

TESTING FOR THE SUCCESS AND THE USE OF CONTRARIAN STRATEGIES
IN İSTANBUL STOCK EXCHANGE

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ABSTRACT

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This thesis analyses an anomaly, namely the Overreaction Hypothesis, which is a widely studied behavioural finance approach that has challenged the Efficient Market Hypothesis. The Overreaction Hypothesis states that extreme movements in the stocks prices will be followed by subsequent movements in the opposite direction; i.e. past losers significantly outperform past winners, which is a violation of the weak form efficiency. We examine the presence of such price correction and the success of contrarian strategies in İstanbul Stock Exchange (ISE) for the period of 1986 to 2001. We use a modified version of De Bondt and Thaler's methodology to form winner, loser and arbitrage portfolios of one, two and three year formation / test periods.

We find out that for all formation / test periods, there is a substantial price correction in the market, which supports the Overreaction Hypothesis and the profitability of contrarian strategies. Our evidence may indicate that ISE is not weak form efficient.

Furthermore, we inspect the foreign investors' behaviour and its effects in ISE. A significant relation between foreign investors purchase or sales decision and the return of the stocks is detected. It is also found that foreign investors behave rationally since they use contrarian strategies in ISE.

Keywords: Overreaction Hypothesis, Efficient Market Hypothesis, weak form efficiency, contrarian strategies, price correction.

ÖZET

İSTANBUL MENKUL KIYMETLER BORSASINDA TERSİNE YATIRIM STRATEJİLERİNİN BAŞARI VE KULLANIMININ SINANMASI

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Bu tez Etkin Pazar Hipotezinin karşıtı bir davranışsal finans yaklaşımı olan Aşırı Tepki Hipotezini incelemektedir. Aşırı Tepki Hipotezi, hisse senetlerindeki anormal fiyat hareketlerinin, ters yönde fiyat hareketleri ile takip edildiğini yani geçmişte kaybeden hisselerin, geçmişte kazanan hisselerle göre daha yüksek getiri sağladığını savunmaktadır. Bu çalışmada 1986-2001 yılları arasında İstanbul Menkul Kıymetler Borsası'nda (İMKB) fiyat düzeltmesi ve tersine yatırım stratejisinin karlılığı incelenmektedir. Bir, iki, üç yıllık formasyon/test periyotlarında kazanan, kaybeden ve arbitraj portföyleri oluştururken De Bondt ve Thaler metodolojisinin değiştirilmiş bir versiyonu kullanılmıştır.

Tüm formasyon/test periyotları için pazarda Aşırı Tepki Hipotezini ve tersine yatırım stratejisinin karlılığını destekleyen fiyat düzeltmesi olduğunu tespit edilmiştir. Bulgular İMKB'nin zayıf tür etkin olmadığı yönünde sonuçlar vermiştir.

Bu tezde ayrıca, İMKB'deki yabancı yatırımcıların hareketleri ve bunun pazara etkileri incelenmektedir. Yabancı alımlar ve satışların hisse getirilerine önemli etkisi olduğu belirlenmiştir. Ayrıca, yabancı yatırımcıların İMKB'de tersine yatırım stratejisini seçtikleri ve bu anlamda rasyonel davrandıkları tespit edilmiştir.

Anahtar Kelimeler: Aşırı Tepki Hipotezi, Etkin Piyasa Hipotezi, zayıf tür etkinlik, tersine yatırım stratejisi, fiyat düzeltmesi.

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CHAPTER 1

INTRODUCTION

In the 1960s Efficient Market Hypothesis (EMH), which argues that the markets are efficient when prices fully reflect available information, is the dominant perception supported by the studies of Fama (1970). According to the EMH, investors are rational, if there is some deviation from the fundamental values by the investors' sentiment; arbitrage (the simultaneous buying and selling of two or more different, but closely related securities in different markets to take advantage of price disparities) 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. Efficient market condition is stated as follows;

$$E(R_{j,t} - E_m(R_{j,t} / F_{t-1}^m) / F_{t-1}) = E(ER_{j,t} / F_{t-1}) = 0 \quad (1)$$

where $R_{j,t}$ stands for the return of stock j at time t , F_{t-1} stands for the complete set of information at time $t-1$, $ER_{j,t}$ stands for the excess return of stock j at time t , $E_m(R_{j,t} / F_{t-1}^m)$ stands for the expectation of $R_{j,t}$ assessed by the market on the basis of information set F_{t-1}^m . The efficient market implies that $E(ER_{j,t} / F_{t-1}) = 0$, past return

performance of the stocks does not affect the current values, which is known as weak form of efficiency.

