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INVESTOR MOOD AND STOCK RETURNS

Evidence from Ice Hockey

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ABSTRACT
Recent literature has investigated the impact of behavioral biases on asset pricing and one of these biases is shown to be investor mood. A number of studies have already documented a link between mood bias and stock returns. The objective of this thesis is to expand the existing evidence linking mood to asset prices and to investigate the stock market reaction to sudden changes in investor mood.

Motivated by the abundance of psychological evidence showing the strong effect that sports results have on mood, the purpose of this thesis is to investigate whether there is a link between sport results, investor mood and stock prices. Therefore, the results of international ice hockey games, which have particularly attractive properties as a measure of mood, are used to examine the mood changes of investors.

The data used in this thesis consist of the price of broadly-based stock market indices of Czech Republic, Finland, Russia and Sweden. The time-series data for regression are formed by the closing price of the index, from which returns are defined logarithmically. Indices from each country form a time-series between 1.1.1998 – 26.6.2007. Wins and losses in international ice hockey games of these countries are used to measure the sudden changes in investor mood. The games included in the study are the Olympic Games, World Championship games and World Cup games.

To estimate the effect of wins and losses on stock returns, a regression model is used. No negative stock market reaction after ice hockey losses is found, except for Czech Republic after elimination games. No evidence of positive stock market reaction after ice hockey wins can be found either. It can be concluded that in most of the cases losses have more profound impact on stock returns than wins and also in half of the cases more profound impact was found when examining only elimination games. Results suggest that it may be possible that the effect associated with winning or loosing an international ice hockey game is too small to influence the national stock market index.

1. INTRODUCTION

There is no simple theory, which can explain the behavior of financial markets. Theories are usually based on many assumptions, which are often unrealistic. However, theories about perfect and efficient markets have turned out to be especially useful to explain financial markets. (Leppiniemi 1993: 112–113.)

The efficient market hypothesis (EMH) reached the dominant position in the 1970's and has been the central proposition of finance for over 30 years. The idea that speculative asset prices, such as stock prices, always incorporate the best information about fundamental values and that prices change only because of good and sensible information, are very consistent with theoretical trends of that time. Anomalies, however, i.e. deviations from efficient markets, were discovered and in 1980's people started to support other competing theories such as behavioral finance. In the last twenty years, both the theoretical foundations and the empirical evidence of the EMH have been challenged. The main forces, by which markets are supposed to obtain efficiency, such as arbitrage, are likely to be more limited and much weaker than the efficient market theorists have supposed. With the new evidence, behavioral finance appeared as an alternative view of financial markets. In this view financial markets are not supposed to be efficient. Rather, systematic and significant deviations from market efficiency are expected. (Shleifer 2000: 1–2; Shiller 2003: 83.)

With the new evidence, some scholars started to argue that anomalies and exceptions from market efficiency could be explained by this behavioral psychology. People are not 100 per cent rational 100 per cent of the time. This can be seen in two areas – in people's attitudes towards risk and in the way people assess probabilities. (Brealey, Myers & Allen 2006: 343.)

Evidence from the psychological literature shows that human behavior is often inconsistent with the type of rationality that has traditionally been assumed in finance. Recent research has shown that investor irrationality and mood are, for example, due to weather, winter, daylight, Friday the thirteenth, and sport. Most importantly, it has been shown that when investor mood changes, so does his/her economic behavior. These

studies combine investor mood and investment decisions closely together. It may be impossible to create one profitable trading strategy based on investor mood and irrationality, but rational behavior of the investors can be enhanced by identifying the situations when they are most likely to act irrationally.

Based on this new evidence Kahneman characterizes financial markets as an individual investor: "*the market has a psychology, more specifically it has a character. It has thoughts, beliefs, moods, and sometimes stormy emotions. The main characteristic of the market is extreme nervousness. It is full of hope one moment and full of anxiety the next moment. It often seems to be afraid of good economic news, which makes it worry about inflation. In short, the market closely resembles a stereotypical individual investor*". (Shefrin 2005: 203–204.)

1.1. Background

The majority of financial theory is based on the notion that individuals act rationally and consider all available information in their decision-making process. However, researchers have found evidence that this is frequently not the case. Dozens of examples of irrational behavior and repeated errors in judgement and decision-making have been documented in academic studies. Repeated patterns of irrationality, inconsistency, and incompetence are revealed in the ways human beings make choices and decisions when they are faced with uncertainty. (Bernstein 2007.)

Behavioral finance studies how these psychological phenomena impact on investor behavior. The long-term objective of behavioral finance is to behavioralize finance. Among others, Shefrin (2005: 1) has tried to behavioralize the traditional asset pricing theory, i.e. trace the implications of behavioral finance for equilibrium prices.

Financial economists are debating about paradigm shift from a neoclassical-based paradigm to a behaviorally based. The basis for the debate about the paradigm shift in finance involves the way people make decisions. People generally make observations,

process data, and arrive at judgements. In finance, these judgements and decisions pertain to the composition of individual portfolios, the range of securities offered in the market, the character of earnings forecasts, and the manner in which securities are priced through time. When academics are building a framework for the study of financial markets, they have to face a fundamental choice. They need to choose a set of assumptions about the judgements, preferences, and decisions of participants in financial markets. The paradigmatic debate centers on whether these assumptions should be neo-classically-based or behaviorally based. (Shefrin 2005: 1.)

Traditionally, finance has adopted the neoclassical framework of microeconomics. In the neoclassical framework, financial decision-makers possess von Neumann-Morgenstern preferences over uncertain wealth distributions, and use Bayesian techniques to make appropriate statistical judgements from the data that is at their disposal. The main pillars of pricing in neoclassical finance are the efficient market hypothesis, factor models such as the capital asset pricing model, Black-Scholes option pricing theory, and mean-variance efficient portfolios. In behavioral approach to the asset pricing those main pillars are replaced by heuristics, biases and Prospect theory. (Shefrin 2005: 1, 12.)

A number of studies have investigated behavioral biases stemming for example from over- or underreaction to new information, as well as how such biases can influence prices despite the offsetting actions of rational arbitrageurs. However, even in the absence of new information, the psychological literature suggests another source of investor irrationality: *mood*.

It has been documented that many different matters are likely to affect investor mood. For example, casual observation of sport fans makes it clear that sport has an effect on mood as it regularly brings us laughter and tears, bliss and pain, in a sense of euphoria as well as gloom. No other type of regular event produces such substantial and correlated mood swings in a large proportion of a country's population. That is why sport results are used to represent the investor mood in this thesis.

Sport, in general, is documented to have a great influence on people's lives. It attracts immense audiences, and has great economic influence and power, and it reaches into countries and communities. Sport is played or watched by the majority of the world's population and it has moved from being an amateur pastime to a significant industry. (Hoye, Smith, Westerbeek, Stewart & Nicholson 2006: 3.)

Environmental and individual factors influence on how and to what extent people become involved and committed to sport. The more committed an individual is to some sport, the bigger is the disappointment if the supported team performs poorly and the bigger the joy if the team performs well. (Mullin, Hardy & Sutton 2000: 56–58.)

1.2. Problem Statement and Approach

The objective of this thesis is to examine the stock market reaction to the sudden changes in investor mood. Especially the purpose is to investigate whether there is a link between sport results, investor mood and stock prices. Behavioral finance has recently been one of the most examined fields in finance, but the effect of sport results on stock prices has not been studied that diligently. Nevertheless, some studies have already been made about the impact of sport results on investor mood, which leads to changes in stock prices. A strong link between them has already been discovered, for example from soccer by Edmans, Carcía and Norli (2006).

Contrary to Edmans et al. (2006) who used soccer results in their study; ice hockey results are forming the main set of data in this thesis. One of the main reasons why ice hockey results are used is that it enables also the examination of the Finnish stock market. Ice hockey is closer to Finnish people's minds than for example soccer. Thus, a stronger impact on investor mood and stock prices may be discovered. Czech Republic, Russia and Sweden are also chosen, because of the great importance of this sport in those countries. To examine ice hockey results' impact, stock indices from these countries are being used as well as the results of the most important ice hockey games during

the last 7 years. The games studied include the Olympic games, World Championship games and World Cup games.

In order to test the stock market reaction to the sudden changes in investor mood and the link between sport results and stock prices, two hypotheses are formed. The first hypothesis states that wins in ice hockey games lead to a positive stock market reaction and losses in ice hockey games lead to a negative stock market reaction. The second states that wins in elimination games lead to a more profound positive stock market reaction and losses in elimination games lead to a more profound negative stock market reaction than if all the games in the sample were included.

It is reasonable to assume that elimination games have a bigger impact on investor mood than non-elimination games or all the games in the sample altogether, because of the importance of the games. In elimination games the asymmetric reaction between losses and wins is also expected to be bigger, because while winning the game only advances a country to the next level, a loss immediately removes the country from the competition.

The research is done as a time-series event study. The main advantage of the event approach compared to the use of a continuous variable is that it clearly identifies a sudden change in the mood of investors. The main disadvantage is that the number of observed signals tends to be low, reducing statistical power. Stock market indices of the countries form a time-series data, and they are used to measure the ice hockey results' influence on stock prices. Indices from each country cover the time period from 1.1.1998 to 26.6.2007. The returns are calculated from differences of logarithmic price quotations.

To estimate the effect of wins and losses on stock returns, a regression model of the time-series variability of stock returns is employed. The dependent variable in the regression analyses is the time series of stock indices, more closely, the logarithmic stock market returns from the each examined country. The independent variable consists of the results of the ice hockey games, that is, wins and losses. Wins and losses are forming the dummy variables. The objective is to solve whether there is a link between sport

results, investor mood and stock prices by investigating Czech Republic, Finland, Russia and Sweden.

1.3. Structure of the Thesis

This paper consists of a theoretical and an empirical part. The objective of the theoretical part is to introduce the earlier research done in this field and also to explain the main aspects of the theories of efficient markets and behavioral finance.

The first chapter gives the basic information about the topic and introduces the research problem, data and methodology in brief. In chapter two the previous research is being presented concerning investor sentiment, i.e. the errors that investors make in their judgements, as well as sport sentiment. Previous studies about sport include the explanations on how important sport is to people and how it causes, for example, mood swings. Previous studies about the link between sport results and stock prices are also presented.

The main aspects of the theory of market efficiency and anomalies are presented in the chapter three and the main aspects of the theory of behavioral finance in chapter four. At the end of the theoretical part a discussion about the controversy of the two main theories presented in this thesis is going to take place.

The empirical part of the thesis is presented in chapters five and six. Chapter five describes the data, the hypothesis and the methodology of the thesis as well as the research process. Empirical results are documented in chapter six. Finally, chapter seven concludes the results of the thesis.

2. PREVIOUS RESEARCH

This chapter presents the earlier literature by concentrating on investor sentiment and secondly sport sentiment. Psychology has been combined to business science only from the beginning of 1980's, and since then the behavioral finance has been one of the most examined fields in finance. A large number of studies have also been made about investor sentiment and the factors affecting investor mood and decision-making.

Also the sport results' connection to people's mood has been studied relatively much. Some previous studies do link sport results, especially soccer games results on investor mood and changes in asset prices, but the connection of ice hockey results, investor mood and stock prices has not been examined extensively.

2.1. Investor Sentiment

According to Nofsinger (2005: 144–145, 157), the emotions are very important in decision-making. He stated that the social mood affects investor's mood strongly meaning that the general atmosphere and other investor's opinions have a great influence on the final decision. The main purpose of the study was to confirm that people make the market fluctuate by their behavior, not the other way around.

Vihanto (2006: 30) stated that the impact of feelings on stock markets and on the whole economy can be considered as an indisputable fact. There are no more differences in opinions about the fact that mood and feelings do have an effect on investor mood, but the question is, in which way these feelings and mood should be handled. Economists consider feelings as disturbance, and bias are often discussed. For example, in financial markets people are more likely to sell stocks that are winning than stocks, whose price has decreased compared to the time of the purchase. However, it should not matter, because it is a sunk cost and it should have no impact if investors act rationally. Explanation to this kind of behavior could be the feelings of disappointment and regret. To avoid these feelings investors postpone the realization of a loss.

Also Barber and Odean (1999: 51–52) documented a similar findings on how investors behave. Firstly, they found that investors are more reluctant to sell stocks that have declined in value, if compared to stocks that have appreciated. Actually, the effect of taxes is to push investors to do just the opposite. Secondly, they found that investors display overconfidence in the sense that they trade too much. This overconfident behavior is more pronounced among men.

Some papers have connected stock prices to exogenous changes in human emotions. Saunders (1993: 1337) studied stock prices from exchanges in New York City and whether they have been systematically affected by local weather. The results of the study supported the view that security markets are systematically influenced by investor psychology and argue for including behavioral variables in models of asset-pricing.

