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OVERREACTION HYPOTHESIS: EVIDENCE FROM ISTANBUL STOCK EXCHANGE

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FOREWORD

I should first thank my family for always supporting me and believing in me. My mother deserves most of the thanks for her extra efforts. She did not sleep until I sleep which cannot be forgotten. I should thank my father for his help and for his helpful comments on my thesis and for any conditions he provided to me. I thank my brother for enliving my life with his joyful jokes and with his incredible music.

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F. DİLVİN TAŞKIN

ÖZET

Tezli Yüksek Lisans Projesi

Aşırı Tepki Hipotezi ve İstanbul Menkul Kıymetler Borsası'ndan Kanıtlar

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İngilizce Finansman Programı

Bu tezin amacı davranışsal finansın ünlü bir yaklaşımı ve Etkin Pazar Hipotezinin karşıtı olan Aşırı Tepki Hipotezini incelemektir. Aşırı Tepki Hipotezi, hisse senetlerindeki anormal fiyat hareketlerini, ters yönde fiyat hareketlerinin takip ettiğini savunur. Geçmiş kaybedenler geçmiş kazananlara göre önemli oranda daha yüksek getiri getirmektedir ve bu durum da zayıf formda etkinliğin mevcut olmadığı söylenebilir.

Bu tezde, Ocak 1992, Aralık 2005 dönemi arasında İstanbul Menkul Kıymetler Borsası (İMKB)'de aşırı tepkinin varlığı ve zıtlık stratejisinin karlılığı incelenmiştir. DeBondt ve Thaler yönteminin değiştirilmiş bir versiyonu kullanılarak bir yıllık, iki yıllık ve üç yıllık portföy oluşturma ve takip dönemleri için kazanan, kaybeden ve arbitraj portföyleri oluşturulmuştur. Verilerin istatistiksel anlamlılığını ve gözlem sayısını arttırmak için veriler 3 ay kaydırılarak çakıştırılan dönemler oluşturulmuştur.

Tüm portföy oluşturma ve takip dönemleri için elde edilen sonuçlar, Aşırı Tepki Hipotezini destekler yönde fiyat dönüşümlerinin varlığına işaret etmektedir. Bu bulgular İMKB'nin zayıf formda etkin olmadığı sonucunu vermektedir. Bir yıllık, iki yıllık ve üç yıllık portföy oluşturma ve takip dönemleri içinde arbitraj portföyü zıtlık stratejilerinin kullanımıyla önemli kar sağladığı bulunmuştur. Üç yıllık analiz dönemi dışındaki analizlerde, kazanan portföyün getirilerinin mutlak değeri, kaybeden portföyünün getirilerinden büyük olduğunun görülmesi DeBondt ve Thaler'ın (1985) bulgularının aksinedir.

Anahtar Kelimeler: 1) Aşırı Tepki Hipotezi, 2)Etkin Piyasalar Hipotezi, 3) Zıtlık Stratejileri, 4)Piyasa Anomalileri, 5) İMKB

ABSTRACT

Master Thesis

Overreaction Hypothesis and Evidence from Istanbul Stock Exchange

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The aim of this thesis is to analyze the Overreaction Hypothesis, which is a famous behavioral finance approach that has challenged the Efficient Market Hypothesis. The overreaction hypothesis states that extreme movements in stock prices will be followed by subsequent movements in opposite direction. Past losers significantly outperform past winners, which is a violation of the weak form efficiency.

In this thesis, the period between January 1992 and December 2005 is analyzed in order to examine the evidence of overreaction and the success of contrarian strategies in Istanbul Stock Exchange (ISE). Using a modified version of DeBondt ad Thaler's methodology winner, loser and arbitrage portfolios are formed for one- two- and three- year portfolio formation and test periods. The data is overlapped by shifting the periods for three months in order to increase the number of observations and the statistical significance.

The results show that for all formation and test periods, there is substantial price correction in the market, which supports the overreaction hypothesis. The evidence may indicate that ISE is not weak form efficient. The use of contrarian strategies will provide substantial profits in the arbitrage portfolio both for one-year two-year and three-year portfolio formation and test periods. Except for the three-year analysis, the absolute values of returns of winner portfolios are higher than the loser portfolios, which is in contrast with DeBondt and Thaler's (1985) findings.

Keywords: 1) Overreaction Hypothesis, 2) Efficient Market Hypothesis, 3) Contrarian Strategies, 4) Market Anomalies, 5) ISE

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EVIDENCE FROM ISTANBUL STOCK EXCHANGE

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ABBREVATIONS

D/E: Debt / Equity

EMH: Efficient Market Hypothesis

ISE: Istanbul Stock Exchange

MV/BV: Market Value / Book Value

MVE: Market Value of Equity

P/E: Price / Earnings

S/P: Sales/Price

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INTRODUCTION

Efficient Market Hypothesis (EMH), which argues that the markets are efficient when prices reflect all available information, is the dominant perception supported by the studies of Fama (1970). EMH assumes that investors are rational, if there is some deviation from the fundamental values by the investors' sentiment, arbitrage takes place quickly and correctly and no abnormal profit occurs in the market. Hence, prices should change only with news about changes in fundamental value and there should be no underreaction and overreaction in the market to the new information.

Fama defines three types of efficiency in the market: weak form efficiency, semi-strong form efficiency and strong form efficiency. The weak form of the efficient market hypothesis claims that prices fully reflect the information implicit in the sequence of past prices. The semi-strong form of the hypothesis asserts that prices reflect all relevant information that is publicly available, while the strong form of market efficiency asserts information that is known to any participant is reflected in market prices.

In a weak form efficient market, it is impossible to make profits over market returns. Although most empirical evidence supports the weak-form and semi-strong forms of the efficient market hypothesis, they have not received uniform acceptance. Many investment professionals still meet the efficient market hypothesis with a great deal of skepticism. There are various studies that find evidence of different types of anomalies. Anomalies are empirical results that seem to be inconsistent with maintained theories of asset pricing behavior (Thaler, 1987). They indicate either market inefficiency (profit opportunities) or inadequacies in the underlying asset pricing model. Anomalies often seem to disappear, reverse, or defused. These raise the question of whether profit opportunities existed in the past, but have never since been arbitraged away or whether the anomalies were simply statistical deviations that attracted the attention of academics and practitioners.

Behavioral finance challenge the EMH with the examples of limited arbitrage, unexplained movements, realized abnormal profits in the market and the crash of 1987. Behaviorals state that not all the investors are rational in the market and there can be deviations from the fundamental values.

This thesis is about one of the anomalies of the behavioral approach against EMH; overreaction. Overreaction states that the price corrections occur for the stocks, which have extreme deviations from fundamental values due to the overweighting of investors' previous information. Extreme movements in the stock prices will be followed by the subsequent movements in the opposite direction, which means that past losers significantly outperform past winners, which is a violation of weak form of efficiency. An investor can earn abnormal profit by exploiting this inefficiency with a contrarian strategy, which is based on buying stocks that have been losing and selling stocks that have been winning in a determined time period. The strategy is based on the expectation of price reversals in the future.

The trading strategy contradicts with the main assumptions of EMH, which declares that any abnormal return cannot be earned, and investors are rational. Investors overreact and underreact to news and DeBondt and Thaler (1985) support their findings with Kahneman and Tversky's 1982 study in experimental psychology in which they found that people tend to overreact to unexpected dramatic events.

With this thesis, it would be possible to mention whether investors in Istanbul Stock Exchange (ISE) overreact to news or not. If overreaction exists in ISE contrarian strategies works and with this type of trading strategy it should be possible to earn abnormal returns. The existence of overreaction will lead us to the idea that ISE is not weak-form efficient.

This thesis consists of three parts: First chapter will concentrate on EMH, anomalies and behavioral finance concepts, second chapter will summarize the

literature on overreaction hypothesis and finally chapter three will give the empirical analysis and the results.

The thesis provides the following contributions to the literature:

It provides a very comprehensive literature on EMH and clarifies the historical development of this hypothesis very briefly.

It gives a classified and a neat examination of the literature on Overreaction Hypothesis.

It analyzes the overreaction and the contrarian strategies both for one-, two- and three-year portfolio formation and test periods.

It also provides a contribution to the literature of emerging markets on the subject.

CHAPTER 1

EFFICIENT MARKET HYPOTHESIS and ANOMALIES

In this chapter, the literature on Efficient Markets Hypothesis (EMH) will be presented. After giving the historical developments in EMH, contrary views on EMH, anomalies will be analyzed, and behavioral finance concepts will be defined briefly.

The milestone of finance is simply related with the supply of funds. Households, firms and governments might be facing a mismatch between their income and desired spending and may be willing to pay for the funds they need. Also, they may spend less than their income and may be willing to invest the surplus of their funds and let someone else to use their savings. This mismatch between income and spending for individuals and organizations creates the opportunity to trade (Hubbard, R. G., 2001, pp.2-12).

The financial system provides channels to transfer the funds from the individuals and groups who have saved money to individuals and groups who want to borrow money. The services provided by the financial system are risk sharing, liquidity and information. The financial system provides risk sharing by giving the investors the opportunity to hold many different assets. Financial markets ensure an ease for an asset to be exchanged for money, namely liquidity. The informational role of the financial system covers the collection and communication of information about borrowers of funds and the expectations about the returns on financial assets (Bodie, Z., Alex, K. and Marcus, A. J., 2005, pp.6-7).

Financial markets issue claims on individual borrowers directly to savers. The financial markets can be divided into different subtypes. Capital markets consist of stock market and bond market. Stock markets facilitate equity investment and buying and selling of shares. Bond markets provide financing through the issue of debt contracts and the buying and selling of bonds and debentures. Money markets provide short-term debt financing and investment. Derivatives markets provide

instruments that derive its value from an underlying asset for handling of financial risks. Derivatives markets offer standardized contracts for trading assets at some forward date. Insurance markets facilitate the redistribution of various risks. And finally, foreign exchange markets which facilitates the trading of foreign exchange. The focus of this work is stock markets (Bodie et al., 2005, pp.31-54).

Market participants use the information contained in market prices when they are performing a trade. When we are talking about the market prices for financial assets the expectations of borrowers and lenders determine how much they are willing to accept or pay for a financial claim. The knowledge of economic conditions, political events, consumer behavior, and conditions affecting individual industries or firms determines their expectation and estimates of the future value of financial assets.

1.1 Market Efficiency

A market in which security prices "fully reflect" all available information is called "efficient" (Fama, 1970). This definition leads us to the conclusion that any available information which could influence a company's stock should already be reflected in that company's stock price. With the light of these expressions, anyone can tell that there is no difference in the gains of the professional investors and the investors who knows nothing about the stocks. No one can earn any more than the average of the market.

The stock market seemed to work in a way that allowed all information reflected in past prices should be incorporated into the current price. In other words, the market efficiently processed the information contained in past prices. Again Fama (1965a, pp.383) defined an efficient market as:

> *a market where there are large numbers of rational profit maximizers actively competing, with each trying to predict future*

market values of individual securities, and where important current information is almost freely available to all participants.

In an efficient market security prices should equal the security's investment value, where investment value is the discounted value of the security's future cash flows as estimated by knowledgeable and capable analysts (Sharpe & Alexander, 1990).

A good description of market efficiency is the one by Cootner (1964, pp.21):

"If any substantial group of buyers thought prices were too low, their buying would force up the prices. The reverse would be true for sellers. Except for appreciation of tomorrow's price, given today's price, is today's price.

In such a world, the only price changes that would occur are those that result from new information. Since there is no reason to expect that information to be non-random in appearance, the period-to-period price changes of a stock should be random movements, statistically independent of one another."

In a perfect market these criteria are obviously fulfilled. But this does not mean that an efficient market is the one that is perfect. In a perfectly competitive market, every seller earns a normal profit. If we adopt that this is true for the stock market, it follows that any new information that becomes available to the market will be very quickly reflected in the prices. Otherwise, there will be opportunities for abnormal returns. In an efficient market, on the average, competition will cause the full effects of new information on intrinsic values to be reflected immediately in actual prices (Fama, 1965a).

If we are to define the intrinsic value we can use Lorie and Hamilton (1973)'s definition:

> *Intrinsic value is the value that the security ought to have and will have when the other investors have the same insight and knowledge as the analyst.*

The characteristics of a perfect market are listed as follows: (Rees Bill (1990) as cited in Recep Bildik (2000, pp.2)).

- All the market participants can get all the information without incurring any costs.

- Transaction costs are zero.

- There are lots of competing investors in an efficient market.

- Market participants are rational and make their investment decisions according to the mean variance. They prefer high return to the low, low risk to the high.

- All financial assets are divisible.

- All market participants agree on the implications of current information for the current price and distributions of future prices of each security (Fama, 1970).

Nevertheless, today most of these conditions cannot be met. The information cannot be provided without paying any costs. In order to increase the efficiency in the financial markets, the prices should be formed in a competitive market and also the transaction costs should be determined in very low costs again determined in a

competitive environment. As also mentioned in Fama (1970), these conditions are sufficient for market efficiency, but they are not necessary.

Market efficiency can be considered in several dimensions. Barone (1990) defined efficiency in four dimensions:

- Informational Efficiency: The most important criteria for a market to be informationally efficient, is to reflect all available information in the equity prices. It is a measure of how quickly and accurately the market reacts to new information.

- Fundamental Efficiency: Fundamental efficiency defines the fact that the stock markets should be efficient in the means of fundamental analysis. The pricing of initial public offerings will be based on the rational expectations of the future cash flows of those companies.

  According to Grossman and Stiglitz (1980) the investor are basing their decisions on the decisions of the other investors. According to them, stock markets are like a beauty contest, in which the jury bases his / her decisions thinking that which candidate will be chosen as the most beautiful by all the members in the jury.

  By looking at these, it would be logical to say that the fundamental efficiency reflects the average of investors' expectations.

- Full Insurance Efficiency: The third criterion related to the stock market is that it should be perfect. In other words, there should be a large amount of securities in the market, the returns from a stock is very like the returns of other stocks in the market. And also the varieties of the stocks provide a means for diversification which is good for the traders in order to decrease their risks.

- Functional Efficiency: The meaning of functional efficiency is the same as the operational efficiency. The transactions should be realized with minimum transaction costs. It is a measure of how well things function in terms of speed of execution and accuracy.

1.2 Evolution of Efficient Market Hypothesis

The efficient market hypothesis (EMH) is one of the most important paradigms in modern finance. It was largely accepted to hold by the early 1970s. The efficient market hypothesis says that at any given time, asset prices fully reflect all available information. That apparently straightforward proposition is one of the most controversial ideas in social science research, and its implications continue to be discussed.

Timmermann and Granger (2004), define EMH in their own words as "EMH in its crudest forms says that series we would very much likely to forecast, the returns from speculative assets, are unforecastable. The chief corollary of the idea that markets are efficient, that prices fully reflect all information, is that price movements do not follow any pattern or trends. This means that past price movements cannot be used to predict future price movements. Rather, prices follow the pattern of random walk which means that intrinsically unpredictable movements.

According to Gordon and Rittenberg (1995), EMH's main proposition is that stock prices are the efficient reflection of all information surrounding the market. This proposition means that stock prices completely incorporate all available information. It comes to saying that the price of a stock must result from the aggregate efforts of all the market participants who struggle to adopt all the information that they can acquire in order to achieve profit-maximization. The second meaning of this proposition is related with the sophistication of the decision-making process of the investors. The investors attempt to make their trading decision on the basis of all available information including past performances of securities,

recent economic developments and forecasted future economic events. The third meaning of the proposition describes that stock prices respond to new information very quickly and accurately. It signs that any price variation caused by new information should occur in a rapid and unbiased manner. The average of this bias should be very close to zero in the long run. When the new information is entirely absorbed by the market, new price equilibrium will be reached.

In order to test if a market is efficient or not, a hypothesis testing should be done. At this point, forming a testable hypothesis forms the main concern. The model should elaborately describe the price formation, because the main assumption of EMH is reflection of all available information by the price of the stock. The efforts to define price formation and analyze that process have been mostly neglected and most of the available work is based only on the assumption that the conditions of market equilibrium can be stated in terms of expected returns (Fama, 1970).

1.2.1 Expected Return or Fair Game Models

Most of the available work in the finance literature is based on the assumption that the conditions of market equilibrium can be stated in terms of expected returns. Most theories posit that the equilibrium price can be explained as a function of its risk.

All members of the class of such "expected return theories" can however be described notionally as follows (Fama, 1970):

$$E(\tilde{p}_{j,t+1}\left|\Phi_t\right.) = [1 + E(\tilde{r}_{j,t+1}\left|\Phi_t\right.]p_{jt} \qquad (1)$$

where E is the expected value operator; p_{jt} is the price of security j at time t; $p_{j,t+1}$ is its price at t+1 (with reinvestment of any intermediate cash income from the security); $r_{j,t+1}$ is the one-period percentage return $(p_{j,t+1} - p_{j,t})/ p_{j,t}$; Φ_t is a general symbol for whatever set of information is assumed to be "fully reflected" in the price at t; and the tildes indicate that $p_{j,t+1}$ and $r_{j,t+1}$ are random variables at t. The

conditional expectation notation of (1) is meant to imply, however, that whatever expected in expected return is assumed to apply; the information in Φ_t is fully utilized in determining equilibrium expected returns.

The assumptions that the conditions of market equilibrium can be stated in terms of expected returns and that equilibrium expected returns are formed on the basis of (and thus "fully reflect") the information set Φ_t have a major empirical implication- they rule out the possibility of trading systems based only on information in Φ_t that have expected profits or returns in excess of equilibrium expected profits or returns. Thus let

$$x_{j,t+1} = p_{j,t+1} - E(p_{j,t+1}|\Phi_t) \quad (2)$$

Then

$$E(\tilde{x}_{j,t+1}|\Phi_t) = 0 \quad (3)$$

which by definition, says that the sequence $\{x_t\}$ is a "fair game" with respect to the information sequence $\{\Phi\}$. Or equivalently, let

$$z_{j,t+1} = r_{j,t+1} - E(\tilde{r}_{j,t+1}|\Phi_t) \quad (4)$$

then

$$E(\tilde{z}_{j,t+1}|\Phi_t = 0 \quad (5)$$

so that the sequence $\{z_{jt}\}$ is also a "fair game" with respect to the information sequence$\{\Phi_t\}$.

In economic terms, $x_{j,t+1}$ is the excess market value of security j at time t+1 : it is the difference between the observed price and the expected value of the price

that was projected at t on the basis of information Φ_t. And similarly, $x_{j,t+1}$ is the return at t+1 in excess of the equilibrium expected return projected at t. Let

$$\alpha(\Phi_t) = [\alpha_1(\Phi_t), \alpha_2(\Phi_t), ..., \alpha_n(\Phi_t)]$$

be any trading system based on Φ_t which tells the investor the amounts $\alpha_j(\Phi_t)$ of funds available at t that are to be invested in each of n available securities. The total excess market value at t+1 that will be generated by such a system is

$$V_{t+1} = \sum_{j=1}^{n} \alpha_j(\Phi_t)[r_{j,t+1} - E(\tilde{r}_{j,t+1}|\Phi_t]$$

which, from the fair game property of (5) has expectation,

$$E(\tilde{V}_{t+1}|\Phi_t) = \sum_{j=1}^{n} \alpha_j(\Phi_t) E(\tilde{z}_{j,t+1}|\Phi_t) = 0$$

Fair game models imply the impossibility of various sorts of trading systems. The serial covariances of a fair game are zero, so that these tests are also relevant for the expected return models.

If x_t is a fair game, its unconditional expectation is zero and its serial covariance can be written in general form as

$$E(\tilde{x}_{t+r}\tilde{x}_t) = \int_{x_t} x_t E(\tilde{x}_{t+r}|x_t) f(x_t) dx_t \ ,$$

where f indicates a density function. But if x_t is a fair game,

$$E(\tilde{x}_{t+r}|x_t) = 0 \, .$$

From this it follows that for all lags, the serial covariance between lagged values of a fair game variable are zero. Thus, observations of a fair game variable are linearly independent.

But the fair game model does not necessarily imply that the serial covariances of one-period returns are zero. In the weak form tests of this model the fair game variable is

$$z_{j,t} = r_{j,t} - E(\tilde{r}_{j,t} \left| r_{j,t-1}, r_{j,t-2}, ... \right.) . \quad (6)$$

But the covariance between, for example, r_{jt} and $r_{j,t+1}$ is

$$E([\tilde{r}_{j,t+1} - E(\tilde{r}_{j,t+1})][\tilde{r}_{jt} - E(\tilde{r}_{jt})]$$

$$= \int_{r_{jt}} [r_{jt} - E(\tilde{r}_{jt})][E(\tilde{r}_{j,t+1} \left| r_{jt} \right.) - E(\tilde{r}_{j,t+1})] f(r_{jt}) dr_{jt} \ ,$$

and (6) does not imply that $E(\tilde{r}_{j,t+1} \left| r_{jt} \right.) = E(\tilde{r}_{j,t+1})$: In the fair game efficient markets model, the deviation of the return for t+1 from its conditional expectation itself can depend on the return observed for t.

Fair game model defines that tomorrow's price for a security is a random variable that reflects all the available information for that stock for today (Kıyılar, 1997, pp.12-13). Consequently, fair game model, on average means that, a security's expected return is equal to the realized return for that stock.

According to the fair game model any trading rule can provide an excess return using the available information at any time, t. For fair game model to be true no trading rule should bring any extra return than the market average using the information line Φ_t.