Since 1978, EMH has been challenged with the behavioural finance approaches. Limited arbitrage, unexplained movements, realized abnormal profits in the market as well as the crash of 1987 have been put the new discipline; behavioural finance. Behavioural explanations of these situations are called anomaly. Behaviourals 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 EMH, behaviourals argue that real world arbitrage is risky and limited since arbitrageurs' decisions are valid in the short term and there is not always a close substitute for the arbitrage. (Shleifer, 2003).

This thesis is about one of the anomalies of the behavioural approach against EMH; overreaction. Overreaction states that price corrections occur for the stocks, which have experienced extreme deviations from fundamental values due to the overweighting of investors of previous information. Contrary to EMH, past performance of the stocks influences the current market, implying that $E(ER_{j,t} / F_{t-1}) \neq 0$. Extreme movements in the stocks prices will be followed by the subsequent movements in the opposite direction- past losers significantly outperform past winners - which is a violation of the weak form of efficiency. An investor can earn abnormal profit by

exploiting this inefficiency with a Contrarian Strategy¹, which is selling past winners and purchasing past losers.

The first attempt that examined the Overreaction Hypothesis for a general stock market (NYSE) is the study of De Bondt and Thaler (1985). They form winner and loser portfolios based on past excess returns, by using the monthly stock returns from January 1926 to December 1982 and test the price reversals for different formation / test periods (2, 3 and 5 years) and portfolio sizes. Their findings of 3 year formation / test periods with a portfolio size of 35 stocks support the Overreaction Hypothesis:

1. Past losers subsequently outperform past winners over the following three years.
2. Past losers (Loser Portfolio) are up to 19.6 % relative to the market in general.
3. Past winners (Winner Portfolio) are down to 5% relative to the market in general.
4. Arbitrage Portfolio, which is the difference of two portfolios, earns 24.6 %.
5. Price reversals are asymmetric; losers win approximately four times the amount that winners lose.

The similar findings are recorded for the other formation / test periods and portfolio sizes.

In their following study, De Bondt and Thaler (1987) find out additional evidences that show the existence of overreaction in US market for short terms. De Bondt (1987) and Thaler also state that the overreaction is not primarily size effect. Indeed, Lo and Mckinley (1990) argue that the majority of abnormal profits earned by

¹ Momentum strategy, which is selling past losers and buying past winners, is the opposite of the contrarian strategy.

contrarian strategies are due to cross effects among the stocks and there is a pronounced lead-lag structure which means that return of large stocks led those of small stocks. De Bondt and Thaler (1987) also argue that overreaction cannot be attributed to changes in risk as measured by CAPM-betas. Indeed, Chan (1988) argues that the risk of loser and winner portfolios is not constant overtime, therefore the abnormal profit earned by contrarian strategies is sensitive to the model and estimation methods. To control the risk changes for loser and winners, Chan uses Capital Asset Pricing Model -CAPM- and find out that contrarian strategies earn a very small abnormal profit.

In both studies of De Bondt and Thaler, seasonality in excess return (January effect) is the important unresolved part in which price reversal for loser portfolio occur mostly in January returns (16.6% of the 24.6% for the 3 years formation/ test period with a size of 35 stocks) and this effect is observed as late as 5 years after portfolio formation.

Conrad and Kaul (1993) state that the findings of De Bondt and Thaler suffered from a methodological drawback since cumulating single period returns does not only show the true short term returns, but also the upward bias in each of these single period returns due to the measurement errors such as bid-ask errors. With an alternative method, they form the winner and loser portfolios by averaging the holding period returns of each stock in US market for each holding period. They find out that the positive returns of the arbitrage portfolio are entirely due to the January effect and the arbitrage earns consistently negative returns in non-January months, which is inconsistent with the Overreaction Hypothesis. Moreover, they also provide evidence that the January effect has no relation with the Overreaction Hypothesis.