Also Hirshleifer and Shumway (2003: 1009–1010, 1013, 1028–1029) investigated whether weather has an effect on stock prices. They examined could sunshine lead to good mood, which would further lead to positive stock returns. The impact of weather on mood has been studied for decades and the studies have shown that sunshine affects on mood positively. In their research they proved that there is a significant positive correlation between sunshine and stock returns. On the other hand, bad weather, such as rain and snow, did not have an impact on stock returns. They established that investors may benefit when knowing in what mood they are at a particular moment. Then they can avoid the mistakes caused by their mood that they might make when making investment decisions.

Kamstra, Kramer and Levi (2003: 340) found that market returns are on average lower through the fall and winter than during spring and summer. They characterized it as the onset of seasonal affective disorder, i.e. a depressive disorder associated with declining hours of daylight. They found it to be especially strong in the Nordic countries. Patterns at different latitudes were also consistent with this interpretation. They concluded that because of the lack of sunshine people may get more easily depressed, which lowers the general good mood and eagerness to invest. If investors realized this beforehand, they could prevent the irrational decisions they might make.

Baker and Wurgler (2006: 2) found that stocks of low capitalization, relatively young, unprofitable, high volatility, non-dividend paying and growth companies are especially likely to be disproportionately sensitive to broad waves of investor sentiment. Also the stocks of firms in financial distress were, in particular, sensitive to investor sentiment.

Avery and Chevalier (1999: 520) showed that investor sentiment apply also in sport. They found that sentimental bettors can affect the bath of prices in football betting markets. They hypothesized that football bettors, bet on past winners, follow the advice of experts, and bet on teams with name-recognition or prestige. They showed that bettors do have the mentioned betting proclivities and that these proclivities lead to predictable movements in betting line. They also showed that a betting strategy designed to exploit the sentiment-induced mispricing of betting line is borderline profitable in their sample.

2.2. Sport Sentiment

Wann, Dolan, Mcgeorge and Allison (1994: 347–348) documented that fans often experience a powerful positive reaction when their team performs well and a corresponding negative reaction when the team performs poorly. Such reactions were documented to lead to increased or decreased self-esteem and to positive or negative feelings about life in general.

Bizman and Yinon (2002: 381–382) examined self-esteem and emotions, following a win or loss of one's favorite team. They measured the state of self-esteem and emotional responses of basketball fans as they exited the sport arena after their team had won or lost an official game. The fans tended to associate more with the team after team success than after team failure.

Boyle and Walter (2003: 225–226) found that stock prices are systematically related to economically-neutral events. These results provided a significant challenge to conventional finance theory as they implied that investor behavior and consequently market prices responded to factors and events that were not indicated by economic fundamen-

tals. Boyle et al. attempted to generate further evidence using the relationship between sporting team success and fan self-esteem. They hypothesed that if sporting event outcomes influence investor self-esteem, the outcomes might also have an effect on stock prices. They examined New Zealand national rugby team and the New Zealand stock market, because the situation where majority of investors are likely to support the same team is provided. However, they did not find any evidence of relationship between national sports team success and New Zealand stock market return behavior.

Study made by Edmans et al. (2006) investigated the stock market reaction to sudden changes in investor mood due to sport results. Their study was motivated by psychological evidence that there is a strong link between soccer outcomes and mood. Their soccer data was formed from a cross-section of 39 countries. Their study concentrated on international soccer results, but they also used other sport results such as ice hockey and rugby. They did not find a significant market decline after ice hockey losses like there was a strong negative stock market reaction after losses of national soccer teams. The size of the loss effect was economically significant. There was no evidence of a corresponding reaction to wins in any of the sports they investigated. (Edmans et al. 2006: 1, 23.)

Also Ashton, Gerrard and Hudson (2003: 783) documented a strong association between the performance of the England football team and subsequent daily changes in the FTSE 100 index. FTSE 100 index represents the price of shares in the 100 largest companies traded on the London stock exchange.

Boido's and Fasano's (2007) goal was to verify whether football results have a sufficiently large impact on mood to justify a reaction in asset prices. They analyzed three Italian football teams: Rome, Lazio and Juventus, which have been quoted since the beginning of 2000. Their goal was to demonstrate whether there is a link between mood and stock returns on the basis of team performance and the special events concerning the Italian football teams. Results of their study showed that the average price/return ratio following wins is higher than average price/return ratio following losses.

3. MARKET EFFICIENCY

Market efficiency is often defined with information efficiency. When the markets are informatically efficient all the relevant information is reflected without any delays, i.e. immediately and perfectly to the prices of the security. By examining *information effi-ciency* it is aspired to solve whether the security prices could be predicted. By examin-ing *market efficiency* it is aspired to solve whether the observed predictability is eco-nomically exploitable. (Malkamäki 1990: 33–34.)

When markets are efficient investors receive profits only related to the risk they are willing to take. If they wish to have higher returns, they need to accept also higher risk, that is, volatility of the profit. Making money in finance means making a superior return after an adjustment for risk. (Shleifer 2000: 3; Koistinen 2006.)

The stock market efficiency can also be approached by the CAP-model (*Capital Asset Pricing Model, CAPM*), which explains the price formation. It shows that the equilib-rium rates of return on all risky assets are a function of their covariance with the market portfolio. CAPM can be formulated the following way:

$$(1) \quad E(r_s) = r_f + \beta_s \big(E(r_m) - r_f \big)$$

where $E(r_s)$ is the expected return of a stock, r_f is the risk-free return, β_s is the beta of the stock and $E(r_m)$ is the expected return of the market. (Sharpe, Alexander & Bailey 1999: 235.)

The CAP-model was developed by Treynor (1961), Sharpe (1963) and Lintner (1965). The assumptions of efficient markets are presumed in the model. It states that the ex-pected risk premium of an asset is directly proportional to its beta, and that the expected return is the sum of a risk-free asset return and the risk premium. The risk premium of an asset is calculated as the product of expected market return over the risk-free return and the correlation coefficient (β) between the asset return and the return of the market. Given the directly proportional relationship between the asset beta and the expected

return, it can be expressed in a linear fashion by using *Security Market Line* (SML), which is the linear relationship between the expected return of security and its systematic risk. Thus, the CAPM states that the expected return of every asset must lay on the SML. If the CAPM is valid, any evidence of persistent deviations from the security market line can be interpreted as evidence of inefficiency of the markets. Thus, empirical CAPM tests can be regarded as the efficiency tests of the markets. (Copeland, Weston & Shastri 2005: 147, 371–372.)

A second important equilibrium pricing model, *the arbitrage pricing theory* (APT), was developed by Ross (1976). The return on any risky asset is seen to be a linear combination of various common factors that affect asset returns. It allows numerous factors to explain the equilibrium return on a risky asset and is therefore more general than the CAPM. Market efficiency relies on the ability of arbitrageurs to recognize that prices are out of line and to make a profit by driving them back to an equilibrium value consistent with available information. (Copeland et al. 2005: 147, 372.)

The APT imposes following four assumptions:

- asset markets are perfectly competitive and frictionless;
- investors are expected utility maximizers;
- the number of stocks is much greater than the number of factors in k-factor model;
- investors believe homogenously that the random returns of securities are governed by k-factor model of the form:

$$(2) \quad \begin{aligned} R_{it} &= E_i + \beta_{it} \cdot \delta_1 + \ldots + \beta_{ik} \cdot \delta_k + \varepsilon_i \\ i &= 1, \ldots, n \end{aligned}$$

where R_{it} is the return of the stock i at time t, E_i is the stock's expected return, δ_{kt} is the realization of the common factor k, β_{ik} is the sensitivity of the return of stock i to the common factor k, i.e. the factor loading and ε_{it} is the idiosyncratic return on the stock i. The idiosyncratic return is assumed to be sufficiently independent across stocks and to

have zero mean and finite variance so that the corresponding risk can be eliminated by using large and well diversified portfolios. (Roll & Ross 1980: 1076; Huberman 1982: 189−190; Lehman & Modest 1988: 215.)

When compared with the CAPM, which explains the differences in stock returns with differences in their betas, the APT makes an assumption that stock returns are explained by an unknown number of unknown factors (Sharpe et al. 1999: 283). In fact, CAPM and APT are so close to each other econometrically that the former can be seen as a special case of the latter when the return of the market portfolio is assumed to be the only relevant factor affecting the return of each stock (Copeland & Weston 1988: 219).

3.1. Perfect Markets

The constraints that make stock markets efficient are derived in the theory of finance. However, it is useful first to describe the perfect markets (Copeland et al. 2005: 353−354). The following constraints are considered to be necessary for perfect capital markets:

- markets are frictionless; i.e. there are no transaction costs or taxes, all assets are divisible and marketable, and there are no constraining regulations;
- there is perfect competition in securities markets; i.e. all participants are price takers;
- markets are informationally efficient; i.e. information is costless, and it is received simultaneously by all individuals;
- all individuals are rational and expected utility maximizers.

Given these conditions, markets will be both allocationally and operationally efficient. *Allocationally efficient* markets mean that prices are determined in a way that equals the marginal rates of return. *Operational efficiency* means that the transaction costs are assumed to be zero and markets are perfectly liquid. (Copeland et al. 2005: 353−354.)

In reality perfect markets do not exist. For example, transaction costs are always related to a trade. Efficiency can be obtained although the constraints mentioned above do not come true. Market efficiency is much less restrictive than the notion of perfect markets. In efficient markets, prices fully and instantaneously reflect all available relevant information. This means that when assets are traded, prices are accurate signals for capital allocation. (Fama 1970: 387–388; Lev 1974: 214–218; Copeland et al. 2005: 353–354.)

3.2. Efficient Market Hypothesis (EMH)

Because there are no perfect markets, the concept is often replaced with the market efficiency. Many investment strategies and models explaining stock prices are created based on the theory about market efficiency. (Leppiniemi 1993: 115–116.)

Fama (1970: 384) categorized market efficiency into the three following classes on the basis of what type of information is relevant according to phrase 'all prices fully reflect all relevant information':

1) *Weak-form efficiency.* Security prices fully reflect all historical price or return information. Excess returns can not be earned by observing past prices or returns. The future stock returns are random and entirely unpredictable based on past returns.

2) *Semi-strong efficiency.* Security prices will instantaneously reflect all public information. Excess returns cannot be earned by analyzing any publicly available information, i.e. as soon as information becomes public, it is immediately incorporated into the prices, and hence an investor cannot gain by using this information to predict returns.

3) *Strong-form efficiency.* Security prices reflect all information, both publicly available and insider information. No excess returns can be earned by analyzing any information, public or not.

The three degrees of efficiency are dependent on each other. In other words market has to fulfill the conditions of weak-form efficiency before it can fulfill the conditions of semi-strong efficiency, and in order to fulfill the conditions of the strong-form efficiency the semi-strong conditions have to be achieved. If this relation does not exist, the prices do not reflect all fundamental information. (Fama 1970: 384.)

3.2.1. The Theoretical Foundation of the EMH

The EMH rests on three theoretical arguments. Firstly, investors are assumed to be rational, and to value securities rationally. Secondly, to the extent that some investors are not rational, their trades are random and therefore cancel each other out without affecting prices. Thirdly, to the extent that investors are irrational in similar ways, they are met in the market by rational arbitrageurs, who eliminate their influence on prices. (Shleifer 2000: 2.)

Sharpe et al. (1999: 907) defined arbitrage as the simultaneous purchase and sale of the same, or essentially similar, security in two different markets at advantageously different prices. Thus, when people are rational, markets are rational, and when some people are irrational, they usually trade with each other. Hence, that has only a limited influence on prices even without countervailing trading by the rational investors. Such countervailing traders do exist and it brings prices closer to fundamental values. Competition between arbitrageurs for superior returns ensures that the adjustment of prices to fundamental values is immediate. (Shleifer 2000: 3.)

When investors are considered to be rational, they value each security for its fundamental value, which is the net present value of its future cash flows, discounted using their risk characteristics. When investors receive some new information about fundamental values of the securities, they quickly respond to that information by bidding up prices, if the information is good, and bidding down prices when the information is bad. As a result, security prices incorporate all the available information almost immediately and prices adjust to new levels, corresponding the new net present values of cash flows. If

the irrational investors manage to transact with prices that are not fundamental values, they usually only hurt themselves. (Shleifer 2000: 2–3.)

3.3. Anomalies

Anomalies are empirical results that seem to be inconsistent with maintained theories of asset pricing behavior. They indicate either market inefficiency (profit opportunities) or inadequacies in the underlying asset pricing model. After they are documented and analyzed in the academic literature, they often seem to disappear, reverse or attenuate. Theoretically an anomaly should disappear as traders attempt to take advantage of it in advance. (Shleifer 2000: 18–19; Schwert 2002: 3.)

Despite the strong evidence that the stock markets are highly efficient, anomalies do exist. While the existence of these anomalies is accepted, the question of whether investors can exploit them so that they could earn abnormal returns in the future is subject to debate.