1.2.2 Submartingale Model

This model is again a model to define the price formation and in fact it is a special form of fair game model (Fama, 1970). Suppose we assume that in (1) that for all t and Φ_t

$$E(\tilde{p}_{j,t+1}|\Phi_t) \geq p_{jt} \text{ , or equivalently, } E(\tilde{r}_{j,t+1}|\Phi_t) \geq 0 \text{ .} \quad (7)$$

This is a statement that the price sequence $\{p_{jt}\}$ for security j follows a submartingale with respect to information sequence $\{\Phi_t\}$, which is to say nothing more than that the expected value of next period's price, as projected on the basis of the information Φ_t, is equal to or greater than the current price. If Equation (7) holds as an equality (so that expected returns and price changes are zero), then the price sequence follows a martingale.

A submartingale in prices has one important empirical implication. Consider the set of "one security and cash" mechanical trading rules by which we mean systems that concentrate on individual securities and that define the conditions under which the investor would hold a given security, sell it short, or simply hold cash at any time t. Then the assumption of (7) that expected returns conditional on Φ_t are non-negative directly implies that such trading rules based only on the information in Φ_t cannot have greater expected profits than a policy of always buying-and-holding the security during the future period in question.

1.2.3 Random Walk Model

Another special case of the fair game efficient market model, the random walk model requires the successive price changes be independent and identically distributed. Formally, these conditions can be expressed as follows:

$$f(r_{j,t+1}|\Phi_t) = f(r_{j,t+1}) \quad (8)$$

which is the usual statement that the conditional and marginal probability distributions of an independent random variable are identical. In addition the density function f must be the same for all t.

The random walk model does not imply that past prices contain no information about future return distributions. On the contrary, if the random walk hypothesis is confirmed, past prices constitute the best information for forecasts. What the model does imply is that the past price sequence cannot be used to obtain information about future price sequences (Kıyılar, 1998, pp.15).

The concept of random walk has first been anticipated by Bachelier. Bachelier (1900) conducted an empirical study of French government bonds and found out that their price were consistent with a random walk model. Bachelier mentioned that past, present and even discounted future events are reflected in market price, but often show no apparent relation to price changes. As a result it is hard to outguess the market. This is considered as the recognition of the informational efficiency of the market. Dimson and Mussavian (1998), describes Bachelier's point of view as a conclusion of commodity prices to fluctuate randomly, followed later by the studies of Working (1934) and Cowles and Jones (1937) which were to show that US stock prices shared these characteristics. A comment at the beginning of Working is also worth to mention:

> *It has several times been noted that time series commonly possess in many respects the characteristics of series of cumulated random numbers. The separate items in such time series are by no means random in character, but the changes between successive items tend to be largely random. This characteristic has been noted conspicuously in sensitive commodity prices.* (Working, 1934, pp.11).

This view of Working proposes that stock prices resemble cumulations of purely random changes even more strongly than do commodity prices.

In fact the concept of random walk has first been anticipated by Bachelier, the term "random walk" has been introduced by Pearson (1905). Pearson assimilates the behavior of stock returns to those of finding a drunk left in the middle of a field. The drunk will be faltering in an unpredictable fashion and he is expected to end up at a point closer to where he had been left. Both the drunk and the stock returns would be expected to stagger in a totally unpredictable and random way. Malkiel (1989) ascertained that stock prices behaved as if a blindfolded chimpanzee threw darts at the stock page of The Wall Street Journal.

Fama (1965b) describes the random walk as a theory saying that the future path of the price level of a security is no more predictable than the path of a series of cumulated random numbers. In statistical terms the theory says that successive price changes are independent, identically distributed random variables. Most simply this suggests that series of price changes do not have a memory, which in turn results in the fact that past cannot be used to predict the future. So, the random walk is valid as long as knowledge of the past behavior of the series of price changes cannot be used to increase expected gains.

The works on random walk were later extended by Cowles (1933). In his paper, Cowles presented the results of analyses of forecasting efforts of 45 professional agencies and professionals whose aim are to ensure superior returns to investors or to forecast the future movements of the stock market itself. His results ended with the finding that the agencies compiled an average record that was worse than the average of the stock market itself. This study is valuable in the way that it shows even professionals can not beat the market.

The roots of the random walk model extend to Kendall (1953), who examined 22 UK stock and commodity price series. Kendall concludes that "in series of prices which are observed at fairly close intervals the random changes from one term to the next are so large as to swamp any systematic effect which may be present. The data behave almost like wandering series". Kendall's empirical observations are later labeled as the random walk model.

Bachelier's work was a milestone for the random walk model, but it has been overlooked for almost half a century. It was Osborne (1959) who overworked his model fifty years later. The Bachelier-Osborne model begins by assuming that price changes from transaction to transaction in an individual security are independent, identically distributed random variables. It further assumes that transactions are fairly uniformly spread across time, and that the distribution of price changes from transaction to transaction has finite variance. If the number of transactions per day, week, or month is very large, then price changes across these differencing intervals will be sums of many independent variables. Another breakthrough by Osborne is that he shows that the logarithms of common stock prices can be regarded as an ensemble of logarithms of prices, each varying with the time, has a close analogy with the ensemble of coordinates of a large number of molecules. He applies the methods of statistical mechanics to the stock market with a detailed analysis of stock price fluctuations from the point of view of a physicist.

Roberts (1959) going through Kendall's work (1953) and Working's work (1934) illustrated that market technicians' work did no good, because US stock prices and a series from a sequence of random numbers were undistinguishable.

In his paper named "Stock Market Patterns and Financial Analysis" Roberts (1959, pp.2) wrote:

> *If the stock market behaved like a mechanically imperfect roulette wheel, people would notice the imperfections and, by acting on them, remove them. This rationale is appealing, if for no other reason than its value as counterweight to the popular view of stock market irrationality, but it is obviously incomplete.*

Roberts generated a series of random numbers and plotted the results to see whether any patterns that were known to technical analysts would be visible. He

demonstrated that the random walk will look like very much like an actual stock series.

In 1960s there was another breakthrough; the realization autocorrelation should be included into returns series as a result of using time-averaged stock prices. This has been discovered by Working (1960) that if return series are based on end-of-period prices, returns appears to fluctuate randomly. This time-averaging problem is a precursor on thin-trading and market microstructure. Also this paper was first to test for nonlinear dependence.

In 1964, Cootner has published his book, "The Random Character of Stock Market Prices" which is a collection of papers by Roberts, Bachelier, Cootner, Kendall, Osborne, Working, Cowles, Moore, Granger and Morgenstern, Alexander, Larson, Steiger, Fama, Mandelbrot and others. It is important in the way that it both combines the seminal papers about random walk and also it mentions about market efficiency implicitly. In the outline it follows:

> *The random walk hypothesis about the movement of stock prices is that in a competitive market the present price of shares reflects all information now available that bears on the value of those shares. It follows, therefore, that on the basis of available information it should not be possible to predict any change in the price of shares except for those shares having to do with time preference.*

At first the random walk model seemed completely to contradict not only fundamental analysis, but also the very idea of rational securities pricing (LeRoy, 1989). Adam Smith (1968) expressed the skepticism about the random walk model that was characteristic of market professionals, and also the sense that the random walk model is diagrammatically opposed to the fundamentalist model: "I suspect that even if the random walkers announced a perfect mathematic proof of randomness, I would go on believing that in the long run future earnings influence present value…"

On the other hand, some other economists like Harry Roberts took random walk from a different side. Roberts (1959) mentioned that in the economist's idealized market of rational investors one would expect exactly the instantaneous adjustment of prices to new information that the random walk implies. A pattern of systematic slow adjustment to new information, on the other hand, would imply the existence of readily available and profitable trading opportunities that were not being exploited.

These considerations have been criticized by the opponents of fundamental analysts. According to their point of view new entrants of fundamental analysis would realize this fact and plan to participate in the trading gains and compete those gains away. Fundamentalists had no good answers to those questions.

However, the random walk model left many questions unanswered. Huge sums of money are spent every year on security analysis which, if the random walk model is correct, is entirely unproductive. Random walkers, expect us to believe that unexploited patterns in securities prices cannot persist because for them to do so would imply that investors are irrationally passing up profit opportunities, but also those investors are nevertheless irrationally wasting their money employing useless security analysts. Thus the continuing existence of large incomes based on generating investment advice is a thorn in the side of the random walkers.

Fama (1995) expresses that it is unlikely that the random walk hypothesis provides an exact description of the behavior of stock market prices. Even though the model does not fit the facts really it may be acceptable for practical purposes. But Fama in spite of all these, make comment in favor of random walk theory, because he deems that the theory of random walks stock market prices presents important challenges to both the chartists and the proponents of fundamental analysis.

Prospectively, Fama (1969) expounds that the random walk model should be considered as an extension of the general expected return or fair game efficient markets model in the sense of making a more detailed statement about the

macroeconomic environment. The difference between the fair game model and the random walk model arises in the way of explaining the stochastic process generating returns. The fair game model just says that the conditions of market equilibrium can be stated in terms of expected returns. On the other hand, a random walk appears within the context of such a model when the environment is such that the development of investor tastes and the process generating new information combine to produce equilibria in which return distributions repeat themselves through time.

Thus it would be to the purpose to say that empirical tests of the random walk model are in fact tests of fair game properties are more strongly in support of the model than tests of additional pure independence assumption.

1.2.4 Efficient Market Hypothesis

Random walk model, reflected as a set of observations considering a better understanding of price formation in competitive markets, is consistent with the efficient market hypothesis. In the late 1950s and early 1960s empirical work by several statisticians and economists showed that price changes appeared to be random. Many economists viewed this as implying that prices were irrational and not subject to economic laws.

The shift of emphasis began with Samuelson. Samuelson (1965) with "Proof That Properly Anticipated Prices Fluctuate Randomly" observes that in a competitive market there is a buyer for every seller and if somebody is sure that a price would rise, it would have already risen. Samuelson showed that randomness is not a sign of rationality. He also added rigor to the understanding of a well-functioning market. He describes the fact with his words:

> *We would expect people in the market place, in pursuit of avid and intelligent self-interest, to take account of those elements of future events that in a probability sense may be discerned to be casting their shadows before them (Samuelson, 1965, pp.43).*

Samuelson's work is also important in the way that it is the first formal economic argument for efficient markets and the random walk hypothesis. After Samuelson's work there came Fama to the scene, shaking the finance literature thereafter. Fama (1970) with his famous seminal paper "Efficient Capital Markets: A Review of Theory and Empirical Work" assembled a comprehensive review of the theory and evidence of market efficiency. As mentioned before with this paper Fama put forward the definition of market efficiency: A market in which prices always fully reflect available information is called efficient. This definition follows that any new information that becomes available to the stock market will be very quickly reflected in the prices. Otherwise, there will be opportunities for abnormal returns. In Fama's own words:

> *In an efficient market, on the average, competition will cause the full effects of new information on intrinsic values to be reflected instantaneously in actual prices (Fama, 1965b, pp.57).*

In fact, the theory of Rational Expectations underlies the Efficient Market Hypothesis. In equilibrium the risk-adjusted return on all investments should be equal to the return one may expect from a share of stock should exactly equal the return that can be had on any other financial instrument with similar risk characteristics. If any single financial instrument exhibits a higher risk-adjusted rate of return than others, investors can be expected to attempt to purchase that instrument, thereby causing its price to rise and its rate of return to fall. This suggests that it is not possible to systematically beat the market by picking a stock which will outperform the market.

Fama defines three types of efficiency in the market: weak form efficiency, semi-strong form efficiency and strong form efficiency. The weak form of the efficient market hypothesis claims that prices fully reflect the information implicit in the sequence of past prices. The semi-strong form of the hypothesis asserts that prices reflect all relevant information that is publicly available, while the strong form

of market efficiency asserts information that is known to any participant is reflected in market prices.

In Fama's 1970 paper, it is concluded that the results are strongly in support of the weak form of market efficiency.

1.2.4.1 Weak- Form Efficiency

The weak form of the efficient markets hypothesis asserts that the current price fully incorporates information contained in the past history of prices only. That is, nobody can detect mis-priced securities and beat the market by analyzing past prices. The weak form of the hypothesis got its name for a reason- security prices are arguably the most public as well as the most easily available pieces of information. Thus, one should not be able to profit from using something that everybody else knows. On the other hand, many financial analysts attempt to generate profits by studying exactly what this hypothesis asserts is of no value – past stock price series and trading volume data. This technique is called technical analysis. (Bodie, Z., Kane, A. and Marcus, A. J., 2005, pp. 386).

The empirical evidence for this form of market efficiency, and therefore against the value of technical analysis, is pretty strong and quite consistent. After taking into account transaction costs of analyzing and of trading securities it is very difficult to make money on publicly available information such as the past sequence of stock prices.

A number of studies have attempted to test this hypothesis by examining the correlation between the current return on a security and the return on the same security over a previous period. A positive serial correlation indicates that higher than average returns are likely to be followed by higher than average returns, while a negative serial correlation indicates that higher than average returns are followed, on average, by lower than average returns. If the random walk hypothesis so did the weak form of market efficiency hold, we would expect zero correlation. Consistent

with this theory, Fama (1965a) found that the serial correlation coefficients for a sample of 30 Dow Jones Industrial stocks, even though statistically significant, were too small to cover transaction costs of trading.

Another stand of literature tests the weak form of market efficiency by examining the gains from technical analysis. While many earlier studies found technical analysis to be useless, recent evidence by Brook, Lakonishok and LeBaron (1992) finds evidence that relatively simple trading rules would have been successful in predicting changes in the Dow Jones Industrial Average. However, subsequent research has found that the gains from these strategies are insufficient to cover their transaction costs. Consequently, the findings are consistent with weak-form market efficiency.

1.2.4.2 Semi- Strong Form Efficiency

The semi-strong form of market efficiency hypothesis suggests that the current price fully incorporates all publicly available information. Public information includes not only past prices, but also data reported in a company's financial statements, earnings and dividend announcements, announced merger plans, the financial situation of company's competitors, expectations regarding macroeconomic factors such as inflation or unemployment. In fact, the public information does not have to be of a strictly financial nature (Civelek, M. and Durukan, M. B., 1998, pp.378).

The assertion behind semi-strong market efficiency is still that one should be able to profit using that everybody else knows. Nevertheless, this assumption is far stronger than that of weak-form efficiency. Semi-strong efficiency of markets requires the existence of market analysts who are not only financial economists able to comprehend implications of vast financial information, but also macroeconomists, experts expert at understanding processes in product and input markets. Arguably acquisition of such skills must take a lot of time and effort. In addition the public information may be relatively difficult to gather and costly to process.

The semi-strong form of the efficient market hypothesis is perhaps the most controversial, and thus, has attracted the most attention. If a market is semi-strong form efficient, all publicly available information is reflected in the stock price. It implies that investors should not be able to profit consistently by trading on publicly available information.

Investment Managers

Many people suggest that mutual fund managers are skilled investors who are able to beat the market consistently. Unfortunately, the empirical evidence does not support this view. In one of the first studies of its kind, Michael Jensen (1969) found that over the period 1955 to 1964 mutual funds achieved a risk-adjusted performance of approximately zero percent per year. In other words, mutual fund managers exhibited no special stock picking ability. Furthermore, this return fell to -0.9% per year after taking commissions and expenses into account. More recently, Burton Malkiel (1999) compared the performance of managed general portfolio funds to the performance of S&P 500 Index. During 1984-1994, the S&P500 gained 281.65%, while the equity funds on average appreciated only by 214.80%.

Multiple studies have demonstrated that mutual funds, on average, do not exceed the return of the market index. This has been demonstrated in both large markets and smaller, supposedly less-efficient markets. Equally important to investors is whether or not they can identify some managers or mutual funds that can consistently beat the index. The findings show that a mutual fund's performance over the past 1, 3, 5, or 10 years is not predictive of its future performance.

Event Studies

If markets are efficient and security prices reflect all currently available information should rapidly be converted into price changes. Many research studies have examined announcements to determine whether the market reacts as predicted. Many types of events have been studied, including mergers and acquisitions, seasoned equity offerings, spin-offs, dividend announcements, etc. The evidence generally indicates that the market reacts quickly to these various corporate

announcements, often in a couple of minutes. Thus, investors cannot expect to earn superior returns by trading on the announcement date.

In the study of Fama, Fisher, Richard and Roll (1969), they examined the stock price reaction around stock splits. Conventional wisdom had long held that stock splits were good news for investors, because they were generally followed by dividend increases. Fama, Fisher, Richard and Roll found that stock splits were preceded, on average, by periods of strong performance, most likely because firms tend to split in good times. However, following the split, they observed no evidence of abnormal stock price performance. That is, investors would not be able to profit by purchasing the stock on the split date. This evidence is consistent with the efficient market hypothesis.

There is overwhelming evidence in the finance literature suggesting that targets of takeover attempts gain significantly upon an announcement of the acquisition plan by the bidder. Interestingly, there becomes a small upward drift in price prior to the announcement, indicating that some information leaked out. However, after the announcement the stock price changes are, on average, close to zero, without any visible trend. This finding is consistent with efficient market hypothesis, since it suggests that the full effect of the information is incorporated immediately.

1.2.4.3 Strong Form Efficiency

The strong form of market efficiency hypothesis states that the current price fully incorporates all existing information, both public and private which is mostly referred to as the insider information. The main difference between the semi-strong and strong efficiency hypothesis is that in the latter case, nobody should be able to systematically generate profits even if trading on information not publicly known at the time. In other words, the strong form of efficient market hypothesis states that a company's management are not be able to systematically gain from inside

information by buying company's shares to pursue what they perceive to be a very profitable acquisition.

The rationale for strong-form market efficiency is that the market anticipates, in an unbiased manner, future developments and therefore the stock price may have incorporated the information and evaluated in a much more objective and informative way than the insiders. Not surprisingly, empirical research in finance literature found evidence that is inconsistent with the strong form of market efficiency.

Empirical tests of the strong-form version of the efficient market hypothesis have typically focused on the profitability of insider trading. If the strong-form efficiency hypothesis is correct, then insiders should not be able to profit by trading on their private information. Jaffe (1974) finds considerable evidence that insider traders are profitable. A more recent paper by Rozeff and Zaman (1988) finds that insider profits, after deducting an assumed 2 percent of transaction costs per year, are 3 percent per year. Thus, it does not appear to be consistent with the strong-form of the EMH.

1.2.5 Efficient Market Hypothesis and Istanbul Stock Exchange

Stock market efficiency is crucial for the following sections of this thesis. If there is a violation for market efficiency, this pushes us forward to think that there will be much more evidence for anomalies in the market.

Bekçioğlu and Ada (1985) used serial correlation and runs test in order to analyze the market efficiency by using the prices of 42 firms available in the market between the period 1975 and 1981. Their results show that the price changes are not independent from time and thus the random walk hypothesis was rejected.

Gürsakal (1982) wanted to test if the changes in stock prices are independent from each other. Using monthly data for 45 firms in 1980 using chi-square

independence tests, they found out that price changes are not independent from the previous changes. This means the rejection of random walk model. But because it considers only one year, it is a limited study in giving correct results.

Öncel (1993), used filter tests on 43 common stocks traded between January 1988 and February 1993. The results show that using "buy and hold strategy" it has been possible to earn abnormal returns, which in turn means that Istanbul Stock Exchange is even not weak form efficient.

With the same methodology, Köse (1993) analyzed the 45 common stocks closing data. Again, it has been found that it was possible to earn abnormal returns, again leading to a result that the market is not weak form efficient.

Balaban (1995a) analyzed the period between January 1988 and August 1994. He concludes that the Istanbul Stock Exchange is neither weak form nor semi-strong form efficient. Random walk model is rejected for all periods under consideration. Again Balaban (1995b) presented some empirics of the Istanbul Stock Exchange. He applied both parametric and non-parametric tests to daily, weekly and monthly returns. Those tests reject the random walk hypothesis for daily and weekly returns. However, monthly index returns follow a random walk.

Alparslan (1989) uses two groups of weak form tests which are statistical tests of independence (autocorrelation and runs tests) and tests of trading rules (filter rules). He finds that runs and autocorrelation tests cannot overthrow weak form efficiency completely. However, filter tests indicate that an individual can have beaten the market by buying and holding some of the stocks. So, this pushes us further to think that Istanbul Stock Exchange is not efficient.

Using the same methodology that Alparslan used, Unal (1992) analyzed weak form efficiency of Istanbul Stock Exchange. He used the data composed of daily adjusted closing prices of twenty major stocks. His results also support that the Istanbul Stock Exchange is not weak form efficient.

Özer (2001) tests the randomness and autocorrelation of Istanbul Stock Exchange. Both autocorrelation and randomness indicate whether a market is weak efficient. For the market to be considered as weakly efficient both of the conditions of lack of autocorrelation and randomness properties should be satisfied. The test period was between January1998 and June 2001. The findings show that Istanbul Stock Exchange is inefficient.

Çevik and Yalçın (2003) used a larger period of data compared to the other studies. Their analysis covers the weekly data between 1986-2002 employing random walk process. As an alternative to the previous studies concerning the weak efficiency of the Istanbul Stock Exchange, stochastic unit root analysis was performed for price changes. Secondly, roots for each time point were estimated by Kalman Filter Method which enables us to determine weak efficiency for each time point instead of periodic determination. With the exception of year 1987, Istanbul Stock Exchange is found as inefficient.

A study using classifier system by Aksoy and Sağlam also found Istanbul Stock Exchange as inefficient in weak form. A classifier system is used to calculate expected return and risk at various levels of ISE100 Index. It is observed that the expected returns from the market portfolio are higher at the low levels of the market index, which is a cursor for inefficiency.

Again using a runs test and also a Dickey-Fuller unit root test Taş and Dursunoğlu (2005) tested the weak form efficiency for the interval of January 1995 to January 2004. The findings approve that the market is inefficient and concluded that stock prices do not follow a random walk.

The papers presented up to now have shown evidence against that weak form efficiency of Istanbul Stock Exchange. Most of the studies regarding the market efficiency of Istanbul Stock Exchange are in favor of the fact that the stock market is inefficient. On the contrary, there are studies putting forward evidence in favor of weak form efficiency of the market.