Güner and Yener (2000) test for the existence of overreaction and the profitability of a contrary investment strategy in İstanbul Stock Exchange (ISE) by using a modified version of Conrad and Kaul. Although Conrad and Kaul state that there is no overreaction in the NYSE, Güner and Yener show the existence of the overreaction for the stocks listed on the ISE by finding out that arbitrage portfolios of contrarian strategies earn abnormal profit of 63.32 %, 51.29%, 47.09% over one, two, three years holding periods, respectively.

Jegadeesh and Titman (1993) state that in the short term momentum strategies, which is selling past losers and buying past winners, are successful. They show that buying stocks with high returns over the previous three to twelve months and selling stocks with poor returns over the same period earns profits of about 1% per month for the following year. However, in the following study of Jegadeesh and Titman (2001), the cumulative excess return in thirteen – sixty months momentum strategies realize negative return (which means the contrarian strategies have positive returns), which is consistent with De Bondt and Thaler's findings but not with the Conrad and Kaul's. Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999) also suggest the success of switch strategy, which is the application of momentum strategies in the short term and contrarian strategies in the long term. Başcı and Caner (2001) show in a preliminary work that the switch from the momentum strategies to contrarian ones takes place when the cumulative absolute returns in the past nine months reaches a level of 11.5%.

Contrarian and Momentum strategies were also analysed in the non-US stock markets. Baytaş and Çakıcı (1999) find abnormal profits with the long-term contrarian strategies in the markets of seven industrialized non-US countries. Chang et al. (1995), along with Hameed and Ting (2000) find out abnormal profits of short term contrarian strategies in the Japanese and Malaysian markets, respectively. Rouwenhorst (1998) find out momentum profits in twelve European markets and Rouwenhorst (1999) find out abnormal profits of momentum strategies in six emerging markets. Hameed and Yuanto (2000) find out that a momentum strategies earn small but statistically significant profits in six Asian markets. Schiereck et al. (1999) find abnormal profits for medium term momentum strategies, as well as short and long term contrarian strategies in Germany. Kang et al. (2002) find abnormal profits for short term contrarian and medium term momentum strategies in the Chinese stock exchange.

This thesis is organised as follows; the next section provides data and methodology, the third section presents findings of the survey, the fourth section examines the behaviour of foreign investors and the last section has the summary of findings and concluding remarks.

CHAPTER 2

DATA AND METHODOLOGY

Monthly return data for stocks in the İstanbul Stock Exchange (ISE) are used for the period between January 1986 and December 2001. The index data is obtained from ISE, ESTIM and ANALIZ². The returns are adjusted to remove the effect of stock splits, rights offerings and dividend payments, which might lead to bias and/or incorrect results.

The stocks (j), which have return data for less than 2 years, are discarded. The remaining 187 stocks are listed in Appendix A. In order to cumulate the returns over periods, the natural logarithm of the raw data is calculated with the formula below:

$$R_{j,t+1} = \ln(P_{j,t+1}) - \ln(P_{j,t}) \quad (2)$$

where $P_{j,t}$, $P_{j,t+1}$ stands for the price of the stock j in month t and $t+1$, respectively and $R_{j,t+1}$ stands for the return of the stock j in month $t+1$.

² URLs are www.imkb.gov.tr, www.estim.com.tr and www.analiz.com, respectively. Data is available from the author upon request.

An equally weighted average of returns is calculated for each month (t). In order to find the excess returns of the stocks, the average returns are subtracted from each of the corresponding monthly returns $R_{j,t}$.

$$ER_{j,t} = R_{j,t} - R_{m,t} \quad (3)$$

where $ER_{j,t}$ is the excess return of the stock j for the month t ; $R_{j,t}$ is the return of the stock j for the month t , $R_{m,t}$ is the equally weighted average market return for the month t .

2.1 Winner, Loser and Arbitrage Portfolios

We use a modified version of De Bondt and Thaler's methodology to form winner, loser and arbitrage portfolios of one, two and three year formation / test periods.