3.3.1. Calendar Anomalies

The best knows calendar anomalies are January effect, turn-of-the-month effect and day-of-the-week effect. In January returns are higher than normally and it has also been historically the best month to invest in stocks. The January effect is shown to occur most dramatically for the smaller firms, because the small-firm group includes stocks with the greatest variability of prices during the year. Although, there is no evidence that using standard measure of risk small stocks are riskier in January. (Shleifer 2000: 18–19; Bodie, Kane & Marcus 2005: 390.)

According to Haugen & Jorion (1996: 27–31) the January effect is, perhaps the best-known example of anomalous behavior in security markets throughout the world. Since the coming of the January is information known to the market, this evidence points out that excess returns can be obtained in contrast to semi-strong form efficiency.

There are also many empirical findings that mean stock rates of return vary according to the day of the week. The average return on Mondays is found to be much lower than the average return on any other day of the week. In other words, at the end of the week the returns are higher than normally. Returns are also showed to be higher at the beginning of the month. (Sharpe et al. 1999: 497.)

3.3.2. Fundamental Anomalies

The best-known fundamental anomalies are the size effect as well as P/BV (price/balance value) and E/P (earnings/price) anomalies. These mean that bigger abnormal returns occur for those companies that have bigger P/BV and E/P numbers and that smaller companies have greater returns than bigger ones. It is shown that in the long run small stocks have earned higher returns than large stocks, even if proportioned with risk. (Martikainen & Martikainen 2002: 133.)

It has also been discovered that companies with the highest market-to-book ratios are relatively the most expensive *growth firms*, whereas those with the lowest ratios are relatively the cheapest *value firms* (Shleifer 2000: 19). Lakonishok, Shleifer and Vishny (1994: 1575) found that portfolios of companies with high market-to-book ratios have earned sharply lower returns than those with low ratios.

The size and the market-to-book ratio present a serious challenge to the EMH. Fama and French (1993: 53−55; 1996: 82) interpreted both a company's market capitalization and its market-to-book ratio as measures of fundamental riskiness of a stock in so-called three-factor-model. According to this model, stocks of smaller firms or of firms with low market-to-book ratios must earn higher average returns because they are fundamentally riskier as measured by their higher exposure to size and market-to-book factors. Conversely, large stocks earn lower returns because they are safer. Growth stocks with high market-to-book ratios also earn lower average returns because they represent hedges against market-to-book risk.

Important academic discussion arose in the 1980's about the consistency of the efficient market model for the aggregate stock market with econometric evidence about the time-series properties of prices, dividends and earnings. Especially, whether these stocks show excess volatility relative to what would be predicted by the efficient market model was discussed. The anomalies that had been discovered could be considered as a failure of efficient market theory to explain the fundamental truth of financial markets. However, if most of the volatility in the stock market was unexplained, it would call into question the basic underpinnings of the entire efficient market theory. (Shiller 2003: 84.)

The anomaly of excess volatility seems to be much more troubling for the theory of efficient markets than other financial anomalies, such as the January effect or the day-of-the-week effect. It has been discovered that in the United States stock returns are somewhat predictable by using stock price volatilities (Malkamäki 1990: 36). The evidence regarding excess volatility seems to imply that changes in prices occur for no fundamental reason at all, but that they occur for example because of mass psychology. (Shiller 2003: 84).

3.3.3. Explanations for Anomalies

When the stock markets are efficient the phenomena mentioned earlier and systematic profits should disappear, because all essential anomalies are known. If these phenomena occur anyhow, it could be a sign of inefficiency in the stock markets. According to Puttonen (2001: 102) possible inefficiencies disappear very rapidly and are not likely to come back as identical. Exploiting inefficiencies at the markets is very difficult, because they are changing when time passes by. In addition there are many companies and individuals that have big resources trying to find the inefficiencies in the market. (Martikainen et al. 2002: 133−134.)

Many believe that these observed anomalies are caused by cash flows that are coming to the market unsteadily. Other explanations can be reporting and taxation practices at the turn of the year (Chang and Pinegar 1989: 59–60). For example, salaries are paid at the

end of the month or in the middle of the month, not smoothly every day. Investors have more time to analyze stocks during the weekends than during weekdays. Some believe that anomalies occur because of psychological factors. This presents an interesting question: Could the effect be caused by the mood of market participants? People are generally in better mood on Fridays and before holidays, but are generally grumpy on Mondays. Thus, it can be seen that at the end of the week returns are higher and lower on Mondays. (Martikainen et al. 2002: 133−134.)

Some researchers believe that stock markets function efficiently despite of the anomalies. They think that these phenomena are more or less measurement errors than genuine proof of market inefficiency. To measure stock returns there are many statistic questions that may distort the measurement results, such as normal distribution of returns, logarithmic versus percentual returns, and how mean returns are calculated. Because the stocks of small companies are traded scantier than bigger companies' stocks, there is a possibility that the beta coefficient, which measures risk, will distort and become too small when measuring small companies. This will make risk-adjusted returns look higher when considering small firms. Risk-adjusted return means return earned on an asset, which is normalized by the amount of risk associated with that asset. For example, when using Capital Asset Pricing Model, the risk-adjusted return can be obtained when the stock return given by the CAPM is being reduced from the actual return. Problems related to risk measurement are often interpreted as notable reasons, which lead to anomalies. (Martikainen et al. 2002: 133−134.)

3.4. Data Mining

It is questioned whether anomalies are really anomalies or an artifact of data mining, which is the process of automatically searching large volumes of data for patterns using tools such as classification. In this regard, some anomalies have not shown much permanency after being reported in the academic literature. (Bodie et al. 2005: 396.)

The rapid evolution of computer technology in the last few decades has given investors the capability to access and analyze great amounts of financial data. Additionally, the World Wide Web and email make it possible for people around the world to access this information quickly, as well as provide a means for individuals to share their opinions and interact. As a result, some of the most intriguing topics of debate in recent years have been about the practice and consequences of data mining. (Bodie et al. 2005: 396.)

Data mining involves searching through databases for correlations and patterns that differ from results that would be anticipated to occur by chance or in random conditions. For example, in an attempt to improve life expectancy researchers might use data mining to analyze causes and correlations with death rates. However, probably the most interesting group of data miners is stock market researchers that are trying to predict future stock price movement. Most of the stock market anomalies have been discovered via data mining of past prices and related variables. (Bodie et al. 2005: 396.)

3.5. Predictability of Stock Returns

In 1953 Kendall realized that stock prices do not follow any regular price cycles, but they are random (see Brealey et al. 2006: 333). In other words, stock prices seemed to follow a random walk. Thus, price changes are independent of one another. More generally, any information that could be used to predict stock performance should already be reflected in stock prices. New information must be unpredictable, because if it could be predicted, then the prediction would be a part of today's information. Thus, stock prices that change in response to new information must also move unpredictably. This is the essence of a random walk, which means that price changes should be random and unpredictable. Randomly evolving stock prices are the necessary consequences of intelligent investors trying to discover relevant information, on which to buy or sell stocks before the rest of the market also obtains that same information. (Bodie et al. 2005: 370–371.)

Although the stock market was long thought to be a random walk, and thus unpredictable, numerous researchers have found that over long horizons the returns on the stock market are at least somewhat predictable (Thaler 2005: 2). Malkiel (2003: 60) stated that at the beginning of 21st century people started to believe that at the certain probability prices could be predicted. According to recent studies future stock prices could be partly predicted with the historical prices. According to those in favor of efficient market hypothesis for example (see Russel & Torbey 2002) the rational price of a stock is a result of the risk investors have to take. According to critics the predictability of stock returns is a result of psychological factors.

Researchers have documented ways to successfully predict security returns based on past returns. Jegadeesh and Titman (1993: 89) found that momentum shows that movements in individual stock prices over the period of six to twelve months tend to predict future movements in the same direction. Momentum means the rate of acceleration of a security's price or volume. An economy with strong growth that is likely to continue is said to have a lot of momentum.

Shiller (1981: 291) stated that when estimating information efficiency, stock price volatilities can be used to predict the future prices. He found that stock market prices are more volatile than could be justified by a simple model in which prices are equal to the expected net present value for future dividends. Even Fama (1991: 1581−1583) admitted that stock returns are predictable from past returns.

Several other studies have also shown the ability of easily observed variables to predict market returns. For instance Campbell and Shiller (1988: 661−662) found that earnings yield can predict market returns, which implies that stock returns can be predicted, in violation of the efficient market hypothesis. However, they stated that it is more likely that these variables are proxying for variation in the market risk premium. For example Bodie et al. (2005: 388) also stated that the predictability of the returns is a risk premium rather than evidence of market inefficiency.

4. BEHAVIORAL FINANCE

Academic research and understanding of finance have evolved much from the days when the efficient market hypothesis was widely considered to be proved beyond the doubt. A lot of the focus of the academic discussion shifted towards developing models of human psychology and its relationship with financial markets, away from econometric analyses of time-series of prices, dividends, and earnings. Nowadays one of the most widely researched and examined field of finance is behavioral finance. Behavioral finance means finance from a broader social science perspective including psychology and sociology, which also stands in contradiction with the efficient market hypothesis. (Shiller 2003: 83, 90-91.)

Behavioral finance attempts to better understand and explain how emotions and cognitive errors influence investors and the decision-making process. Many researchers believe that the study of psychology and other social sciences can shed considerable light on the efficiency of financial markets as well as explain many stock market anomalies, market bubbles, and crashes. Many researchers believe that these humans' flaws are consistent, predictable, and can be exploited for profit.

4.1. Outset of the Theory

Behavioral finance started to develop in the 1980's. Kahneman, Slovic and Tversky had a central role in development of the theory. Tversky and Kahneman originally described *Prospect theory* in 1979. They found that, contrary to expected utility theory, people placed different weights on gains and losses, and on different ranges of probability. They found that individuals are much more distressed by prospective losses than they are happy by equivalent gains. Some economists have concluded that investors typically consider the loss of 1 dollar twice as painful as the pleasure received from a 1 dollar gain. They also found that individuals will respond differently to equivalent situations depending on whether it is presented in the context of losses or gains. People are also willing to take more risks to avoid losses than to realize gains. Faced with sure gain,

most investors are risk-averse, but faced with sure loss, investors become risk-takers. (Shefrin 2002: 7–8.)

As it can be seen from the Figure 1 and from the shape of the proposed value function, people do not give equal weights for gains and losses. This tendency of exaggerating the relative importance of losses is called loss aversion. (Tversky & Kahneman 1991: 1039.)
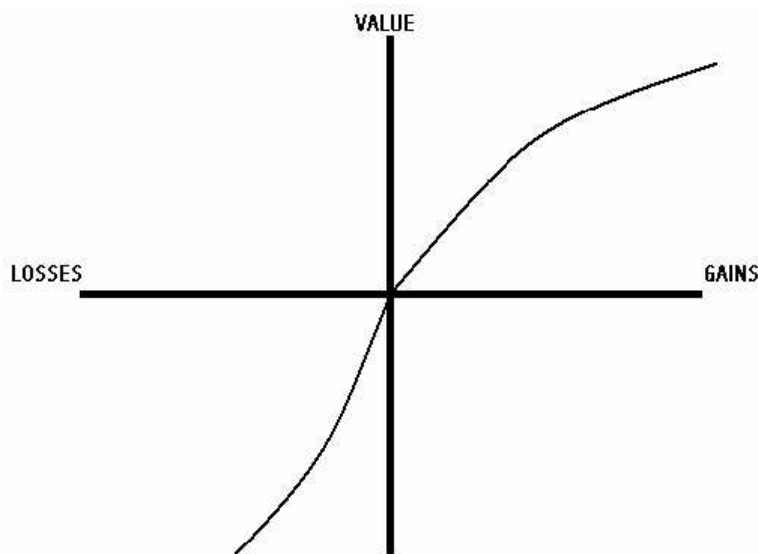
Figure 1. A hypothetical value function (Kahneman et al. 1979: 279).

The pain of a loss also varies. Once investors have suffered a loss, they may be even more concerned not to risk a further loss. On the contrary, investors may be more willing to run the risk of a stock market dip after they have experienced a period of substantial gains, just like gamblers (see Thaler & Johnson 1990: 643). Many researchers theorize that the tendency to gamble and to take unnecessary risks is a basic human trait. Entertainment and ego appear to be some of the motivations for people's tendency to take risks. People also tend to remember their successes, but not their failures, and are thereby unjustifiably increasing their confidence. (Brealey et al. 2006: 344–345.)

The assumption of expected utility distinguishes the behavioral approach to asset pricing from the traditional approach. Traditional asset pricing theorists assume that inves-

tors seek to maximize expected utility. However, the proponents of behavioral finance are critical of expected utility as a descriptive theory. They state that people generally behave in ways that are inconsistent with expected utility theory. Instead they suggest that people behave more in accordance with a psychologically based theory, such as Prospect theory and violate expected utility in systematic ways. (Shefrin 2005: 365, 382.)