Özün (1997) also found evidence of weak form efficiency even including the stocks that are not always traded. This paper provided different methodology taking care of the changes in market volatility and time difference effects on market risk premium. The results show that Istanbul Stock Exchange is weakly efficient in the period between 1987 and 1998, except 1995 and 1996.

The literature differs related to the time period considered, the frequency of the data used, and the stocks taken into account. But when we look at the total, the literature conspicuously rejects the weak form efficiency of the Istanbul Stock Exchange.

1.3 Evidence against the Efficient Market Hypothesis

1.3.1 Anomalies

Although most empirical evidence supports the weak-form and semi-strong forms of the efficient market hypothesis, they have not received uniform acceptance. Many investment professionals still meet the efficient market hypothesis with a great deal of skepticism. Warren Buffet, the greatest investor of all times, and the second richest man in the world explains his views on efficient market hypothesis with his own words: "*I would be a bum in a street, with a tin cup, if the markets were efficient."*

Anomalies are empirical results that seem to be inconsistent with maintained theories of asset pricing behavior (Thaler, 1987). They indicate either market inefficiency (profit opportunities) or inadequacies in the underlying asset pricing model. Anomalies often seem to disappear, reverse, or defused. These raises the question of whether profit opportunities existed in the past, but have never since been arbitraged away or whether the anomalies were simply statistical deviations that attracted the attention of academics and practitioners.

At a fundamental level, anomalies can only be defined relative to a model of normal return behavior. Fama (1970) pointed out that tests of market efficiency have a joint hypothesis problem because they also test a maintained hypothesis about equilibrium expected asset returns. Thus, whenever someone concludes that a finding seems to indicate market inefficiency, it may also be evidence that the underlying asset-pricing model is inadequate.

It is also important to consider the economic relevance of a presumed anomaly. Jensen (1978) stressed the importance of trading profitability in assessing the market efficiency. In particular, if anomalous return behavior is not large enough to make it profitable for an efficient trader to make money on this information, it is not economically significant. This definition of market efficiency directly reflects the relevance of this type of academic research to practitioners.

In the finance literature, there are huge amount of studies questioning the efficient market hypothesis and pointing out to different anomalies, which of them related to seasonal trends can be classified as follows (Özmen, 1997):

i) Anomalies related to days:
   (1) Day of the week effect / weekend effect
   (2) Intra-day effects
   (3) Friday the thirteenth effect
ii) Anomalies related to months:
   (1) January effect (Turn-of-the year effect)
   (2) Mark Twain effect
   (3) Intra-month effect
   (4) Turn-of-the month effect
iii) Anomalies related to holidays:
   (1) Before holiday /After Holiday Effects
iv) Anomalies related to firms:
   (1) Small/ big firm effect.

There are also some anomalies in the literature such as price-earnings ratio effect, risk premium effect, winner-loser effect and neglected- firm effect.

The growth in the amount of data and the computing power available to researchers, along with the growth in the number of active empirical researchers in finance since Fama's (1970) survey article, has created an explosion of facts that raise questions about the simple models of efficient capital markets that were first studied. Many people have noted that the normal tendency of researchers to focus on unusual facts could lead to the over-discovery of anomalies. For example, if a random process results in a particular sample that looks unusual, and this attracts the attention of researchers to study it, this "sample selection bias" could lead to the perception that the underlying model was not random. Of course, the key test is whether the anomaly persists in new, independent samples.

1.3.1.1 Over-reaction and Under-reaction

The Efficient Market Hypothesis implies that investors react quickly and in an unbiased manner to new information. In two widely publicized studies, DeBondt and Thaler (1985) present contradictory evidence. They find that stocks with low long-term past returns tend to have higher future returns and stock with high long-term past returns tend to have lower future returns or long-term reversals. This notion will construct the rest of the work.

These findings received significant publicity in the popular press, which ran numerous headlines touting the benefits of these so-called contrarian strategies. The results appear to be inconsistent with the efficient market hypothesis. However, they have not survived the test of time. Although the issues are complex, recent research by Fama and French (1996) indicates that the findings might be the result of methodological problems arising from the measurement of risk. Once the risk is measured correctly, the findings tend to disappear.

One of the most enduring anomalies documented in the finance literature is the empirical observation that stock prices appear to respond to earnings for about a year after they are announced. Prices of companies experiencing positive earnings surprises tend to drift upward, while prices of stocks experiencing negative earnings surprises tend to drift downward. This "post-earnings-announcement drift" was first noted by Ball and Brown (1968) and has since then been replicated by numerous studies over different time periods and different countries. After more than thirty years of research, this anomaly has yet to be explained. Over and under-reaction is also under the consideration of behavioral finance.

Another study reported that stocks with high returns over the past year tended to have higher returns over the following three to six months. This momentum effect is a fairly new anomaly and consequently significantly more research is needed on the topic. However, the effect is present in other countries and has persisted throughout the 1900s.

A variety of anomalies have been reported. Some indicate market over-reaction to information, and others under-reaction. Some apparent anomalies, such as the long-term reversals of DeBondt and Thaler, may be a by-product of rational pricing. This is not evident until alternative explanations are examined by appropriate analysis.

1.3.1.2 Value versus Growth

A number of investment professionals and academicians argue that value strategies are able to outperform the market consistently. Typically, value strategies involve buying stocks that have low prices relative to their accounting book values, dividends or historical prices. Lakonishok, Scheleifer, and Vishny (1994) find evidence that the average in returns between stocks with low price-to-book ratios (value stocks) and stocks with high price-to-book ratios (glamour stocks) was as high as 10 percent year. Surprisingly, this return differential cannot be attributed to higher risk- value stocks are typically no riskier than glamour stocks. Rather, the authors

argue, market participants consistently overestimate the future growth rates of glamour stocks relative to value stocks.

Furthermore, around the same time as early size effect papers, Basu (1977, 1983) noted that firms with high earnings price (E/P) ratios earned positive abnormal returns relative to the CAPM. Many subsequent papers have noted that positive abnormal returns seem to accrue to portfolios of stocks with high dividend yields (D/P) or to stocks with high book/market (B/M) value of common stock.

Consequently, these results may represent strong evidence against the EMH. It was also interesting that nearly the entire advantage of the value stocks occurred in January each year. However, current research indicates that the anomalous returns may be caused by a selection bias.

Besides, Ball (1978) made the important observation that such evidence was likely to indicate a fault of the CAPM, rather than the market inefficiency, because the characteristics that would cause a firm to enter a trader's portfolio following this strategy would be stable over time and easy to observe. In other words, turnover and transaction costs would be low and information collection costs would be low. If such a strategy earned reliable abnormal returns, it would be available to a large number of potential arbitrageurs at a very low cost.

Following this, Fama and French (1992, 1993) have argued that size and value as measured by the book/market value of common stock represent two risk factors that are missing from CAPM. In particular, they suggest using regressions of the form:

$$(R_{it} - R_{ft}) = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + \varepsilon_{it}$$

to measure abnormal performance, α_i. In the equation SMB represents the difference between the returns to portfolios of small and large capitalization firms, holding constant to the B/M ratios for these stocks, and HML represents the

difference between the returns to portfolios of high and low B/M ratio firms, holding constant the capitalization for these stocks. Thus, the regression coefficients s_i and h_i represent risk exposures to size and value risk in much the same way that β_i measures the exposure to market risk.

Fama and French (1993) use their three factor model to explore several of the anomalies that have been identifies in earlier literature, where the test of abnormal returns is based on whether, $\alpha_i=0$ in the equation above. They find that abnormal returns from the three-factor model are not reliably different from zero for portfolios of stocks sorted by equity capitalization, or B/M ratios, or D/P ratios, or E/P ratios. The largest deviations from their three-factor model occur in the portfolio of B/M (or growth) stocks, where small capitalization stocks have returns that are too low and large capitalization stocks have returns that are too high.

Fama and French (1996) extend the use of their three-factor model to explain the anomalies studied by Lakonishok, Shleifer and Vishny (1994). They find no estimates of abnormal performance in their equation that are reliably different from zero based on variables such as B/M, E/P, cash flow –price ratio (C/P) and the rank of past sales growth rates.

1.3.1.3 The Size Effect

Banz (1981) and Reinganum (1981) uncovered another puzzling anomaly. He found that average returns on small stocks on AMEX and New York Exchanges were too large to be justified by the Capital Asset Pricing Model, while the average returns on large stocks were too low. This effect is also considered as the *small firm effect*.

Small firm effect, generally speaking, underlies the fact that the small firms tend to earn better rates of return than large firms. Various research studies using the total dollar value of all outstanding common stock as a measure of the firm's size have affirmed the size effect.

Like Banz (1981) and Reinganum (1981), Keim (1983) also analyzed the same stock markets for the periods of 1963-1979, and concluding that the 50% of returns in particular to the small firms have been realized in January, 26% in the first week of January, 11% is on the first day of January. On the contrary, he found that the big firms realized negative returns.

Likewise, Lamoraux and Sanger (1989) have found a great evidence of firm effect between the period 1972 and 1985. As the firms grew in size, returns fell constantly. As the small firms realized 13.3% returns in January, big firms realized only 3.1%. Same findings have been also analyzed by Schwert (1983), Kato and Schallheim (1985), Loughran (1997).

There is also considerable research about the interaction of the size effect and other return regularities like Keim's (1983) study. Combined effects of size and price-earnings ratio have been obtained by Cook and Rozeff (1984), Goodman and Peavy (1986).

Subsequent research indicated that most of the difference in the returns between small and large stocks occurred in the month of January. The results were particularly surprising because for years economists had accepted that systematic risk or beta was the single variable for predicting returns. These findings were documented by Roll (1983), Lakonishok and Smidt (1986), Schultz (1985).

Current research by Fama and French (1992) indicates that this finding is not evidence of market inefficiency, but rather indicates a failure of the Capital Asset Pricing Model.

Some research expounds that this anomaly does not exist. Claessens, Dasgupta and Glen (1995) have analyzed 20 emerging stock markets from different countries and they could not find any systematic evidence of small firm effect.

Stoll and Whaley (1983) take attention to the transaction costs, emphasizing that the fact that the transaction costs of small firms are much higher than the costs of

big firms. If the costs are taken into consideration big firms will bring more returns than small ones. This statement was falsified by Schultz (1983), Reinganum (1983) and Roll (1983) underlying the fact that this finding was related to the stocks of whose prices depreciated sharply.

There is fair evidence in favor of and against this anomaly, but it is for sure that this anomaly has been analyzed in most of the stock markets from different parts of the world.

1.3.1.4 The Turn-of-the- Year (January) Effect

Another return regularity is the tendency for stock prices to decline during the last trading days of December and go up later on in January. The research of Dyl (1977), Branch (1977), Jones, Pearce and Wilson (1987) associated the effect to tax-loss selling in December, accompanying a reinvestment during the next few weeks in January. The well-known January effect and the turn-of-the-year effect, has also been linked to various other effects, since January effect have also been observed in papers presenting other kinds of anomalies.

Keim (1983) and Reinganum (1983) showed that much of the abnormal return to small firms occurs during the first weeks of January. This anomaly became known as the turn-of-the-year effect. Roll (1983) hypothesized that the higher volatility of small capitalization stocks caused more of them to experience substantial short-term capital losses that investors might want to realize for income tax purposes before the end of the year. This selling pressure might reduce prices of small capitalization stocks in December leading to a rebound in early January as investors repurchase these stocks to reestablish investment positions. The persistence of this effect in many different studies is an imperfection in weak form efficient market hypothesis.

1.3.1.5 The Weekend Effect

Stock prices tend to rise on Fridays more often than any other day of the week and have risen least often on Mondays. Not only have a large number of losses occurred on Mondays, most of the losses occurred before lunch. On the other four trading days of the week prices tend to rise throughout the day. These statistically significant return regularities represent another defect in the weakly efficient market hypothesis.

French (1980) noted that average return to the S&P composite portfolio was reliably negative over weekends from 1953-1977. His findings reveal that for all the periods considered the Mondays brought negative returns up to -0.168%, the rest of the days brought positive returns peaking on Wednesdays and Fridays.

French wanted to analyze whether the returns on a stock is realized on trading time or on calendar time. He developed to hypothesis: trading time hypothesis and calendar time hypothesis According to the assumptions of those hypotheses, when holidays ignored there are three calendar days from closing of Friday to Monday, so the returns of Monday reflects three calendar days. If the return is a linear function of the investment period, Monday's average return should be three times the other trading days which is also mentioned by Oldfield and Rogalski (1980). If the returns are appearing only on trading days, than the average return on each trading day should be the same. But French's findings resulted in a rejection of both hypotheses, triggered by the fact that the Monday's brought negative returns. French reasoned these negative returns to the *weekend effect*.

There is also evidence which shows interaction of weekend effect with other anomalies. According to Rogalski's (1984) findings the returns realized on Mondays is positive in January, whereas negative in the rest of the year. Another anomaly in this paper is that the positive returns in these January-Mondays are also related with the size effect. Stocks of firms with lower market values provide more return on the Mondays of January's compared to those with higher market values.

There is also some conflicting evidence on weekend effect. Jaffe and Westerfield (1989) analyzed markets from 5 and in the markets rather than USA and England there is a positive correlation in the returns of Mondays and Fridays. Likewise, Abraham and Ikenberry (1994) support the idea that if the returns on Fridays are negative, it is 77.3% probable that the returns will be negative on Mondays too and if the returns on Fridays are positive, returns of Monday will be positive with 56.4% probability.

1.3.1.6 The Neglected Firm Effect

Neglected stocks are variously defined as stocks that lack popularity with the large institutional investors, stocks not followed by many professional security analysts, or stocks about which it is difficult to get information. Arbel and Strebel (1982) and Merton (1987) provided evidence about this anomaly and concluded that these neglected stocks can outperform the returns of market average, pointing to another anomaly in efficient markets hypothesis.

1.3.2 Behavioral Finance

Since the early 1980s, there has been a movement toward incorporating more behavioral science into finance. The proponents of behavioral finance cite several key areas where the reality seems to be most at odds with the efficient market hypothesis.

One is the excess volatility problem. Price movements seem to be much greater than efficient market would allow. A related puzzle is that of trading volume. If everyone knows that everyone is rational, then every trader might wonder what information the seller has that the buyer doesn't, and vice versa. Figuring out exactly how little trading should be occurring under the efficient market hypothesis is difficult.

Next is the great dividend puzzle. In a perfect world, investors should be indifferent between dividends and capital gains (Modigliani, Miller, 1958). In the real world, because of the structure of the tax system, investors should prefer capital gains to dividends, and companies should prefer share repurchases to dividends. At the same time, most large companies pay dividends. In addition, stock prices tend to rise when dividends are increased or initiated. The current literature treats dividends as another instance of signaling- companies that increase or initiate dividends send signal of their financial health to the investors.

Finally, it seems that future returns can at least partially, be predicted on the basis of various historic measures such as price-earnings and price-to-book ratios, earnings surprises, dividend changes, or share repurchases.

However, in spite of these irregularities, real-world portfolio managers are still having a hard time trying to beat the market. Most of the studies of mutual funds and pension fund performance still show that, on average, active managers do no better than the market (Malkiel, 2005). Moreover, good performance this year consistently fails to predict good performance next year. These facts push us further towards behavioral finance.

Behavioral finance studies how individual and collective behaviors influence market prices. The base of behavioral finance is that humans depart from rationality in a consistent manner. In fact, investors do not follow the way the expected utility theory says; they do not act rationally (Sebora & Cornwall, 1995, Olsen, 1997). Prejudices and perceptions, which do not meet the criteria of rationality, take an important place on the scene when we are making our investment decisions. Behavioral finance takes its roots from behavioral cognitive psychology, which is a link between human decision making and the financial market economics. Behavioral finance –finance from a broader social science perspective including psychology and sociology- is now one of the most vital research programs and it stands in sharp contradiction to much of the efficient markets theory (Shiller, 2003, pp.83).

Market efficiency is being challenged by behavioral finance in the sense that market prices reflect fundamental market characteristics and that excess returns on the average are leveled out in the long run. There are lots of papers in the literature that cannot be explained with standard financial theories. These anomalies suggest that the principles of rational behavior underlying efficient market hypothesis are not entirely correct and that we need to look, as well, at other models of human behavior (Shiller, 1998).

1.3.2.1 Prospect Theory

Prospect theory is a mathematically formulated alternative to the theory of expected utility maximization. Expected utility model is the major theory of decision-making under risk. According to the expected utility theory investors are risk averse and truly rational in all circumstances. The choices of an individual can be described in terms of the utilities of various outcomes for that individual. The utility of a risky prospect is equal to the expected utility of its outcomes, obtained by weighting the utility of each outcome by its probability. When faced with a choice, a rational decision-maker will prefer the prospect that offers the highest expected utility (Tversky & Kahneman, 1981). Despite the attractiveness of this theory; it has failed to answer the questions about investor behavior in some cases. The prospect theory by Kahneman and Tversky (1979) is trying to fill this gap.

Allais (1953) reported examples showing that in choosing between certain lotteries, people systematically violate the theory. Kahneman and Tversky (1979) give the following experimental evidence to illustrate one of Allias' examples. When their subjects were asked to choose between a lottery offering a 25% chance of winning 3000 and a lottery offering 20% chance of winning 4000, 65% of their subjects chose the second option, while when subjects were asked to choose between a 100% chance of winning 3000, and an 80% chance of winning 4000, 80% choose the former. Expected utility theory predicts that they should be indifferent. Their

preference for the first choice in the lottery when it is certain in this example illustrates what is called the *certainty effect*, a preference for certain outcomes.

Prospects theory actually resembles expected utility theory in that individuals are represented as maximizing a weighted sum of utilities, although the weights are not the same as probabilities and the utilities are determined by a *value function* rather than a *utility function* (Shiller, 2001).

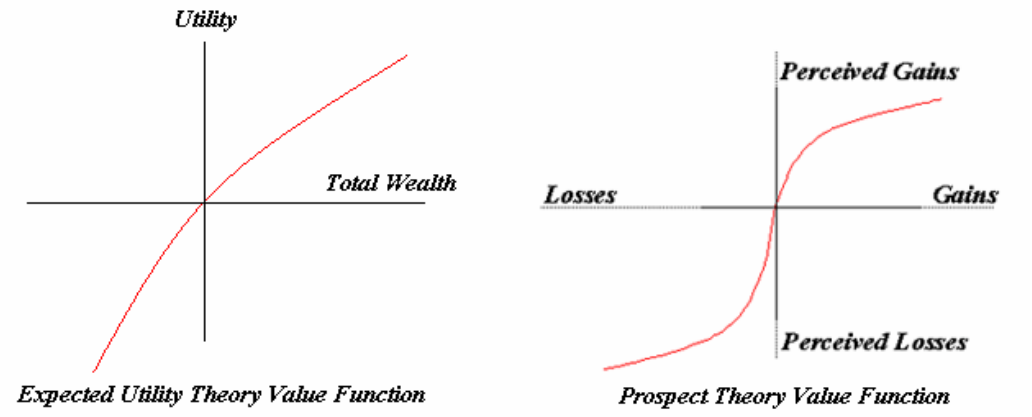


Figure 1 Expected Utility Theory and Prospect Theory Value Functions

According to Kahneman and Tversky (1979), the weights are determined by a function of true probabilities which gives zero weight to extremely low probabilities and a weight of one to extremely high probabilities. Which mean is this, people behave as if they regard extremely improbable events as impossible and extremely probable events as certain. However, events that are just very improbable are given too much weight; people behave as if they exaggerate the probability. Events that are very probable are given too little weight; people behave as if they underestimate the probability. What constitutes an extremely low probability or an extremely high probability is determined by individuals' subjective impression and prospect theory is nor precise about it. Between the very low and high probabilities, the weighting function which weights as a function of true probabilities has a slope of less than one.

This shape for the weighting function allows prospect theory to explain the certainty effect. Since the 20% and 25% probabilities are in the range of the weighting function where its slope is less than one, the weights people attach to the two outcomes are more nearly equal than the probabilities, and people tend just to choose the lottery that pays more if it wins. In contrast, in the second lottery choice the 80% probability is reduced by the weighting function while the 100% probability is not; the weights people attach to the two outcomes are more unequal than are the probabilities, and people tend just to choose the outcome that is certain.

Kahneman and Tversky (1979) value function differs from the utility function in expected utility theory in a very critical respect: the function of wealth has a knot in it at a point, the reference point, the location of which is determined by the subjective impressions of the individual. The reference point is the individual's point of comparison, the status quo against which alternative scenarios are contrasted. Usually, the status quo is taken as the reference point, but

> *there are situations in which gains and losses are coded relative to an expectation or aspiration level that differs from the status quo… A person who has not made peace with his losses is likely to accept gambles that would be unacceptable to him otherwise* (Kahneman & Tversky).

Durukan (1999) interprets Figure 1 as that the prospect theory value function is upward sloping everywhere, but with a steep decline in slope at the reference point. For wealth levels above the reference point, the value function is concave downward. For wealth lovers below the reference the value function is concave upward. People are risk lovers for losses they asserted (Kahneman & Tversky, 1979).

As a sum, prospect theory contradicts the expected utility theory in the way that it welcomes investors as if they are not rational. Also investors are not risk-seeker; they are loss-seeker, which is named as a *loss aversion* (Bernstein, 1999). In the value function the investor is risk averse in the gains side, and risk seeker in the

losses side. This is referred to as the *reflection effect*. As the loss-averseness of the investors increase, the portfolio performance measurement frequency also increases. The decrease in portfolio evaluation time results in a *myopic loss aversion.* Another point that should be mentioned here is that the framing of decisions affects the investors' decisions. This is not considered in expected utility model, rather this model takes the framed relational system as a given and provides numerical representation (Demski & Swieringa, 1981), whereas the prospect theory considers these because the theory is a framing aspect of behavioral finance (Tversky & Kahneman, 1986).

