, it synergistically benefits from the predictability of all subcomponents of growth. They find that the negative relation between
returns and the asset growth and financing components is not as strong as the relation between returns and total asset growth. For example changes in current assets are the most important components for small companies, whereas changes in property, plant and equipment become the most important components for large companies. Similarly, different components on the finance side of the balance sheet are important to different companies. Therefore Cooper et al. (2007) find that this measure is better at predicting the cross-section of returns relative to any other component.

These very strong t-statistics cannot be supported by the test presented here. The t-statistic for the ASSETG measure is not significant and it does not seem more robust than the other measures. As I had a hard time finding and documenting this great new measure, the question therefore is whether this new variable really is a new better determinant at all. When looking more into the variable and the decomposition that the authors make, the measure seems to look more and more like the measures we already know. The argumentation supporting the ASSETG ratio is that it can capture the mispricing in the market which arises when companies acquire and dispose assets. Corporate events associated with asset expansion tend to be followed by periods of abnormally low returns, whereas events associated with asset contraction tend to be followed by periods of abnormal high returns. This means that growth stocks are defined as expanding companies. The question however is whether this definition is so different from the one for the market-to-book ratio (P/B). When looking for growth stocks within the market, it is assumed that a high P/B value reflects growth opportunities that have reached the market price but not the book price. This means that the investors simply valuate for example an expansion to high compared to the realized book value. If this definition is used, the two measures look very alike and it can be difficult to find the innovative feature in the variable. Therefore it seems like the new variables, ASSETG, is just a new definition of something well known. Further, as the t-statistics are not improved compared to the other measures the greatness fades. However, it will be interesting to the results of the multiple year tests.

All together, the one-year value-weighted strategy is a good strategy, which earns a positive return. When sorting by the variables based on future growth, the results where rather mixed as P/E showed positive and P/C negative results. When I sorted by the past growth the results were in line with one another, but still the average premium for the P/B was almost the double of the one for ASSETG. Figure 4.5 below illustrates that the year-by-year returns are mixed.
In the 1980s, beginning of 1990s and 2000s there seem to be no tendency in the returns across the variables. It is only the mid and late 1990s that show a generally negative tendency for all the variables. It is worth mentioning that at the beginning of the 1990s the P/C variable produced very negative results whereas the other variables produced very positive results. This difference could be part of the reason for the bad results from the P/C ratio. Further, the P/E variable produced very negative results during the last years 2005-2007 where the other variables produced positive returns.

It seems that even though the strategy can be good when based on one variable in one year, it can be poor when based on another variable. Therefore there seems to be some uncertainty when the strategy is performed on short horizons. This clearly indicates that the strategy has to be performed on longer horizons, so the poor years can be balanced by some good years. Therefore the strategy will be carried out with two and three years’ holding periods in the next sub-chapters, but first the results for the equally-weighted portfolios will be presented.

Table 4.2 below lists the output of the performed equally-weighted one-year strategies.
One reason for the increased premiums when the stocks are equally-weighted could be that the results are small-cap biased. The small-cap effect, also called the size effect, is the tendency of small cap shares to outperform large caps over the long term. The size effect can be explained by the illiquidity of small companies, particularly as a result of higher trading costs. Further less liquid stocks must offer higher expected returns to attract investors. It is well known that
small capitalization companies have had higher average returns in the past, although the premium may have decreased the recent years (Brealey, Myers, & Allen, 2006). The greatest weakness of these small-cap stocks is that the real performance is likely to be offset by trading costs, which are not included in the calculations here. Further Cooper et al. (2007) showed that the pricing errors are the largest for the smaller size companies.

Even though there is a small-cap effect in the equally-weighted value premium results, the reader must remember that the portfolios are constructed from the largest and most liquid stocks in the Swedish market. Therefore one should not expect the small-cap effect to have a large influence on the results presented in this study, but the reader is encouraged to take the effect into consideration when interpreting the results.

4.3.2 Results of the two-year strategy

So far I have looked at one-year holding periods. Table 4.3 shows the results of the strategy when the holding period is increased to two years.

<table>
<thead>
<tr>
<th>Year-by-Year Returns: Value minus Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-year strategy</td>
</tr>
<tr>
<td>Formation year</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>1987</td>
</tr>
<tr>
<td>1988</td>
</tr>
<tr>
<td>1989</td>
</tr>
<tr>
<td>1990</td>
</tr>
<tr>
<td>1991</td>
</tr>
<tr>
<td>1992</td>
</tr>
<tr>
<td>1993</td>
</tr>
<tr>
<td>1994</td>
</tr>
<tr>
<td>1995</td>
</tr>
<tr>
<td>1996</td>
</tr>
<tr>
<td>1997</td>
</tr>
<tr>
<td>1998</td>
</tr>
<tr>
<td>1999</td>
</tr>
<tr>
<td>2000</td>
</tr>
<tr>
<td>2001</td>
</tr>
<tr>
<td>2002</td>
</tr>
<tr>
<td>2003</td>
</tr>
<tr>
<td>2004</td>
</tr>
<tr>
<td>2005</td>
</tr>
<tr>
<td>2006</td>
</tr>
<tr>
<td>Arithmetic mean</td>
</tr>
<tr>
<td>%age</td>
</tr>
<tr>
<td>T-stat</td>
</tr>
</tbody>
</table>
The results obtained when the constructed portfolios are held for two years instead of one year are in line with the results from the one-year strategy presented previously. The average of the four value premiums is a bit higher for the two-year strategy (4.009%) than for the one-year strategy (3.662%), but still the results are not statistically significant. Therefore the results are not significant enough to conclude that the two-year value return is significantly higher than the two-year growth return, given that the t-statistics are all below the critical value of 1.960.

In line with the one-year strategy, the P/E and P/B measures give the largest premiums and the most significant results. Likewise the year-by-year returns are rather mixed, some years earn high returns and others earn negative returns. During the 1990s the strategy has been performing rather poorly, but in the 2000s the returns are very high. All in all these mixed results give a value premium, which vary between -0.993 and 7.926% depending on the sorting variable.

One again the P/C sorting variable yields a negative return, as the only variable, whereas the ASSETG sorting variable earns a positive value premium, but still less significant than the other two variables. Therefore still the ASSETG variable has not proved its worth compared to the other variables and the innovation measure, which Cooper et al. (2007) have presented it to be.

In the Table 4.4 below the equally-weighted results are presented for the two-year strategy.
Table 4.4

<table>
<thead>
<tr>
<th>Year-by-Year Returns: Value minus Growth</th>
<th>Two-year strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equally-weighted</strong></td>
<td><strong>P/E</strong></td>
</tr>
<tr>
<td>1987</td>
<td>0.1052</td>
</tr>
<tr>
<td>1988</td>
<td>0.3538</td>
</tr>
<tr>
<td>1989</td>
<td>-0.1202</td>
</tr>
<tr>
<td>1990</td>
<td>-0.0304</td>
</tr>
<tr>
<td>1991</td>
<td>0.3271</td>
</tr>
<tr>
<td>1992</td>
<td>0.4337</td>
</tr>
<tr>
<td>1993</td>
<td>0.4248</td>
</tr>
<tr>
<td>1994</td>
<td>0.1049</td>
</tr>
<tr>
<td>1995</td>
<td>0.0357</td>
</tr>
<tr>
<td>1996</td>
<td>0.0832</td>
</tr>
<tr>
<td>1997</td>
<td>-0.2065</td>
</tr>
<tr>
<td>1998</td>
<td>-0.1220</td>
</tr>
<tr>
<td>1999</td>
<td>0.0965</td>
</tr>
<tr>
<td>2000</td>
<td>0.2696</td>
</tr>
<tr>
<td>2001</td>
<td>0.4947</td>
</tr>
<tr>
<td>2002</td>
<td>0.4598</td>
</tr>
<tr>
<td>2003</td>
<td>0.2124</td>
</tr>
<tr>
<td>2004</td>
<td>0.0608</td>
</tr>
<tr>
<td>2005</td>
<td>-0.0577</td>
</tr>
<tr>
<td>2006</td>
<td>-0.0565</td>
</tr>
<tr>
<td><strong>Arithmetic mean</strong></td>
<td><strong>0.1435%</strong></td>
</tr>
<tr>
<td><strong>T-stat</strong></td>
<td><strong>2.9711</strong></td>
</tr>
</tbody>
</table>

Again the results are perfectly in line with the one-year results. In general the two-year equally-weighted strategy is a good strategy. When the stocks are equally-weighted, all the variables have a positive mean, but only two of them enough to conclude that the two-year value return is significantly higher than the two-year growth return, given that the t-statistics are above the critical value of 1.960. Once again the average value premium is generally higher when the stocks are equally-weighted than when value-weighted. When ranking the four measures P/E yields by far the highest premium, followed by P/C, P/B and at last ASEETG. This means that yet again it is doubtful whether ASSETG is such a great new measure.

It is interesting to see how significantly the P/E and P/C variables have increased. A premium way above 10% for both measures is rather extreme, compared to both the two-year value-weighted strategy and the one-year strategies. This could indicate that the equally-weighted results are small-cap biased. As previously mentioned this would mean that the value portfolio is created from less liquid stocks with higher transaction costs, which is not taken into account here.
4.3.3 Results of the three-year strategy

Finally the strategy is also performed with a three year holding period. Table 4.5 below shows the results for the value-weighted strategy.