The Prospect theory has most probably had more impact than any other behavioral theory on examining finance. Prospect theory can be described as a descriptive framework of choice in the face of risk. The theory has three components, a utility function over gains and losses, a weighting function, and a mental accounting structure that includes a reference point, from which gains and losses are measured in each account. (Shefrin 2005: 382.)

4.2. Information Processing

The premise of behavioral finance is that conventional financial theory ignores how people make decisions. A growing number of economists have started to interpret the anomalies literature as consistent with several irrationalities that individuals exhibit when making complicated decisions. These irrationalities occur due to two main reasons. Firstly, investors do not always process information correctly and therefore infer incorrect probability distributions about the future rates of return. Secondly, even if a probability distribution is given, investors often make inconsistent or systematically suboptimal decisions. (Bodie et al. 2005: 396.)

Errors in information processing can lead investors to misestimate the true probabilities of possible events. Several biases like these have been documented such as forecasting errors, overconfidence and conservatism. People tend to emphasize recent experience compared with prior beliefs when making forecasts. People also tend to make forecasts that are too extreme when considering the uncertainty inherent in their information. In addition, people tend to overestimate the precision of their beliefs or forecasts and their

abilities. Conservatism bias means that investors are too slow to update their beliefs in response to recent event. As a result investors might initially underreact to news, which lead to that prices will fully reflect new information only gradually. (Bodie et al. 2005: 397–398.)

4.2.1. Overconfidence

Psychologists have observed that when judging possible future outcomes, individuals tend to look back at what has happened in some similar situations. As a result, they place too much weight on a very small number of representative occurrences. Another systematic bias is overconfidence. People are overconfident of their own abilities, and investors, and analysts are particularly overconfident in areas where they have some knowledge. Most of the investors think that they are better than average investors, but for every winner there must be a loser. Presumably investors are prepared to continue trading because each is confident that it is he/she, who is going to make money out of the deal, not the other investor. Increasing levels of confidence frequently show no correlation with greater success. For example, money managers, advisors, and investors are consistently overconfident in their ability to outperform the market, however, most fail to do so. (Brealey et al. 2006: 347.)

One of the most robust behavioral findings is that people are typically overconfident about their knowledge when the issues at hand are difficult. Overconfidence also occurs in the certainty that people express in their judgements. They consistently underestimate the chances of an unlikely event to occur. (Shefrin 2005: 54; Brealey et al. 2006: 347.)

4.2.2. Over- and Underreaction

There are two families of pervasive regularities that are apparently inconsistent with weak and semi-strong form market efficiency, namely *underreaction* and *overreaction*. The underreaction evidence shows that security prices underreact to news such as earnings announcements. If the news is good, prices keep trending up after the initial positive reaction. On the other hand, if the news is bad, prices keep trending down after the

initial negative reaction. In other words, current news has power in predicting not just the returns on the announcement of this news, but also future returns, when the news is already stale. The momentum evidence is closely related to underreaction, since the positive autocorrelation of returns over relatively short horizons may reflect slow incorporation of news into stock prices. (Shleifer 2000: 112.)

The overreaction evidence shows that, over longer horizons of three to five years, security prices overreact to consistent patterns of news pointing in the same direction, i.e. securities that have had a long record of good news tend to become overpriced and have low average returns afterwards. Securities with good performance, however, receive high valuations and these valuations return to mean on average. (Shleifer 2000: 112–113.)

The cross-sectional overreaction and underreaction evidence shows rather reliable regularities. These regularities are difficult to reconcile with the efficient market hypothesis. In the case of overreaction, there is considerable evidence inconsistent with the fundamental risk explanation and no direct evidence to support it. In the case of underreaction, an efficient markets explanation has not even been proposed. (Shleifer 2000: 127.)

4.2.3. Other Biases

The behavioral decision literature identifies many systematic errors to which people are vulnerable. Most important to asset pricing theory is representativeness. Representativeness induces naive individual investors to indulge to extrapolation bias. Overconfidence amplifies representativeness based errors and also induces to underestimate risk. When psychologists use the term heuristics they mean the rule of thumb. When they use the word judgement they mean assessment. The major finding in heuristics and biases is that when people form judgements and rely on heuristics, these heuristics bias and judgements produce systematic errors. (Shefrin 2005: 15, 449.)

Tversky and Kahneman (1974: 33) defined the behavioral heuristic known as representativeness, or the tendency of experimental subjects to view events as typical or repre-

sentative of some specific class and also to ignore the laws of probability. An important manifestation of the representativeness heuristic is that people think that they see patterns truly random sequences. A person who follows the heuristic evaluates the probability of an uncertain event, or a sample, by the degree to which it is similar in its essential properties to its parent population and by the degree to which it reflects the salient features of the process by which it is generated.

Psychologists contend that people rely on particular heuristics to form judgements. Representativeness is one of the most prevalent heuristics and it plays a prominent role in financial forecasts. Representativeness involves overreliance on stereotypes and it leads people to form probability judgements that systematically violate Bayes rule. People who rely on representativeness rather than Bayes rule have different probability beliefs and it also leads people to make predictions that are insufficiently regressive relative to the mean. (Shefrin 2005: 23, 38.)

Another phenomenon is also presented in psychology literature, namely conservationism. It is defined as the slow updating. Individuals update their posteriors in the right direction, but by too little relative to the rational Bayesian benchmark. In particular people tend to underweight useful statistical evidence relative to the less useful evidence used to form their priors. In other words when investors get a good piece of earnings news, they act as if part of the shock will be reversed in the next period. (Edwards 1968: 17−18; Shleifer 2000: 113, 227−228; Barberis & Thaler 2002: 39.)

Conservatism occurs for example when a company announces surprisingly good earnings. Investors react insufficiently to the announcement and push the price up too little. Since the price is too low, subsequent returns will be higher on average, thereby generating both post-earnings announcement drift and momentum. After a series of good earnings announcements, representativeness causes people to overreact and push the price up too high. The reason is that after many periods of good earnings, the law of small numbers leads investors to believe that this is a firm with particularly high earnings growth, and hence to forecast high earnings in the future. (Barberis et al. 2002: 38−39.)

A common finding in behavioral studies is that people are heterogeneous. People hold different beliefs, differ in their tolerance for risk and in their levels of patience. These differences can be important and affect both prices and trading volume. Individual differences are typically large. People are different in the way they form judgements. Some form judgements as if they rely on heuristics such as representativeness, while other form judgements as if they use Bayes rule. The degree of heterogeneity can be wide even among those who rely on representativeness and even investors in investment firms show heterogeneous behavior. Representativeness causes heterogeneity to have a time varying structure. Some of the heterogeneity can be explained by the level of experience and the presence of incentives. (Shefrin 2005: 44, 57, 450.)

Some studies also document that investors exhibit also a pronounced home bias. French and Poterba (1991: 222) reported that investors in the U.S., Japan and U.K. allocate 92,2 %, 95,7 % and 92 % of their overall equity investment, respectively, to domestic equities. Grinblatt and Keloharju (2001: 614–615) also found that investors in Finland are much more likely to hold and trade stocks of Finnish firms, which are located close to them geographically, which use their mother tongue in company reports, and whose chief executive shares their cultural background. Investors prefer local or familiar stocks even though there may be no rational reason to prefer the local stock over other comparable stocks that the investor is unfamiliar with.

4.3. Two Major Foundations of Behavioral Finance

At the general level, behavioral finance is the study of human fallibility in competitive markets. It does not just simply deal with an observation that people are biased, confused, and irrational. This observation is uncontroversial, although understanding the precise nature of biases and confusions is an enormously difficult task. Behavioral finance goes beyond this uncontroversial observation and places the biased, the irrational and the confused people into competitive financial markets, in which at least some arbitrageurs are fully rational. Behavioral finance then examines what happens to prices and

other dimensions of market performance, when the different types of investors trade with each other. (Shleifer 2000:24–25.)

As a study of human fallibility in competitive markets, the theory of behavioral finance rests in two major foundations. The first is *limited arbitrage*, which suggests that arbitrage in the real-world securities markets is far from perfect. Many securities do not have perfect or even good substitutes, which makes arbitrage fundamentally risky. Even if good substitutes are available, arbitrage remains risky and limited, because prices do not converge to fundamental values instantaneously. The fact that arbitrage is limited helps to explain why prices do not necessarily react to information by the right amount and why prices may react to non-information expressed in uninformed changes in the demand. Limited arbitrage, thus explains, why markets may remain inefficient when perturbed by noise trader demands, but it does not tell us much about the exact form that inefficiency might take. For that, we need the second foundation of behavioral finance, namely *investor sentiment*: the theory of how real-world investors actually form their beliefs and valuations and more generally their demands for securities. Combined with limited arbitrage, investor sentiment theory may help generate precise predictions about the behavior of security prices and returns. (Shleifer 2000: 24.)

Both of these elements are necessary. If arbitrage is unlimited, then arbitrageurs accommodate the uninformed shifts in demand as well as make sure that news is incorporated into prices quickly and correctly. Markets then remain efficient although many investors are irrational. Without investor sentiment, there are no disturbances to efficient prices and so prices do not deviate from efficiency. A behavioral theory, thus, requires both an irrational disturbance and limited arbitrage. (Shleifer 2000: 25.)

4.3.1. Limits to Arbitrage

Arbitrage plays a critical role in the analysis of securities markets, because it brings prices to fundamental values and keeps markets efficient. The central argument of behavioral finance states that, in contrast to the efficient market hypothesis, real-world arbitrage is risky and therefore limited. Securities do not necessarily have close substi-

tutes as is expected in EMH. There might not be a riskless hedge for the arbitrageur. If an arbitrageur is risk-averse, his/her interest in such risky arbitrage is limited. With a finite risk-bearing capacity of arbitrageurs as a group, their aggregate ability to bring prices of broad groups of securities into line is limited as well. Another risk for arbitrageur comes from unpredictability of the resale price in the future, i.e. the mispricing becomes worse before it disappears. Arbitrage is also limited in cases where arbitrageurs need to worry about financing and maintaining their position, when price divergence can become worse before it gets better. This is called a noise trader risk. Noise trader risk must be borne by any arbitrageur with a short time horizon and it limits his/her willingness to bet against the noise trader. Noise trader risk appears also to be a good explanation of price divergences between fundamentally identical securities. (Shleifer 2000: 13–14, 29.)

Arbitrage is extremely limited even in an environment that is very close to efficient markets. In more complicated environments it is even more limited. The theoretical presumption for market efficiency based on arbitrage simply does not exist once the realities of real-world arbitrage begin to be modeled seriously. The potential costs of arbitrage are often underestimated. An important reason for that arbitrage is limited is that movements in investor sentiment are in part unpredictable. Therefore arbitrageurs betting against mispricing run the risk that at least in the short horizon, investor sentiment becomes more extreme and prices move even further away from the fundamental value. As a consequence arbitrage positions often lose money in the short run. That is why arbitrageurs need long horizons to be able to bet successfully on slow-moving market mispricing. (Barberis, Shleifer & Vishny1997: 2; Shleifer 2000: 52.)

It is apparent that the existence of irrational investors would not by itself be sufficient to render capital markets inefficient. The arbitrageurs would take advantage of the profit opportunities and they would be expected to push prices back to their proper values. Behavioral biases would not matter for stock pricing, if rational investors could perfectly profit from the mistakes of behavioral investors. Behavioral advocates argue, though, that in practice, several factors limit the ability to profit from mispricing. (Bodie et al. 2005: 396–399.)

4.3.1.1. The Closed End Fund Puzzle

One example of limited arbitrage is a closed end fund puzzle. This puzzle refers to the fact that closed end mutual funds, i.e. the funds that hold portfolios of other securities and have a fixed number of shares that are themselves traded in the market, often sell at prices that are different from the market values of the portfolios they hold. Three explanations are often presented: agency costs, tax liabilities, and illiquidity of assets. (Shleifer 2000: 26, 53.)

When enough stocks in addition to closed end funds are affected by the same investor sentiment, risk from this sentiment cannot be diversified and it is therefore priced. The noise trader approach to the closed end fund puzzle explains why fund mispricing relative to its portfolio is not eliminated by arbitrage. Substantial evidence has been found that investor sentiment and especially individual investor sentiment influences the prices of closed end funds. (Shleifer 2000: 61, 89.)

4.3.1.2. Noise Trader Risk in Financial Markets

Noise is described as price and volume fluctuations in the market that can confuse one's interpretation of market direction. Noise trader risk is a form of market risk associated with the investment decisions of noise traders. Noise traders attempt to take advantage of market noise by entering buy and sell transactions without the use of fundamental data. In general, the shorter the time frame, the more difficult it is to separate the meaningful market movements from the noise. The higher the volatility in market prices for a particular security, the greater the associated noise trader risk. Behavioral finance researchers have attempted to isolate this risk in order to explain and capitalize upon the sentiment of the majority of investors. For example, if the noise trader risk for a particular stock is high, an issuance of good news related to a particular company may influence more noise traders to buy the stock, artificially inflating its market value. (Shleifer 2000: 33, 51.)