1.3.2.2 Regret and Cognitive Dissonance

There is a human tendency to feel the pain of regret at having made errors. It is a feeling of ex-post remorse about a decision that led to a bad outcome. If one wishes to avoid the pain of regret, one may alter one's behavior in ways that would in some cases be irrational.

The pain of regret at having made errors is in some senses embodied in the Kahneman-Tversky notion of a kink in the value function at the reference point. There are also other ways of representing how people behave who feel the pain of regret. Loomes and Sugden (1982) have suggested that people maximize the expected value of a modified utility function which is a function of the utility they achieve from a choice as well the utility they would have achieved from another choice was considered. Bell (1982) proposed a similar analysis.

Regret theory may apparently help explain the fact that investors covering loss aversion defer selling stocks that have gone down in value (Shefrin and Statman, 1985). The theory may be interpreted as implying that the investors avoid selling stocks that have gone down in order not to finalize the error they make and in that way avoid feeling regret. They sell stocks that have gone up in order not to feel the regret of failing to do so before the stock later fell. This behavior has been documented using volume of trade data by Ferris, Haugen and Makhija (1988).

This can be explained by the Kahneman- Tversky value function. As mentioned before usually status quo is taken as a reference point from, but

> *There are situations in which gains and losses are coded relative to an expectation or aspiration level that differs from the status quo…A person who has not made peace with his losses is likely to accept gambles that would be unacceptable to him otherwise.* (Kahneman and Tversky, 1979).

This effect has been also documented as *disposition effect* by Shefrin and Statman (1985). They mention that because of their desire to avoid regret, the investors will tend to hold their loosing investments too long and sell their winners too soon; they labeled this tendency the disposition effect. Odean (1998) predicted that because of their overconfidence, investors will trade too frequently and thereby reduce their returns. Barber and Odean (1999) also corroborated two common mistakes investors make as excessive trading and the tendency to disproportionately hold on to losing investments while selling winners. The tendency for human beings to be overconfident causes the first bias in investors, and the second bias is reasoned by the desire of human beings to avoid regret prompts.

Cognitive dissonance is the mental conflict that people experience when they are presented with evidence that their beliefs or assumptions are wrong. Cognitive dissonance may be classified as a sort of pain or regret, regret over mistaken beliefs. There is a tendency for people to take actions to reduce cognitive dissonance that would not normally be considered as rational, such as avoiding new information or developing contorted arguments to maintain beliefs or assumptions. The theory of regret may attribute to phenomenon of money flowing into mutual funds or stocks that have performed well than flowing out of stocks or funds that have performed extremely poor.

1.3.2.3 Anchoring

Psychologists have documented that when people make quantitative estimates, their estimates may be heavily influenced by previous values of the item. Fuller (2000) gives a good example to clarify this:

> *…it is not an accident that a used car salesman always starts negotiating with a high price and then works down. The salesman is trying to get the consumer anchored on the high price so that when he offers a lower price, the consumer will estimate that the lower price represents a good value. Anchoring can cause investors to underreact to new information.*

People have in their mind some reference points – *anchors*- , for example previous stock prices. When they get new information they adjust to this past reference insufficiently to the new information acquired. Anchoring describes how individuals tend to focus on recent behavior and give less weight to longer time trends.

Anchoring on past prices helps determine present prices in the stock market might be inconsistent with the low serial correlation of stock price changes that is with the roughly random-walk behavior of daily or monthly stock prices. However, this conclusion is not warranted (Shiller, 2001). Models of smart money seeking to exploit serial correlation in price, models which also include ordinary investors, are consistent with the implications that serial correlation is low and yet the anchoring remains important for the levels of stock prices (Shiller, 1990).

1.3.2.4 Overconfidence, Over- and Under-reaction and the Representativeness Heuristic

The key behavioral factor and perhaps the most robust finding in the psychology of judgment needed to understand market anomalies is overconfidence.

People tend to exaggerate their talents and underestimate the likelihood of bad outcomes over which they have no control.

The combination of overconfidence and optimism causes people to overestimate the reliability of their knowledge, underestimate risks and exaggerate their ability to control events, which leads to excessive trading volume and speculative bubbles. The greater confidence a person has in himself, the more risk of overconfidence. A surprising aspect is the relationship between overconfidence and competence. March and Shapira (1987) showed that managers overestimate the probability of success in particular when they think of themselves as experts. Overconfidence is also linked to genders. Barber and Odean (2001) documented that men traded 45% more than women, because overconfident people tend to trade more excessively. The results show that trading reduces men's net returns by 2.62 points a year. The same thing was analyzed on the investors of Istanbul Stock Exchange by Döm (2003) and the result were the same as Barber and Odean's results.

DeBondt and Thaler (1985) show that people tend to overreact to unexpected and dramatic news events. Consistent with the predictions of the overreaction hypothesis, portfolios of prior losers are found to outperform prior winners. Price reactions to information are crucial for market behavior. Barberis, Schleifer and Vishny (1998) have uncovered two families of pervasive regularities: underreaction of stock prices to news such as earnings announcements and overreaction of stock prices to a series of good and bad news. The underreaction evidence shows that over horizons of one to twelve months, security prices underreact to news. As a consequence, news is incorporated only slowly into prices, which tend to exhibit positive autocorrelations over these horizons.

Kahneman and Tversky (1974) show that when people try to determine the probability that a data set A was generated by a model B, or that an object A belongs to a class B, they often use the representativeness heuristic. This means that they evaluate the probability by the degree to which A reflects the essential characteristics of B.

Representativeness is a helpful heuristic mostly, but it can sometimes generate biases. One is the *base rate neglect*. Kahneman and Tversky (1974) give an example to illustrate this effect:

> *Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.*
>
> *When asked which of "Linda is a bank teller" (Statement A) and "Linda is a bank teller and is active in feminist movement" (Statement B) is more likely, subjects typically assign greater probability to B.*

Representativeness provides a simple explanation. The description of Linda sounds like the description of a feminist; it is a representative of feminist- leading subjects to pick B. In fact that is not correct, because if you choose B you already choose A, because B covers A.

1.3.3 Anomalies in Istanbul Stock Exchange

After analyzing the anomalies in the finance literature, it would be essential to cover the anomalies in Istanbul Stock Exchange documented in the literature.

Most of the researches about the anomalies in Istanbul Stock Exchange is associated with the calendar effects such as intra-day effects, day of the week effects and turn-off-the-year effects.

Berument, Inamlık and Kıymaz (2004) examined the day of the week effect on stock return and volatility for the period of 1986 through 2003. Using generalized autoregressive conditional heteroskedasticity (GARCH) model, they find statistically

significant evidence of the day of the week effect. Their results are consistent with the literature. Friday has the largest return with 0.015 while Monday has the lowest return with -0.003 compared to return on Wednesday.

Küçükkocaoğlu (2002) investigated intra-day stock returns. Their data was composed of eight stocks from ISE-30 index companies. Day-end prices of the selected stocks increased at closing time. Day-end closing returns are large and positive.

Bildik (2001) analyzed the intra-day seasonality of the stock returns using 15-minute interval data, considering the period from1996 to 1999. Results show that stock returns follow a W-shaped pattern over the trading day since there are two trading sessions in a day. This result is consistent with the previous findings in the literature. Opening and closing returns are significantly large and positive.

Metin, Muradoğlu, Yazıcı (1997) examined the day-of-the week effect. Excluding the crisis period there is a Friday effect both in TL and dollar terms. Even if there is evidence of negative Monday effect during the crisis periods and two days after the settlement date, these are not statistically significant. Their results are consistent with Balaban's (1995a) results.

Balaban and Bulu (1996) searched for a semi-monthly effect for the period 1988 to 1995. Their results support that there do not exist semi-monthly effect or intra-month effect. While they do not find any evidence Oğuzsoy and Güven (2006) find that the average return in the turn of a month is drastically smaller than the average return in the rest of the month.

Balaban (1995c) investigated the month of the year effect for the period 1988-1993. The paper reports significantly large returns during three months: January, June and September. Among these, January has the highest daily mean return. Another interesting anomaly concerned in this paper is the Mark-Twain

effect, which exists when the average returns during October are significantly lower than those in the rest of the year. The paper reports no significant Mark Twain effect.

Aydoğan (1999) found that especially price-earnings ratio and some other calendar effects are present in Istanbul Stock Exchange. The stocks with P/E ratio relatively smaller than the rest bring in more returns In January and before the legal holidays stock returns are higher. Size effect and winner-loser effect are not found in Istanbul Stock Exchange.

Durukan and Mandacı (2003) analyzed the relationship between return and fundamental variables- beta coefficient, Market Value / Book Value (MV/BV), Debt/Equity (D/E), Market Value of Equity (MVE), Price / Earnings (P/E) and Sales/Price (S/P). They also analyzed the influence of January effect on the relationship between fundamental factors and stock returns. Their findings support that the beta coefficient, MVE, P/E and S/P have higher explanatory power in explaining stock returns and strengthening effect of January on the relationship between stock returns and beta coefficients.

There are also different kinds of research on the anomalies in Istanbul Stock Exchange. Tufan and Hamarat (2003), investigate if the cloudy days in the stock market affect ISE-100 index returns. Their methodology includes not only the regression but also the Granger Causality Analysis. Their findings show that there is no relation between them.

Bildik (2000) commented that almost all of the anomalies were present in Istanbul Stock Exchange. The returns at the second half of the week (from Wednesday to Friday) are significantly higher than the returns at the first half of the week (from Monday to Tuesday). The highest return in the week is on Friday and two times more than the rest of the week. The smallest and the unique return is on Tuesday. The highest volatility is on Monday and lowest on Friday. The average daily return peaks in January. The returns are lowest in August, followed by October and July. The same results were also obtained by Özmen (1997).

Baştürk (2004) analyzed the period between 01/01/1995 and 31/12/2000 in ISE and used the firm level data that has positive P/E ratios. The aim of the study was to test the existence of P/E anomaly in ISE. The findings are in favor of firm size effect but a disappearing P/E effect.

CHAPTER 2

OVERREACTION HYPOTHESIS

After analyzing the literature on EMH, the focus of this chapter will be the literature on Overreaction Hypothesis. The purpose of this part is to give a brief look on overreaction hypothesis, both the opponent and contrary views on the hypothesis. The literature of this thesis is important in the way it classifies the articles in an organized way. The chapter will present the literature on four parts: long term, short term, international stock market overreaction and reversals and miscellaneous studies.

Efficient Market Hypothesis, which supports that the markets are efficient when prices fully reflect all available information, is supported by the studies of Fama (1970). Efficient Market Hypothesis asserts that investors are rational, if there is some deviation from the fundamental values by the investors' sentiment, arbitrage takes place quickly and correctly and thus no abnormal profit occurs in the market. Prices should only change with news about changes in fundamental value and there should be no underreaction and overreaction in the market to the new information.

Efficient market hypothesis has been challenged with the behavioral finance approaches and there have been many works reporting the evidence of anomaly. Limited arbitrage, unexplained movements, realized abnormal profits manifest a new discipline, behavioral finance. Behaviorals state that not all the investors are rational in the market and there can be deviations from the fundamental values due to the investors' sentiment. Contrary to the efficient market hypothesis, behaviorals argue that the real world arbitrage is risky and limited since arbitrageur's decisions are valid in the short term and there is not a always a close substitute for the arbitrage. (Shleifer, 2003).

There are two important studies criticizing the efficient market hypothesis has been carried out by DeBondt and Thaler (1985, 1987). In their studies they have analyzed the period between January 1933 and December 1980, and they have

reported that they found evidence contradicting the efficient market hypothesis. Their results were in favor of another anomaly that has not been reported in the literature.

DeBondt and Thaler (1985, 1987) reported that investors evaluate the prices of stocks according to the new information that arrives to the market and they overreact to bad or good news, and they correct this overreaction in the long term.

DeBondt and Thaler (1985, 1987) name this anomaly as overreaction hypothesis.

> *"If stock prices systematically overshoot, then their reversal should be predictable from past return, data alone, with no use of any accounting data such as earnings. Specifically two hypotheses are suggested: (1) extreme movements in stock prices will be followed by subsequent price movements in the opposite direction. (2) The more extreme the initial price movement, the greater will be the subsequent adjustment. Both hypotheses imply a violation of weak-form market efficiency (DeBondt and Thaler, 1985, pp.795).*

The term overreaction considers an implicit comparison to some degree of reaction that is deemed to be appropriate. One class of tasks which have a well-established norm are probability revision problems for which Bayes' rule is not an appropriate characterization of how individuals actually respond to new data. In revising their beliefs, individuals tend to overweight recent information and underweight prior data. People seem to make predictions according to a simple matching rule: "The predicted value is selected so that the standing of the case of the distribution of the outcomes matches its standing in the distribution of impressions" (Kahneman, Slovic, and Tversky, 1982, pp.416). This defined concept is referred as the representativeness heuristic, which in turn violates the basic statistical principal that the extremeness of predictions must be moderated by considerations of predictability.

The reaction to recent dramatic information opens the door to the prediction of stock price movement. That is, if stock prices swing too high on recent good news and too low on recent bad news then the prediction of stock price movement has been implied. This concept is a violation of the theory of efficient markets.

2.1 Overreaction Hypothesis

Overreaction is the tendency for stock returns to experience reversals. Firms that lose (win) in one period are likely to win (lose) in the subsequent period. In addition, the more extreme the original price movement, the more extreme the reversal will be.

DeBondt and Thaler (1985) establish the overreaction hypothesis from a behavioral principle expanded to explain market movements. The basis of the theory is that individuals acting in the market place are not basing their decisions on the Bayes' rule. Bayes' rule asserts that individuals will make their decisions based on probability revisions as new information is introduced.

In contrast to Bayes rule, the overreaction hypothesis ascertains that individuals will abnormally weight new information while under weighting old information. Overemphasis of current information will cause new positive (negative) information to be overly weighted and will result in excessively high (low) stock prices. The meaning under overreaction hypothesis is that if stock returns consistently overshoot their target price, earnings, financial reports or any other accounting information are no longer needed to predict the reversals. All information needed to predict the reversals is contained in the stock returns.

DeBondt and Thaler (1985) explain the overreaction hypothesis in terms of Fama's (1970) efficient market condition:

$$E(\tilde{R}_{jt} - E_m(\tilde{R}_{jt} \left| F_{t-1}^m \right) \left| F_{t-1} \right.) = E(\tilde{u}_{jt} \left| F_{t-1} \right.) = 0$$

where $\tilde{R}_{jt}$ is the return on security j at time t, F_{t-1} is all information at time t-1. $E_m(\tilde{R}_{jt}|F_{t-1}^m)$ is the market expectation of the return on security j at time t conditional on the information assessed by the market at time t-1. Therefore the efficient market condition states,

$$E(\tilde{u}_{W,t}|F_{t-1}) = E(\tilde{u}_{L,t}|F_{t-1}) = 0$$

where $\tilde{u}_{W,t}$ equals the mean return of securities that have performed well in the past, winners, and $\tilde{u}_{L,t}$ equals the mean return of securities that have performed poorly in the past, losers. The winners (losers) are determined from abnormal positive (negative) returns in the prior period.

In contrast, the overreaction hypothesis implies that

$$E(\tilde{u}_{W,t}|F_{t-1}) < 0 \ \ and \ \ E(\tilde{u}_{L,t}|F_{t-1}) > 0$$

In order to test the overreaction hypothesis, abnormal returns are obtained for a specified formation period and portfolios are formed based on whether the firms in that period are winners, those with positive abnormal returns, or losers, those with negative abnormal returns. These portfolios are then analyzed in a subsequent testing period to determine if the market has overreacted by overpricing (underpricing) the positive (negative) information of the winner (loser) portfolios. If the market has overreacted, the winner portfolios will experience a negative price adjustment during the testing period and the losers will experience a positive price adjustment during the testing period.

In their methodology, DeBondt and Thaler (1985) they used monthly return data for New York Stock Exchange (NYSE) common stocks that are compiled by the Center for Research in Security Prices (CRSP) for the period between January 1926 and December 1982. For every stock with at least 85 months of return data the next

72 monthly residual returns are calculated. An equally weighted arithmetic average rate of return on all CRSP listed securities serves as the market index.

Later on, for every stock they compute the cumulative excess returns for the prior 36 months, the portfolio formation periods. The cumulative excess returns are ranked from low to high and portfolios are formed. Firms in the top 35 stocks are assigned to the winner portfolio W, firms in the bottom 35 stocks to the loser portfolio L. They later calculate the cumulative average residual returns of all securities in the portfolio for the test period.

The findings show that over the last half-century, loser portfolios of 35 stocks outperform the market by, on average, 19.6%, thirty-six months after portfolio formation. Winner portfolios earn approximately 5% less than the market. The difference in cumulative average residual between the extreme portfolios, [$ACAR_{L,36}$-$ACAR_{W,36}$] equals 24.6%. Figure 2 shows the movement of ACAR's progressing through the test period.

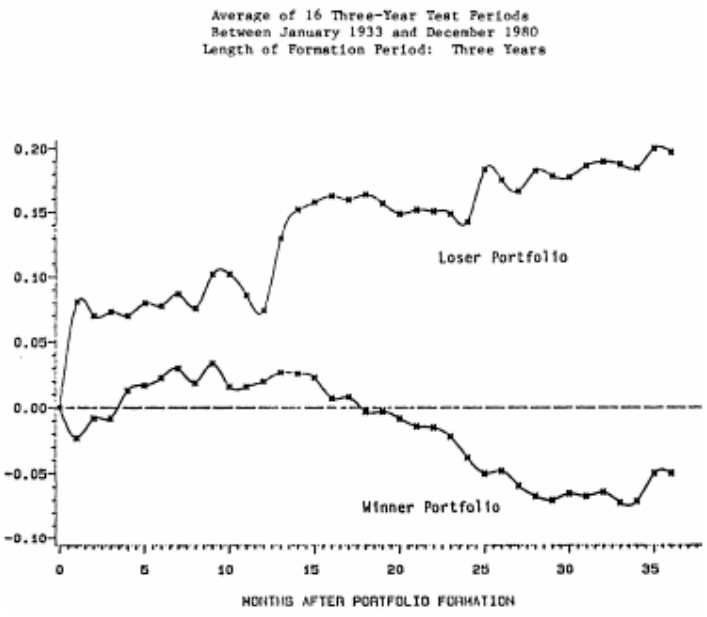


Figure 2 Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks

Another notable finding is that the overreaction effect is asymmetric; it is much larger for losers than winners. Also, another striking finding is most of the excess returns are realized in January. Overreaction mostly occurs during the second and third year of the test period.

The findings of DeBondt and Thaler (1985) are broadly consistent with the overreaction hypothesis, but unfortunately several aspects of the results remain without adequate explanation. Most important one stands as the extraordinarily large positive excess returns earned by the loser portfolio in January.

DeBondt and Thaler's (1985) study stands as the seminal work on overreaction hypothesis, leading various opponent and proponent studies in finance literature.

2.2 Review of the Literature

There are various numbers of studies addressing the issue of investor overreaction in financial markets. In general, these studies find evidence of stock market overreaction and reversals both in the short and long run.

The studies in the literature can be classified along these four categories according to the main points they consider:

1. Long-term stock market overreaction and reversals
2. Short-term stock market overreaction and reversals
3. International stock market overreaction and reversals
4. Miscellaneous

2.2.1 Long-Term Stock Market Overreaction and Reversals

2.2.1.1 Studies Confirming Long-Term Overreaction and Reversals

The seminal study of long-term stock market overreaction and perhaps the most important study in this area is by DeBondt and Thaler (1985). DeBondt and

Thaler investigated all the stocks listed on the Center for Research in Security Prices (CRSP) tape of the University of Chicago from 1926 to 1982, the authors show that over 3- to 5-year holding periods stocks that have performed poorly over the previous 3 to 5 years performed better than the stocks that have performed well over the same period. Another finding by DeBondt and Thaler is that there is an asymmetric overreaction effect which is larger for losers than winners. Also, the long-term losers outperform the long-term winners in January.

Another fundamental study related to the subject is again by DeBondt and Thaler. Using the same methodology, DeBondt and Thaler (1987) present that excess returns for losers in the test period, and particularly in January, are negatively related to both long-term and short-term formation period performance. Moreover, their results show that the winner-loser effect cannot be attributed to changes in risk as measured by Capital Asset Pricing Model (CAPM)-betas or by the size of the firms being investigated. On the other hand, the small firm effect is partly a losing firm effect, but even if this effect is removed, excess returns to small firms remain. Lastly, the earnings of winning and losing firms show reversal patterns that are consistent with investor overreaction. That is, an effective fall (rise) is stock prices is predictive of a subsequent rise (fall) in company-specific earnings. Thus, the main stream of the both studies of DeBondt and Thaler is that the stock market investors overreact in the long-run.

Seyhun (1990) points out another fact by analyzing the U.S. stock market crash. He claims that investors overreact at least in certain time periods. Seyhun describes the nature of the 1987 stock market crash was a surprise for the corporate insiders, that corporate insiders purchased stocks declining more during the crash more extensively during October 1987. Later on these stocks showed larger positive returns in 1988. The evidence supported that overreaction was an important part of the crash.

Pettengill and Jordan (1990) investigated the period between 1962 and 1986 in order to find out if there is a long term overreaction effect. Their results pointed out a definite and substantial pattern for formation period losers. In the study, it has

also been documented an asymmetric effect; the firms with the largest formation-period gains continue to earn positive excess returns. Yet, firm size is an important factor, and large-firm return behavior is more consistent with overreaction. Furthermore, the results specify that most of the effect leading to the observed pattern of returns is attributable to the January effect.