<table>
<thead>
<tr>
<th>Year-by-Year Returns: Value minus Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-year strategy</td>
</tr>
<tr>
<td>Formation year</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1987</td>
</tr>
<tr>
<td>1988</td>
</tr>
<tr>
<td>1989</td>
</tr>
<tr>
<td>1990</td>
</tr>
<tr>
<td>1991</td>
</tr>
<tr>
<td>1992</td>
</tr>
<tr>
<td>1993</td>
</tr>
<tr>
<td>1994</td>
</tr>
<tr>
<td>1995</td>
</tr>
<tr>
<td>1996</td>
</tr>
<tr>
<td>1997</td>
</tr>
<tr>
<td>1998</td>
</tr>
<tr>
<td>1999</td>
</tr>
<tr>
<td>2000</td>
</tr>
<tr>
<td>2001</td>
</tr>
<tr>
<td>2002</td>
</tr>
<tr>
<td>2003</td>
</tr>
<tr>
<td>2004</td>
</tr>
<tr>
<td>2005</td>
</tr>
<tr>
<td>Arithmetic mean</td>
</tr>
<tr>
<td>Percentage</td>
</tr>
<tr>
<td>T-stat</td>
</tr>
</tbody>
</table>

The value premiums for the three-year strategy are rather dispersed, ranging from -3.131 to 13.203, and still none of them are statistically significant. However, the average premium from the four sorting variables is still higher than the one from both the one- and two-year strategies, namely 5.416%. Once again P/E and P/B are by far the strongest measures, with very high means and close to being significant. In contrast the results based on the ASSETG sorting variable came out negative when the strategy was extended to a three-year holding period due to really low value premiums during the 1990s. This is interesting as it indicates that large asset expansions of growth companies during the 1990s, especially from IT companies, were profitable. Companies with large total asset growth experienced high returns during the 1990s, but after the IT bubble burst in 2000 these companies experienced large loses. The value premiums also show this as the premiums in 2000-2001 were extremely high.
Below the results of the equally-weighted three-year strategy are shown in Table 4.6. Once again the results are basically in line with the former results presented.

<table>
<thead>
<tr>
<th>Table 4.6</th>
<th>Year-by-Year Returns: Value minus Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-year strategy</td>
<td>Eqally-weighted</td>
</tr>
<tr>
<td>Formation year</td>
<td>P/E</td>
</tr>
<tr>
<td>1987</td>
<td>0.1757</td>
</tr>
<tr>
<td>1988</td>
<td>0.3454</td>
</tr>
<tr>
<td>1989</td>
<td>0.0956</td>
</tr>
<tr>
<td>1990</td>
<td>-0.0449</td>
</tr>
<tr>
<td>1991</td>
<td>0.3190</td>
</tr>
<tr>
<td>1992</td>
<td>0.3820</td>
</tr>
<tr>
<td>1993</td>
<td>0.5376</td>
</tr>
<tr>
<td>1994</td>
<td>0.1895</td>
</tr>
<tr>
<td>1995</td>
<td>-0.1449</td>
</tr>
<tr>
<td>1996</td>
<td>-0.2088</td>
</tr>
<tr>
<td>1997</td>
<td>-0.3951</td>
</tr>
<tr>
<td>1998</td>
<td>0.0693</td>
</tr>
<tr>
<td>1999</td>
<td>0.3191</td>
</tr>
<tr>
<td>2000</td>
<td>0.7033</td>
</tr>
<tr>
<td>2001</td>
<td>0.6083</td>
</tr>
<tr>
<td>2002</td>
<td>0.5258</td>
</tr>
<tr>
<td>2003</td>
<td>0.2473</td>
</tr>
<tr>
<td>2004</td>
<td>0.0743</td>
</tr>
<tr>
<td>2005</td>
<td>-0.0624</td>
</tr>
</tbody>
</table>

| Arithmetic mean | 0.1966 | 0.0912 | 0.1296 | 0.0504 |
| Percentage | 19.663% | 9.124% | 12.958% | 5.036% |
| T-stat | 2.9317 | 1.0805 | 1.9339 | 0.8551 |

When the holding period is extended to three years, the average value premium increased dramatically and is ranging from 5.036% up to 19.663%, which is extremely high. Both the P/E and the P/C sorting variables show statistically significant results. It is worth mentioning that the negative decade, the 1990s, is less negative when the holding period is extended.

4.3.4 Summary and additional comments

In general the results presented in this chapter are to a large degree comparable to those found in other studies on different markets. In general the contrarian strategy can be carried out with great success on the Swedish market. Both the value-weighted and equally-weighted results from the three different holding periods generally turned out positively. Even though not many results where statistically significant, the test can still be characterized as successful. The low significance level of the results found on the Swedish market can be interpreted as either (i) that the return differences are real, but not enough to be significant in a sample with so few observations or (ii) that the differences in returns are in fact insignificant for most of the
strategies presented. The second interpretation implies that the contrarian investment strategy is not suitable for the Swedish stock market. However, the similarities found between the returns presented in the tests performed here and other studies are rather convincing. Both results from the Danish and the US market point in the same direction as the ones from the Swedish market. Moreover, the results are also in line with those presented by Fama and French (1998) on the Swedish market. Therefore, it appears that the first interpretation of too few observations to create significant results is the most convincing.

The newly introduced sorting variable ASSETG does not show its worth in this study. Cooper et al. (2007) present the variable as a highly improved variable, which increases the statistics significantly and the value premium dramatically. However, ASSETG is not close to meeting these high standards at all. The variable most of all looks a lot like the other old and well-known sorting variables. When interpreting all the results all together, the P/E sorting variable looks like the strongest measure, when testing the Swedish market. The P/E ratio is commonly used in many former studies when testing for the value premium, as it is the oldest and best documented measure and therefore has become a very robust and strong measure, which is also documented here.

4.4 Sub conclusion

In this chapter it has been tested whether the contrarian investment strategy can successfully be carried out on the Swedish market. The Swedish market is the largest one in the Nordic region and is dominated by the industrial sector. Firstly, a randomness test is performed on the market to see whether the market characteristics are suitable for the strategy. The test results clearly rejected the null hypothesis of a random walk and indications of momentum effects and mean reversion were found. The former study by Freenberg and Hansson (1993) also supported these results. Therefore, support to further analysis of the contrarian investment strategies in the Swedish stock market was present, since they are long-term strategies powered by investor behavior and mean reversion in stock prices.

The contrarian investment strategies tested on the Swedish market clearly showed successful results. Even though the statistically significant level within the results was rather low, the results still gave an indication of a present value premium in the market over the sample period July 1987 to July 2008. The value-weighted results were less significant and extreme than the
equally-weighted results, which could indicate a small-cap bias in the equally-weighted portfolios. Further the returns increased with the extension of the holding period, which clearly supports the fundamental idea of the strategy being superior in the long term.

The fact that the contrarian strategy can successfully be implemented on the Swedish stock market, gives cause to wonder. Therefore further analysis and discussion of the reasons for the present value premium on the Swedish stock market will be considered in the next chapter.
Chapter 5 Explanation of the results

There is a clear tendency in the data presented in the last chapter for value strategies to earn higher returns than growth strategies. Even though the results were less significant, the results obtained were still in line with the former results presented in earlier studies of other markets. Based on evidence from studies, the academic community has generally come to agree that value investment strategies outperform growth investment strategies. Much less consensus exists however on the underlying reason for the superior returns. It was mentioned earlier that researchers within this field have two interpretations for the reason for the premium. Firstly, some think that due to the fact that the market is efficient, the differences in returns must be due to different exposures to risk. Secondly, others think that the market is not totally efficient and the explanation for the value premium should be found in the behavioral finance theory. Therefore, in this chapter I will try to explain the fundamental reasons for the existence of the premium through both standard finance and behavioral finance argumentation.

5.1 Standard finance explanation

The EMH and rational choice theory should be able to explain the value premium if the results are in line with standard finance theory. In a framework of rational asset pricing theory differences in returns must be explained by differences in exposures to systematic risk. In the following a risk measure of the constructed portfolios will be calculated, so it can be determined, whether the value portfolios are riskier than the growth portfolios. Further, other risk measures and standard finance explanations will be investigated in the search for explaining the value premium on the Swedish stock market.

5.1.1 Testing for systematic risk

In relation to the traditional CAPM model the risk exposure with respect to systematic risk is measured by the beta value. In terms of finance and investing, the beta describes how the expected return of a stock or portfolio is correlated to the return of the financial market as a whole. Beta is measuring the part of the risk that affects the expected return of the asset (the market risk) and is therefore easily compared across assets. Beta is estimated monthly with the standard formula from (Elton, Gruber, Brown, & Goetzmann, 2003):
Chapter 5 – Explanation of the results

$$\beta_i = \frac{\sigma_{im}}{\sigma^2_m}$$

(5.1)

where $\sigma^2_m$ is the variance of the market return and $\sigma_{im}$ is the covariance between stock i’s return and the market return. The covariance between the market return and the individual asset return is what affects the expected return. If the covariance is high, the asset contributes with more risk to the market portfolio than if the covariance is low. Thus, investors will demand a higher expected return on assets with high covariance. Therefore the theory predicts that stocks with high returns have higher risk than stocks with low returns, hence due to the fact that the market is efficient and that all investors are fully rational. Therefore according to standard finance theory the expectations to the calculated beta values must be that $\beta_{\text{growth}} < \beta_{\text{value}}$.

It was concluded in the former chapter that the P/E sorting variable was the strongest measure, when testing the Swedish market. Also the P/E ratio is commonly used in many former studies when testing for the value premium, as it is the oldest and best documented measure. Therefore the beta values are only calculated for the portfolios based on the sorting variable P/E. If the value premium can be explained by beta when sorted by P/E, the result is probably applicable for the other measures as well.

The beta values for all stocks are estimated for all test periods with monthly return observations, which means that the beta value is estimated once during each of the one-, two- and three-year test periods for each stock. The beta on each portfolio is calculated as the weighted average of the included stocks, where the weights are both value- and equally-based. When estimating beta like this, it is assumed that beta can be correctly estimated based on only 12, 24 and 36 data points. This is of course arguable, so the reader is encouraged to take this point into consideration when interpreting the results in the following.