Noise traders form erroneous beliefs about the future distribution of returns on a risky asset. They may be subjected for example to behavioral biases in processing information and forecasting returns. Alternatively they may incorrectly perceive the riskiness of return, perhaps because they are overconfident. Noise traders select their portfolios on the basis of such incorrect beliefs. In response it is optimal for arbitrageurs to exploit noise traders' misperceptions. Overall, noise trader risk is only the beginning of the long story of the costs of what traditional finance has come to call arbitrage. (Shleifer 2000: 33, 51.)

Risk created by the unpredictability of investor sentiment significantly reduces the attractiveness of arbitrage. Noise trading can lead to a large divergence between market prices and fundamental values. Opinions of noise traders are to some extent unpredictable and arbitrage requires bearing the risk that their misperceptions become even more extreme in the future than they are now. More generally speaking, unpredictability seems to be a general property of the behavior of irrational investors. (Shleifer 2000: 52.)

4.3.1.3. Professional Arbitrage

Commonly arbitrage is conducted by relatively few professionals, highly specialized investors, who combine their knowledge with resources of outside investors to take large positions. The fundamental feature of such arbitrage is that brains and resources are separated by an agency relationship. For instance, mutual and pension funds manage money for millions of individual investors. Hedge funds take money from wealthy individuals, banks endowments and other investors with only a limited knowledge of individual markets and invest it using highly specialized knowledge. (Shleifer 2000: 89.)

Much of the money in financial markets is allocated by professional managers of pension and mutual funds on behalf of individual investors and corporations. Professional money managers are, of course, people as well and also subject to the same biases as individual investors. That is why it is not enough to refer to irrationality of individual

investors, it must be also explained, why financial institutions do not compete away the profit opportunities that may arise. (Shleifer 2000: 11–12; Brealey et al. 2006: 347.)

4.3.2. Investor Sentiment

Sentiment distinguishes the behavioral approach to asset pricing from the traditional approach. Proponents of behavioral finance treat sentiment as a major determinant of market prices, stemming from systematic errors that investors commit. Proponents of traditional finance treat sentiment as minor and they assume that investors are free from biases. Whereas behavioral asset pricing theorists attribute observed phenomena to sentiment, traditional asset pricing theorists attribute observed pricing phenomena to fundamental risk or time varying risk aversion. (Shefrin 2005: 365.)

Sentiment measures the degree of excessive optimism or pessimism among investors, although, sentiment is more complex than that. Rather, sentiment pertains to the entire distribution of investors' errors. Zero sentiment corresponds to the case of zero errors at the level of the market. (Shefrin 2005: 219.)

Like mentioned earlier, according to the defense of the efficient market hypothesis, irrational investors trade randomly. However, psychological evidence shows precisely that people do not deviate from rationality randomly, but rather most deviate in the systematic way. This problem becomes more severe only when the noise traders behave socially and follow each others' mistakes by listening to rumors. Investor sentiment reflects the common judgement of errors made by a substantial number of investors, rather than uncorrelated random mistakes. (Shleifer 2000: 11–12.)

To describe investors, whose preferences and beliefs conform to the psychological evidence rather than the normative economic model, a number of terms have been used. Beliefs based on heuristic rather than Bayesian rationality are sometimes called investor sentiment. The investors, who do not behave rationally according to the normative model are described as unsophisticated or noise traders. Irrational exuberance is one

aspect of sentiment and it suggests investors' naively extrapolating the upward market trend into the future. (Shefrin 2005: 11–12, 324.)

Sentiment is a stochastic process that describes the overall market error. The term sentiment is synonymous with error, either at the level of the individual investor or at the level of the market. Sentiment has sometimes a simple structure, as when investors are uniformly optimistic or pessimistic. However, when investors exhibit considerable heterogeneity, sentiment is typically complex. Behavioral asset pricing theorists often model sentiment as a scalar variable, such as the bias to the mean of a particular distribution. In general, sentiment is not a scalar but a stochastic process. It evolves according to a distribution that interacts with fundamental variables. The prices of some assets in the market may feature excessive optimism while the prices of other assets feature excessive pessimism. (Shefrin 2005: 6, 450.)

When proponents of behavioral finance talk of sentiment they are talking about the aggregate errors of investors that are designated in security prices. A formal definition of a sentiment variable Λ is based on two terms. The first term, and the more important one is the likelihood ratio $P_R(x_1)/\Pi(x_1)$. The second term involves the value of δ_R that arises from the equation, when all investors hold objectively correct beliefs. This value is called (of δ_R) $\delta_{R,\Pi}$. (Shefrin 2005: 206–207.) It can be defined:

$$(3) \quad \Phi\left(x_t\right) = \frac{P_R\left(x_t\right) \cdot \delta_R(t)}{\Pi\left(x_t\right) \cdot \delta_{R,\Pi}(t)}$$

The variable Φ reflects two of the deviations that can arise, because of investor errors. The first deviation stems from the beliefs of the representative investor, what one might call the beliefs of the market, relative to objective beliefs. The second deviation stems from the representative investor's equilibrium time discount factor, relative to the situation when all investors hold objectively correct beliefs. When all investors hold objectively correct beliefs, $\Phi = 1$. The sentiment function can be defined by $\Lambda = \ln(\Phi)$. (Shefrin 2005: 206–207.) Formally,

$$(4) \quad \Lambda \equiv \ln\left(\frac{P_R}{\Pi}\right) + \ln\left(\frac{\delta_R}{\delta_{R,\Pi}}\right)$$

4.4. Investor Irrationality

Psychologists working in the area of behavioral decision-making have produced much evidence that people do not behave as if they have von Neumann-Morgenstern preferences and do not form judgements in accordance with Bayesian principles. Rather, they systematically behave in a manner different from both. Notably, behavioral psychologists have advanced theories that address the causes and effects associated with these systematic deviations. The behavioral counterpart to von Neumann-Morgenstern theory is known as Prospect theory. The behavioral counterpart to Bayesian theory is known as heuristics and biases. Von Neumann-Morgenstern utility describes a utility that has the expected utility property: the agent is indifferent between receiving a given bundle or a gamble with the same expected value. (Shefrin 2005: 2.)

Rationality means two things. Firstly, when investors receive new information, they update their beliefs correctly, in the manner described by Bayes' law. Secondly, given their beliefs, investors make choices that are normatively acceptable, in the sense that they are consistent with Savage's notion of Subjective Expected utility (SEU). SEU combines two distinct subjective concepts: a personal utility function and a personal probability analysis based on Bayesian probability theory. (Barberis et al. 2002: 2.)

It is difficult to sustain the situation that investors are fully rational. Many investors react to irrelevant information and they trade on noise rather than information. For instance, investors may follow the advice of investor gurus, fail to diversify and sell winning stocks and hold on to loosing stocks. In short, investors do not pursue the passive strategies expected of uninformed market participants by the efficient market hypothesis. Economists' belief to investors' rationality is the most powerful in the field of finance, because there wrong decisions lead to immediate punishment of wrong decisions and mistakes. (Shleifer 2000: 10, 14–16.)

Yet, people trade for both cognitive and emotional reasons. They trade because they think they have information when they have nothing but noise, and they trade because trading can bring them the joy of pride. Trading brings pride when decisions turn out well, but it brings regret when decisions turn out to be bad. Investors try to avoid the pain of regret by avoiding the realization of losses, employing investment advisors as scapegoats, and avoiding stocks of companies with low reputations.

Investors look more askance at losses, if the investment has not been profitable in the past. If the investment on the other hand has been profitable, investors are more eager to make even riskier investments. Investors often believe that what has happened in the past will happen also in the future. Beliefs about probability are wrong. Many people have a hard time accepting some facts despite mathematical proof. People often see order where it does not exist and interpret accidental success to be the result of skill. Investors believe that they are better than average investors and that makes them act irrationally. People have limited capacity to process information; in addition people are impressionable to make mistakes and to trust other peoples' opinions. (Russel et al. 2002; Brealey et al. 2003: 358–360.)

Investors' deviations from the maxims of economic rationality have turned out to be highly pervasive and systematic (Shleifer 2000: 10). According to Kahneman and Riepe (1998: 52–54) people deviate from standard decision-making in a number of fundamental areas. Three broad groups can be formed from these areas:

1) attitude towards risk
2) non-Bayesian expectation formation
3) sensitivity of decision making to the framing of problems

4.4.1. Attitude towards Risk

Proponents of behavioral finance assume that psychological phenomena prevent most investors from being fully rational. Instead, investors are assumed to be imperfectly rational. Imperfectly rational investors are not uniformly averse to risk. In some circum-

stances they act as if they are risk seeking. Moreover, imperfectly rational investors do not rely on optimal statistical procedures. Instead, they rely on heuristics that predispose their beliefs to bias. (Shefrin 2005: 3.)

When assessing risky gambles, people do not look at the levels of final wealth they can attain, but at gains and losses relative to some reference point, which may vary from situation to situation. Such references are helpful for thinking about a number of problems in finance, and they were first described by Kahneman and Tversky (1979) in Prospect theory. (Shleifer 2000: 11.)

One of these problems is reluctance of the investors to sell stocks that lose value (Odean 1998: 1775−1776). Another is investors' aversion to holding stocks more generally, known as the premium puzzle (Benartzi & Thaler 1995: 75). In premium puzzle historical difference between the return on equities and the risk free rate has been judged too big to be explained within traditional asset pricing models of expected utility maximization. An explanation offered by Shleifer (2000: 11) and by Thaler (2005: 2) comes from the psychology of decision-making, namely loss aversion, which is the tendency to weight losses much more heavily than gains. Another explanation is narrow framing, which is the tendency to consider returns over brief periods of time rather than long run.

4.4.2. Non-Bayesian Expectation Formation

Bayes rule states that if D and F are two events, then $P(F|D) = P(D|F)P(F)/(D)$. The representativeness hypothesis has many implications, and one of the most important ones is that people form probability judgements that violate Bayes rule. In particular, reliance on representativeness will lead people to underweight the prior probability $P(F)$ and overweight the conditional probability $P(D|F)$. (Shefrin 2005: 16.)

Individuals systematically violate Bayes rule and other maxims of probability theory in their predictions of uncertain outcomes (Kahneman & Tversky 1973). The essence of the Bayesian approach is to provide a mathematical rule explaining how existing beliefs should be changed new evidence. For instance, people often predict future uncertain

events by taking a short history of data, and asking what broader picture this history is representative of. In focusing on such representativeness, they often do not take into account the possibility that the recent history is generated by a chance rather than by a model they are constructing.

Such heuristics are useful in many life situations, for example, they help people to identify patterns in the data, but they also may mislead the investors. For instance, investors may extrapolate short past histories of rapid earnings growth of some companies too far into the future and therefore overprice these companies. Such overreaction lowers future returns as past growth rates fail to repeat themselves and prices adjust to more plausible valuations. (Shefrin 2005: 11.)

People typically give too much weight to recent experience and extrapolate recent trends. They tend to become more optimistic when the market goes up and more pessimistic when the market goes down. Many believe that when high percentages of participants become overly optimistic or pessimistic about the future, it is a signal that the opposite scenario will occur. However, investors who violate Bayes rule and do not learn quickly enough will typically vanish in the long run. (Shefrin 2005: 237.)

4.4.3. Decision-making and Framing

Even if information processing was perfect investors might make less than fully rational decisions using that information. These behavioral biases emerge, depending on how investors frame choices and questions of risk versus return and therefore make risk-return trade-offs, i.e. framing influences decision-making. (Shleifer 2000: 11; Bodie et al. 2005: 398.)

Psychologists have proven that individuals who make decisions which turn out badly have more regret when decision was more unconventional. People also tend to feel sorrow and grief after having made an error in judgement. Investors deciding whether to sell a security are typically emotionally affected by whether the security was bought for more or less than the current price. One theory is that investors avoid selling stocks that

have gone down in order to avoid the pain and regret of having made a bad investment. The embarrassment of having to report the loss, for example, to the accountants may also contribute to the tendency not to sell the losing investments. Some researchers theorize that investors follow the crowd and conventional wisdom to avoid the possibility of feeling regret in the event that their decisions prove to be incorrect. (Bodie et al. 2005: 399.)

Many investors find it easier to buy a popular stock and rationalize it going down since everyone else owned it too. Buying a stock with a bad image is harder to rationalize if it goes down. For example, when buying a blue-chip portfolio that turns down is not as painful as experiencing the same losses on an unknown start-up firm. Any losses on the blue-chip stocks can be more easily attributed to bad luck rather than bad decision-making, and case less regret. (Bodie et al. 2005: 399.)

Psychographics describe psychological characteristics of people and are particularly relevant to each individual investor's strategy and risk tolerance. An investor's background and past experiences can play a significant role in the decisions an individual makes during the investment process. For instance, women tend to be more risk averse than men and passive investors have typically became wealthy without much risk while active investors have typically become wealthy by earning it themselves.