Fama (1998) reexamines stock market efficiency and argues that while market efficiency survives the challenge from the literature on long-term return anomalies in the sense that anomalies are chance results, apparent overreaction to information is as common as underreaction.

Dreman and Lufkin (2000) present evidence of overreaction by showing that important fundamentals like growth in earnings, growth in cash flow, growth in sales, return on equity and profit margin. They also show that over- and underreaction may be a part of the same process. They observe that the superior performance of the best (or the worst) stocks can be explained by investor overreaction before portfolio formation, which results in their returns being driven too high (low). The process is a five-year process. Similarly, the correction process in the study took five years, indicating underreaction. They conclude that they can find no explanation other than psychological influences.

Chopra, Lakonishok, and Ritter (1992) reexamine DeBondt and Thaler's findings. They investigated stock returns from New York Stock Exchange (NYSE) issues from 1926 to 1986 and incorporate size, prior returns, and betas in a multiple regression model. Findings indicate that loser portfolios formed on the basis of prior 5-year returns outperform winners by 5 to 10 percent per year during the subsequent 5 years. On the other hand, their findings suggest larger arbitrage portfolio returns during January and for smaller firms.

2.2.1.2 Competing Explanations for Contrarian Returns in Long-Term Overreaction

There are many explanations offered for the returns accruing to arbitrage portfolios. Among them are the size effect, the January effect, increasing loser risk, and the bid/ask spread.

It has been found that small firms earn abnormally high returns (Banz, 1981, Reinganum, 1981). Also, the excess returns of small firms cluster primarily in January (Keim, 1983, Roll, 1983). If it can be shown that losers tend to be smaller than average firms while winners are not, the losing firm effect could simply be a manifestation of the small firm effect. Similarly, if the returns to the arbitrage portfolio occur primarily in January, then the loser effect may simply be an exposure of the January effect. The argument that the positive arbitrage portfolio returns are traced to risk relies on the idea that, loser firms have been through a financially rough time, and thus they have become more risky. Accordingly, the apparent excess return is simply a normal return to their high level of risk. As a conclusion, the literature suggests that overreactions are stronger for smaller firms and in January.

Fama and French (1988) provide specific tests questioning the strong findings of DeBondt and Thaler of a stock market overreaction on grounds of differences between winner and loser stocks. They first form decile portfolios ranked by size. Then, within each size portfolio they examine the returns for 3-year winners and loser quartiles. They found that losers outperform the winners, but insignificantly except in January. They also find asymmetric reversals in favor of the winners, which is in contrast to the findings by DeBondt and Thaler.

Another similar study is by Zarowin (1990). Zarowin finds that the three-year return on an arbitrage portfolio ranges from 7 to 19 percent for the smallest four quintiles, but virtually zero for the largest quintile. However, his findings indicate that none of the returns are significantly different from zero. Thus both Fama and

French (1988) and Zarowin (1990) indicate that the losing firm effect is compassed by the size effect.

Following Zarowin's criticisms Dissanaike (2002) construct a data set as the same way he did in his study in 1997. The study begins on January 1975, and is restricted around 1000 larger and better-known UK companies which were members of FT500 on that date. Dissanaike finds size effect within the sample, but does conclude that there is no evidence to suggest that the size effect subsumes the winner-loser effect. With Dissanaike's (2002, pp.152) words:

> *Nevertheless, if the winner-loser effect is an indication of stock market overreaction, the findings of this paper would be potentially more damaging to the efficient market hypothesis- after all, one would expect the EMH to have greater chance of validity for large firms rather than for small."*

The size effect seems to explain most of the abnormal returns to the contrarian investment strategy; the abnormal returns appear to remain in January after controlling for firm size. This point is challenged by Davidson and Dutia (1989), who investigate data from a large sample of stocks traded on the American and New York Stock Exchanges. Their findings indicate that abnormal returns in one year are positively related to the abnormal returns earned in the next year and to returns earned in January. The results support the January effect. However, when forming winner and loser portfolios, results do not support the overreaction hypothesis; winners keep on winning and losers keep losing.

There are various works which includes tests investigating whether arbitrage portfolio returns may be attributable to risk differences between winners and losers in the test period by Chan (1988), Ball and Kothari (1989), Jegadeesh and Titman (1993), and Chen and Sauer (1997).

Chan (1988) argues that risks of winners and losers are not constant over time. Employing the standard Sharpe- Lintner CAPM, samples are constructed every three years between 1932 and 1983. Findings indicate that the risk of losers and winners are not constant and that only small abnormal returns exist once risk changes are controlled for. Ball and Kothari (1989) similarly investigated all stocks on the CRSP monthly tapes with a minimum of 10 years of data focusing on any of the 52 years from 1930 to 1981. Their evidence indicates that negative serial correlation in relative returns is almost entirely to variation in relative risks, and therefore expected relative returns, through time. Another finding is that the systematic risks of contrarian portfolios are not stable over time.

Jegadeesh and Titman (1993) contradict the preceding studies in the intermediate-term. They show that trading strategies that buy past winners and sell past losers realize significant abnormal returns over the 1965-1989 periods. A strategy which selects stocks based on their past six-month returns and holds them for another six months realizes compounded excess returns of 12.01% per year, on average. Importantly, it is shown that the profitability of the relative strength strategies is not due to their systematic risk. Thus, although contrarian profits over intermediate terms are of the opposite sign than expected, they are not driven by systematic risk considerations.

Contrarian profits after accounting for systematic risk are also documented by Chen and Sauer (1997), who find significant abnormal returns after accounting for systematic risk. They take the approach of reexamining the overreaction hypothesis in a time-series context. Returns from the contrarian investment strategy over the 1926 to 1992 period indicate that stock market overreaction is not stationary, and that extreme portfolios over successive time periods. More importantly, their findings indicate a strong positive relationship between the arbitrage portfolio returns and risk premia. In other words, the arbitrage portfolio's abnormal returns disappear after the market factor is incorporated into the model. In summary, although numerous studies have investigated whether contrarian strategy returns are explainable by systematic risk, the evidence is conclusive.

In the literature, there are also studies who projected that the overreaction effect is explained by bid/ask spread. Kaul and Nimalendran (1990) show that the main source of price reversals for NASDAQ stocks is the bid-ask spread. After accounting for the spread, there is little evidence of market overreaction. Conrad and Kaul (1993) show that the returns to the typical long-term contrarian strategy implemented in the studies in the literature are upwardly biased because they are calculated by cumulating single-period (monthly) returns over long intervals. Thus, the cumulation process not only cumulates true returns but also the upward biases in single-period returns induced by measurement errors. Conrad and Kaul document that most of DeBondt and Thaler's (1985) findings can be attributed to a combination of bid/ask effects when monthly cumulative average returns are used. They explain their contrary evidence by:

> *Using a buy and hold performance measure, we show that all non-January returns to long-term contrarian strategies are eliminated. The actual return to an arbitrage portfolio of losers and winners is solely due to January returns, and we show that "January effect" has no relation to past performance of the securities. Hence there is no evidence of market overreaction: the abnormal performance of the previous long-term contrarian strategies is due to a combination of a biased performance measure and a "January effect" that is unrelated to prior performance." (Conrad & Kaul, 1993, pp.61).*

Ball, Kothari and Shanken (1995) also document problems in measuring raw and abnormal five-ear contrarian portfolio returns. Specifically, loser stocks are low-priced and exhibit skewed return distributions. Also, long positions in low-prices stocks occur disproportionately after bear markets and thus induce expected-returns effects. With keeping this idea in mind, a contrarian portfolio formed at June-end is found to earn negative abnormal returns, in contrast with the December-end portfolio.

However, Loughran and Ritter (1996) contradict Conrad and Kaul's (1993) and Ball, Kothari, and Shanken's (1995) findings by showing that there is little difference in test-period returns whether cumulative average returns or buy-and-hold returns are used, and also that the price has little predictive ability in cross-sectional regressions. The concern of the bid-ask spreads fully explain contrarian strategy returns remains unresolved.

2.2.2 Short-Term Stock Market Overreaction and Reversals

In the finance literature, there are several studies that used a similar methodology like DeBondt and Thaler's (1985) to examine short-term price movements. Portfolios of winner and loser firms are formed based on a very short formation period, and subsequent portfolio returns are examined. Also, in these studies again there are competing explanations for the overreaction hypothesis. But generally, the results provide strong evidence for the overreaction hypothesis.

2.2.2.1 Studies Confirming Short-Term Overreaction and Reversals

Brown and Harlow (1988) investigate the overreaction hypothesis fro CRSP-listed NYSE firms from January 1946 through December 1983. Extreme price movements, defined as stocks with residual returns that gain/lose between 20 and 65 percent in absolute terms between one to six months are examined for signs of overreaction. Findings indicate large price reversals for losers. Conversely, winners do not show any decline subsequent to the first month.

Howe (1986) investigated overreaction for stocks traded on AMEX and the NYSE over the period 1963 to 1981 using weekly returns. In his analysis, all stocks whose returns rise or fall more than 50 percent within one week are investigated. Howe finds strong support for the overreaction hypothesis for both winners and losers. The results show that winners show returns of -13.0% over the following ten weeks and losers recorded returns of 13.8%.

Rosenberg, Reid, and Lanstein (1985) analyzed whether the stock market is efficient by comparing a strategy based on purchasing stocks with a high book-to-market ratio with a contrarian strategy that involves the purchase of prior-month losers and the shorting of prior-month winners. The two strategies are analyzed for 1400 largest firms listed on S&P's Compustat for the 1980-1984 period. Although both strategies were successful, the performance of the contrarian strategy generated arbitrage portfolio returns of 1.36 percent per month, with profits being generated mostly by prior losers.

Bremer and Sweeney (1991) consider all cases where a Fortune 500 company has a one-day price change of 10 percent or greater for the period from July 1962 to December 1986. Bremer and Sweeney consider only large firms in their analysis. Because for very low-priced stocks large percentage price changes could reflect the bid-ask spread. Furthermore, it is certain that the small firm effect cannot be mentioned here to explain the results. Findings indicate that losers earn a total of 3.95 percent five days subsequent to the event. On the contrary, winners show virtually no excess returns in the period immediately following the event. Bremer and Sweeney conclude that the correction increases with the size of the initial price jump. Currently, Bremer, Hiraki, and Sweeney (1997) applied the co-authors' earlier methodology to firms traded in Nikker-300 index. Results are very similar to the U.S. market. Besides, it was found that the results exist independently of the market movements and of the October 1987 market crash.

Lehmann (1990) analyzes NYSE and AMEX, listed stocks for the period from 1962 to 1986. The strategy examined involves buying stocks that lagged the market during the previous week and selling short the equivalent winners. His findings indicate that, for $1 long in a zero-investment arbitrage portfolio, 39 cents are earned every 6 months, with two-thirds of these profits being generated mostly by prior period losers.

Ferri and Chung-ki (1996) investigate the overreaction hypothesis for daily price changes in the S&P 500 Index between 1962 and 1991. Their findings indicate

that the market experienced sudden and substantial price reversals on a number of days. Importantly, there was not always evidence of economic or fundamental information that might explain why stock values changed so dramatically. Ferri and Chung-ki infer that the stock market's behavior on these days is inconsistent with the overreaction theory.

Liang and Mullineaux(1994) also researched the short-term overreaction. Their study covered the period from 1964 to 1989. They documented strong support for the overreaction hypothesis after controlling for event direction, the magnitude of event day surprises, the potentially contradicting effects due to calendar regularities in stock returns, and ex-post outlier month of October 1987. Also their results indicate a pre-event stock price behavior which they label the *reverse anticipation puzzle:* stock prices tend to decrease (increase) before positive (negative) surprise events.

Larson and Madura (2003) identify samples of losers and winners by selecting daily stock price returns in excess of 10% and determine whether these samples over- or underreact. They then identify informed events, which correspond to announcements in the Wall Street Journal (WSJ), and uninformed events, which are not explained in the WSJ. For winners there is overreaction in response to uninformed events but no overreaction on average in response to informed events. This finding suggests the degree of overreaction to new information depends on whether the cause of the extreme stock price change is publicly released.

Nam, Pyun, and Avard (2001) investigate the uneven mean reverting pattern of monthly return indexes of the NYSE, AMEX and NASDAQ, using asymmetric non-linear smooth transition (ANST) GARCH models. They also evaluate the extent to which time-varying volatility in the index returns support the stock market overreaction hypothesis. Their models illuminate patterns of asymmetric mean reversion and risk decimation. Between 1926:01 and 1997:12, not only did negative returns reverse to positive returns quicker than positive returns reverted to negative ones, but negative returns, in fact, reduced risk premiums from predictable high

volatility. The findings support the market overreaction hypotheses. The asymmetry is due to mispricing behavior on the part of investors who overreact to certain market news. The findings also corroborate arguments for the contrarian portfolio strategy.

The short-term overreaction studies indicate relatively strong support for the overreaction hypothesis using daily, weekly, or monthly data. But unfortunately, the findings show that arbitrage portfolio returns are primarily driven by losers rather than winners.

2.2.2.2 Competing Explanations for Contrarian Returns in Short-Term Overreaction

In the short-term overreaction literature, there are plenty of studies questioning whether arbitrage portfolios are explainable by investor optimism or pessimism or through alternative explanations such as firm size, seasonality, systematic risk, or the bid-ask spread. However the seasonality component is now focused on day-of-the-week effects, such as the Monday effect. In general means, the evidence provided by these studies indicates that short-term reversals to an initial overreaction is moderated by the stocks' systematic risk and liquidity considerations such as the bid-ask spread.

The size effect is primarily investigated by Zarowin (1989), who examines short-run price movement to determine whether size and seasonality can account for short-run price reversals. According to Zarowin's study losers significantly outperform winners over all months, regardless of which group is smaller. Zarowin concludes that short-run overreaction is a stock market anomaly separate from size and seasonality effects.

Brown, Harlow, and Tinic (1988), in their study, work over systematic risk. They investigated the *Uncertain Information Hypothesis* (UIH), which predicts that both the risk and expected return of affected firms increase systematically and later they find that prices react more strongly to bad news than to good news. Only the

200 largest firms in the S&P 500 index are considered, and it is shown that average post-event returns following both favorable and unfavorable events tend to be significantly positive. However, the correlations between the immediate price changes caused by the events and the direction of subsequent price changes are found to be extremely low, a finding consistent with the UIH. Moreover, evidence is found that these increases in expected returns are directly linked to increases in stock variability induced by the events themselves, controverting the overreaction hypothesis. Thus, Brown, Harlow, an Tinic (1988) demonstrate that arbitrage portfolio returns persist after controlling for size, but disappear once systematic risk is taken into account.

Firm size is also an important factor in the study by Ketcher and Jordan (1994), who also investigate the overreaction hypothesis and compare it with the UIH by examining the behavior of security returns in the period immediately following abrupt changes in value. After controlling for firm size, overall market volatility, and event direction, the results indicate significant negative abnormal returns following positive events. Thus, the findings are more consistent with short-term market overreaction with the UIH.

Lo and MacKinlay (1990) take a somewhat different approach to investigate the effect of firm size on contrarian profits. They demonstrate that contrarian profits are possible even in the absence of overreaction. Specifically, Lo and MacKinlay argue, if return on some stocks systematically lead or lag those of others, a portfolio strategy that sells winners and buys losers can produce positive expected returns even if no stock's returns are negatively autocorrelated as implied by overreaction models. The findings indicate that, despite negative autocorrelation in individual stock returns, weekly portfolio returns are strongly positively autocorrelated and are the results of cross-auto-correlations. Importantly, the returns of large stocks tend to lead those of smaller stocks.

Jegadeesh and Titman (1995a) separately examine the nature of price reactions to common factors and firm-specific information. The delayed reactions to

common factors give rise to the lead-lag effect in stock returns. While in principle both overreaction and delayed reaction could lead to the profitability of contrarian strategies, their results indicate that the delayed reactions cannot be exploited by contrarian trading strategies. The main finding is that most of the contrarian profit is due to stock price overreaction and a very small fraction of the profit can be attributed to the lead-lag effect. Jegadeesh and Titman (1995b) also find that the return reversals are caused by price pressure generated by liquidity motivated trades. Under this interpretation, the magnitude of return reversals, and hence the profitability of contrarian strategies, may be expected to decline over time as the liquidity of the market improves. But regardless of this, the evidence is in support of significant economic returns from contrarian strategies.

The bid-ask spread is offered as an explanation for anomalous reversal returns by Atkins and Dyl (1990), who investigate the short-term overreaction for NYSE stocks listed on the CRSP over the January 1975 to December 1984 period. 300 trading days are selected at random to eliminate any biases resulting from day-of-the-week and/or month-of-the-year patterns in common stock returns. Then six common stocks, the three with the largest percentage loss in value and the three with the largest percentage gain in value during the 300 trading days are selected. Findings indicate that the stock market appears to have overreacted, especially in the case of price declines. However, the magnitude of the overreaction is small compared to the bid-ask spreads observed for the individual stocks in the sample. Thus, the Atkins and Dyl (1990) study indicates the arbitrage portfolios earn positive returns after eliminating seasonality effects. However, it also suggests that the stock market is efficient after transactions costs are considered.

The bid-ask spread is also offered as a potential explanation for reversals by Cox and Peterson (1994), who examine stock returns following large one-day price declines and find that the bid-ask bounce and the degree of market liquidity explain short-term price reversals. Unlike Atkins and Dyl, Cox and Peterson do not document the evidence consistent with the overreaction hypothesis. In fact, they

observe that securities with large one-day price declines perform poorly over an extended time horizon.

Wong (1997) documents significant 5-day, 10-day and 20-day cumulative abnormal returns following large one-day advances/declines in some Asian emerging stock markets, such as Hong Kong, Taiwan, Singapore, Thailand, Australia and Philippines. Stock prices tend to rise after large one-day advances and fall after large one-day declines. These findings are inconsistent with DeBondt and Thaler's (1985, 1987) overreaction hypothesis. However, they are consistent with Cox and Peterson's (1994) finding that prices of longer term (5 to 20 days) tend to decline following large price declines.

Ratner and Leal (1998) examine the equity market overreaction in the ten of the largest emerging stock markets, Argentina, Brazil, Chile, India, Korea, Malaysia, Mexico, Philippines, Taiwan and Thailand, using daily data from January 1982 through March 1995. Market overreaction is observed in some emerging markets, but the evidence for the majority of the emerging markets is contrary to the market overreaction hypothesis. A logit analysis reveals that movements in the Japanese, US, and world indexes explain some of the large one-day movements in the emerging markets, particularly in the Asian markets. Given the generally insignificant abnormal returns following a large one-day movement, it is unlikely that a short-term trading strategy based on market overreaction would be beneficial.

Using intraday data, Park (1995) also investigates the short-term overreaction. He finds that the predictable variation in stock returns following large price declines is driven by the sample selection bias arising from the systematic movements of closing transaction prices within the bid-ask spread. By using the average of the bid-ask prices in the sample selection process, the price reversal on the day following the event disappears. However, for a short-run period after that day, systematic abnormal returns patterns are still observed, even though they are not large enough to cover the transaction price movement between the bid and ask prices.

2.2.3 International Stock Market Overreaction and Reversals

2.2.3.1 Single Country Studies

Clare and Thomas (1995) investigate the overreaction hypothesis in the UK. Winner and loser portfolios are formed using monthly stock data taken from the London Business School LSPD tapes, which consists of the end-of-month dividend adjusted returns on all those stocks quoted on the London Stock Exchange since January 1955. Stocks are ordered into portfolios according to their performance over one, two, and three years. Findings indicate that previous losers tend to subsequently outperform previous winners over the 1955 to 1990 period, although the difference in performance is economically significant. Furthermore, losers tend to be small, and the overreaction effect appears to be primarily a size effect.

The UK stock market is more recently investigated by Campbell and Limmack (1997), who test for long-term reversals in the abnormal returns of UK companies classified as winners and losers over the period from January 1979 to December 1990 using the LSPD tapes. The findings indicate that, in the 12 months following portfolio formation, loser companies generated positive abnormal returns, thus appearing to contradict the findings of US studies the winner-loser effect. Furthermore, the smallest loser companies did experience a reversal in their abnormal returns over the following 12 months, but no such reversal existed for smallest winner companies.

Yet another study focusing on the UK stock market is by Dissanaike (1997) who investigates nearly 1,000 larger UK companies, thereby eliminating the size, bid-ask, and liquidity affects that may drive overreaction. The evidence is in favor of the overreaction hypothesis. Furthermore, differential risk does not seem to be driving the results.

daCosta (1994) investigates the overreaction hypothesis for the Brazilian stock market over the period 1970-1989 using both market-adjusted returns and the

standard Sharpe-Lintner CAPM adjusted returns. Price reversals in two-year returns are detected, and the results contrast with the US evidence in that the magnitude of the effect is more pronounced than in the US. Lastly, the evidence indicates that reversals are asymmetric, losers have larger reversals.

Alonso and Rubio (1990) investigate the overreaction hypothesis in the Spanish stock market. The behavior of extreme winners and losers is followed for the period 1967-1984. Consistent with the predictions of the overreaction hypothesis, portfolios of losers are found to outperform winners through the years after the formation period, when five extreme winner and losers securities are chosen. One year after portfolio formation, the losing stocks have earned 24.5 percent more than the winners. For the most part, the size effect appears to be a clearly independent phenomenon.

Most recently, Bowman and Iverson (1998) investigate the behavior of stock prices in New Zealand after large weekly price changes. Bowman and Iverson document a stock market overreaction that is especially pronounced in the case of price declines. Moreover, the reversal is confined to the week following the overreaction and is larger the larger initial overreaction is, is a finding consistent with the results reported by Bremer and Sweeney (1991) for the US.