Figure 5.1 and 5.2 below show the output of the performed beta calculations when the portfolios are value-weighted and equally-weighted for the one-, two- and three-year strategies. The reported beta values are the arithmetic average values. The beta values for each year for each strategy are given in Appendix 4.
First the value-weighted results will be commented and later the equally-weighted results.

In general it is clear that the beta values are poor at explaining the value premium when the portfolios are value-weighted. For all strategies the difference between the value and growth betas are negative. This indicates that the value strategies are less risky than the growth strategies and also surprisingly, that the value strategies have betas less than one. The rational asset pricing theory predicts that portfolios that are less risky than the market portfolio have a beta less than one, and portfolios that are more risky have a beta above one (Elton, Gruber, Brown, & Goetzmann, 2003). This indicates that the value strategy is less risky than the market portfolio in general, which is pretty unexpected. Therefore the calculated betas suggest than even though the value strategies earn higher returns they are less risky than both the growth strategy and the market portfolio. This is totally the contrary of what the standard finance theory otherwise states. However, it is worth mentioning that for several of the years the beta values for the value portfolios are above one (see Appendix 4) and thus more risky than the market portfolio, but the means are still below one.

The results for the strategies when the portfolios are equally-weighted generally show the same tendencies. Once again the betas are lower for the value strategies than for the growth
strategies for all holding periods. Even thought the differences are less significant, the same conclusions can be made. Remember that the equally-weighted strategies earned even higher returns than the value-weighted strategies and therefore it might have been expected that the value strategy in this case was even riskier. However, the systematic risk measure, beta, does not support this hypothesis.

5.1.2 Bad states performance

It seems clear that the traditional risk measure is not capable of explaining the value premium. The results found are similar to results found in other studies on different markets. As mentioned Lakonishok et al. (1994) found that traditional risk measures, such as betas and standard deviation were not able to explain the value premium. However, the possibility exists that beta and volatility are crude proxies that do not capture all the relevant risks. Therefore they also looked at the frequency of superior performance of value strategies and their performance in bad states of the world. If the value strategy is fundamentally riskier, then it should underperform relative to the growth strategy during undesirable states of the world when the marginal utility of wealth is high. However, with these tests they found only little if any, support for the view that value strategies are fundamentally riskier. Risager (2008) also found that traditional CAPM risk measures could not explain the premium. It was found that the value portfolio outperforms the glamour portfolio even in bad states; moreover the value portfolio had more upside risk (potential) than the glamour portfolio.

A test of the bad states performance of the portfolios is not performed here. The sample size is only based on 21 years of observations and thus only a few decades. If I made an economic analysis of the GDP development and the stock market development on so few observations, the results would probably be doubtful. Therefore I only compare the Gross domestic product (GDP) development for Sweden, with the results obtained earlier.

If the value premium decreases significantly in periods with decreasing growth in the economy it could indicate increased downside risk. Downside risk is important because a high level of downside risk would make the portfolio riskier during periods of decreasing consumption. Stocks that decrease dramatically during depressions or bad states will be considered highly correlated with consumption, and therefore be a bad hedge against decreasing wealth. This will make investors require a higher return of these stocks. Therefore a poor performance of the
contrarian strategy during bad states could indicate that investors want compensation for the increased downside risk.

Remember that during the 1990s the value strategy performed rather poorly compared to the growth strategy, especially from 1994 to 1999. Figure 5.1 below illustrates the GDP estimates 1951-2007 as annual volume change in percentage points for Sweden.

Figure 5.1 – GDP estimates 1951-2007 as annual volume change in percentage for Sweden

The graph clearly shows that during the start of the 1990s the GDP development was negative in Sweden. The reason for the negative development in GDP during the early 1990s is probably the Swedish banking crisis, which took place at that point in time (Englund, 1999). During this period the value strategy actually performed rather well compared to the growth strategy. Almost all the strategies had positive value premiums in the early 1990s. This indicates like Risager (2008) also argues that the strategy has increased upside risk, as it performed better in bad states of the economy. However, from 1994 to 1999, which is the period where I found negative value premiums, the GDP development was actually positive. This clearly indicates that the Swedish banking crisis, for which the total direct cost to the taxpayer of the salvage has been estimated at around 2% of GDP and thereby had a huge impact on the Swedish economy, in general, did not have a direct impact on the value premium. Even during the crisis the value strategy did well. Further, there is no evidence that the poor performance of the value strategy in the late 1990s can be explained by Sweden being in bad state. The Swedish economy was rather healthy during the late 1990s with positive growth in GDP.

________________________________________

7 Source: Statistics Sweden – www.scb.se GDP annual change in percentage, constant prices reference year 2000
Chapter 5 – Explanation of the results

I also experienced both some negative and some positive value premiums during the 2000s. As mentioned, the P/E one-year value-weighted strategy performed rather poorly in 2005-2007, like it also did on the Danish market. The graph clearly shows that during the 2000s the GDP development was positive. In the early 2000s I found the largest premiums, where the GDP growth is the lowest, which again indicates upside risk. So if the bad states of the world is defined as years with falling GDP, it cannot be concluded that the value strategies perform worse in bad states of the world compared to growth strategies. Further as the value premium does not decrease significantly in periods with decreasing growth in the economy, no indication of increased downside risk is found. The reverse turned out, as the value strategy in general outperform the growth strategy in bad states of the world.

As the GDP development cannot explain the poor results of the value strategy during the 1990s other explanations must be considered. It is of course important to clarify why the strategy did so badly in this period, as it has a high impact on the results. If strategy had not performed so badly in this period, the results would have turned out significantly better.

The fact that value strategies underperformed growth strategies in the 1990s is basically in line with the results presented in a study by Chan, Karceski and Lakonishok (2000). They found that overall value stocks were outplaced by growth stocks by 1.1 pps a year on average over 1990-1998, and from 1994-1998 the underperformance was 1.6 pps. They also found that the stocks traded in the late 1990s were traded at very high multiples, which could indicate that they were trading on a bubble. It must be noticed that the paper was published in 2000, before it was known that the valuation for growth stocks in the technology field was actually an irrational bubble, which burst in 2000. The "dot.com bubble" was a speculative bubble covering roughly 1995–2001 during which stock markets in Western nations saw their value increase rapidly from growth in the new Internet sector and related fields. Lakonishok et al. (2000) discuss potential explanations of this shift towards the growth strategy and whether it is likely that this pattern will continue into the future. They test different explanations including the rational asset pricing, new paradigm and the behavioral explanation. Since the relative stock price performance in the 1990s could not be explained by differences in their operating performance, Lakonishok et al. (2000) concluded that the most likely explanation of the shift towards growth stocks in the period is the behavioral one. When reviewing the history, it is of course obvious that their conclusions are right. Investors overreacted to companies within the
Chapter 5 – Explanation of the results

IT sector, which pushed returns away from the long-term pattern, without support from fundamental values.

When examining the results from the Swedish stock market it is clear that this market was also affected by the IT bubble. The underperformance is simply an international phenomenon. The same tendencies are found and therefore the IT bubble had a huge negative impact on the analysis. It is up to the reader to imagine if such a bubble can occur again with the same power. Therefore it seems as if the Swedish market is highly affected by international tendencies. For example the correlation between the returns found from the P/E sorting variable in Sweden and in Denmark indicates that the markets are affected by international forces. Thus, it is worth mentioning that in a small open economy like Sweden, there seems to be a strong dependency on foreign trade and factors describing the investment opportunities set are likely to be determined by both local and international forces.

5.1.3 Summary and additional comments

I can conclude that the return differences between value and growth strategies cannot be explained by different exposures to systematic risk. Likewise, there seems to be no evidence that value strategies systematically underperform growth strategies in bad states of the world. Sweden had a positive GDP growth during the 1990s, which was the period were the value strategy performed worst. However, what seems to explain the poor performance during this period is the IT bubble created by investor overreaction. Further, the value strategy seems to outperform the growth strategy when GDP is decreasing, which could indicate potential upside risk.

All in all, the evidence does not support the view that the superior returns on value stocks reflect their higher fundamental risk. Nonetheless, there are many possible proxies for risk, so the risk-based explanation cannot be definitely written off, but it seems like the explanation for superior performance of value strategies over growth strategies should be found in the behavioral finance theory.

5.2 Behavioral finance explanation

It was documented previously that explanations based on risk measures are insufficient to explain the obtained value premium and therefore other explanations are necessary. In the
following the premium will be tried explained through the behavioral finance theory. The behavioral finance literature is as mentioned and explained in Chapter 2 based on two building blocks, namely limits to arbitrage and investor sentiments. One theory which can fully explain why investors do not act rationally has not yet been developed, but there are a number of closely related theories, which all point at the explanation of limited cognitive capacity of human beings. These theories are based on a large number of empirical studies, which all show that the majority of investors are underlying the different biases when investing in stocks.

5.2.1 Limits to arbitrage

The fact that it is proved that the value premium exists on the Swedish stock market when tested over two decades gives cause to wonder. It indicates that there are traders within the market who are not fully rational. If market participants were rational, the premium opportunity would be utilized. Proponents of the efficient market hypothesis claim that rational traders would undo any dislocation caused by irrational traders in the market, due to the fact that attractive investment opportunities are always apparent to the rational traders. This is of course obvious, but the question is why the premium is still present after so many years of existence. This is answered by behavioral finance supporters, who claim that a correction of a mispricing is both costly and risky and therefore might be unattractive. It is documented previously that the systematic risk is not higher for the value portfolio than for the growth portfolio. However, noise trader risk is still an issue. The fact that an arbitrageur will be faced with the danger that irrational, pessimistic investors get even more pessimistic decreasing the price even more is important. This might be one of the reasons behind the ongoing premium. Traders are simply too nervous to invest in past looser stocks, as these might continue to lose, but what is forgotten is that past winner stock might turn into losers as well.