People often see other people's decisions as the result of disposition, but they see their own choices as rational. Investors frequently trade on information they believe to be superior and relevant when, in fact, it is not and is fully discounted by the market. This results in frequent trading and consistently high volumes in financial markets that many researchers find puzzling. On one side of each speculative trade is a participant, who believes he or she has superior information and on the other side is another participant who believes that his/her information is superior. Yet they cannot both be right.

4.5. Models of Behavioral Finance

There is no single unifying model in behavioral finance. In many behavioral models of securities markets there are two types of investors: rational arbitrageurs, who are senti-ment-free and irrational traders prone to exogenous sentiment. These two groups com-pete in the market and set prices and expected returns. Nonetheless, arbitrageurs are limited in various ways as mentioned before. These limits come from short horizons or costs and risks of trading and short selling. Thus, prices are not always at their funda-mental values. In such models, mispricing arises out of the combination of two factors: a change in sentiment on the part of the irrational traders, and a limit to arbitrage from the rational ones. (De Long, Shleifer, Summers & Waldmann 1990: 706–709; Shleifer 2000: 25.)

Researchers in behavioral finance have been working to build an alternative behavioral model based on two basic assumptions. According to first assumption, investors are subject to sentiment. Investor sentiment is a belief about future cash flows and invest-ment risks that are not justified by the facts available. The second assumption is that betting against sentimental investors is costly and risky. And so, rational investors, or arbitrageurs, are not as aggressive in forcing prices to fundamentals as the standard model would suggest. (Baker et al. 2006: 1.)

According to Baker et al. (2006: 2–3, 25) the strongest tests of the effects of investor sentiment involve return predictability. One approach to measure investor sentiment and quantity of its effects is called *bottom up approach*. It uses biases in individual investor psychology, such as overconfidence, representativeness, and conservatism, to explain how individual investors underreact or overreact to past returns or fundamentals.

4.5.1. Feedback Model

A price-to-price feedback theory is one of the oldest theories about financial markets. When speculative prices go up, creating successes to some investors, this may attract public attention, promote word-of-mouth enthusiasm, and heighten expectations for

further price increases. This process increases investor demand and generates an other round of price increases. If the feedback is not interrupted, it may produce a speculative bubble, in which high expectations for further price increases support very high current prices. The high prices are ultimately not sustainable, since they are high only because of expectations of further price increases, and so the bubble eventually bursts, and prices come falling down. The same feedback may also produce a negative bubble, downward price movements propelling further downward price movements, promoting word-of mouth pessimism, until the market reaches an unsustainably low level. (Shiller 2003: 91.)

In so-called price bubbles prices go up without much news just because noise traders are chasing the trend. Noise traders in price bubbles react to past price changes, as opposed to particular news. An example from such behavior is Internet stocks in 1998. Companies providing Internet related services, such as Yahoo!, Ebay and Amazon.com, have often very few assets, little market power and negative earnings. During 1998, however, they kept on rising in price and acquired market capitalizations in the tens of billions of dollars. Noise traders' behavior in such bubbles can be described by positive feedback trading. Positive feedback investors buy securities after prices rise, and sell after prices fall. It can result, for example, from extrapolative expectations about prices. The feedback theory was supported by research in cognitive psychology, which shows that the human judgements of the probability of future events show systematic biases. (Shleifer 2000: 154–155; Shiller 2003: 93–94.)

4.7. Controversy between Efficient Market Hypothesis and Behavioral Finance

Because the two main theories that are presented more detailed contradict at some extent, some controversy can be seen in this thesis. It is not the purpose to come to a conclusion, which one is truer than the other, but the comprehensive picture is given from both of the theories.

Traditional asset pricing theory and behavioral asset pricing theory share a common framework. The features that are different between these theories are the differing assumptions and results. Traditional asset pricing theory assumes that prices are set as if investors have correct beliefs about the underlying stochastic process governing returns and have preferences that conform to expected utility theory. In contrast, behavioral asset pricing theory assumes that investors are subject to systematic psychologically induced errors and have preferences that violate the assumptions of expected utility theory. (Shefrin 2005: 449.)

According to Bodie et al. (2005: 384–386), there are three issues that together imply that the debate whether efficient market hypothesis is true or not, will probably never end. The first one is *the magnitude issue*. Everybody could agree that stock prices are very close to fair values and that only managers of large portfolios can earn enough trading profits to make the exploitation of minor mispricing worth the effort. According to this view, the actions of intellectual investment managers are the driving force behind the constant progress of setting market prices to fair levels. In this view, more consistent would be to ask how efficient are markets rather than are markets efficient. The second is *the selection bias issue* meaning that the outcomes we are able to observe have been preselected in favor of failed attempts. On that account, we cannot fairly evaluate the true ability of portfolio managers to generate winning stock market strategies. The third is *the lucky event issue*. There is an equal likelihood of winning or loosing the bet when tossing a coin. Under the hypothesis that any stock is fairly priced given all available information, any bet on a stock really is a coin toss. Although, if many investors using a variety of schemes make fair bets, some of those investors will be lucky and win a majority of these bets. For every big winner there may be many big losers. The proper test would be to see, whether the successful investors can repeat their performance in another time period.

The proponents of market efficiency hold that there are enough well-informed investors to seize all unexploited profit opportunities. The efficient market hypothesis emphasizes that arbitrage rapidly eliminates any profit opportunities and drive market prices back to fair value. According to the evidence from behavioral decision-making studies people

learn slowly. Behavioral finance specialists may admit that easy profits do not exist, but argue that because arbitrage is costly, and sometimes slow-working, deviations from fair value may persist. The question remains whether there are enough quick learners to eliminate mispricing in the financial markets. (Shefrin 2002: 80; Brealey et al. 2006: 349).

Bodie et al. (2005: 405) established that markets are efficient. They also stated that markets are competitive enough to state that only differentially superior information or insight will earn money. In the end, it is likely that the margin of superiority that any professional manager can add is so scarce that the statistician will not easily be able to detect it. Shiller (2003: 96) on the other hand disputed that theoretical models of efficient financial markets that represent investors as rational optimizers cannot be more than metaphors for the world around us. According to him it is unreasonable to claim that everyone knows how to solve complex stochastic optimization models.

Concerning the strength of the behavioral critique, there is considerable debate among financial economists. Critics argue that it is too easy to reach for psychology text every time behavior that cannot be explained is observed. It is easy to find caprices in investor behavior that will explain with hindsight any of the market anomalies, but the usefulness of behavioral finance is going to depend on whether it can predict future mispricing.

 Behavioral finance is still in its infancy. Yet, it has presented financial economics with a new theory, a new set of explanations of empirical regularities, as well as the new set of predictions. The critique of full rationality in investor decision-making is well-taken, but the extent to which limited rationality impacts on asset pricing is controversial. It is still too early to judge behavioral approach, specifically, which behavioral models will last and become tools of financial analysts. (Shleifer 2000: 27; Bodie et al. 2005: 400–401; Brealey et al. 2006: 347.)

5. DATA AND METHODOLOGY

Edmans et al. (2006: 2–3) introduced a novel mood variable to investigate the effects of investor sentiment on asset prices. They argued that a mood variable has to satisfy three key characteristics to rationalize studying its link with stock returns. Firstly, the given variable must drive mood in a substantial and unambiguous way, so that its effect is powerful enough to appear in asset prices. Secondly, the variable must impact the mood of a large proportion of the population, so that it is likely to affect enough investors. Thirdly, the effect has to be correlated across the majority of individuals in the country.

The data of this thesis consist of stock market indices and the results of international ice hockey games. Ice hockey is assumed to meet the conditions mentioned above, because only such countries are being studied, where ice hockey truly is the number one sport.

5.1. Data Description

The purpose of this thesis is to investigate the stock market reaction to the sudden changes in investor mood. A strong link between investor mood and sport has already been discovered. Therefore, the results of ice hockey games are used to investigate the mood changes of the investors. The main contribution is to study a variable, international ice hockey results, which has particularly attractive properties as a measure of mood. Especially in the chosen countries ice hockey can be referred as a national sport. Extensive psychological evidence also shows that sport in general has a significant effect on mood. Also the growth and professionalization of sport has driven changes in consumption and TV-viewing figures. For example, during the final game Finland against Canada in the latest ice hockey World Championship in 2007, there were about 1,8 million TV viewers in Finland. That is about 35 per cent of Finland's population. (Suomen Tietotoimisto 2007.)

According to government regulation, the most important sport events should be broadcasted live in Finland. World Championships of men's ice hockey are one of them as

well as the Olympic Games and men's ice hockey in Olympics. For example, Formula 1 is not included to these sports mentioned above. Thus, the importance of ice hockey can be seen. (Valtioneuvosto 2007.)

5.1.1. Stock Indices

A stock market index is a listing of stocks as well as a statistic reflecting the composite value of its components. It is used as a tool to represent the characteristics of its component stocks, all of which bear some commonality such as trading on the same stock exchange or belonging to the same industry. Stock market indices can be classified in many ways. A broad-base index, which is used in this thesis, represents the performance of a whole stock market – and by proxy, reflects investor sentiment on the state of the economy. Broad-base indices are the most regularly quoted market indices including the largest listed companies on a nation's largest stock exchange. The market indices that are used in this thesis are obtained from Datastream and the returns are computed using the price index.

The indices used in this thesis are from Czech Republic, Finland, Russia and Sweden. In Czech Republic, the broad-base market index is the PX index, which is an index of major stocks traded on the Prague Stock Exchange. It consists of 50 companies traded on the Prague Stock Exchange. The OMX Helsinki 25 is a stock market index for Helsinki Stock Exchange. It is a market value weighted index consisting of the 25 most-traded stock classes. The RTS Index is an index of 50 companies that trade on the RTS Stock Exchange in Moscow. The OMX Stockholm 30 is a stock market index for the Stockholm Stock Exchange. It is a market value weighted index consisting of the 30 most-traded stock classes. Also world index is used to compare it with the country based indices. (Russian Trading System 2007; The Nordic Exchange 2007; The Prague Stock Exchange 2007.)

Indices from each country form a time-series between 1.1.1998 – 26.6.2007. The average time series has 2 473 trading days, which gives a total of 9 892 daily return observations.

5.1.2. Ice Hockey

Four major ice hockey countries from Europe are examined: Czech Republic, Finland, Russia and Sweden. One of the main reasons why to include these countries is that these countries play against each other in Euro Hockey Tournament. These countries have also succeeded well in international tournaments, and are also ranked among the best ice hockey countries in Europe and worldwide. The third reason is that ice hockey has a really important position in these countries. It can be classified as a national sport in Finland and in Czech Republic, and it is very highly appreciated also in Russia and Sweden. As the importance of ice hockey increases in a particular country, the more significant effects may be obtained. Fro example Edmans et al. (2006) used in their ice hockey data countries such as Switzerland and Germany, in which soccer plays the more important role than ice hockey. That is why they are left out from the data of this thesis.

The most succeeded ice hockey countries ever have been Canada, Russia (also the USSR), Sweden, Czech Republic (also Czechoslovakia), USA, and Finland. The reason why Canada and The United States are not included in the sample is that NHL (National Hockey League) plays more important role in those countries than international ice hockey games and therefore the results would not be comparable. The annual men's Ice Hockey World Championships are less important to North Americans, also because they coincide with the Stanley Cup playoffs. (International Ice Hockey Federation 2007.)

The most important international ice hockey games are included in the sample. The ice hockey games are Olympic, World Championship and World Cup games. World Championship results are from year 2001 to year 2007. Also the results of the Olympic Games from years 2002 and 2006 are included. In addition the results from the World Cup from year 2004 are included.

The ice hockey data consist altogether of 10 tournaments and 227 games which are divided as follows: Czech Republic 57 games, Finland 58 games, Russia 51 games and

Sweden 61 games. The total amount of wins is 152 and losses 75. The amount of games played by each country depends on how well they have succeeded in the tournaments. The elimination games include altogether 80 games, which are divided as follows: Czech Republic 18 games, Finland 22 games, Russia 18 games and Sweden 22 games. The data of the results of the ice hockey games is collected from the web pages of International Ice Hockey Federation, Wikipedia and World Cup of Hockey.

5.2. Hypotheses

The first research hypothesis is formulated in accordance with the literature of psychology that suggests that wins are associated with good mood and losses with bad mood. According to this earlier literature, changes in investor mood also affect the economic behavior. Evidence can be found that sport outcomes have an impact on subjects' optimism or pessimism, not only about their own abilities, but life in general. This suggests that ice hockey results might affect investors' views about future stock prices.

H1: Wins in ice hockey games lead to a positive stock market reaction and losses in ice hockey games lead to a negative stock market reaction.