Ahmad and Hussain (2001) investigate long-term overreaction and seasonality in the returns of stocks traded on Malaysia's Kuala Lumpur Stock Exchange (KLSE) during 1986-1996. The results indicate that stocks in the best (worst) performing decile experience a reversal of fortune in the following three years. There is also evidence of potential profits from employment of a contrarian trading strategy. These results are consistent with patterns which may be generated by long run overreaction. In addition, an examination of the interaction between the size effect and overreaction indicates that the reported results are more likely due to an overreaction than a manifestation of the size effect.

Durukan (2004) investigate the long-term overreaction effect for the period between 1988 and 2003 in Istanbul Stock Exchange (ISE). The findings of the study confirm that there is an overreaction phenomenon in ISE. The returns from the loser portfolio and price reversals are higher compared to the winner portfolio which is consistent with the literature.

Again Durukan (2006) investigated the overreaction effect at Istanbul Stock Exchange for the 1988-2003 period. In the paper, the overreaction is found in ISE and also a regression analysis is carried out to determine the relationship between the average cumulative abnormal return of each stock in the test period and the independent variables of a) price of stock on the portfolio formation date, b) size calculated as the number of shares outstanding times the price of stock on the portfolio formation date and c) the stock's portfolio formation return. By looking at he results, it can be argued that as prior return decreases, subsequent return increases, which also confirms the existence of overreaction effect.

Karan and Tarım (2001) tested the overreaction effects in ISE by using daily price limits between 01.01.1990 and 30.06.1999. Their results support overreaction to the price limits in the period of 1994-1999.

Wang, Burton and Power (2004) test the weak form efficiency of the Chinese stock market by examining the evidence of overreaction effect. Beginning in August 1994 Wang et al. cover a six year period and 301 companies traded on the two main equity markets in China in order to examine the short-run overreaction. The analysis suggests that many Chinese share returns exhibit patterns that are consistent with investor overreaction.

Another study on China is realized by Kang, Liu and Ni (2002). The authors find statistically significant abnormal profits for some short-horizon contrarian and intermediate-horizon momentum strategies, using data on "A" shares, accessible only to local investors in China. Further analysis indicates that: (1) overreaction to firm-specific information is the single most important source of short-term contrarian

profits; (2) the intermediate-term momentum profits are not, however, distinct due to the dominance of overreaction effect; and (3) the negative cross-serial correlation contributes to momentum profits. The lead-lag structure in China is unique in that (i)lag firms follow lead firms in the opposite direction and (ii)large firms lead small firms in holding periods from 1 to 8 weeks, while small firms lead large firms in holding periods from 12 to 26 weeks. These findings are robust to bid-ask spread and nonsynchronous trading, time-varying market risk and firm-size effect.

Gunaratne and Yonesawa (1997) examine extreme movements in stock returns to market overreaction. They find that the extreme losers outperform the extreme winners by 11% per annum in terms of risk-adjusted abnormal returns during the subsequent period. It is controversial whether these abnormal returns are due to overreaction by the investor. However, their evidence suggests that this is an independent phenomenon with some ups and downs along the way in the market during the sampling period from 1955 to 1990.

Antoniou, Galariotis and Spyrou (2005) investigate the existence of contrarian profits and sources of these profits for the Athens Stock Exchange (ASE). The empirical analysis decomposes contrarian profits to sources due to common factor reaction, overreaction to firm-specific information, and profits not related to the previous two terms as suggested by Jegadeesh and Titman (1995). Furthermore, the paper examines (i)size-sorted sub-samples that are rebalanced annually, and (ii) whether the results are due to the well-known January effect. The findings suggest that, when January returns are excluded, contrarian profits in ASE are due more to firm specific overreaction than reaction to a common factor. This implies that the delayed reaction phenomenon in the ASE is restricted to January.

Fung (199) analyzes Hong Kong stock market using monthly returns of all 33 constituent stocks in the Hang Seng Index (HIS) from January 1980 to December 1993. The loser portfolios of the 33 stocks in the HIS, on average, outperform the winner portfolios by 9.9% 1 year after the formation periods. Besides its emphasis on the importance of the Hong Kong market in international investment, this paper is

unique in some special features related to the overreaction study. Hong Kong has markets for index futures and stock futures. Only three stocks are used in the portfolios. All the stocks in HIS have large market capitalization and liquidity and can be shorted with no up-tick rule. Unlike other studies in international markets, the arbitrage portfolio of buying the loser portfolio and shorting the winner portfolio can actually be formed with minimum cost and easy execution, which makes the overreaction phenomena in this study very powerful.

As a conclusion, studies investigating individual foreign equity markets seem to find overreaction evidence.

2.2.3.2 Multiple- Country Context Studies

Ajayi and Mehdian (1994) compare the overreaction hypothesis to the uncertain information hypothesis (UIH), under which price changes are positive regardless of whether the initial event was good or bad, in a global setting. Specifically, the big eight industrial markets, Canada, Germany, France, Italy, Japan, Netherlands, UK and US are investigated. 26 good and 41 bad events are identified over the period from April 1, 1985 to July 7, 1990 that affects all eight markets. Results indicate that stock return variability is higher following the arrival of unexpected information and that post-event price variability is larger following unfavorable news than favorable news. Additionally, the average price changes following negative events are positive and those following positive events are positive or at least non-negative. Furthermore, increases in post-event returns are positively related to increases in post-event volatilities. An implication of this finding is that investors are rewarded for bearing higher risks associated with surprises across domestic and international markets. Overall, the evidence appears to favor the UIH and overreaction hypothesis.

Richards (1995, 1997) presents evidence of winner-loser reversals in national stock market indexes. The studies differ from single country studies of overreaction and from the multi-country study by Ajayi and Mehdian (1994) in that winner-loser

reversals indicate negative autocorrelation in return relative to other markets. That is, portfolio returns are calculated relative to the return on a world market portfolio. Therefore, mean-reverting behavior in national markets is unlikely to be due purely to a common mean-reverting world component. Richards form formed four portfolios, each consisting of four countries. Formation and test periods are varied in legth from three to sixty months. Similar to the findings reported by Jegadeesh and Titman (1993) for the U.S. market, findings for short, six-month horizons, indicate that winners continue to outperform losers by an annualized 3.4 percent. However, at horizons of more than one year, ranking-period winners begin to outperform ranking-period winners. Specifically, the three- and four- year horizons show the highest returns to the contrarian strategy, with average annual returns of 6.4 and 5.8 percent, respectively. These results are due to return reversals in both winners and losers. Furthermore, there is no evidence that test-period returns of prior losers are significantly riskier than those of prior winners, either in terms of their standard deviations, their correlation with the world market return, or their performance in adverse states of the world. Nevertheless, Richards (1997) documents a small country effect, that is, winner-loser reversals are larger among the smaller than larger markets.

Shen, Szakmary, Sharma (2005) investigates linkages between value versus growth investment styles and momentum strategies in international markets. Their full sample results show that momentum profits are concentrated in the growth indices, and that there is evidence of short-term overreaction in these and other indices that is subsequently corrected. Their sub-sample results are mixed; there is some evidence that the profitability of momentum (but not contrarian) strategies persists in the post-December 1987 period. However, unlike the earlier period, there is no evidence that markets overreact and that these overreactions are subsequently corrected.

Using Conrad and Kaul's (1993) methodology Baytas and Cakici (1999) test for the overreaction hypothesis- which maintains that stock prices systematically overshoot and therefore their reversal can be predicted from past performance- in

seven industrialized countries. Consistent with findings of Conrad and Kaul, they see no evidence of overreaction in the US. However, returns to long-term contrarian strategies in other countries seem to be generally significant. Moreover, they find that in the majority of the countries, while returns to arbitrage portfolios based on price are higher than those based on size, the latter generally outperform the winner-loser arbitrage portfolios.

Mun, Vasconcellos and Kish (2000) use a multi-factor asset pricing model, within both the US and Canadian stock markets. Results from risk-adjusted, non-parametric, multi-factor bootstrap-simulated estimates show that, for the US, short-term and intermediate-term contrarian portfolios yield significant returns above the market. For the Canadian market, the intermediate-term contrarian portfolio works best.

The overreaction evidence in a global setting appears to support the overreaction hypothesis for individual countries once a world-pricing model is incorporated into the analysis.

2.2.4 Miscellaneous

Literature investigating the overreaction hypothesis for specific events confirms stock market overreaction and the subsequent reversal of stock prices. Specifically, there is evidence of stock market overreaction to announcements of bankruptcy, awards of excellence, and open-market stock purchases.

Schatzberg and Reiber (1992) investigate the overreaction hypothesis for cases of extremely negative announcements in the form of corporate bankruptcy. Strong evidence is found for the overreaction hypothesis. Moreover, the results are not attributable to estimation errors, missing test period data, or transaction costs. Schatzberg and Reiber conclude that it is plausible that apportion of the observed price reversals is driven by information. The notion that overreaction is particularly strong in the absence of events or information is supported.

Lauterbach and Vu (1992) focus on excellence award winners. Their sample consists of 101 companies whose chief executive officer received a best manager award from a panel of specialists appointed by Financial World magazine. If the award is a manifestation of market overenthusiasm about these firms, then, by the time of the award, their stock could be overvalued. In the post-award period, performance could be dismal. Findings support for the overreaction hypothesis. Using event-study methodology, a positive 21 percent average excess return was documented in the two years preceding the award, and a negative 9.3 percent average excess return was documented in the two years following the award.

Zarowin (1989) tests whether the stock market overreacts to extreme earnings, by examining firms' stock returns over the 36 months subsequent to extreme earnings years. While the poorest earners do outperform the best earners, the poorest earners are also significantly smaller than the best earners. When poor earners are matched with good earners of equal size, there is little evidence of differential performance. This suggests that size, and not investor overreaction to earnings, is responsible for the overreaction phenomenon, the tendency for prior period losers to outperform prior period winners in the subsequent period.

Liu and Ziebart (1997) investigate the overreaction hypothesis for another specific event, open-market stock repurchase announcements. The particular event was chosen for the study because of the uncertainty regarding the appropriate interpretation of the repurchase announcement. Using a cross-sectional regression model to test the relation between the reaction to the repurchase announcement and returns in subsequent periods, results indicate that the market overreacts to repurchase announcements that are deemed to be good news by the market. However, neither reversal nor drift is observed following repurchase announcements that are deemed to be bad news. Furthermore, the results are robust and are not driven by beta shifts or bid-ask bounce.

The remaining studies identify two issues related to stock market overreaction: the asymmetric reaction of winners and losers to events and investor overconfidence and biased self-attribution. The studies show that asymmetric winner/loser returns disappear after certain corrections are made and that investor overconfidence and biased self-attribution can be used to explain the negative long-run and positive short-run autocorrelations in stock markets.

Dissanaike (1996) attempts to investigate the asymmetric reversal of losers initially reported by DeBondt and Thaler (1985, 1987) more closely. He demonstrates that the apparent anomaly is illusory and resulting from the peculiar properties of returns. Specifically, the test-period return on a contrarian portfolio is not always a satisfactory measure of the strength of the price reversal, which renders interportfolio comparisons about the symmetry of reversals more difficult. Dissanaike develops an alternative measure *reversal coefficient* which takes account of the deficiency.

Daniel, Hirshleifer and Subrahmanyam (1998) propose a theory of security market under- and overreaction based on two well-known psychological biases: investor overconfidence about the precision of private information and biased self-attribution, which causes asymmetric shifts in investors' confidence as a function of their investment outcomes. Daniel et al. theorize that overconfidence implies negative long-lag autocorrelations, excess volatility, and, when managerial actions are correlated with stock mispricing, public-event-based return predictability. Biased self-attribution adds positive short-lag autocorrelations, short-run earnings drift, but negative correlation between future returns and long-term past stock market and accounting performance. A similar model based on investor psychology has also been developed by Barberis, Shleifer, and Vishny (1998) to explain stock market under- and overreaction. The authors interpret their model as capturing both the representativeness heuristic and conservatism, and there is no doubt that they intend for their representative investor to be interpreted in a behavioral sense.

Amir and Ganzach (1998) examine hypothesis derived from behavioral decision theory, regarding the conditions that lead to overreaction and conditions that

lead to underreaction in analysts' earning forecasts. They argue that three heuristics jointly influence earnings forecasts: leniency (the tendency towards overly optimistic predictions), representativeness and anchoring and adjustment. The results of their analysis show a tendency towards overreaction in forecast revisions. They also find overreaction for positive forecast modifications and underreaction for negative forecast modifications. Finally they conclude that overreaction, underreaction and excess optimism increase with the forecast horizon suggesting that the longer the predicted horizon, the larger the prediction bias.

CHAPTER 3

EMPIRICAL ANALYSIS ON OVERREACTION HYPOTHESIS in ISTANBUL STOCK EXCHANGE

Up to now, in Chapter 1 adherent and contrary views on EMH are given. In the 2nd Chapter the literature on Overreaction Hypothesis has been analyzed. The aim of this chapter is to test whether there is an overreaction effect in Istanbul Stock Exchange (ISE). The existence of overreaction in ISE will mean that use of contrarian strategies- buying the loser portfolio and selling the winner portfolio- will result with over the market average returns. Another important effect of overreaction hypothesis is that it contradicts with weak form efficiency. The existence of overreaction will mean that ISE is not weak form efficient. With overreaction tests, we will also make an efficiency test on ISE. In this part of the study, the characteristics of the data used in the analysis will be given briefly. Following that, the methodology used in the analysis will be defined.

3.1 Data and Methodology

The sample consists of all the stocks listed in Istanbul Stock Exchange during the period analyzed. Monthly return data for the stocks in Istanbul Stock Exchange (ISE) are used for the period between December 1991 and December 2005. The data before 1992 are not included in the analysis because the number of stocks is limited so; it is thought that these limited data would result in biased results. The number of firms in December 1991 is 106, whereas it reaches to 288 at the end of December 2005. The stocks that form the return data set are given in Appendix A.

The data is obtained from www.analiz.com. The adjusted price data is used in order to remove the effects of stock splits, rights offerings and dividend payments.

The monthly returns are calculated using the closing prices of the stocks at month end. The monthly return values are computed in terms of domestic currency.

In the literature, it is seen that contrarian strategy analysis is built upon forming the winner and loser portfolios on a determined *portfolio formation period* and testing the returns of these portfolios on the determined *portfolio test period*.

Using DeBondt and Thaler's (1985) methodology and by modifying it, one-year, two year, and three year formation and test periods are formed and winner and loser portfolios are determined. Also in order to increase the number of observations and statistical significance Ritter and Loughran (1996) and Baytas and Cakici (1999)'s methodology is adopted and overlapping periods are taken as separate formation and test periods. The data is overlapped for 3-months. As an example for one year analysis the formation period begins with January 1993, April 1993, July 1993, October 1993, January 1994…. This way, the returns of the same stocks in different years are treated as different observations. The formation and test periods are documented in Appendix B.

The return is calculated as follows for every stock (i) on the tape:

$$R_{i,t} = (P_{i,t} / P_{i,t-1}) - 1$$

where $R_{i,t+1}$ stands for the return of the stock i in month t and $P_{i,t}$ and $P_{i,t-1}$ stands for the closing price of the stock i at the end of month t and month t-1. In order to find the excess returns of the stocks the following formula is adopted:

$$A_{i,t} = R_{i,t} - R_{m,t}$$

where $A_{i,t}$ stands for the excess return of the stock i for month t; $R_{i,t}$ is the return of the stock i for the month t, $R_{m,t}$ is the return for the market index. ISE-100 index is taken as the market index and the market return is calculated using this index.

The cumulative abnormal return for each stock is calculated using the formula:

$$CAR_i = \sum_{t}^{0} AR_{i,t}$$

t is -11 for one-year portfolio, -23 for two-year portfolio, and -35 for three-year portfolio. Stocks with missing data in any formation period are not included in the sample.

The stocks are ranked according to their CAR_i values, and following Conrad and Kaul's (1993) methodology best performing 20% of the stocks are taken to form winner portfolio and the bottom 20% of the stocks are taken to form the loser portfolio. Winner and loser portfolios are formed on the assumption that in these portfolios the best performing and worst performing stocks are equally invested. And for the test periods for every month t, the cumulative abnormal return for the portfolio is calculated using the formula below:

$$CAR_{p,z,t} = \sum_{t}\left[(1/N)\sum_{i=1}^{N} AR_{i,t}\right]$$

p denotes the loser (L) and the winner (W) portfolios, z denotes the portfolio formation period and N represents the number of stocks in the portfolio. For the loser and winner portfolios the average cumulative abnormal return is calculated for each month for the test months with the formula:

$$ACAR_{p,t} = \frac{\sum_{z=1}^{Z} CAR_{p,z,t}}{Z}$$

The overreaction hypothesis predicts that, for t>0, $ACAR_{W,t}<0$ and $ACAR_{L,t}>0$, so that by implication, $[ACAR_{L,t} - ACAR_{W,t}]>0$.

To test the overreaction hypothesis and price reversals (H_1 and H_2), t-test is used. The study also tests whether the winner-loser portfolio formed based on the overreaction hypothesis provides excess returns over the market return (H_3).

H_1= $ACAR_{L,t}$= 0; t=1,2,…,t

H_2= $ACAR_{W,t}$=0; t=1,2,…,t

H_3= $ACAR_{L-W,t}$=0; t=1,2,…,t

t is 12 for one-year analysis, 24 for two-year analysis and 36 for three-year analysis.

3.2 Empirical Findings

The findings for one year portfolio formation / test periods are summarized in Table 1 for winner, loser and arbitrage portfolios. Arbitrage portfolios represent the difference portfolio; selling the winner and buying the loser portfolio. The rows indicate the months (t), the first column standard deviation of average cumulative abnormal returns (ACAR), the second column standard deviation of average cumulative abnormal returns (stdACAR) and the third column t-statistics for testing the statistical significance of average cumulative abnormal returns.

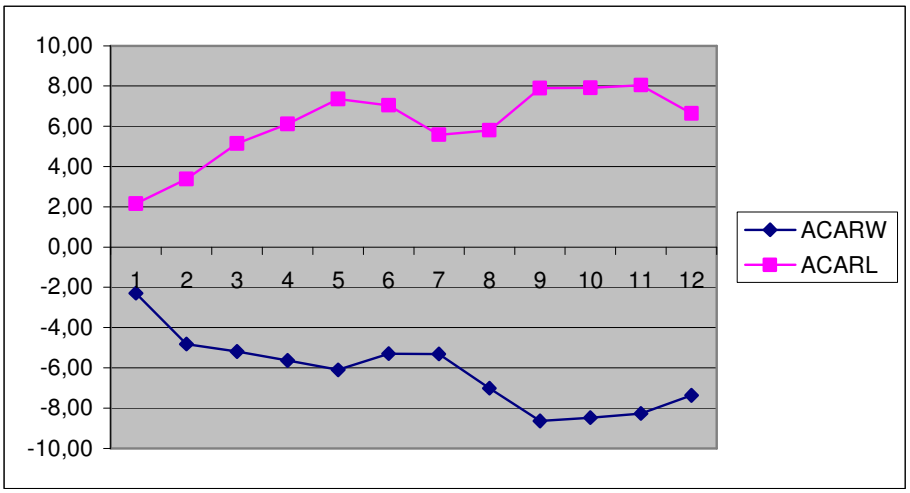
	Winner Portfolio				**Loser Portfolio**				**Arbitrage Portfolio**		
t	$ACAR_W$(%)	std	t-stat		$ACAR_L$(%)	std	t-stat		$ACAR_A$(%)	std	t-stat
1	-2.29	1.09	-0.37		2.16	1.13	1.4		4.45	1.59	1.21
2	-4.81	1.62	-2.88		3.39	1.61	2.12		8.20	2.21	3.66
3	-5.19	1.94	-2.84		5.14	1.97	2.85		10.33	2.61	3.82
4	-5.64	2.01	-2.77		6.11	2.29	3.03		11.75	3.01	4.07
5	-6.1	2	-2.89		7.35	2.51	2.57		13.45	3.57	3.55
6	-5.3	2.29	-2.23		7.04	2.85	1.91		12.34	4.13	4.12
7	-5.31	2.48	-2.02		5.58	3.12	1.85		10.89	4.02	2.87
8	-7.01	2.66	-2.43		5.81	3.07	2.27		12.82	4.65	3.03
9	-8.64	2.79	-2.87		7.9	3.54	2.3		16.54	4.7	2.76
10	-8.47	3.21	-2.62		7.91	3.68	2.4		16.38	4.73	3.87
11	-8.27	3.28	-2.76		8.04	3.88	1.9		16.31	4.88	3.93
12	-7.37	3.39	-2.16		6.64	3.91	1.87		14.01	5.14	2.84

Table 1 Returns following one year formation period

Table 1 shows that the returns of winner portfolio are negative in all months and year end cumulative returns turns out to be -7.37% with a statistically significant t-statistics of -2.16. The winner portfolio returns are statistically significant starting from the second month. The returns of the loser portfolio are positive in all months

and statistically significant between second and fifth month and the eighth month. The end of period cumulative return reaches 6.64%.

The asymmetry in average cumulative abnormal returns shows that price reversals are different for winners and losers. Graph 1 shows the cumulative returns for the winner and loser portfolios.



Graph 1 The Cumulative Returns for the Winner and Loser Portfolios for one year period

The returns are free from January effect because the portfolios do not always start from January. This caused the observations to get rid of any seasonal effect. This three-month overlapping makes this study different from most of the studies in the literature, since it eliminates the seasonal effects.