The different risk factors discussed in Chapter 2 are all important when analyzing the reason for the premium as they might restrain investors from correcting the mispricing in the market and consequently force rational investors not to act completely rationally. Additional costs may also be part of the explanation of the limits to arbitrage on the Swedish stock market. All kinds of costs arise, costs associated with the information gathering and utilization of the opportunity and the actual holding of the stock. These costs are not taken into consideration in the calculations made in this thesis and might have an impact on the results. However, it is
unlikely that the results would change dramatically. Therefore limits to arbitrage seem to exist in the market and resulting in fluctuation of prices away from their fundamental value. Some stocks become overvalued and others undervalued as the market is incapable of correcting the prices correctly.

5.2.2 Investor sentiment

The other aspect of behavioral finance is investor sentiment, which is the theory of how real life investors actually form beliefs, valuations and their demands for assets. This aspect takes into account that all market participants do not act as expected in the traditional finance theory and do not always optimize completely efficiently. This can very well be the case of the Swedish market. Like the rest of the western world the Swedish market has been through a huge technology development. The amount of information received daily is enormous and it has become even more difficult to sort the valuable information from the noise. Therefore the limited cognitive capacity, which we all have to deal with, may prevent investors from acting rationally in some situations.

The representativeness heuristics might add to the explanation of why some stocks are overvalued. Contrarian investors are investors for whom it is well-known that value stocks outperform growth stocks. By definition, this group of investors is rather small compared to the naive group of investors. The naive investors overvalue the probability of a growth stock being identical to a growing stock, as they assume that it is the same. When naive investors think that a new growing stock is found, they often tend to get too optimistic and thereby extrapolate the past trend too far into the future. Further, an underreaction is often seen to bad news about growth stocks. When naive investors buy these growth stocks, which they assume are growing stocks, they create overvalued stocks compared to the fundamental value. The representativeness heuristics and extrapolation can also partly explain why value stocks often seem undervalued. Likewise naive investors get too pessimistic about the future performance of value stocks as they extrapolate the poor past performance too far into the future.

The extrapolation hypothesis can be tested in a simple manner. We can take a look at the overall growth before and after the portfolio formation date. Growth stocks are defined as stocks with former high growth in net profit and value stocks have former low growth in net profit. I have chosen to look at the net profit result, because investors tend to look at the
Chapter 5 – Explanation of the results

bottom line when a company reports the yearly results. The net profit growth shows, whether a company is generating more or less profit compared to the year before.

The average growth in net profit is calculated for the growth and value portfolio each year. Once again the calculations are only made for the P/E portfolios. Net profit growth two years before portfolio formation is the arithmetic average annual net profit growth two years before formation. Net profit growth two years after formation is defined analogously to ex-ante net profit growth.

The results of the extrapolation test are shown in Figure 5.4 below, which summarizes the evidence of the net profit growth for the two portfolios. The yearly net profit growth before and after formation for each portfolio is given in Appendix 5.

<table>
<thead>
<tr>
<th></th>
<th>One year before and one year after</th>
<th>Two years before and two years after</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>Value portfolio</td>
<td>-0.0774</td>
<td>0.0762</td>
</tr>
<tr>
<td>Growth portfolio</td>
<td>0.3869</td>
<td>-0.1044</td>
</tr>
</tbody>
</table>

The figure shows the average net profit growth before and after formation for both the value and growth portfolios. The net profit growth one year ahead of portfolio formation is slightly negative for the value portfolio, whereas net profit after formation is slightly positive. This indicates that the value portfolios turns the negative results into positive ones. The picture is the opposite for the growth portfolio. Net profit is very high prior to the formation date and turns negative one year after the formation date. This clearly indicates that it is not possible for the growth companies to keep up the good results.

The results for the growth portfolio at the two year window are a bit weaker. Once again the average net profit decreases dramatically, but not as significant as for the one year formation. The same conclusion can be made for the value portfolio, which also once again improves its average net profit, but the difference is once again less than for the one year window.
Chapter 5 – Explanation of the results

The strong net profit growth for the growth stocks prior to formation could have lured investors into buying these growth stocks, which may later lead to regret due to the disappointing return performance after formation. The picture is of course the opposite for the value stocks with low net profit prior to formation but high growth after the portfolio formation.

Like on the Danish (Risager, 2008) and the US markets (Lakonishok, Shleifer, & Vishny, 1994) the results show that Swedish growth stocks tend to perform better before than after portfolio formation. Therefore it can be argued that growth stocks tend to disappoint investors, as they cannot keep up the high growth rates over time. Investors have exaggerated hopes of growth stocks and end up being disappointed when future performance falls short of their expectations. By the same token, they are unduly pessimistic about value stocks and wind up being pleasantly surprised.

The results presented are consistent with the idea of extrapolation. Investors simply invest in growth stocks based on past performance and extrapolate this performance into the future. Likewise, investors are afraid of investing in value stocks, due to the poor performance prior to formation. This simply means that investors go for the “safe” investment, because it is easier to defend. Therefore investors prefer to invest in stocks that have done well compared to those that have done poorly in the past. Imagine an agent who makes a decision that turns out badly and engages in self-recrimination for not having done the right thing. Here the hindsight bias may set in. It will look obvious that this would happen when investing in a loser stock and the investor will properly feel like a fool and experience the pain of regret. On the other hand if the stock was a former winner stock, the investor would make light of it as pure bad luck.

Further prospect theory can help explaining why investors avoid investing in value stocks. As illustrated in Chapter 2, the value function is steeper for losses than for gains in prospect theory, which implies loss aversion. This basically means that losses hurt more than gains satisfy. Therefore investors are very careful when investing, so they are sure that they do not lose. Many value companies may look distressed due to the low level of the different sorting variables and this may discourage investors from investing in them, as these stocks offhand look more risky. But as illustrated previously this is not the case.

The availability heuristics can also give additional substance to the explanation of the value premium. In a study by Gadarowski (2002) the relationship between stock returns and the press
coverage of the stocks are investigated. He finds that stocks with high news counts predict lower subsequent returns over the next two years. The study indicates that investors overinvest in stocks with high levels of press coverage and therefore these stocks become overvalued. High levels of press coverage is closely related to the availability heuristics, because these highly discussed stocks are easier to remember compared to stocks with no or very little press coverage. Moreover, growth stocks that have performed well in the past are often present in investors’ minds as they appear glamorous and as these stocks have become popular due to their good performance, investors think of them as great investments. Therefore the availability heuristics can help explain the overvaluation of growth stocks.

Likewise, the anchoring heuristics can also help explaining the value premium and why some stocks are overpriced while other are underpriced. The usage of the anchoring heuristics can trigger an underestimation. In Chapter 2 an explanation of the anchoring heuristics is presented of how human beings might experience difficulties when assigning probabilities. An example could be when investors try to identify good investments. When assigning the probabilities for a rise in the stock price of a particular stock, many investors may feel tempted to use former rises as indicators for the future rise. This may not be the right approach. Therefore the usage of the anchoring heuristics may give rise to overconfidence, meaning that investors believe too much in their own estimates, because the agents simple believe that the estimates are very well calibrated. As mentioned in Chapter 2 behavioral research has found that overconfidence causes agents to overestimate their knowledge, underestimate the risk and overstate their skills to control occurrences. There are two main implications of investor overconfidence. Firstly agents make bad investments because of lack of realization, which might be one of the reasons why investors avoid value stocks. Secondly agents trade too frequently, which leads to excessive trading volume.

All the examples and explanations given previously give rise to one really important issue, namely framing. It is argued that press coverage, former performance, heuristics etc. all influence the investment decision. However, how we see a company often depends on how it is framed, as perception is affected by whether it is described from a positive or negative angle. Prospect theory accommodates the effects of framing and these effects can be extremely powerful, as there are numerous examples of shifts in preferences solely depending on the framing of the problems. This means that how a company is framed can completely determine how investors think of the future performance and consequently whether it is a good
investment. The fact that value stocks are determined and framed as stocks that have performed poorly in the past and are expected to continue to perform poorly, might intimidate investors. Value stocks are therefore often framed as more risky as investors have to bank that the performance turn around, which could take a long time.

Agents also tend to form the problems differently within their minds. This means that when information is received, agents form different decisions due to a dispersed experience and evaluation of the received input and will also experience the outcome differently from one another. Many investors tend to narrow the framing of decisions and narrow the framing of the outcomes, e.g. myopic behavior. As mentioned this will lead investors to evaluate gains and losses frequently and make short-sighted decisions. This might also be part of the explanation of why investors keep investing in growth stocks, even though it is proved that these stocks do not earn excess profit over time. The myopic investor may make suboptimal investment decisions, which is not efficient in the long run and might even be tempted to sort out the contrarian investment strategy, which is based on longer horizons.

5.3 Sub conclusion

The value premium on the Swedish stock market cannot be explained by the traditional systematic risk measure, beta. The value stocks had on average a lower beta compared to the growth stocks, which totally contradict the traditional finance theory. If the results should have been in line with the theory, the additional returns earned from the value investments should be offset by additional risk. However, I found the opposite. Further the strategy does not perform worse in bad states of the economy, which otherwise could have indicates that the value stocks had increased downside risk. The bad performance of the contrarian investment strategies during the late 1990s can be explained by the IT bubble, which racked the western world.

Therefore a more convincing explanations of the value premium rests on the characteristics of investor behavior. Several studies have provided evidence in support of extrapolative biases in investor behavior. When performing a simple extrapolation test on the Swedish stock market, I found that the net profit growth ahead of portfolio formation is slightly negative for the value portfolio, whereas net profit after formation is slightly positive. This indicates that the value portfolios turn the negative results into positive ones. The picture is the opposite for the
growth portfolio. Therefore there seems to be a clear tendency towards extrapolation in the Swedish stock market.