The psychology literature also documents a significant difference in the behavior of fans following wins and losses. Especially, while an increase in heart attacks, crimes and suicides is shown to be related to sport losses, there is no evidence of improvements in mood of a similar magnitude after wins. This asymmetry suggests that a more profound effect should be observed after ice hockey losses than wins. A similar prediction follows from the Prospect theory of Kahneman and Tversky (1979). Prospect theory suggests that it is its reliance on gains and losses as carriers of utility, rather than wealth levels. That is the reference point, against which gains and losses are measured becomes an important determinant of utility.

The reference point in this thesis is supporters' pre-game expectations of how their team will perform. Numerous studies have shown that fans are subject to an *allegiance bias*,

where individuals, who are psychologically invested in a desired outcome, generate biased predictions (Markman & Hirt 2002: 58–60). Thus, if the reference point for ice hockey fans is that their team will win, a greater stock price reaction after losses than after wins is expected.

Another reason why asymmetric reaction to losses and wins is expected is because of the eliminations games. It is reasonable to assume that gold medal, bronze medal and elimination games in general have a bigger impact on investor mood, because of the importance of the games. While winning the game only advances a country to the next level, a loss immediately removes the country from the competition. Elimination games are forming the second hypothesis.

H2: Wins in elimination games lead to a more profound positive stock market reaction and losses in elimination games lead to a more profound negative stock market reaction than if all the games in the sample were included.

5.3. Methodology Description and Research Process

Time-series data from the stock indices from the four countries mentioned earlier, more specifically the price on a broad-base stock market index for each country is used. The time-series data for regression are formed by the closing price of the index. Returns are defined logarithmically. This approach is backed up by the notion that logarithmic returns follow better standard distribution than absolute returns. Returns are computed by:

$$(5) \quad R_{it} = \log(P_{it}) - \log(P_{it-1})$$

where R_{it} is the logarithmic return of share i on day t. P_{it} and P_{it-1} are closing prices for share i on day t and $t-1$ and log is the natural logarithm.

Under the first and second hypothesis, ice hockey outcomes are correlated with asset prices. To estimate the effect of wins and losses on stock returns, a regression model

similar to previous studies of the time-series variability of stock returns is used. The impact of the outcome of international ice hockey games on stock returns for each country i is estimated using the following model:

(6) $R_{it} = \beta_0 + \beta_1 W_{it} + \beta_2 L_{it} + u_{it}$

where R_{it} is the daily logarithmic return of share i on day t, W_{it} is the dummy variable for wins and L_{it} is the dummy variable for losses. More closely, W_{it} is a dummy variable that equals one, if country i wins an ice hockey game on a day that makes t the first trading day after the game and zero otherwise. L_{it} is a dummy that is defined at the same way than the win dummy. Finally, u_{it} is the random error term.

To measure the effect of international ice hockey results on stock prices, the return on stock market indices from the countries on the first trading day following the game is used. Some games that are played during weekdays start already when markets are still open. To ensure that the return for a full day when the game outcome is known, the first trading day after the game for all games is used.

The dependent variable is the time series of stock indices, more closely the logarithmic stock market returns from each country examined. The independent variable consists of the results of the ice hockey games, that is, wins and losses.

6. EMPIRICAL RESULTS

The empirical analysis is based on ice hockey wins and losses of four countries, which are Czech Republic, Finland, Russia and Sweden. To measure the effect of international ice hockey results on stock returns, the returns on stock market indices from these four selected countries are being used as well as the world index.

Between the returns of the market indices and the world index the correlation is significant at the ,01 level (2-tailed) measured with Pearson correlation as it can be seen from the Table 1. Between Finland and Sweden the correlation is highest and between Russia and the other countries the correlation is lowest. The correlation between the world index is highest also for Sweden and Finland and lowest for Russia. Since every index is significantly correlated with the world index, no significant differences are assumed. In Pearson Correlation test SPSS uses only two levels of significance: * means that p<,05 and ** means that p<,01. The third level *** (p<,001) is not used.

Table 1. Correlations between stock indices.

		Czech Republic	Finland	Russia	Sweden	World
Czech Republic	Pearson Correlation	1	,410**	,326**	,427**	,373**
	Sig. (2-tailed)		,000	,000	,000	,000
Finland	Pearson Correlation	,410**	1	,268**	,716**	,554**
	Sig. (2-tailed)	,000		,000	,000	,000
Russia	Pearson Correlation	,326**	,268**	1	,266**	,276**
	Sig. (2-tailed)	,000	,000		,000	,000
Sweden	Pearson Correlation	,427**	,716**	,266**	1	,631**
	Sig. (2-tailed)	,000	,000	,000		,000
World	Pearson Correlation	,373**	,554**	,276**	,631**	1
	Sig. (2-tailed)	,000	,000	,000	,000	

** Correlation is significant at the ,01 level (2-tailed).

Regression analysis is used to examine the impact of ice hockey game outcomes on stock indices. Each country is examined separately. The results from the regression analyses can be found from the Table 2 and 3. Table 2 presents the results when all games in the sample are included and Table 3 when only elimination games are included.

As it can be seen from the t-values of Table 2, the only significant results are β_0 (constant) for Czech Republic and Russia. For Czech Republic the result is significant at the ,05 level and for Russia at the ,01 level. The coefficients of the regression analyses in Table 2 can be interpreted so that when β_1 or β_2 are positive the daily stock index return is expected to increase by the coefficient and when the coefficients are negative the daily stock index return is expected to decreases by the coefficient, when compared with the days when no games were played, i.e. when dummy variable is zero. β_2, which represents the loss dummy, is more negative than β_1, which is the win dummy, in every country and also when examined with world index. This implies that losses have a greater effect on stock returns.

F-test results and the coefficient of determination represent the explanation power of the regression analysis. In the Table 2 the coefficient of determination is almost negligible. The coefficient of determination in this case implies that ice hockey results do not explain the changes in stock index returns very well, only ,1 per cent of the changes in the stock returns can be explained by ice hockey outcomes. For Russia the coefficient of determination is zero. In Table 2, the F-test result is significant only for Czech Republic at the ,05 level. It can be seen from the significance mentioned under the F-test results.

Table 2. Results from the Linear Regression: All Games.

	β_0	β_1	β_2	R^2	F
Czech Republic	,001	-,002	-,004	,001	1,452
t-value/sig.	(2,315)*	(-1,029)	(-1,490)		(,0234[a])*
Finland	,001	,000	,-007	,001	1,174
t-value/sig.	(1,392)	(-,500)	(-1,531)		(,309[a])
Russia	,001	,001	-,002	,000	,030
t-value/sig.	(2,634)**	(,044)	(-,218)		(,971[a])
Sweden	,000	-,001	-,005	,001	,767
t-value/sig.	(1,056)	(-445)	(-1,217)		(,464[a])
World	,000	,001	-,003	,001	1,489
t-value/sig.	(1,457)	(1,111)	(-1,726)		(,226[a])

a. Predictors: (Constant), Wins, Losses

b. Dependent Variable: Stock Index Return

*significant at the ,05 level

** significant at the ,01 level

*** significant at the ,001 level

As it can be seen from the t-values of Table 3, the only significant results are β_0 (constant) and β_2 (losses) for Czech Republic and β_0 (constant) for Russia. For Czech Republic the results are significant at the ,05 level and for Russia at the ,01 level. The coefficients of the regression analyses in Table 3 can be interpreted the same way mentioned earlier. β_2, which represents the loss dummy, is more negative than β_1, which is the win dummy, in every country and also when examined with world index. This implies that losses have a greater effect on stock returns. From Table 3 can be seen that the win dummy is more positive and the loss dummy is more negative in most of the cases compared with the dummies in Table 2. That is consistent with the second hypothesis, which states that wins in elimination games lead to a more profound positive stock market reaction and losses lead to a more profound negative stock market reaction than if all the games in the sample were included.

When elimination games are examined the coefficient of determination is also almost negligible as it can be seen from Table 3. The coefficient of determination implies that elimination games results do not explain the changes in stock index returns very well either, only ,1 per cent of the changes in the stock returns can be explained by ice hockey outcomes. In Czech Republic's case ,3 per cent of the changes can be explained. In Table 2, the F-test result is significant only for Czech Republic at the ,05 level. It can be seen from the significance mentioned under the F-test results.

Table 3. Results from the Linear Regression: Elimination games.

	β_0	β_1	β_2	R^2	F
Czech Republic	,001	-,002	-,004	,003	3,678
t-value/sig.	(2,315)*	(-1,056)	(-2,414)*		(,025[a])*
Finland	,001	,007	-,010	,001	1,209
t-value/sig.	(1,196)	(,512)	(-1,386)		(,229[a])
Russia	,001	,016	-,005	,001	1,406
t-value/sig.	(2,569)**	(1,581)	(-,004)		(,245[a])
Sweden	,000	,001	-,008	,001	,871
t-value/sig.	(,998)	(,157)	(-1,302)		(,419[a])
World	,000	-,001	-,002	,001	1,199
t-value/sig.	(1,578)	(-,001)	(-,002)		(,302[a])

a. Predictors: (Constant), Wins, Losses

b. Dependent Variable: Stock Index Return

*significant at the ,05 level

** significant at the ,01 level

*** significant at the ,001 level

In the next chapter only t-statistics and p-values are gathered from regression analyses to test the hypotheses presented earlier. Also the mean daily logarithmic stock market returns and standard deviations between countries are being compared.

6.1. Results from All the Included Games

Table 4 provides information about the number of wins and losses in international ice hockey games that are included in the sample, as well as the mean daily logarithmic stock market returns and standard deviations on the fist trading day after wins and losses. The results of the t-tests and p-values of regression analyses can also be seen from the table.

Table 4. Wins and losses.

	Czech Republic	Finland	Russia	Sweden
Wins				
N	39	37	31	45
Mean	-,00152	-,00123	,00166	-,00073
Std	,0146	,01821	,02243	,014
Losses				
N	18	21	20	16
Mean	-,00385	-,00655	,00012	-,00443
Std	,01748	,01543	,01862	,01248
Stock index time-series of each country				
N	2473	2473	2473	2473
Mean	,000533	,000497	,00144	,000295
Std	,00556	,002387	,004669	,003226
t-statistic (wins)	-1,029	-,500	,044	-,445
p-value (wins)	,303	-,617	,965	,656
t-statistic (losses)	-1,49	-1,531	-,218	-1,217
p-value (losses)	,136	,126	,827	,224
World index				
t-statistic (wins)	,416	,406	,902	,625
p-value (wins)	,678	,685	,367	,532
t-statistic (losses)	-,224	1,602	,433	,509
p-value (losses)	,822	,109	,665	,611

* significant at the ,05 level
** significant at the ,01 level
*** significant at the ,001 level

As it can be seen from the Table 4, the mean return for stock index time-series from each country examined is positive. However, the mean return after both wins and losses on a first trading day after the game is negative for all other countries except for Russia. It does not seem to matter whether it is a win or a loss. The mean return after losses is lowest for Finland. The standard deviation for stock index time-series from each country examined is highest for Czech Republic and after that for Russia. The standard deviation after wins and losses is highest for Russia.

It can be seen from the t-statistics and p-values of Table 4 that significant results cannot be found at any significance levels. It can be concluded from the t-statistics and p-values that for every country, except for Russia, losses seem to have a more significant effect than wins, as it was assumed earlier in this thesis. When comparing the results of each country with the p-values of world index the biggest difference can be seen in losses of Czech Republic. After that the biggest difference was after wins of Czech Republic and wins of Russia as well as losses of Sweden. Because no significant market decline or increase was observed, H1 is rejected and it is stated that there are no statistically significant differences in investor behavior after ice hockey wins or losses compared with the days when no ice hockey games were played.

Also Table 5 reports the number of wins and losses in international ice hockey games for each country in the sample. The difference between Table 4 is that outliers have been detected from the sample. Outliers are identified as observations with large negative or large positive returns on a day that makes the dummy variables W_{it} or L_{it} equal to one. 20% of the game-day observations are removed (10% extreme negative observations and 10% extreme positive observations).

The mean return after removing the outliers is highest for Russia after wins and losses and lowest for Czech Republic after wins and for Finland after losses as it was also in Table 4. The standard deviation is highest for Russia after wins and losses and lowest for Sweden after wins and losses, just like it was in Table 4. As it can be seen from the Table 5, the effect remains statistically insignificant after removing outliers. Only little improvements in every country's p-values can be seen after losses. After wins im-

provements can be seen only in Czech Republic's and Finland's p-values. The movements were rather small. For example after losses the p-value of Czech Republic's improved from ,136 to ,131 and Finland's p-value from ,126 to ,108.

Table 5. Wins and losses (outliers removed).