For every stock j starting in January 1986 cumulative excess returns (CER_j) are computed for the following 12 months taken as the portfolio formation period. This process is repeated 15 times for every one year formation period. Stocks with missing data in any formation period are not included in the sample.

$$CER_j = \sum_{t=1}^{t=12} ER_{j,t} \quad (4)$$

Different from the De Bondt and Thaler's methodology, all one year portfolio formation samples (from 1986 to 2000) along with the corresponding one year test period samples (from 1987 to 2001), are pooled. This way, the returns of same stocks in different years are treated as different observations. The pooled sample is sorted from high to low with respect to the annual cumulative excess returns of the portfolio formation sample. Stocks in the top 10% are assigned to the Winner portfolio and stocks

in the bottom 10% assigned to the Loser portfolio. Winner and Loser portfolios are also formed with 20% of the pooled sample. Winner and Loser portfolios with 10% and 20% of the pooled sample consist of 162 and 323 data, respectively.

The same process is applied for the two and three year overlapping and non-overlapping portfolio formation samples. Table 1 lists the number of the stocks in the portfolios (N).

	One Year	Two year		Three year	
		Overlapping	Non-overlapping	Overlapping	Non-overlapping
Pooled sample	1616	1059	674	873	294
10%	162	106	67	87	29
20%	323	212	135	175	59

Table 1. Number of the stocks in the portfolios

For 2 and 3 year overlapping and non-overlapping formation periods, the test periods are also taken as two and three years, respectively. The test period becomes the formation period in the next step for non-overlapping periods. Table 2 lists the one, two and three year overlapping and non-overlapping formation / test periods.

	Formation Period	Test Period
One Year	January-86 / December-86 January-87 / December-87 January-88 / December-88 January-89 / December-89 January-90 / December-90 January-91 / December-91 January-92 / December-92 January-93 / December-93 January-94 / December-94 January-95 / December-95 January-96 / December-96 January-97 / December-97 January-98 / December-98 January-99 / December-99 January-00 / December-00	January-87 / December-87 January-88 / December-88 January-89 / December-89 January-90 / December-90 January-91 / December-91 January-92 / December-92 January-93 / December-93 January-94 / December-94 January-95 / December-95 January-96 / December-96 January-97 / December-97 January-98 / December-98 January-99 / December-99 January-00 / December-00 January-01 / December-01
Two Year Overlapping	January-86 / December-87 January-87 / December-88 January-88 / December-89 January-89 / December-90 January-90 / December-91 January-91 / December-92 January-92 / December-93 January-93 / December-94 January-94 / December-95 January-95 / December-96 January-96 / December-97 January-97 / December-98 January-98 / December-99	January-88 / December-89 January-89 / December-90 January-90 / December-91 January-91 / December-92 January-92 / December-93 January-93 / December-94 January-94 / December-95 January-95 / December-96 January-96 / December-97 January-97 / December-98 January-98 / December-99 January-99 / December-00 January-00 / December-01
Two Year Non-overlapping	January-86 / December-87 January-88 / December-89 January-90 / December-91 January-92 / December-93 January-94 / December-95 January-96 / December-97 January-98 / December-99	January-88 / December-89 January-90 / December-91 January-92 / December-93 January-94 / December-95 January-96 / December-97 January-98 / December-99 January-00 / December-01
Three Year Overlapping	January-86 / December-88 January-87 / December-89 January-88 / December-90 January-89 / December-91 January-90 / December-92 January-91 / December-93 January-92 / December-94 January-93 / December-95 January-94 / December-96 January-95 / December-97 January-96 / December-98	January-89 / December-91 January-90 / December-92 January-91 / December-93 January-92 / December-94 January-93 / December-95 January-94 / December-96 January-95 / December-97 January-96 / December-98 January-97 / December-99 January-98 / December-00 January-99 / December-01
Three Year Non-Overlapping	January-86 / December-88 January-89 / December-91 January-92 / December-94 January-95 / December-97	January-89 / December-91 January-92 / December-94 January-95 / December-97 January-98 / December-00

Table 2. Formation and test periods

For Winner and Loser portfolios, we compute the average excess returns (AER) of the test period samples.

$$AER_{W,t} = \frac{1}{N} \sum_{j=1}^N ER_{j,t} \quad (5)$$

$$AER_{L,t} = \frac{1}{N} \sum_{j=1}^N ER_{j,t} \quad (6)$$

where N stands for the number of the stocks in the Winner and Loser portfolio, t stands for the months for each portfolio ($t=12$ or $t=24$ or $t=36$).