In conclusion it may be said that the above exposition indicates that investors form expectations for the future based on the past, as they make decisions on heuristic principles without considering the mistakes and errors, which this might induce. When investors finally realize that they have been too optimistic when it comes to the future growth, they get disappointed in the growth stocks. Conversely the value stocks often surprise positively.

The question is why investors do not learn from their mistakes. The answer to this should probably be that because cognitive errors are systematic and hard to eliminate through experience, they do not even want to. Further it is very difficult to realize that what is happening is investor errors and not just bad luck.
Chapter 6 Conclusion

In 1977 Basu was one of the first to publish research in this field. He proved that the average annual returns increase as one moves from high P/E stocks to low P/E stocks. Many researchers have since documented the existence of the value premium on different stock markets world wide at different points in time. Thus, there is almost universal agreement on the existence of the value premium on stock returns, but the issue of the underlying causes for the value premium is far more contentious.

The purpose of this thesis has been to investigate the existence of a value premium on the Swedish stock market as no recent research has been presented of this market. Another objective was to study whether the cause of the premium is due to increased risk or due to the fact that the strategy is contrary to naive strategies, as a result of the existence of irrational investors.

The underlying assumption of investor rationality of the standard finance theory can indeed be questioned when investigated with the behavioral finance theories. The fact that all agents should be capable of making the right choices at all times based on the correct set of data is questionable. Behavioral finance proponents argue that the limited computational resources available and the limited intellectual capacities of market participants make it difficult to believe that the right relevant information is found and used at all times. To compensate investors often use heuristics. This use may lead to cognitive errors since relevant information may be neglected and investors may therefore underreact or overreact to information. Finally the framing of the problem is important for how investors interpret the investment opportunity as investors are risk averse in the domain of gains and risk seeking in the domain of losses, which violates with the assumption of individual rationality.

The contrarian investment strategy is based on the fact that a mispricing across stock categories takes place. A contrarian investor attempts to utilize the situation to make an abnormal profit by investing differently from the conventional manner by exploiting the fact that some stocks become mispriced by the market. The strategy, which is based on long positions in value assets and short positions in growth assets, has proven to yield a superior return on markets world wide.
In the analysis of whether a value premium also exists on the Swedish market a randomness test is performed to see if the market characteristics are suitable for the contrarian investment strategy. One fundamental factor that has to be fulfilled for the strategy to work is that the market is mean reverting. This means that when a stock is categorized as a value stock, this undervaluation is only temporary, and an abnormal profit may be earned over time. The test results clearly rejected the null hypothesis of a random walk. When looking at the return pattern and the results obtained from the Ljung-Box test based on daily observations, indications of momentum effect and mean reversion were found. However, when the same test is performed on yearly data the conclusion becomes muddy. These last results show a tendency towards random walk due to very low statistics, but these results might be biased by the small sample size.

In the study on the Swedish stock market of whether a value premium is present, I have collected accounting and return data for the companies included in the OMXS30 index from July 1987 to July 2008. The data set has been used to test four different value strategies based on P/E, P/B, P/C and ASSETG for one-, two- and three-year holding periods. When the relevant portfolio formations were made, the test results clearly showed successful outcomes. For the one-year value-weighted strategy the premium ranged from -1.082% to 7.233%. When the stocks within the portfolios were equally-weighted, the premiums became even stronger and more significant. One reason for the increased premium could be that the results were small-cap biased when equally-weighted. However, it should be remembered that the portfolios are constructed from the largest and most liquid stocks in the Swedish stock market. The same pattern was found when the holding periods were extended to two and three years. Namely, that a value premium was found when value-weighted, but it was even more significant when equally-weighted. The highest premium found in all tests was 19.663% when sorting by P/E and equally-weighted and held for three years, while the lowest premium was found when the data was sorted by ASSETG, value-weighted and held for three years as well, namely -3.131%. All in all the P/E sorting variable was the strongest variable throughout the tests performed, with stable premiums in all tests. On the contrary ASSETG could not fulfill the expectations created with the article by Cooper et al. (2007).

Even though many of the results where statistically insignificant, the test can still be characterized as successful. I found that the low significance level of the results found on the Swedish market can be interpreted as that the return differences are real, but not enough to be
significant in a sample with so few observations due to the similarities found between the returns presented in the tests performed and other studies. Therefore, all in all the contrarian investment strategies tested on the Swedish market clearly showed a successful result. Even though the statistically significant level within the results was rather low, the results still gave an indication of a present value premium in the market over the sample period July 1987 to July 2008. The returns increased with the extension of the holding period, which clearly support the fundamental idea of the strategy being superior in the long term.

The fact that the contrarian strategy can be successfully implemented on the Swedish stock market gave cause to wonder. Therefore further analysis and discussion of the reasons for the present value premium on the Swedish stock market were made.

In the analysis of whether value strategies are fundamentally riskier than growth strategies, I have tested whether the traditional systematic risk measure beta, known from the CAPM theory, is on average higher for value portfolios than for growth portfolios. Thus, it turned out that the value stocks had on average a lower beta compared to the growth stocks, which totally contradict the traditional finance theory. Further the strategy does not perform worse in bad states of the economy, which otherwise would have indicated that the value stocks had increased downside risk. The classic correlation between risk and return implies that if value portfolios are riskier than growth portfolios, these will outperform in good states of the economy and underperform in bad states. However, the bad performance of the contrarian investment strategies during the late 1990s cannot be explained by the poor performance of the Swedish economy in general but rather by the IT bubble. This indicates that the factors describing the investment opportunities in Sweden are likely to be determined by both local and international economic forces. The GDP growth in Sweden during the late 1990s was stable and positive. In general the value premium has been positive in both good and bad states of the economy.

In an analysis of whether value strategies yield a higher return, because they are contrary to naive strategies as a result of the existence of irrational investors, I have accounted for different behavioral finance theories and tested the extrapolation hypothesis.

I have found that the behavioral finance explanation of the value premium is that investors like all other human beings have limited cognitive capacity, which is why they use different heuristic principles when making investment decisions. As a consequence the decision-making
Chapter 6 - Conclusion

process becomes irrational, if the investors are not aware of the consequences and errors which the usages of heuristics induce. I have found that incorrect usage of heuristics can encourage investors to extrapolate past performance too far into the future. Therefore investors tend to overvalue growth stocks and undervalue value stocks. When performing a simple extrapolation test on the Swedish stock market, I found that the net profit growth ahead of portfolio formation is slightly negative for the value portfolio, whereas net profit after formation is slightly positive. The picture is the opposite for the growth portfolio. Therefore there seems to be a clear tendency towards extrapolation in the Swedish stock market. Further I have argued that the framing of an investment opportunity is very important as investors are risk averse in the domain of gains and risk seeking in the domain of losses. Therefore the decision-making process will depend on how the investment opportunity is framed and perceived by the investors.

All things considered I can conclude that a constant value premium does exist on the Swedish stock market in the period July 1987 to July 2008. This indicates that former test results from other markets and periods were not sample specific. The value strategies have performed so well on the Swedish market, because market participants have consistently overestimated future growth rates for growth stocks compared to value stocks. It cannot be concluded that value stocks are riskier than growth stocks and therefore the value premium is not a risk premium. However, there are many possible proxies for risk, so the risk-based explanation cannot be definitely written off. Thus, I believe that the test and analysis made in this thesis support the behavioral finance explanation. I believe that the value premium exists due to undervaluation of value stocks compared to their risk-return profiles.


Bibliography


Bibliography


Other sources

Thomson Datastream

www.behavioralfinance.net

www.borsen.dk

www.datastream.com

www.omxnordicexchange.com

www.ordbogen.com

www.sbc.se

www.wikipedia.org
Overview of Appendices

APPENDIX 1 ...................................................................................................................... I
Lakonishok et al. (1994) Average returns based on two variables I

APPENDIX 2 ...................................................................................................................... II
OMXS30 index composition September 1986 – July 2008 II

APPENDIX 3 ...................................................................................................................... V
Explanation of the variables from Datastream V

APPENDIX 4 ...................................................................................................................... VIII
Beta values for each formation year VIII

APPENDIX 5 ...................................................................................................................... X
Net profit growth before and after formation for each formation year X

APPENDIX 6 ...................................................................................................................... XII
CD, where an Excel workbook is found with all calculations XII
### Appendix 1

#### Lakonishok et al. (1994) Average returns based on two variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value stocks</th>
<th>Glamour stocks</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/P and GS</td>
<td>22.1%</td>
<td>11.4%</td>
<td>10.7%</td>
</tr>
<tr>
<td>E/P and GS</td>
<td>22.1%</td>
<td>10.9%</td>
<td>11.2%</td>
</tr>
<tr>
<td>B/M and GS</td>
<td>21.2%</td>
<td>13.0%</td>
<td>8.2%</td>
</tr>
<tr>
<td>E/P and B/M</td>
<td>19.9%</td>
<td>10.0%</td>
<td>9.9%</td>
</tr>
<tr>
<td>C/P and B/M</td>
<td>20.3%</td>
<td>10.3%</td>
<td>10.0%</td>
</tr>
</tbody>
</table>