	Czech Republic	**Finland**	**Russia**	**Sweden**
Wins				
N	39	37	31	45
Mean	-,00152	-,00123	,00166	-,00073
Std	,0146	,01822	,02243	,014
Losses				
N	18	21	20	16
Mean	-,00385	-,00655	,00012	-,00443
Std	,01748	,01543	,01862	,01248
t-statistic (wins)	-1,043	-,543	,032	-,435
p-value (wins)	,297	,587	,974	,664
t-statistic (losses)	-1,509	-1,607	-,255	-1,233
p-value (losses)	,131	,108	,799	,218

  * significant at the ,05 level

  ** significant at the ,01 level

  *** significant at the ,001 level

It can be seen from the t-statistics and p-values of Table 5 that significant results cannot be found at any significance levels after removing the outliers either. It can be concluded from the p-values that losses seems to be more significant than wins for every country. Based on the results, H1 is rejected also after removing outliers and it is stated that there are no statistically significant differences in investor behavior after ice hockey wins and losses compared with the days when no ice hockey games were played.

6.2. Results from the Elimination Games

Table 6 reports the number of elimination games divided into wins and losses. Table 6 also reports the mean daily logarithmic stock market returns and standard deviations on the fist trading day after wins and losses in elimination games. Statistical findings are also reported.

Table 6. Wins and losses in elimination games.

	Czech Republic	Finland	Russia	Sweden
Wins				
N	10	11	9	14
Mean	-,00633	,0038	,0157	-,00037
Std	,02063	,0225	,01721	,02024
Losses				
N	8	11	9	8
Mean	-,01014	-,00704	,00141	-,00687
Std	,02241	,01805	,02447	,01515
t-statistic (wins)	-1,056	,517	1,581	,157
p-value (wins)	,318	,605	,114	,874
t-statistic (losses)	-2,414	-1,386	-,004	-1,302
p-value (losses)	,016*	,196	,997	,193
World index				
t-statistic (wins)	,798	-,517	,300	2,298
p-value (wins)	,425	,605	,764	,022
t-statistic (losses)	,093	,928	,360	1,435
p-value (losses)	,926	,354	,719	,151

* significant at the ,05 level
** significant at the ,01 level
*** significant at the ,001 level

As it can be seen from the Table 6, on the first trading day after ice hockey wins the mean return is negative for both Czech Republic and Sweden, and positive for Finland and Russia. After losses Russia is the only exception with the positive mean return. Russia has the most positive mean return after wins and Czech Republic the lowest mean return after losses. This can also be seen from the t-statistics and from p-values. After wins, Russia is behaving quite the opposite from the others. Russia's p-value is much lower after wins than losses. When looking at the other countries' p-values, it is the other way around.

Elimination games lead to more profound stock market reaction after wins for Finland and Russia and after losses for Czech Republic and Sweden than if all the wins and losses were included in the sample. This can be seen when comparing the p-values and t-statistics. For those p-values that changed for the worse in Table 6, the change was only minor. The changes for better were bigger and extremely big for Russia after wins. Only in the case of Czech Republic (t = -2,414; p = ,016) it can be said that after losses

the p-value is significant at the ,05 level, which implies that there are statistically sig-
nificant differences in investor behavior after ice hockey losses in elimination games
compared with the days when no ice hockey games were played. It can be stated that in
Czech Republic's case H1 can be accepted.

When comparing the p-value of Czech Republic and the p-value of the world index with
other countries' p-values after losses, the difference is biggest between the world index
and Czech Republic. This makes sense, because it is assumed that losses in ice hockey
games of Czech Republic have an impact on stock index of Czech Republic via investor
mood. A big difference between world index and the country indices can be seen also
after wins of Russia and Sweden. From the results of Czech Republic, Finland and Swe-
den we can conclude that losses seemed to have a bigger influence than wins on inves-
tor behavior.

H2 that states that, after elimination games more profound effect on stock index returns
should be observed, can be accepted in half of the cases. H2 can be examined by look-
ing at the p-values in Table 4 and 6. After wins in elimination games p-values became
better for Finland and Russia and after losses in elimination games for Czech Republic
and Sweden. In these cases H2 can be accepted and it can be stated that wins in elimina-
tion games lead to a more profound positive stock market reaction and losses in elimi-
nation games lead to a more profound negative stock market reaction than if all the
games in the sample were included.

Table 7 reports the number of elimination games divided into wins and losses. It also
reports the mean daily logarithmic stock market returns and standard deviations on the
first trading day after wins and losses in elimination games. The difference with Table 6
is that outliers have been removed from the sample. Outliers are removed as mentioned
earlier.

The mean returns after wins and losses remain almost the same as do the standard de-
viations. Only little change was seen in the outputs of regression analyses and it does
not show in Table 7, when describing mean returns and standard deviations with 5

decimals. Little change, however, can be seen at the t-statistics and p-values. Move-
ments are rather small and they remain statistically as significant as in Table 6 even
after removing outliers. Only significant result is Czech Republic after losses as it was
also in Table 6 before removing the outliers. Other movements in p-values were the
following: After wins the p-value of Czech Republic stayed the same, p-value of
Finland became a little bit better as it did also for Russia. Sweden's p-value became a
little bit worse. After losses all the other p-values became better, except the p-value of
Finland.

Table 7. Wins and losses in elimination games (outliers removed).

	Czech Republic	**Finland**	**Russia**	**Sweden**
Wins				
N	10	11	9	14
Mean	-,00633	,0038	,0157	-,00037
Std	,02063	,0225	,01721	,02024
Losses				
N	8	11	9	8
Mean	-,01014	-,00704	,00141	-,00687
Std	,02241	,01805	,02447	,01515
t-statistic (wins)	-1,056	,524	1,738	-,152
p-value (wins)	,318	,600	,082	,880
t-statistic (losses)	-2,445	-1,239	-,013	-1,324
p-value (losses)	,015*	,215	,989	,186

 * significant at the ,05 level
 ** significant at the ,01 level
 *** significant at the ,001 level

Based on the results of Table 7, the p-value after losses of Czech Republic (t = -2,445; p
= ,015) is significant at the ,05 level. This can be interpreted so that there is a statisti-
cally significant difference in investor behavior after ice hockey losses in elimination
games of Czech Republic compared with the days when no ice hockey games were
played. H1 can be accepted in this case. However, the movement was rather small com-
paring with the result of Table 6. No other statistically significant results are obtained
based on H1 and Table 7.

H2 that states that after elimination games more profound effect on stock index returns should be observed can be accepted in half of the cases. H2 can be accepted based on the p-values in Table 5 and 7. After wins in elimination games p-values became better for Finland and after losses in elimination games for Czech Republic, Russia and Sweden. In these cases H2 can be accepted and it can be stated that wins in elimination games lead to a more profound positive stock market reaction and losses in elimination games lead to a more profound negative stock market reaction than if all the games in the sample were included.

From the results of Czech Republic, Finland and Sweden we can again conclude that losses seemed to have a bigger influence, than wins do, on investor behavior. Russia is an exception again with smaller p-value after wins, which was p = ,082.

6.3. Overall Results from the Empirical Part

Ultimately it is aspired to solve whether there are significant differences between the returns after wins and the returns after losses compared with each other. Earlier wins were compared with the days when no games were played and losses as well. After comparing the returns after wins and losses, the following results were obtained. The results are documented in Table 8. When the difference was examined after all games used in the sample, only one significant result is found. The difference between the returns after wins and losses for Finland (t = 2,433; p = ,019) is significant at the ,05 level.

When using only the elimination games two significant results are found. The difference between the returns after wins and losses in elimination games are significant for Finland (t = 2,602; p = ,020) at the level of ,05 and for Russia (t = 3,425; p = ,005) at the level of ,01. Otherwise no significant results are obtained.

Table 8. Differences between the returns after wins and losses.

	Czech Republic	**Finland**	**Russia**	**Sweden**
All games				
t-test	1,572	2,433	1,260	1,098
p-value	,122	,019*	,215	,227
Elimination games				
t-test	1,515	2,602	3,425	1,454
p-value	,152	,020*	,005**	,164

　*significant at the ,05 level
　** significant at the ,01 level
　*** significant at the ,001 level

No negative stock market reaction after losses of international ice hockey games is found, except for Czech Republic after elimination games. No evidence of positive stock market reaction after wins of international ice hockey games can be found either. Removing the outliers did not give any more significant results. In half of the cases it can be concluded that elimination games did have more profound effect on stock index returns than when using all the games that are included in the sample. In most of the cases it can also be concluded that losses did have a bigger influence on stock returns than wins. When examining whether there is a difference between the returns after wins and losses three significant results were discovered. For Finland after all games and after elimination games and also for Russia after elimination games the difference was significant. Because of the few significant outcomes it can be roughly said that the results embed the view that investors are rational and markets are efficient. More rational explanation, however, would be that the results of this thesis suggest that it may be possible that the effect associated with winning or loosing an international ice hockey game is too small to influence the national stock market index. Also it cannot be concluded based on the thesis that investors are rational and markets are efficient, rather there are more important matters that affect investor behavior and thereby stock returns than outcomes of the international ice hockey games.

There may be many reasons why H1 in every other case, except in Czech Republic's case, and also H2 in that extent that was mentioned earlier, were rejected. It may be that the amount of games was too small. One reason might also be that large amount of ice hockey games are played during the weekends. Since the first trading day after a week-

end is Monday, the stock return on Monday was used in many cases. Usually many games were played for every country during a weekend, so it was quite common that the return on Monday had to be used both after wins and losses for the same country. This may eliminate the effect there could have been after only a win or only a loss. This way wins and losses could have repealed each other's effect on stock indices. In previous studies, it was shown that losses in soccer games have an impact on stock returns, especially Football World Cup games. The reason may be, because they are arranged only every fourth year as Ice Hockey World Championships are played every year. It becomes a more awaited event as it is played more seldom.

There is evidence that sport results have an effect on mood, but at the same time have little direct economic impact. It can be concluded that in most of the cases the outcomes of the ice hockey games are uncorrelated with the asset prices.

7. CONCLUSIONS

In this final chapter both the theoretical and empirical part of the thesis are summed up. In addition main contribution of the thesis is explained and suggestions for future research are also made.

The last 30 years have been very exiting for academic finance. Among the many changes in views, the increased skepticism about market efficiency stands out. This skepticism derives from many sources, including the recognition of the limitations of arbitrage, the accumulation of evidence on predictability on stock returns, the observation of identical securities trading at different prices in different markets, and the salient, but unexplained movements in stock market prices, such as the crash of 1987. Of course the theories, the evidence and even the unexplained movements have all been subject to much debate. However, the cumulative effect has been to put the new discipline, behavioral finance, on the map.

The collaboration between finance and other social sciences has led to a profound deepening of our knowledge about financial markets. It can be concluded that it is essential to understand how investors behave before markets can truly be understood. Behavioral finance has swayed the leading role of efficient market hypothesis in the academic research done in the field of finance during the past decades. According to behavioral finance markets are not correctly priced. Natural persons act in the markets and that is why their behavior has a significant role in financial markets, i.e. the market psychology is acknowledged.

Markets react to new information, but new information is not the only thing that affects stock prices. Recently researchers have shown that also psychological factors have an effect on price formation of the stocks. Moreover, when people begin to see financial markets as places where different types of investors, some rational and some not, trade and understand the forces that shape their demands for securities, many new problems may emerge. Ample opportunities for research of how to make markets efficient may open up.

The objective of the thesis is to show that mood can have an effect on stock returns. The purpose is also to expand the existing evidence linking mood to asset prices and also to describe the basic literature from market efficiency, behavioral finance and investor irrationality. Two hypotheses are set for investigating the link between sport results and stock returns.

Motivated by the psychological evidence showing that sport results have a strong effect on mood, the thesis investigates whether there is a stock market effect based on international ice hockey results. However, no negative stock market reaction after losses of international ice hockey games is found, except for Czech Republic after elimination games. No evidence of positive stock market reaction after wins of national ice hockey games can be found either. Although, it can be seen that in most of the cases losses have a larger impact on stock returns than wins do. It can be also stated that in half of the cases wins in elimination games lead to a more profound positive stock market reaction and losses in elimination games lead to a more profound negative stock market reaction than if all the games in the sample were included.

There are many areas and problems that remain poorly answered in behavioral finance and in explaining investor irrationality. Future research could be done about the ways to calculate and analyze investor sentiment and also how central investor sentiment is for security issuance. The predictability of future mispricing could also be examined. It could also be examined how investors evaluate risk, for instance, why do they sometimes gamble and sometimes reveal extreme caution. Such matters as investor behavior and irrationality after different kinds of events, such as natural disasters, layoffs and wage increases could be examined.

Thaler (2000: 135–139) made some predictions about the future concerning, how economics will develop over the next couple of decades. He predicts that people will become slower learners and more emotional. Economic models are expected to become more heterogeneous. Economists will study human cognition and they will distinguish between normative and descriptive theories.

It now appears likely that the gap between the views in the two disciplines has been permanently narrowed. Yet there are no immediate prospects of economics and psychology sharing a common theory of human behavior. At the moment every prediction about the future can be considered as good as the other one. At least it is certain that extensive research is going to continue.

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