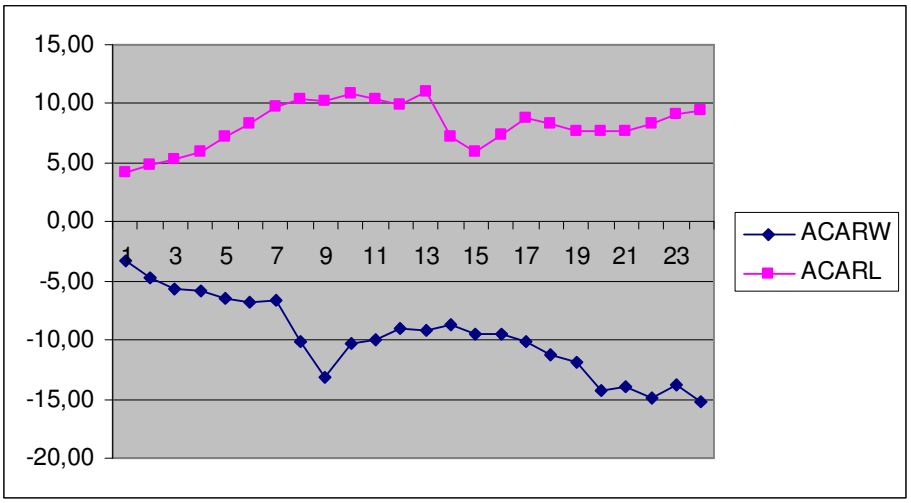
The findings of overlapping and non-overlapping two and three year formation or test periods also support the existence of overreaction in Istanbul Stock Exchange (ISE).

Table 2 summarizes the average abnormal returns for two-year formation /test periods for winner, loser and arbitrage portfolios. The cumulative return of the winner portfolio turns out to be -15.27%, with statistically significant t-statistics. The

cumulative return of the loser portfolio is 9.46% at the end of the two-year period. When we look at the returns of the loser and the winner portfolio, we again see that the price reversal is larger for the winner portfolio, than for the loser portfolio. The return of the arbitrage portfolio at the end of the period is 24.73% again with a significant t-statistic. By applying a contrarian strategy, it is possible to earn profits.

	Winner Portfolio				**Loser Portfolio**				**Arbitrage Portfolio**		
t	$ACAR_W(\%)$	std	t-stat		$ACAR_L(\%)$	std	t-stat		$ACAR_A(\%)$	std	t-stat
1	-3.36	2.29	-1.27		4.12	1.39	2.43		7.48	2.1	2.44
2	-4.69	2.21	-2.75		4.89	1.88	2.58		9.58	2.32	3.76
3	-5.65	2.24	-2.3		5.26	2.34	2.79		10.91	3.14	3.58
4	-5.87	2.65	-2.26		5.93	2.53	2.34		11.80	3.42	3.17
5	-6.41	2.44	-2.28		7.15	3.02	2.36		13.56	4.19	3.29
6	-6.75	2.97	-2.21		8.24	3.39	2.53		14.99	4.43	3.36
7	-6.68	3.01	-2.07		9.68	3.41	2.79		16.36	4.76	3.49
8	-10.21	2.25	-2.14		10.34	3.84	2.84		20.55	5.02	4.12
9	-13.23	3.42	-3.04		10.23	3.89	2.69		23.46	5.27	4.29
10	-10.27	3.62	-2.84		10.89	4.01	2.41		21.16	5.56	3.95
11	-9.94	3.77	-2.27		10.32	4.28	2.19		20.26	5.79	3.08
12	-8.96	3.95	-2.21		9.87	4.42	2.68		18.83	6.02	3.59
13	-9.21	4.07	-2.07		10.97	4.43	1.43		20.18	5.97	2.47
14	-8.73	4.02	-2.46		7.15	4.48	1.67		15.88	5.96	2.92
15	-9.52	3.98	-2.52		5.95	4.59	1.29		15.47	5.94	2.63
16	-9.47	3.84	-2.65		7.29	4.4	1.74		16.76	5.83	2.97
17	-10.15	3.76	-3.05		8.86	4.48	2.21		19.01	5.87	3.51
18	-11.32	3.82	-3.14		8.34	4.47	1.88		19.66	5.88	3.86
19	-11.93	3.82	-3.76		7.63	4.5	1.86		19.56	5.79	3.41
20	-14.27	3.83	-3.75		7.67	4.52	1.4		21.94	5.92	3.83
21	-13.93	3.98	-3.92		7.67	4.51	1.71		21.60	5.9	3.69
22	-14.9	3.83	-3.21		8.28	4.54	1.8		23.18	5.96	3.1
23	-13.8	3.78	-3.85		9.17	4.56	2.03		22.97	5.93	3.92
24	-15.27	3.86	-3.68		9.46	4.58	2.05		24.73	5.99	3.98

Table 2 Returns following two year formation period



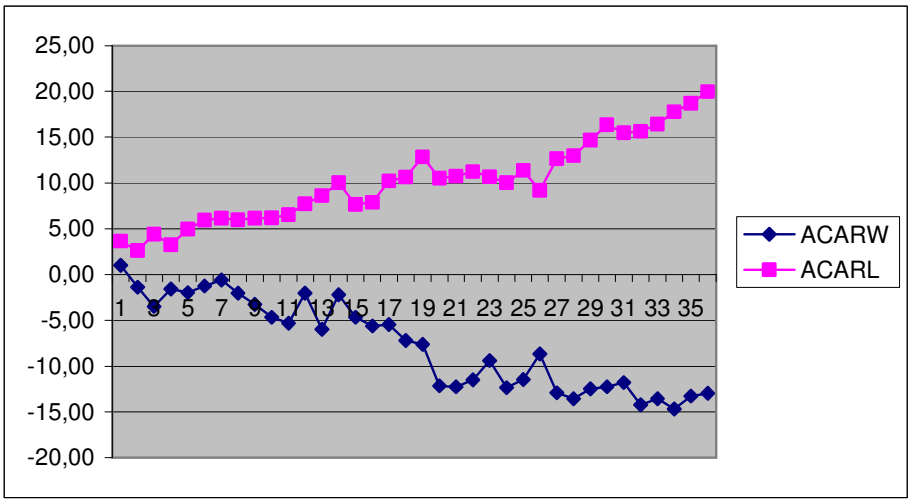
Graph 2 The Cumulative Returns for the Winner and Loser Portfolios for two year period

	Winner Portfolio				**Loser Portfolio**				**Arbitrage Portfolio**		
t	$ACAR_W(\%)$	std	t-stat		$ACAR_L(\%)$	std	t-stat		$ACAR_A(\%)$	std	t-stat
1	1.01	1.66	0.08		3.66	1.47	2.63		2.65	2.43	1.96
2	-1.36	1.84	-0.73		2.63	2.03	1.27		3.99	2.73	1.43
3	-3.47	2.23	-1.54		4.41	2.44	1.76		7.88	3.38	2.35
4	-1.58	2.49	-0.65		3.26	2.94	1.21		4.84	3.90	1.27
5	-1.97	2.87	-0.72		4.97	3.38	1.43		6.94	4.33	1.59
6	-1.23	3.14	-0.39		5.94	3.32	1.74		7.17	4.68	1.58
7	-0.58	3.38	-0.08		6.15	3.85	1.56		6.73	5.07	1.21
8	-2.03	3.56	-0.09		5.99	4.10	1.53		8.02	5.45	1.47
9	-3.24	3.87	-0.57		6.15	4.27	1.74		9.39	5.73	1.67
10	-4.67	4.05	-0.73		6.17	4.43	1.49		10.84	6.02	1.85
11	-5.31	4.23	-1.15		6.54	4.67	1.53		11.85	6.37	1.69
12	-2.03	4.39	-0.98		7.72	4.68	1.48		9.75	6.60	1.98
13	-5.96	4.40	-1.28		8.62	4.89	1.67		14.58	6.59	2.47
14	-2.21	4.45	-0.48		10.03	4.88	1.77		12.24	6.63	1.45
15	-4.66	4.49	-0.98		7.66	4.93	1.63		12.32	6.63	1.87
16	-5.60	4.49	-1.26		7.89	4.86	1.78		13.49	6.62	1.96
17	-5.46	4.53	-1.23		10.21	4.84	2.20		15.67	6.61	2.47
18	-7.20	4.46	-1.60		10.66	4.83	2.67		17.86	6.58	3.01
19	-7.63	4.41	-1.69		12.84	4.79	2.24		20.47	6.49	2.87
20	-12.15	4.39	-2.64		10.51	4.73	2.29		22.66	6.50	3.55
21	-12.24	4.41	-2.78		10.76	4.71	2.38		23.00	6.49	3.61
22	-11.48	4.46	-2.63		11.23	4.58	2.55		22.71	6.51	3.55
23	-9.40	4.43	-2.27		10.67	4.65	2.37		20.07	6.41	3.47
24	-12.35	4.49	-2.51		10.02	4.67	2.16		22.37	6.42	3.43
25	-11.45	4.45	-2.73		11.37	4.63	2.43		22.82	6.41	3.47
26	-8.67	4.46	-1.99		9.21	4.80	2.05		17.88	6.37	2.84

27	-12.89	4.46	-2.63		12.65	4.61	2.66		25.54	6.38	3.75
28	-13.56	4.43	-2.59		12.97	4.64	3.21		26.53	6.40	4.06
29	-12.47	4.48	-3.07		14.68	4.67	3.49		27.15	6.38	4.25
30	-12.24	4.47	-3.21		16.35	4.67	3.38		28.59	6.47	4.38
31	-11.79	4.45	-3.02		15.47	4.47	3.57		27.26	6.41	4.27
32	-14.21	4.49	-2.86		15.63	4.59	3.85		29.84	6.42	4.56
33	-13.55	4.47	-3.21		16.43	4.80	4.03		29.98	6.40	4.67
34	-14.67	4.48	-3.13		17.79	4.63	4.17		32.46	6.41	5.05
35	-13.25	4.47	-3.21		18.69	4.52	4.34		31.94	6.43	5.02
36	-12.96	4.46	-2.86		19.96	4.62	4.11		32.92	6.41	5.13

Table 3 Returns following three year formation period

Table 3 lists the returns for three-year formation/ test periods. When we look at the table we see that the t-statistics have decreased compared to the shorter periods. The returns of winner and loser portfolios are statistically significant after the 20th and 17th month respectively. Winner portfolio loses 12.96% at the end of third year whereas loser portfolio earns 19.96%. This finding is consistent with DeBondt and Thaler (1985). Return of the loser portfolio is higher than the return of the winner portfolio in absolute terms.



Graph 3 The Cumulative Returns for the Winner and Loser Portfolios for three year period

Graph 3 and the Table 3 shows that the returns for the arbitrage portfolio increase gradually to the 36th month. Arbitrage portfolio earns 32.92% at the end of the period with a significant t-statistic.

When Table 3 is analyzed, it is seen that the highest average cumulative abnormal returns are received after one year has passed. In the second and third years, the returns increase for the loser portfolio. Again for the winner portfolio after 20^{th} month the lowest average cumulative abnormal returns are received compared to the first year. In sum, the overreaction effect exists for the three year period after the portfolio formation period and the returns from the arbitrage portfolio are higher in the second and the third years.

In general, after using a modified version of DeBondt and Thaler's methodology; winner, loser and arbitrage portfolios are formed with one, two and three year formation periods to test the success of the contrarian strategies –selling the winner and buying the loser- in ISE. The arbitrage portfolio earns 14.01% for one year formation / test period, 24.73% for two year formation / test period and 32.92% for three year formation / test period.

The findings confirm that winner-loser portfolios formed based on prior returns provides excess subsequent returns. There is overreaction effect in ISE and price reversals are greater in the second and third years. Finally, the existence of overreaction may indicate that ISE is not even weak-form efficient.

CONCLUSION

Efficient Market Hypothesis (EMH) argues that the markets are efficient when prices reflect all available information. EMH assumes that investors are rational, if there is some deviation from the fundamental values by the investors' sentiment, arbitrage takes place quickly and correctly and no abnormal profit occurs in the market. In equilibrium the risk-adjusted return on all investments should be equal; the return one may expect from a share of stock should exactly equal the return that can be had on any other financial instrument with similar risk characteristics. If any single financial instrument exhibits a higher risk-adjusted rate of return than others, investors can be expected to attempt to purchase that instrument, thereby causing its price to rise and its rate of return to fall. This suggests that it is not possible to systematically beat the market by picking a stock which will outperform the market.

Fama defines three types of efficiency in the market: weak form efficiency, semi-strong form efficiency and strong form efficiency. The weak form of the efficient market hypothesis claims that prices fully reflect the information implicit in the sequence of past prices. The semi-strong form of the hypothesis asserts that prices reflect all relevant information that is publicly available, while the strong form of market efficiency asserts information that is known to any participant is reflected in market prices.

The works on EMH has grown too much, but also contrary views on EMH have also taken place in the literature, that found evidence of the occurrences where there may be profit opportunities, namely 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.

In the finance literature, there is a vast amount of studies questioning the efficient market hypothesis and pointing out to different anomalies day of the week

effect / weekend effect, intra-day effects, Friday the thirteenth effect, January effect, Mark Twain effect, intra-month effect, before holiday /after holiday effects, small/ big firm effect, price-earnings ratio effect, risk premium effect, winner-loser effect, neglected- firm effect etc.

In this study one of the most attractive anomaly documented in the literature has been analyzed, the Overreaction Hypothesis. This anomaly has first been detected by DeBondt and Thaler. DeBondt and Thaler (1985, 1987) reported that investors evaluate the prices of stocks according to the new information that arrives to the market and they overreact to bad or good news, and they correct this overreaction in the long term.

The reaction to recent dramatic information opens the door to the prediction of stock price movement. That is, if stock prices swing too high on recent good news and too low on recent bad news then the prediction of stock price movement has been implied. This concept is a violation of the theory of efficient markets. This means that the existence of overreaction in a market, will contradict the weak form efficiency of that market. If a market is not weak form efficient, it should be possible to earn abnormal returns from that market.

The purpose of this thesis is to test the winner-loser effect, by other means the overreaction hypothesis for stocks listed in the Istanbul Stock Exchange (ISE). At the beginning of the thesis, a comprehensive literature is presented on EMH and challenging views on EMH and on the Overreaction Hypothesis. In the last chapter, using a modified version of DeBondt and Thaler's methodology, winner, loser and arbitrage portfolios are formed with on, two and three year formation periods to test the success of contrarian strategies and to find the existence of overreaction effect. By shifting the data for 3-months, overlapping periods have also been formed in order to increase the number of observations and also to increase the statistical significance. If there is overreaction in ISE, it will be possible to earn over the market average returns by applying contrarian strategies. Also according to the

results of the analysis, it will be possible to make a conclusion on the efficiency of ISE.

For the one-year analysis returns of winner portfolio are negative in all months and the returns are statistically significant starting from the second month. The returns of the loser portfolio are positive and significant between second and fifth month and the eighth month. Arbitrage portfolio period- end return reaches to 14.01% and returns are significant starting with the second month. Two-year and three-year analysis results also support the overreaction hypothesis with arbitrage portfolio returns 24.73% and 32.92% respectively. And consistent with DeBondt and Thaler, the price reversals are asymmetric.

The findings confirm that winner-loser portfolios formed based on prior returns provides excess subsequent returns. There is overreaction effect in ISE and price reversals are greater in the second and third years. Finally, the existence of overreaction may indicate that ISE is not even weak-form efficient. But further weak-form efficiency tests are suggested. Another result is for one-, two- and three-year periods buying the winner portfolio and selling the winner portfolio, namely contrarian strategies work in ISE. A limitation of the study is it does not analyze the short term overreaction, which does not exist in the literature related to ISE.

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APPENDIX A

Stocks that Form the Data Set

FIRMS IN THE DATA SET			
ABANA	ABANA ELEKTROMEKANİK	BAGFS.E	BAGFAŞ
ACIBD.E	ACIBADEM SAĞLIK	BAKAB.E	BAK AMBALAJ
ADANA.E	ADANA ÇİMENTO (A)	BANVT.E	BANVİT
ADBGR.E	ADANA ÇİMENTO (B)	BTCIM.E	BATI ÇİMENTO
ADNAC.E	ADANA ÇİMENTO (C)	BSOKE.E	BATISÖKE ÇİMENTO
ADEL.E	ADEL KALEMCİLİK	BEKO.E	BEKO ELEKTRONİK
SASA.E	ADVANSA SASA	BERDN.E	BERDAN TEKSTİL
AFMAS.E	AFM FİLM	BJKAS.E	BEŞİKTAŞ FUTBOL YAT.
AFYON.E	AFYON ÇİMENTO	BISAS.E	BISAŞ TEKSTİL
AKENR.E	AK ENERJİ	BIMAS.E	BİM MAĞAZALAR
AKYO.E	AK YAT.ORT.	BOLUC.E	BOLU ÇİMENTO
AKALT.E	AKAL TEKSTİL	BROVA.E	BOROVA YAPI
AKBNK.E	AKBANK	BRSAN.E	BORUSAN MANNESMANN
AKCNS.E	AKÇANSA	BRYAT.E	BORUSAN YAT. PAZ.
ATEKS.E	AKIN TEKSTİL	BFREN.E	BOSCH FREN SİSTEMLERİ
AKMGY.E	AKMERKEZ GMYO	BOSSA.E	BOSSA
AKSA.E	AKSA	BOYNR.E	BOYNER MAĞAZACILIK
AKGRT.E	AKSİGORTA	BRISA.E	BRİSA
AKSUE.E	AKSU ENERJİ	BSPRO.E	BSH EV ALETLERİ
AKIPD.E	AKSU İPLİK	BUMYO.E	BUMERANG YAT.ORT.
ALCAR.E	ALARKO CARRIER	BURCE.E	BURÇELİK
ALGYO.E	ALARKO GMYO	BURVA.E	BURÇELİK VANA
ALARK.E	ALARKO HOLDİNG	BUCIM.E	BURSA ÇİMENTO
ALCTL.E	ALCATEL TELETAŞ	CEYLN.E	CEYLAN GİYİM
ALKA.E	ALKİM KAĞIT	CYTAS.E	CEYTAŞ MADENCİLİK
ALKIM.E	ALKİM KİMYA	CBSBO.E	ÇBS BOYA
ARFYO.E	ALTERNATİF YAT.ORT.	PRTAS.E	ÇBS PRİNTAŞ
ALNTF.E	ALTERNATİFBANK	CLEBI.E	ÇELEBİ
ALYAG.E	ALTINYAĞ	CELHA.E	ÇELİK HALAT
ALTIN.E	ALTINYILDIZ	CEMTS.E	ÇEMTAŞ
ANACM.E	ANADOLU CAM	CMBTN.E	ÇİMBETON
AEFES.E	ANADOLU EFES	CMENT.E	ÇİMENTAŞ
ANHYT.E	ANADOLU HAYAT EMEK.	CIMSA.E	ÇİMSA
ASUZU.E	ANADOLU ISUZU	DARDL.E	DARDANEL
ANSGR.E	ANADOLU SİGORTA	DMSAS.E	DEMISAŞ DÖKÜM
ARAT.E	ARAT TEKSTİL	DNZYO.E	DENİZ YAT.ORT.
ARCLK.E	ARÇELİK	DENIZ.E	DENİZBANK
ARENA.E	ARENA BİLGİSAYAR	DENCM.E	DENİZLİ CAM
ARSAN.E	ARSAN TEKSTİL	DENTA.E	DENTAŞ AMBALAJ
ASELS.E	ASELSAN	DERIM.E	DERİMOD

ATAYO.E	ATA YAT.ORT.	DESA.E	DESA DERİ
AGYO.E	ATAKULE GMYO	DEVA.E	DEVA HOLDİNG
ATSYO.E	ATLANTİS YAT. ORT.	DITAS.E	DİTAŞ DOĞAN
ATLAS.E	ATLAS YAT. ORT.	DOBUR.E	DOĞAN BURDA
AVIVA.E	AVİVA SİGORTA	DGZTE.E	DOĞAN GAZETECİLİK
AVRSY.E	AVRASYA YAT.ORT.	DOHOL.E	DOĞAN HOLDİNG
AYEN.E	AYEN ENERJİ	DYHOL.E	DOĞAN YAYIN HOL.
AYGAZ.E	AYGAZ	DOAS.E	DOĞUŞ OTOMOTİV
DOKTS.E	DÖKTAŞ	GUBRF.E	GÜBRE FABRİK.
DUROF.E	DURAN DOĞAN BASIM	GUSGR.E	GÜNEŞ SİGORTA
DYOBY.E	DYO BOYA	HZNDR.E	HAZNEDAR REFRAKTER
ECILC.E	ECZACIBAŞI İLAÇ	HDFYO.E	HEDEF YAT.ORT.
ECYAP.E	ECZACIBAŞI YAPI	HEKTS.E	HEKTAŞ
ECBYO.E	ECZACIBAŞI YAT. ORT.	HURGZ.E	HÜRRİYET GZT.
ECZYT.E	ECZACIBAŞI YATIRIM	ISAMB.E	IŞIKLAR AMBALAJ
EDIP.E	EDİP İPLİK	IDAS.E	İDAŞ
EFES.E	EFES HOLDİNG	IHEVA.E	İHLAS EV ALETLERİ
EGEEN.E	EGE ENDÜSTRİ	IHGYO.E	İHLAS GMYO
EGGUB.E	EGE GÜBRE	IHLAS.E	İHLAS HOLDİNG
EGSER.E	EGE SERAMİK	INDES.E	İNDEKS BİLGİSAYAR
EVREN.E	EGELİ YAT. ORT.	INFYO.E	İNFO YAT. ORT.
EPLAS.E	EGEPLAST	IBTYO.E	İNFOTREND YAT. ORT.
EMKEL.E	EMEK ELEKTRİK	INTEM.E	İNTEMA
EMNIS.E	EMİNİŞ AMBALAJ	ISATR.E	İŞ BANKASI (A)
ENKAI.E	ENKA İNŞAAT	ISBTR.E	İŞ BANKASI (B)
ERBOS.E	ERBOSAN	ISCTR.E	İŞ BANKASI (C)
EREGL.E	EREĞLİ DEMİR CELİK	ISKUR.E	İŞ BANKASI (KUR.)
ERSU.E	ERSU GIDA	ISFIN.E	İŞ FİN.KİR.
ESCOM.E	ESCORT COMPUTER	ISGSY.E	İŞ GİRİŞİM
ESEMS.E	ESEM SPOR GİYİM	ISGYO.E	İŞ GMYO
EVNYO.E	EVG YAT.ORT	ISYAT.E	İŞ YAT. ORT.
FACFA.E	FACTOTURK FAKTORİNG	IZMDC.E	İZMİR DEMİR ÇELİK
FVORI.E	FAVORİ DİNLENME YER.	IZOCM.E	İZOCAM
FENER.E	FENERBAHÇE SPORTİF	KAPLM.E	KAPLAMİN
FENIS.E	FENİŞ ALÜMİNYUM	KRDMA.E	KARDEMİR (A)
FFKRL.E	FİNANS FİN. KİR.	KRDMB.E	KARDEMİR (B)
FNSYO.E	FİNANS YAT. ORT.	KRDMD.E	KARDEMİR (D)
FINBN.E	FİNANSBANK	KARSN.E	KARSAN OTOMOTİV
FMIZP.E	F-M İZMİT PİSTON	KRTEK.E	KARSU TEKSTİL
FROTO.E	FORD OTOSAN	KARTN.E	KARTONSAN
DISBA.E	FORTIS BANK	KAVPA.E	KAV DAN.PAZ.TİC.
FRIGO.E	FRİGO PAK GIDA	KLBMO.E	KELEBEK MOBİLYA
GSRAY.E	GALATASARAY SPORTİF	KENT.E	KENT GIDA
GARAN.E	GARANTİ BANKASI	KERVT.E	KEREVİTAŞ GIDA
GARFA.E	GARANTİ FAKTORİNG	KLMSN.E	KLİMASAN KLİMA
GRGYO.E	GARANTİ GMYO	KCHOL.E	KOÇ HOLDİNG
GRNYO.E	GARANTİ YAT. ORT.	KNFRT.E	KONFRUT GIDA