Source: Based on Lakonishok et al. (1994)
## Appendix 2

### OMXS30 index composition September 1986 – July 2008

**THE ORIGINAL OMXS30 - INDEX COMPOSITION AS OF 30-SEPT-1986**

<table>
<thead>
<tr>
<th>DATE</th>
<th>REMOVED</th>
<th>ADDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-okt-87</td>
<td>AGA A</td>
<td>ASEA B fr</td>
</tr>
<tr>
<td>04-jan-88</td>
<td>ASEA B fr</td>
<td>SCA B fr</td>
</tr>
<tr>
<td>01-apr-88</td>
<td>ALFA B fr</td>
<td>ASEA B fr</td>
</tr>
<tr>
<td>10-mar-88</td>
<td>MATCH B fr</td>
<td>SCA B</td>
</tr>
<tr>
<td>02-jan-87</td>
<td>ASEA B fr</td>
<td>CARNEGIE B</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>SAAB B fr</td>
<td>CARNEGIE B</td>
</tr>
<tr>
<td>02-jan-88</td>
<td>ASEA B fr</td>
<td>CARNEGIE B ASTRIdet</td>
</tr>
<tr>
<td>01-apr-87</td>
<td>CARNEGIE B</td>
<td>MUKSJÖ B</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>CARNEGIE B</td>
<td>MUKSJÖ B</td>
</tr>
<tr>
<td>08-apr-87</td>
<td>BEJER</td>
<td>SKAND-INDUSTRI A fr</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>ASEA B fr</td>
<td>AGA A</td>
</tr>
<tr>
<td>02-jan-89</td>
<td>ASEA B fr</td>
<td>STORA fr</td>
</tr>
</tbody>
</table>

## Appendix 2

### OMXS30 index composition September 1986 – July 2008

**THE ORIGINAL OMXS30 - INDEX COMPOSITION AS OF 30-SEPT-1986**

<table>
<thead>
<tr>
<th>DATE</th>
<th>REMOVED</th>
<th>ADDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-okt-87</td>
<td>AGA A</td>
<td>ASEA B fr</td>
</tr>
<tr>
<td>04-jan-88</td>
<td>ASEA B fr</td>
<td>SCA B fr</td>
</tr>
<tr>
<td>01-apr-88</td>
<td>ALFA B fr</td>
<td>ASEA B fr</td>
</tr>
<tr>
<td>10-mar-88</td>
<td>MATCH B fr</td>
<td>SCA B</td>
</tr>
<tr>
<td>02-jan-87</td>
<td>ASEA B fr</td>
<td>CARNEGIE B</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>SAAB B fr</td>
<td>CARNEGIE B</td>
</tr>
<tr>
<td>02-jan-88</td>
<td>ASEA B fr</td>
<td>CARNEGIE B ASTRIdet</td>
</tr>
<tr>
<td>01-apr-87</td>
<td>CARNEGIE B</td>
<td>MUKSJÖ B</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>CARNEGIE B</td>
<td>MUKSJÖ B</td>
</tr>
<tr>
<td>08-apr-87</td>
<td>BEJER</td>
<td>SKAND-INDUSTRI A fr</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>ASEA B fr</td>
<td>AGA A</td>
</tr>
<tr>
<td>02-jan-89</td>
<td>ASEA B fr</td>
<td>STORA fr</td>
</tr>
</tbody>
</table>

## Appendix 2

### OMXS30 index composition September 1986 – July 2008

**THE ORIGINAL OMXS30 - INDEX COMPOSITION AS OF 30-SEPT-1986**

<table>
<thead>
<tr>
<th>DATE</th>
<th>REMOVED</th>
<th>ADDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-okt-87</td>
<td>AGA A</td>
<td>ASEA B fr</td>
</tr>
<tr>
<td>04-jan-88</td>
<td>ASEA B fr</td>
<td>SCA B fr</td>
</tr>
<tr>
<td>01-apr-88</td>
<td>ALFA B fr</td>
<td>ASEA B fr</td>
</tr>
<tr>
<td>10-mar-88</td>
<td>MATCH B fr</td>
<td>SCA B</td>
</tr>
<tr>
<td>02-jan-87</td>
<td>ASEA B fr</td>
<td>CARNEGIE B</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>SAAB B fr</td>
<td>CARNEGIE B</td>
</tr>
<tr>
<td>02-jan-88</td>
<td>ASEA B fr</td>
<td>CARNEGIE B ASTRIdet</td>
</tr>
<tr>
<td>01-apr-87</td>
<td>CARNEGIE B</td>
<td>MUKSJÖ B</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>CARNEGIE B</td>
<td>MUKSJÖ B</td>
</tr>
<tr>
<td>08-apr-87</td>
<td>BEJER</td>
<td>SKAND-INDUSTRI A fr</td>
</tr>
<tr>
<td>01-jul-87</td>
<td>ASEA B fr</td>
<td>AGA A</td>
</tr>
<tr>
<td>02-jan-89</td>
<td>ASEA B fr</td>
<td>STORA fr</td>
</tr>
<tr>
<td>DATE</td>
<td>REMOVED</td>
<td>ADDED</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>03-apr-89</td>
<td>Astra B fr</td>
<td>AGA A</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Asea B fr</td>
</tr>
<tr>
<td></td>
<td>Alfa B fr</td>
<td>Asea B fr</td>
</tr>
<tr>
<td></td>
<td>STORA B fr</td>
<td>Daler B fr</td>
</tr>
<tr>
<td></td>
<td>Gbg</td>
<td>Skåne-gr B</td>
</tr>
<tr>
<td></td>
<td>Marieberg A</td>
<td>Sydkraft A</td>
</tr>
<tr>
<td></td>
<td>Sandvik A</td>
<td>Investor A</td>
</tr>
<tr>
<td></td>
<td>Sydkraft C</td>
<td></td>
</tr>
<tr>
<td>03-jul-93</td>
<td>Asea B fr</td>
<td>AGA A</td>
</tr>
<tr>
<td></td>
<td>Bilsped B</td>
<td>Asea B fr</td>
</tr>
<tr>
<td></td>
<td>Trelleborg B fr</td>
<td>Asea B fr</td>
</tr>
<tr>
<td></td>
<td>Skåne-gr B</td>
<td>Daler B fr</td>
</tr>
<tr>
<td></td>
<td>Bgb</td>
<td>Skanda-gr B</td>
</tr>
<tr>
<td></td>
<td>sydkraft A</td>
<td>Investor A</td>
</tr>
<tr>
<td></td>
<td>Sydkraft C</td>
<td></td>
</tr>
<tr>
<td>02-jul-93</td>
<td>Astra A fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Avesta</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Nobell</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Sandvik B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Sydkraft C</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Sydkraft C</td>
<td>Astra B fr</td>
</tr>
<tr>
<td>02-jun-95</td>
<td>Astra B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Astra B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td>21-may-96</td>
<td>Nordbank</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td>18-jun-97</td>
<td>Nordbank</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td>01-jul-98</td>
<td>Nordbank</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td></td>
<td>Pharmacia B fr</td>
<td>Astra B fr</td>
</tr>
<tr>
<td>DATE</td>
<td>REMOVED</td>
<td>ADDED</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>02-jan-97</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>12-maj-97</td>
<td>AUTOLIV</td>
<td></td>
</tr>
<tr>
<td>01-jul-97</td>
<td>INVESTOR A</td>
<td>NOKIA-SDB</td>
</tr>
<tr>
<td></td>
<td>SCANIA B</td>
<td></td>
</tr>
<tr>
<td>02-jan-98</td>
<td>STORA B</td>
<td>AUTOLIV</td>
</tr>
<tr>
<td>01-jul-98</td>
<td>AVESTA</td>
<td>NBH</td>
</tr>
<tr>
<td>04-jan-99</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>07-apr-99</td>
<td>ASTR-A</td>
<td>AZN</td>
</tr>
<tr>
<td></td>
<td>ASTR-B</td>
<td></td>
</tr>
<tr>
<td>16-jun-99</td>
<td>ABB-A</td>
<td>ABB-TDBA</td>
</tr>
<tr>
<td></td>
<td>ABB-B</td>
<td>ABB-TDBB</td>
</tr>
<tr>
<td>23-jun-99</td>
<td>ABB-TDBA</td>
<td>ABB</td>
</tr>
<tr>
<td></td>
<td>ABB-TDBB</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-jul-99</td>
<td>NETCOM</td>
<td></td>
</tr>
<tr>
<td>18-okt-99</td>
<td>AGA-B</td>
<td></td>
</tr>
<tr>
<td>03-jan-00</td>
<td>STE-A</td>
<td>SECU-B</td>
</tr>
<tr>
<td></td>
<td>SCV-B</td>
<td>WM-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICON-B</td>
</tr>
<tr>
<td>03-apr-00</td>
<td>PHU-SDB</td>
<td></td>
</tr>
<tr>
<td>04-apr-00</td>
<td>PHA</td>
<td></td>
</tr>
<tr>
<td>11-maj-00</td>
<td>SAND-A</td>
<td>SAND</td>
</tr>
<tr>
<td>14-jun-00</td>
<td>TILIA</td>
<td></td>
</tr>
<tr>
<td>03-jul-00</td>
<td>FTID</td>
<td></td>
</tr>
<tr>
<td>02-jan-01</td>
<td>KINV-B</td>
<td>ASSA-B</td>
</tr>
<tr>
<td></td>
<td>TREL-B</td>
<td></td>
</tr>
<tr>
<td>02-jul-01</td>
<td>FTID</td>
<td>ENRO</td>
</tr>
<tr>
<td></td>
<td>ICON</td>
<td>EURO</td>
</tr>
<tr>
<td>02-jan-02</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>01-jul-02</td>
<td>NO CHANGE</td>
<td></td>
</tr>
<tr>
<td>02-jan-03</td>
<td>PHA</td>
<td>ALFA</td>
</tr>
<tr>
<td></td>
<td>WM-B</td>
<td>SWMA</td>
</tr>
</tbody>
</table>
Appendix 3

Explanation of the variables from Datastream

Return index – datatype (RI)

A return index (RI) is available for individual equities and unit trusts. This shows a theoretical growth in value of a share holding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. For unit trusts, the closing bid price is used.