Cumulative average excess returns are calculated for the test periods of each Winner and Loser portfolios.

$$CAER_{W,t} = \sum_0^t AER_{W,t} \quad (7)$$

$$CAER_{L,t} = \sum_0^t AER_{L,t} \quad (8)$$

The Overreaction Hypothesis predicts that Cumulative Average Excess Returns of Winner portfolios shall be lower than zero ($CAER_W < 0$) and Cumulative Average Excess Returns of Loser portfolios shall be greater than zero ($CAER_L > 0$). By implication, the arbitrage portfolio found by subtracting the average cumulative excess returns of Winner portfolio from Loser portfolio shall be greater than zero ($CAER_A > 0$).

In order to judge whether the $CAER_W$, $CAER_L$ and $CAER_A$ are statistically significant from zero, we compute the t-statistics according to the formula below;

$$S_t = \sqrt{\sum_{n=1}^N (ER_{n,t} - AER_t) / N - 1} \quad (9)$$

$$T_t = \frac{CAER_t}{\sqrt{(\sum_{t=1}^t s_t^2) / N}} \quad (10)$$

where s_t stands for the standard deviation of Winner, Loser or Arbitrage portfolios in month t , $\sqrt{(\sum_{t=1}^t s_t^2) / N}$ stands for the cumulative standard deviation of Winner, Loser or Arbitrage portfolios in month t .

2.2 Regression Analysis

The second method that is used to test the Overreaction Hypothesis in this thesis is Pooled Least Squares. After taking the natural logarithm of the raw data and subtracting the equally weighted average of returns, we find excess returns for each month (t). In order to test the relation between excess return at month t and month $t-1$ for every stock (j), this excess returns of the stocks are transferred to E-views and pooled and we regress the excess return of month $t-1$ on the excess return of month t for each stock according to the formula below;

$$ER_{j,t} = \alpha_j + \delta ER_{j,t-1} + \varepsilon_{j,t} \quad (11)$$

where $ER_{j,t}$ stands for excess return of the stock j at the month t , α_i stands for intercept, δ stands for regressor, $ER_{j,t-1}$ stands for excess return of the stock j at the month $t-1$, $\varepsilon_{j,t}$ stands for the residual.

The regression equation is estimated by Least squares on the pooled data with fixed effects on the constant term.

We test for the null of;

$$H_0 : \delta = 0$$

against

$$H_1 : \delta < 0$$

For a further analysis, to test Overreaction Hypothesis for longer periods, we use MOVSUM operator to cumulate the excess returns from month $t-k$ to month $t-1$ and regress this sum ($CER_{k,j,t-1}$) on excess return at month t . In the formula, k stands for the cumulated months that period includes ($k=2\dots\dots\dots36$).

$$ER_{j,t} = \alpha_j + \delta CER_{k,j,t-1} + \varepsilon_{j,t} \tag{12}$$

$$CER_{k,j,t-1} = \sum_{k=1}^k ER_{i,j-k} \tag{13}$$

The null and alternative hypotheses are the same as the above one.

CHAPTER 3

RESULTS

The findings for one year portfolio formation / test periods are summarized in Table 3 for winner, loser and arbitrage portfolios with 10% of the pooled sample. In Table 3; the rows indicate the months (t), the first column reports cumulative average excess returns (CAER), the second column standard deviation of cumulative average excess returns (stdCAER) and the third column t – statistics for testing the statistical significance of the cumulative average excess returns (CAER).