GEDIZ.E	GEDİZ İPLİK	KOTKS.E	KONİTEKS
GENTS.E	GENTAŞ	KONYA.E	KONYA ÇİMENTO
GEREL.E	GERSAN ELEKTRİK	KORDS.E	KORDSA
GIMA.E	GİMA	KOZAD.E	KOZA DAVETİYE
GLYHO.E	GLOBAL YAT. HOLDİNG	KRSTL.E	KRİSTAL KOLA
GOLDS.E	GOLDAS KUYUMCULUK	KUTPO.E	KÜTAHYA PORSELEN
GOODY.E	GOOD-YEAR	LINK.E	LİNK BİLGİSAYAR
GOLTS.E	GÖLTAŞ ÇİMENTO	LIOYS.E	LİO YAĞ
GSDHO.E	GSD HOLDİNG	LOGO.E	LOGO YAZILIM
LUKSK.E	LÜKS KADİFE	TNSAS.E	TANSAŞ
MYZYO.E	M. YILMAZ YAT.ORT.	TATKS.E	TAT KONSERVE
MRDIN.E	MARDİN ÇİMENTO	TUDDF.E	T.DEMİR DÖKÜM
MAALT.E	MARMARİS ALTINYUNUS	TEKTU.E	TEK-ART TURİZM
MMART.E	MARMARİS MARTI	TEBNK.E	T.EKONOMİ BANK.
MRSHL.E	MARSHALL	TEKFK.E	TEKSTİL FİN. KİR.
MZHLD.E	MAZHAR ZORLU HOLDİNG	TEKST.E	TEKSTİLBANK
MNDRS.E	MENDERES TEKSTİL	KIPA.E	TESCO KİPA
MEMSA.E	MENSA MENSUCAT	TIRE.E	TİRE KUTSAN
MERKO.E	MERKO GIDA	TOASO.E	TOFAŞ OTO. FAB.
MTEKS.E	METEMTEKS	TOPFN.E	TOPRAK FİN. KİR.
MIGRS.E	MİGROS	TSPOR.E	TRABZONSPOR SPORTİF
MIPAZ.E	MİLPA	TRKCM.E	TRAKYA CAM
MUTLU.E	MUTLU AKÜ	TSKB.E	T.S.K.B.
NTHOL.E	NET HOLDİNG	TSKYO.E	TSKB YAT. ORT.
NTTUR.E	NET TURİZM	TBORG.E	T.TUBORG
NETAS.E	NETAŞ TELEKOM.	TUKAS.E	TUKAŞ
NUHCM.E	NUH ÇİMENTO	TRCAS.E	TURCAS PETROL
NUGYO.E	NUROL GMYO	TCELL.E	TURKCELL
OKANT.E	OKAN TEKSTİL	TUPRS.E	TÜPRAŞ
OLMKS.E	OLMUKSA	THYAO.E	TÜRK HAVA YOLLARI
OTKAR.E	OTOKAR	PRKAB.E	TÜRK PRYSMİAN KABLO
OYSAC.E	OYSA ÇİMENTO	TTRAK.E	TÜRK TRAKTÖR
OZFIN.E	ÖZ FİNANS FACT.	UKIM.E	UKİ KONFEKSİYON
PRKTE.E	PARK ELEK.MADENCİLİK	UCAK.E	USAŞ
PARSN.E	PARSAN	USAK.E	UŞAK SERAMİK
PENGD.E	PENGUEN GIDA	UZEL.E	UZEL MAKİNA
PERYO.E	PERA YAT. ORT.	ULKER.E	ÜLKER GIDA
PETKM.E	PETKİM	UNTAR.E	ÜNAL TARIM ÜRÜN.
PTOFS.E	PETROL OFİSİ	UNYEC.E	ÜNYE ÇİMENTO
PETUN.E	PINAR ET VE UN	VAKFN.E	VAKIF FİN. KİR.
PINSU.E	PINAR SU	VKFRS.E	VAKIF GİRİŞİM
PNSUT.E	PINAR SÜT	VKGYO.E	VAKIF GMYO
PIMAS.E	PİMAŞ	VKFYT.E	VAKIF YAT. ORT.
RAYSG.E	RAY SİGORTA	VAKBN.E	VAKIFLAR BANKASI
SAHOL.E	SABANCI HOLDİNG	VAKKO.E	VAKKO TEKSTİL
SANKO.E	SANKO PAZARLAMA	VANET.E	VANET
SARKY.E	SARKUYSAN	VARYO.E	VARLIK YAT.ORT.

SELGD.E	SELÇUK GIDA	VESTL.E	VESTEL
SERVE.E	SERVE KIRTASİYE	VKING.E	VİKİNG KAĞIT
SODA.E	SODA SANAYİİ	YKFIN.E	YAPI KREDİ FİN.KİR.
SKTAS.E	SÖKTAŞ	YKGYO.E	YAPI KREDİ KORAY GMYO
SONME.E	SÖNMEZ FİLAMENT	YKSGR.E	YAPI KREDİ SİGORTA
SKPLC.E	ŞEKER PİLİÇ	YKRYO.E	YAPI KREDİ YAT.O.
SKBNK.E	ŞEKERBANK	YKBNK.E	YAPI VE KREDİ BANK.
SISE.E	ŞİŞE CAM	YATAS.E	YATAŞ
TKBNK.E	T. KALKINMA BANK.	YTFYO.E	YATIRIM FİN. YAT.ORT.
TACYO.E	TAÇ YAT. ORT.	YAZIC.E	YAZICILAR HOLDING
YUNSA.E	YÜNSA	ZOREN.E	ZORLU ENERJİ

APPENDIX B

Portfolio Formation and Test Periods

	Formation Period		Test Period
One Year	January-93/ December-93		January-94/ December-94
	April-93/ March-94		April-94/ March-95
	July-93/ June-94		July-94/ June-95
	October-93/ September-94		October-94/ September-95
	January-94/ December-94		January-95/ December-95
	April-94/ March-95		April-95/ March-96
	July-94/ June-95		July-95/ June-96
	October-94/ September-95		October-95/ September-96
	January-95/ December-95		January-96/ December-96
	April-95/ March-96		April-96/ March-97
	July-95/ June-96		July-96/ June-97
	October-95/ September-96		October-96/ September-97
	January-96/ December-96		January-97/ December-97
	April-96/ March-97		April-97/ March-98
	July-96/ June-97		July-97/ June-98
	October-96/ September-97		October-97/ September-98
	January-97/ December-97		January-98/ December-98
	April-97/ March-98		April-98/ March-99
	July-97/ June-98		July-98 June-99
	October-97/ September-98		October-98/ September-99
	January-98/ December-98		January-99/ December-99
	April-98/ March-99		April-99 March-00
	July-98 June-99		July-99 June-00
	October-98/ September-99		October-99/ September-00
	January-99/ December-99		January-00 / December-00
	April-99 March-00		April-00 / March-01
	July-99 June-00		July-00 /June-01
	October-99/ September-00		October-00/ September-01
	January-00 / December-00		January-01/ December-01

	April-00 / March-01		April-01/ March-02
	July-00 /June-01		July-01/ June-02
	October-00/ September-01		October-01/ September-02
	January-01/ December-01		January-02 /December-02
	April-01/ March-02		April-02/ March-03
	July-01/ June-02		July-02 /June-03
	October-01/ September-02		October-02/ September-03
	January-02 /December-02		January-03 / December-03
	April-02/ March-03		April-03 / March-04
	July-02 /June-03		July-03/ June-04
	October-02/ September-03		October-03/ September-04
	January-03 / December-03		January-04 / December-04
	April-03 / March-04		April-04 / March-05
	July-03/ June-04		July-04 / June-05
	October-03/ September-04		October-04 / September-05
	January-04 / December-04		January-05 / December-05

	Formation Period		Test Period
	January-93 / December-94		January-94 / December-96
	April-93 / March-95		April-94 / March-96
Two Year	July-93 / June-95		July-94 / June-96
	October-93 / September-95		October-94 / September-96
	January-94 / December-96		January-95 / December-96
	April-94 / March-96		April-95 / March-97
	July-94 / June-96		July-95 / June-97
	October-94 / September-96		October-95 / September-97
	January-95 / December-96		January-96 / December-97
	April-95 / March-97		April-96 / March-98
	July-95 / June-97		July-96 / June-98
	October-95 / September-97		October-96 / September-98

	January-96 / December-97		January-97 / December-98
	April-96 / March-98		April-97 / March-99
	July-96 / June-98		July-97 / June-99
	October-96 / September-98		October-97 / September-99
	January-97 / December-98		January-98 / December-99
	April-97 / March-99		April-98 / March-00
	July-97 / June-99		July-98 / June-00
	October-97 / September-99		October-98 / September-00
	January-98 / December-99		January-99 / December-00
	April-98 / March-00		April-99 / March-01
	July-98 / June-00		July-99 / June-01
	October-98 / September-00		October-99 / September-01
	January-99 / December-00		January-00 / December-01
	April-99 / March-01		April-00 / March-02
	July-99 / June-01		July-00 /June-02
	October-99 / September-01		October-00 / September-02
	January-00 / December-01		January-01 / December-02
	April-00 / March-02		April-01 / March-03
	July-00 /June-02		July-01 / June-03
	October-00 / September-02		October-01 / September-03
	January-01 / December-02		January-02 / December-03
	April-01 / March-03		April-02 / March-04
	July-01 / June-03		July-02 / June-04
	October-01 / September-03		October-02 / September-04
	January-02 / December-03		January-03 / December-04
	April-02 / March-04		April-03 / March-05
	July-02 / June-04		July-03 / June-05
	October-02 / September-04		October-03 / September-05
	January-03 / December-04		January-04 / December-05

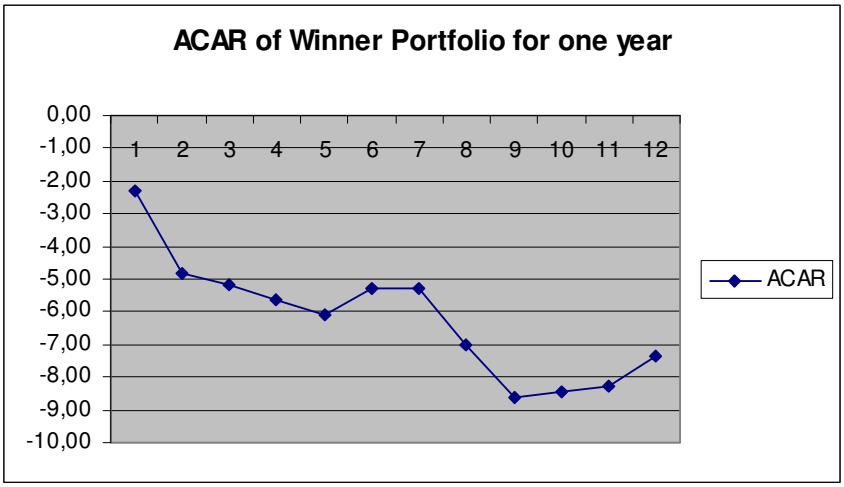
	Formation Period		Test Period
	January-93 / December-95		January-94 / December-97
	April-93 / March-96		April-94 / March-97
Three	July-93 / June-96		July-94 / June-97
Year	October-93 / September-96		October-94 / September-97
	January-94 / December-97		January-95 / December-97
	April-94 / March-97		April-95 / March-98
	July-94 / June-97		July-95 / June-98
	October-94 / September-97		October-95 / September-98
	January-95 / December-97		January-96 / December-98
	April-95 / March-98		April-96 / March-99
	July-95 / June-98		July-96 / June-99
	October-95 / September-98		October-96 / September-99
	January-96 / December-98		January-97 / December-99
	April-96 / March-99		April-97 / March-00
	July-96 / June-99		July-97 / June-00
	October-96 / September-99		October-97 / September-00
	January-97 / December-99		January-98 / December-00
	April-97 / March-00		April-98 / March-01
	July-97 / June-00		July-98 / June-01
	October-97 / September-00		October-98 / September-01
	January-98 / December-00		January-99 / December-01
	April-98 / March-01		April-99 / March-02
	July-98 / June-01		July-99 / June-02
	October-98 / September-01		October-99 / September-02
	January-99 / December-01		January-00 / December-02
	April-99 / March-02		April-00 / March-03
	July-99 / June-02		July-00 /June-03
	October-99 / September-02		October-00 / September-03

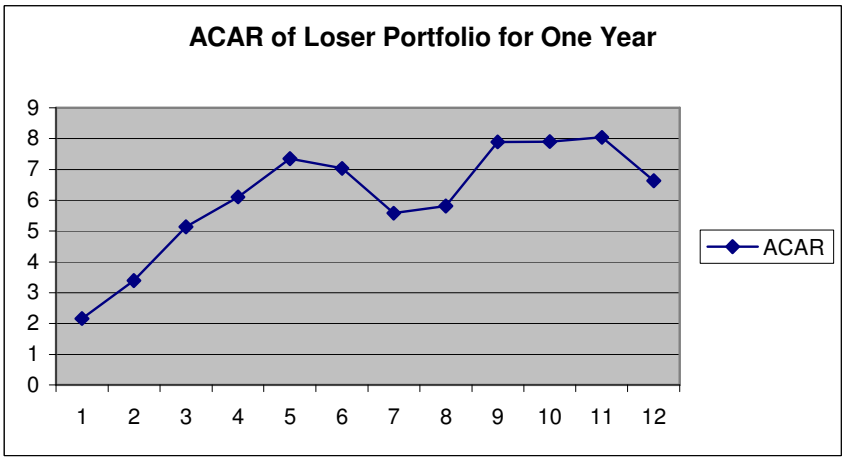
	January-00 / December-02		January-01 / December-03
	April-00 / March-03		April-01 / March-04
	July-00 /June-03		July-01 / June-04
	October-00 / September-03		October-01 / September-04
	January-01 / December-03		January-02 / December-04
	April-01 / March-04		April-02 / March-05
	July-01 / June-04		July-02 / June-05
	October-01 / September-04		October-02 / September-05
	January-02 / December-04		January-03 / December-05

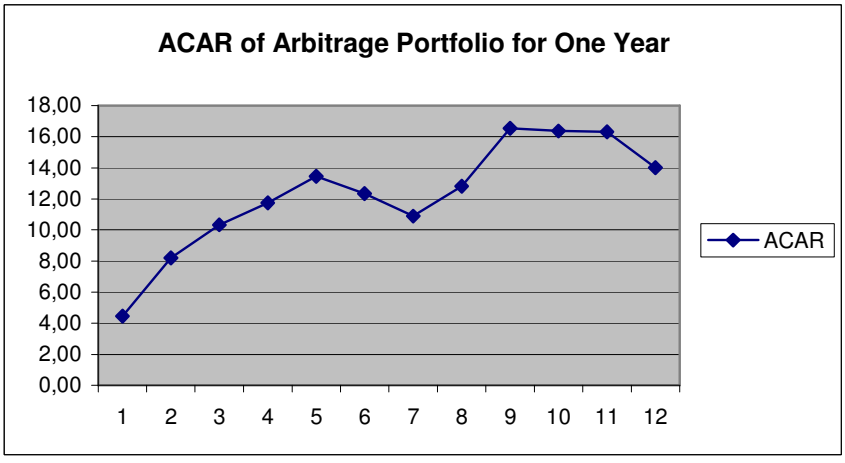
APPENDIX C

Average Cumulative Abnormal Returns for Winner, Loser And Arbitrage Portfolios

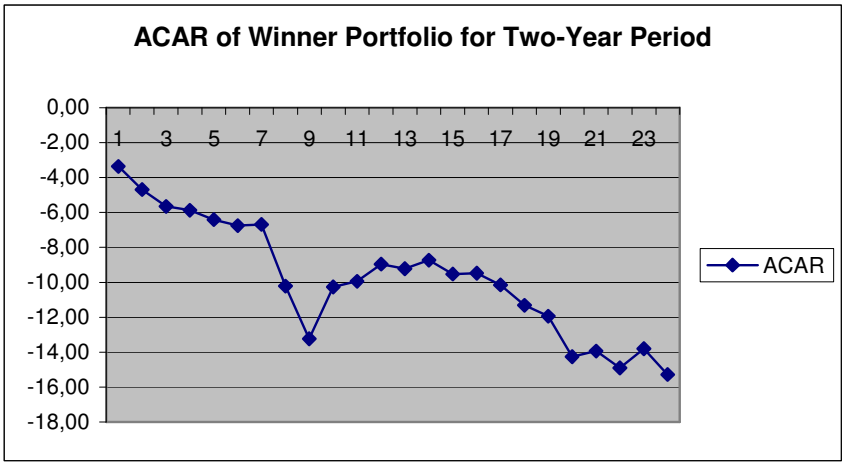
Graphs for 1-Year Portfolio Formation /Test Periods

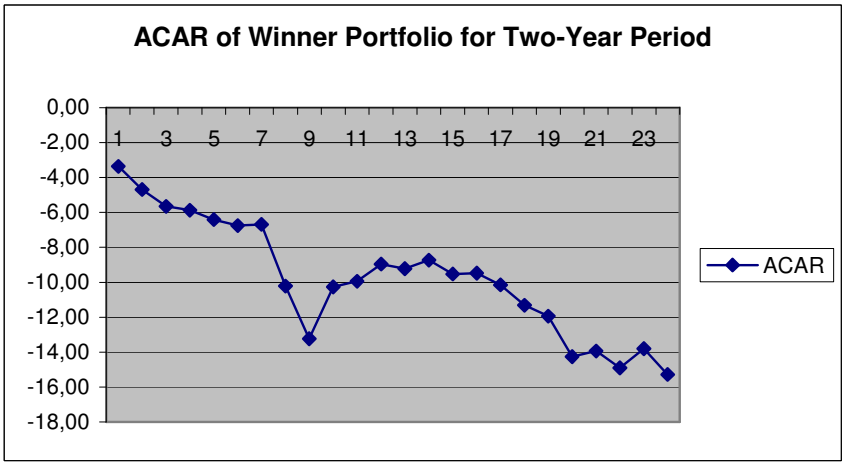


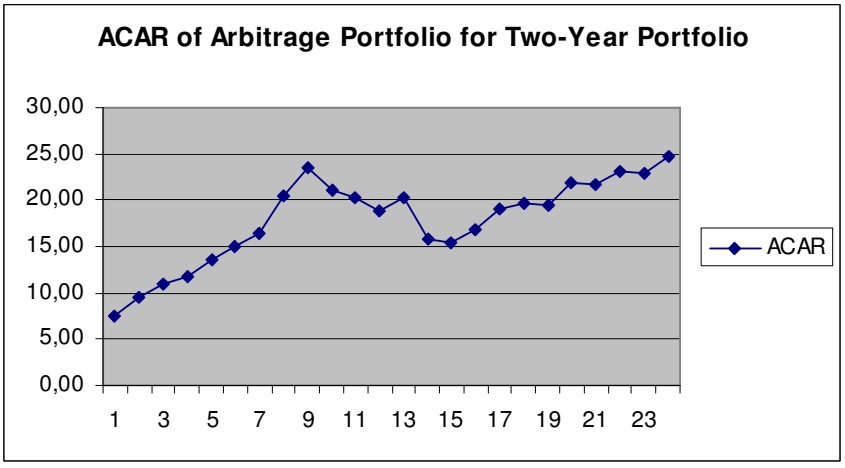




Graphs for 2- Year Portfolio Formation /Test Periods







Graphs for 3- Year Portfolio Formation /Test Periods