For all countries except the USA and Canada detailed dividend payment data is only available on Datastream from 1988 onwards. Up to this time the RI is constructed using an annualised dividend yield, as follows:

\[ R_t = R_{t-1} \times \frac{P_t}{P_{t-1}} \times \left(1 + \frac{DY_t}{100} \times \frac{1}{N}\right) \]

Where:
- \( R_t \) = return index on day \( t \)
- \( R_{t-1} \) = return index on previous day
- \( P_t \) = price index on day \( t \)
- \( P_{t-1} \) = price index on previous day
- \( DY_t \) = dividend yield % on day \( t \)
- \( N \) = number of working days in the year (taken to be 260)

From 1988 onwards (and from 1973 for US and Canadian stocks), the availability of detailed dividend payment data enables a more realistic method to be used in which the discrete quantity of dividend paid is added to the price on the ex-date of the payment. Then:

\[ R_t = R_{t-1} \times \frac{P_t + D_t}{P_{t-1}} \]

except when \( t = ex\)-date of the dividend payment \( D_t \), then:

\[ R_t = R_{t-1} \times \frac{P_t + D_t}{P_{t-1}} \]

Where:
- \( P_t \) = price on ex-date
- \( P_{t-1} \) = price on previous day
- \( D_t \) = dividend payment associated with ex-date \( t \)

Gross dividends are used where available and the calculation ignores tax and re-investment charges. Adjusted closing prices are used throughout to determine price index and hence return index.
Price to book value – datatype (PTBV)
This is the share price divided by the book value per share.

Price/cash earnings ratio – datatype (PC)
This is the share price divided by the cash earnings per share for the appropriate financial period.
Cash earnings are defined as “Funds from operations”.

Price/earnings ratio (PER) – datatype (PE)
This is the price divided by the earnings rate per share at the required date. For full details of the price and earnings figures used in any particular case, see the Price and Earnings per share topics.

Total Assets – datatype (DWTA)
The Datastream Worldscope (DW) datatypes are a set of Datastream Global Equity index and security valuation datatypes using Worldscope data. The data is based on a trailing twelve month period if applicable and represents the sum of the relevant item reported in the last twelve months. From the fiscal period 2002, the items are populated from the quarterly, semi-annual and trimester time series based on the availability of the underlying data. When trailing twelve month data is unavailable or for values before fiscal period 2002, the annual Worldscope datatype is used as indicated below.

All Industries:
Total Assets represent the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.

Banks:
Total Assets represent the sum of cash & due from banks, total investments, net loans, customer liability on acceptances (if included in total assets), investment in unconsolidated subsidiaries, real estate assets, net property, plant and equipment and other assets.

Insurance Companies:
Total Assets represent the sum of cash, total investments, premium balance receivables, investments in unconsolidated subsidiaries, net property, plant and equipment and other assets.

Other Financial Companies:
Total Assets represent the sum of cash & equivalents, receivables, securities inventory, custody securities, total investments, net loans, net property, plant and equipment, investments in unconsolidated subsidiaries and other assets.
**Market value / market capitalisation – datatype (MV)**

Market value on Datastream is the share price multiplied by the number of ordinary shares in issue. The amount in issue is updated whenever new tranches of stock are issued or after a capital change.

- For companies with more than one class of equity capital, the market value is expressed according to the individual issue.
- Market value is displayed in millions of units of local currency.

**Net Profit (Income) – datatype (DWNP)**

The Datastream Worldscope (DW) datatypes are a set of Datastream Global Equity index and security valuation datatypes using Worldscope data. The data is based on a trailing twelve month period if applicable and represents the sum of the relevant item reported in the last twelve months. From the fiscal period 2002, the items are populated from the quarterly, semi-annual and trimester time series based on the availability of the underlying data. When trailing twelve month data is unavailable or for values before fiscal period 2002, the annual Worldscope datatype is used as indicated below.

Net Income – bottom line represents income after all operating and non-operating income and expense, reserves, income taxes, minority interest and extraordinary items.
### Appendix 4

**Beta values for each formation year**

<table>
<thead>
<tr>
<th>Year</th>
<th>One-year Value</th>
<th>One-year Growth</th>
<th>Two-year Value</th>
<th>Two-year Diff. (V-G)</th>
<th>Three-year Value</th>
<th>Three-year Growth</th>
<th>Three-year Diff. (V-G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>1.1844</td>
<td>1.0263</td>
<td>0.1581</td>
<td>1.1705</td>
<td>0.1027</td>
<td>0.1678</td>
<td>1.1081</td>
</tr>
<tr>
<td>1988</td>
<td>0.9430</td>
<td>1.2492</td>
<td>-0.3062</td>
<td>0.8971</td>
<td>1.1062</td>
<td>-0.2090</td>
<td>1.0690</td>
</tr>
<tr>
<td>1989</td>
<td>1.0080</td>
<td>0.7602</td>
<td>0.2478</td>
<td>1.1479</td>
<td>0.8661</td>
<td>0.2818</td>
<td>1.1348</td>
</tr>
<tr>
<td>1990</td>
<td>1.2430</td>
<td>1.0124</td>
<td>0.2307</td>
<td>1.1528</td>
<td>1.1099</td>
<td>0.0426</td>
<td>0.9225</td>
</tr>
<tr>
<td>1991</td>
<td>0.9122</td>
<td>1.7051</td>
<td>-0.7929</td>
<td>0.9429</td>
<td>0.9765</td>
<td>-0.0336</td>
<td>0.9484</td>
</tr>
<tr>
<td>1992</td>
<td>0.8317</td>
<td>0.8163</td>
<td>0.0153</td>
<td>0.7377</td>
<td>0.8327</td>
<td>-0.0949</td>
<td>0.7125</td>
</tr>
<tr>
<td>1993</td>
<td>1.0875</td>
<td>0.8328</td>
<td>0.2546</td>
<td>1.0484</td>
<td>0.8890</td>
<td>0.1594</td>
<td>0.9786</td>
</tr>
<tr>
<td>1994</td>
<td>1.1735</td>
<td>1.0200</td>
<td>0.1534</td>
<td>0.9623</td>
<td>1.1596</td>
<td>-0.1972</td>
<td>0.8946</td>
</tr>
<tr>
<td>1995</td>
<td>0.9527</td>
<td>1.4271</td>
<td>-0.4744</td>
<td>0.8231</td>
<td>1.3943</td>
<td>-0.5712</td>
<td>0.9067</td>
</tr>
<tr>
<td>1996</td>
<td>0.7504</td>
<td>1.3425</td>
<td>-0.5921</td>
<td>0.8958</td>
<td>1.3596</td>
<td>-0.4638</td>
<td>0.9675</td>
</tr>
<tr>
<td>1997</td>
<td>1.0832</td>
<td>1.2638</td>
<td>-0.1806</td>
<td>1.1076</td>
<td>1.1458</td>
<td>-0.0382</td>
<td>0.6911</td>
</tr>
<tr>
<td>1998</td>
<td>1.1813</td>
<td>1.1259</td>
<td>0.0554</td>
<td>0.6656</td>
<td>1.1066</td>
<td>-0.4410</td>
<td>0.5662</td>
</tr>
<tr>
<td>1999</td>
<td>-0.0415</td>
<td>0.3453</td>
<td>-0.3867</td>
<td>0.2332</td>
<td>0.5366</td>
<td>-0.3033</td>
<td>0.3165</td>
</tr>
<tr>
<td>2000</td>
<td>0.7259</td>
<td>0.9802</td>
<td>-0.2543</td>
<td>0.8245</td>
<td>1.1660</td>
<td>-0.3415</td>
<td>1.1102</td>
</tr>
<tr>
<td>2001</td>
<td>0.9677</td>
<td>1.1799</td>
<td>-0.2122</td>
<td>1.3049</td>
<td>1.5023</td>
<td>-0.1974</td>
<td>1.3238</td>
</tr>
<tr>
<td>2002</td>
<td>0.8751</td>
<td>1.4321</td>
<td>-0.5570</td>
<td>0.8026</td>
<td>1.4364</td>
<td>-0.6338</td>
<td>0.8040</td>
</tr>
<tr>
<td>2003</td>
<td>0.6520</td>
<td>0.6406</td>
<td>0.0113</td>
<td>0.7265</td>
<td>0.3022</td>
<td>0.4243</td>
<td>0.7915</td>
</tr>
<tr>
<td>2004</td>
<td>0.8051</td>
<td>-0.1873</td>
<td>0.9923</td>
<td>0.8603</td>
<td>0.3977</td>
<td>0.4625</td>
<td>0.9262</td>
</tr>
<tr>
<td>2005</td>
<td>0.8567</td>
<td>0.5868</td>
<td>0.2699</td>
<td>0.8703</td>
<td>0.5786</td>
<td>0.2916</td>
<td>0.8976</td>
</tr>
<tr>
<td>2006</td>
<td>0.6034</td>
<td>0.8936</td>
<td>-0.2902</td>
<td>0.7171</td>
<td>0.8950</td>
<td>-0.1779</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>1.0951</td>
<td>0.8962</td>
<td>0.1989</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mean** | 0.8898 | 0.9726 | -0.0829 | 0.8945 | 0.9882 | -0.0936 | 0.8984 | 1.0145 | -0.1161
# Beta - Equally-weighted