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	-0.67	1.59	-0.42	0.96	1.79	0.53	1.63	2.44	0.67
2	-6.05	2.45	-2.47	5.28	2.54	2.08	11.33	3.60	3.15
3	-5.79	2.84	-2.04	6.48	3.00	2.16	12.26	4.21	2.91
4	-6.09	3.20	-1.90	7.40	3.42	2.17	13.49	4.77	2.83
5	-8.04	3.60	-2.23	8.34	3.74	2.23	16.37	5.29	3.10
6	-6.00	3.86	-1.55	7.95	4.18	1.90	13.96	5.79	2.41
7	-6.25	4.10	-1.52	5.86	4.39	1.34	12.12	6.12	1.98
8	-8.42	4.36	-1.93	6.08	4.66	1.31	14.50	6.50	2.23
9	-9.70	4.56	-2.13	9.01	4.86	1.86	18.71	6.79	2.76
10	-11.99	4.77	-2.52	9.42	5.10	1.84	21.41	7.11	3.01
11	-11.43	4.96	-2.30	7.88	5.37	1.47	19.31	7.44	2.59
12	-11.52	5.13	-2.24	6.33	5.60	1.13	17.86	7.73	2.31

Table 3. Returns following one year formation period with 10% of the pooled sample

As can be seen in Table 3, the returns of winner portfolio are negative in all months and at the end of the period cumulative return turns out to be -11.52% (CAER_{W,12}) with a statistically significant t -statistic of -2.24. The winner portfolio

returns are statistically significant starting from the 2nd month. However, returns of the loser portfolio are only statistically significant between the 2nd and the 5th month. The returns of the loser portfolio are positive in all months and at the end of the period cumulative return reaches 6.33% (CAER_{L,12}) with a statistically insignificant t-statistic of 1.13. There is asymmetry in returns of winner and loser portfolio. Contrary to De Bondt and Thaler’s finding, cumulative return of loser portfolio is lower in absolute value than the cumulative return of winner portfolio.

As presented in Table 3, the cumulative return of arbitrage portfolio is 17.86% (CAER_{A,12}), with a statistical significant t-statistic of 2.31. The returns of arbitrage portfolio are statistically significant in all months except the first.

In the 2nd month (February), the Winner portfolio loses its maximum return of -5.38% (which can be found by subtracting CAER_{W,1} from CAER_{W,2}) and the loser portfolio earns its maximum return of 4.32% (which can be found by subtracting CAER_{L,1} from CAER_{L,2}), which brings a monthly 9.7% arbitrage value with 3.15 t-statistic. This result can be related with the “January Effect” in De Bondt and Thaler’s study, which is obtained in February in ISE; however in two and three year formation / test periods analyses, the findings do not support this effect.

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	-0.32	1.07	-0.30	1.60	1.14	1.40	1.92	1.59	1.21
2	-4.67	1.57	-2.98	3.27	1.63	2.01	7.95	2.30	3.45
3	-5.19	1.84	-2.83	5.26	1.96	2.68	10.45	2.73	3.82
4	-5.77	2.06	-2.79	6.47	2.27	2.85	12.23	3.12	3.92
5	-6.70	2.31	-2.90	7.54	2.48	3.04	14.24	3.45	4.13
6	-5.47	2.48	-2.20	6.95	2.74	2.54	12.43	3.76	3.31
7	-5.42	2.67	-2.03	5.35	2.91	1.84	10.77	4.02	2.68
8	-6.99	2.84	-2.46	5.58	3.11	1.80	12.56	4.28	2.93
9	-8.50	3.00	-2.84	7.68	3.27	2.35	16.18	4.51	3.59
10	-8.21	3.14	-2.62	7.80	3.43	2.27	16.01	4.73	3.38
11	-8.08	3.28	-2.47	8.06	3.63	2.22	16.14	4.97	3.25
12	-7.19	3.41	-2.11	6.79	3.78	1.80	13.98	5.17	2.70

Table 4. Returns following one year formation period with 20% of the pooled sample

The winner, loser and arbitrage portfolios with 20% of the pooled sample are reported in Table 4. Similar results are found as in the portfolios with 10% of the pooled sample. Arbitrage return decreases from 17.86% to 13.98%. This is consistent with the De Bondt and Thaler's findings of "the more extreme the initial price movement is, the greater the subsequent price adjustment will be". 2nd month (February) performance similar to portfolio with 10% of the pooled sample is observed for winner and arbitrage portfolios; however the loser portfolio earns its maximum in the 9th month.