<table>
<thead>
<tr>
<th>Year</th>
<th>One-year</th>
<th>Two-year</th>
<th>Three-year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Growth</td>
<td>Diff. (V-G)</td>
</tr>
<tr>
<td>1987</td>
<td>1.1648</td>
<td>0.9918</td>
<td>0.1730</td>
</tr>
<tr>
<td>1988</td>
<td>0.9428</td>
<td>1.2700</td>
<td>-0.3272</td>
</tr>
<tr>
<td>1989</td>
<td>1.0135</td>
<td>0.7227</td>
<td>0.2908</td>
</tr>
<tr>
<td>1990</td>
<td>1.1906</td>
<td>0.9629</td>
<td>0.2276</td>
</tr>
<tr>
<td>1991</td>
<td>0.8729</td>
<td>0.7690</td>
<td>0.1039</td>
</tr>
<tr>
<td>1992</td>
<td>0.9214</td>
<td>0.8162</td>
<td>0.1052</td>
</tr>
<tr>
<td>1993</td>
<td>1.1149</td>
<td>0.8032</td>
<td>0.3117</td>
</tr>
<tr>
<td>1994</td>
<td>1.1035</td>
<td>1.0626</td>
<td>0.0409</td>
</tr>
<tr>
<td>1995</td>
<td>0.9736</td>
<td>1.1341</td>
<td>-0.1605</td>
</tr>
<tr>
<td>1996</td>
<td>0.7275</td>
<td>1.0303</td>
<td>-0.3029</td>
</tr>
<tr>
<td>1997</td>
<td>1.1875</td>
<td>1.0572</td>
<td>0.1303</td>
</tr>
<tr>
<td>1998</td>
<td>1.0165</td>
<td>0.8636</td>
<td>0.1530</td>
</tr>
<tr>
<td>1999</td>
<td>-0.0072</td>
<td>0.5279</td>
<td>-0.5351</td>
</tr>
<tr>
<td>2000</td>
<td>0.6482</td>
<td>0.8202</td>
<td>-0.1720</td>
</tr>
<tr>
<td>2001</td>
<td>0.7588</td>
<td>0.9406</td>
<td>-0.1818</td>
</tr>
<tr>
<td>2002</td>
<td>0.8588</td>
<td>1.2606</td>
<td>-0.4018</td>
</tr>
<tr>
<td>2003</td>
<td>0.8888</td>
<td>0.8621</td>
<td>0.0267</td>
</tr>
<tr>
<td>2004</td>
<td>0.7273</td>
<td>0.7634</td>
<td>-0.0361</td>
</tr>
<tr>
<td>2005</td>
<td>0.8599</td>
<td>0.7031</td>
<td>0.1568</td>
</tr>
<tr>
<td>2006</td>
<td>0.9151</td>
<td>0.9037</td>
<td>0.0114</td>
</tr>
<tr>
<td>2007</td>
<td>0.8108</td>
<td>0.8018</td>
<td>0.0090</td>
</tr>
</tbody>
</table>

**Mean**  | 0.8940 | 0.9133 | -0.0193 | 0.8826 | 0.9265 | -0.0439 | 0.8670 | 0.9174 | -0.0504 |
### Appendix 5

**Net profit growth before and after formation for each formation year**

Average net profit growth before and after formation

<table>
<thead>
<tr>
<th></th>
<th>One-year</th>
<th></th>
<th>One-year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value Before</td>
<td>Growth Before</td>
<td>Value After</td>
</tr>
<tr>
<td>1988</td>
<td>-0.0838</td>
<td>0.1971</td>
<td>0.1251</td>
</tr>
<tr>
<td>1989</td>
<td>-0.1554</td>
<td>0.0947</td>
<td>0.2696</td>
</tr>
<tr>
<td>1990</td>
<td>0.1754</td>
<td>0.0980</td>
<td>0.2892</td>
</tr>
<tr>
<td>1991</td>
<td>0.2076</td>
<td>0.2247</td>
<td>1.4036</td>
</tr>
<tr>
<td>1992</td>
<td>-0.0760</td>
<td>-0.1683</td>
<td>0.0536</td>
</tr>
<tr>
<td>1993</td>
<td>-6.3077</td>
<td>-1.6000</td>
<td>1.3712</td>
</tr>
<tr>
<td>1994</td>
<td>3.1400</td>
<td>0.3137</td>
<td>-0.2384</td>
</tr>
<tr>
<td>1995</td>
<td>0.8473</td>
<td>0.0093</td>
<td>0.2243</td>
</tr>
<tr>
<td>1996</td>
<td>0.0253</td>
<td>7.5168</td>
<td>-0.1026</td>
</tr>
<tr>
<td>1997</td>
<td>0.2321</td>
<td>0.1954</td>
<td>-0.7166</td>
</tr>
<tr>
<td>1998</td>
<td>-0.1095</td>
<td>0.1817</td>
<td>0.1648</td>
</tr>
<tr>
<td>1999</td>
<td>-0.0732</td>
<td>-1.7837</td>
<td>0.3693</td>
</tr>
<tr>
<td>2000</td>
<td>0.2894</td>
<td>-0.0397</td>
<td>-0.1976</td>
</tr>
<tr>
<td>2001</td>
<td>0.4129</td>
<td>0.1281</td>
<td>-0.5582</td>
</tr>
<tr>
<td>2002</td>
<td>-0.1387</td>
<td>-0.4857</td>
<td>-0.2933</td>
</tr>
<tr>
<td>2003</td>
<td>0.0660</td>
<td>-0.3601</td>
<td>-0.2566</td>
</tr>
<tr>
<td>2004</td>
<td>0.0567</td>
<td>0.7013</td>
<td>0.1451</td>
</tr>
<tr>
<td>2005</td>
<td>-0.5738</td>
<td>0.7264</td>
<td>-0.8439</td>
</tr>
<tr>
<td>2006</td>
<td>0.1941</td>
<td>0.2621</td>
<td>0.3471</td>
</tr>
<tr>
<td>2007</td>
<td>0.3233</td>
<td>0.0854</td>
<td>-0.0325</td>
</tr>
</tbody>
</table>

**Mean**

-0.0774  0.3869  0.0762  -0.1044
## Average net profit growth before and after formation

<table>
<thead>
<tr>
<th>Year</th>
<th>Value Before</th>
<th>Growth Before</th>
<th>Value After</th>
<th>Growth After</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>-0.1384</td>
<td>0.1191</td>
<td>0.0493</td>
<td>-0.0890</td>
</tr>
<tr>
<td>1990</td>
<td>0.1429</td>
<td>0.0215</td>
<td>0.6092</td>
<td>-0.3375</td>
</tr>
<tr>
<td>1991</td>
<td>0.2080</td>
<td>0.2061</td>
<td>0.8320</td>
<td>-0.1380</td>
</tr>
<tr>
<td>1992</td>
<td>0.0447</td>
<td>-0.0646</td>
<td>-0.4532</td>
<td>0.8360</td>
</tr>
<tr>
<td>1993</td>
<td>-3.5486</td>
<td>0.1529</td>
<td>3.9109</td>
<td>-0.0495</td>
</tr>
<tr>
<td>1994</td>
<td>1.8231</td>
<td>-3.2885</td>
<td>-0.0052</td>
<td>3.7372</td>
</tr>
<tr>
<td>1995</td>
<td>2.2544</td>
<td>0.0162</td>
<td>0.1539</td>
<td>0.1125</td>
</tr>
<tr>
<td>1996</td>
<td>0.1205</td>
<td>4.0789</td>
<td>-0.3663</td>
<td>0.0624</td>
</tr>
<tr>
<td>1997</td>
<td>0.1282</td>
<td>3.4824</td>
<td>-0.1519</td>
<td>-0.2886</td>
</tr>
<tr>
<td>1998</td>
<td>0.1103</td>
<td>0.1572</td>
<td>0.2472</td>
<td>0.0275</td>
</tr>
<tr>
<td>1999</td>
<td>-0.0772</td>
<td>-0.7330</td>
<td>0.0588</td>
<td>0.6441</td>
</tr>
<tr>
<td>2000</td>
<td>-0.4768</td>
<td>-0.1929</td>
<td>-0.4578</td>
<td>3.8246</td>
</tr>
<tr>
<td>2001</td>
<td>0.3161</td>
<td>0.0836</td>
<td>-0.4311</td>
<td>3.1804</td>
</tr>
<tr>
<td>2002</td>
<td>0.1007</td>
<td>-0.2042</td>
<td>-0.0668</td>
<td>-0.0133</td>
</tr>
<tr>
<td>2003</td>
<td>0.1540</td>
<td>-0.0367</td>
<td>-0.0380</td>
<td>0.2549</td>
</tr>
<tr>
<td>2004</td>
<td>0.0258</td>
<td>1.1289</td>
<td>-0.5199</td>
<td>0.0445</td>
</tr>
<tr>
<td>2005</td>
<td>-0.2391</td>
<td>0.7856</td>
<td>-0.2532</td>
<td>0.3137</td>
</tr>
<tr>
<td>2006</td>
<td>0.1537</td>
<td>0.1119</td>
<td>0.1418</td>
<td>-8.0486</td>
</tr>
<tr>
<td>2007</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Mean** | **0.0580** | **0.3065** | **0.1716** | **0.2144**
Appendix 6

CD, where an Excel workbook is found with all calculations

The spreadsheets included are the following:

Sheet 1: Random Walk test – daily observations
Sheet 2: Random Walk test – quarterly observations
Sheet 3: Random Walk test – yearly observations
Sheet 4: Correlation between OMXS30 and OMXC20
Sheet 5: Total Return Index for all companies included in the sample – yearly observations
Sheet 6: Total Return Index – monthly observations
Sheet 7: Market Value for all companies included in the sample
Sheet 8: Net Profit for all companies included in the sample
Sheet 9: Beta – one-year strategy
Sheet 10: Beta – two-year strategy
Sheet 11: Beta – three-year strategy
Sheet 12: ASSETG portfolios
Sheet 13: P/C portfolios
Sheet 14: P/B portfolios
Sheet 15: P/E portfolios including beta and net profit calculations
Sheet 16: Various charts
Sheet 17: Value and Growth outputs
Sheet 18: Strategy results
Sheet 19: Beta results
Sheet 20: Net profit results