These findings of one year formation / test periods with 10% and 20% of pooled sample support the Overreaction Hypothesis and an investor can earn a total of 17.86% and 13.98% with a contrarian strategy, respectively.

The findings of overlapping and non-overlapping two and three year formation / test periods also support the existence of overreaction in İstanbul Stock Exchange (ISE) as follows:

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	0.25	1.90	0.13	3.18	1.94	1.64	2.93	2.71	1.08
2	-4.42	2.66	-1.66	6.43	2.80	2.29	10.85	3.87	2.81
3	-4.04	3.34	-1.21	7.71	3.32	2.32	11.75	4.71	2.49
4	-3.86	3.97	-0.97	5.80	3.78	1.53	9.66	5.48	1.76
5	-4.54	4.32	-1.05	7.91	4.48	1.76	12.45	6.23	2.00
6	-5.02	4.58	-1.10	10.94	4.83	2.26	15.96	6.66	2.40
7	-6.42	4.83	-1.33	12.86	5.15	2.50	19.27	7.06	2.73
8	-9.92	5.10	-1.94	16.89	5.47	3.09	26.81	7.48	3.58
9	-14.19	5.41	-2.62	17.90	5.75	3.11	32.09	7.90	4.06
10	-12.75	5.67	-2.25	19.21	6.07	3.16	31.96	8.31	3.85
11	-11.25	5.92	-1.90	19.05	6.37	2.99	30.30	8.69	3.49
12	-11.08	6.09	-1.82	19.19	6.62	2.90	30.27	9.00	3.36
13	-12.16	6.00	-2.03	20.10	6.62	3.03	32.27	8.94	3.61
14	-11.60	5.95	-1.95	14.19	6.59	2.15	25.79	8.88	2.90
15	-13.61	5.81	-2.34	16.58	6.59	2.52	30.19	8.79	3.44
16	-15.10	5.63	-2.68	14.97	6.69	2.24	30.06	8.74	3.44
17	-14.65	5.55	-2.64	16.35	6.63	2.47	31.00	8.65	3.59
18	-17.05	5.52	-3.09	19.19	6.65	2.88	36.24	8.65	4.19
19	-17.13	5.57	-3.07	19.55	6.76	2.89	36.68	8.76	4.19
20	-19.84	5.57	-3.56	18.95	6.79	2.79	38.80	8.78	4.42
21	-20.49	5.64	-3.63	15.50	6.77	2.29	35.99	8.81	4.09
22	-22.59	5.66	-3.99	17.24	6.72	2.56	39.83	8.79	4.53
23	-20.54	5.68	-3.61	17.16	6.74	2.55	37.71	8.81	4.28
24	-22.71	5.67	-4.01	19.58	6.82	2.87	42.29	8.87	4.77

Table 5. Returns following two year overlapping formation period with 10% of the pooled sample

The cumulative average excess returns for overlapping two year portfolio formation / test periods are summarized in Table 5 for winner, loser and arbitrage portfolios with 10% of the pooled sample. As can be seen in Table 5, the cumulative return of the winner portfolio turns out to be -22.71% ($CAER_{W,24}$) and the t-statistics for winner portfolio indicate statistically significant values after the 8th month. Cumulative return of loser portfolio is 19.58% ($CAER_{L,24}$) at the end of the period and the returns of loser portfolio are statistically significant from the 6th month on. Similar to the annual portfolios, the cumulative return of loser portfolio of two years is lower in absolute value than the cumulative return on winner portfolio. The return of arbitrage portfolio at the end of the period is 42.29% ($CAER_{A,24}$) and the returns are statistically significant except for the 1st month.

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	$CAER_W(\%)$	std	t-ratio	$CAER_L(\%)$	std	t-ratio	$CAER_A(\%)$	std	t-ratio
1	-1.15	1.32	-0.87	3.12	1.29	2.41	4.28	1.85	2.31
2	-5.11	1.85	-2.76	4.89	1.90	2.58	10.00	2.65	3.77
3	-5.15	2.24	-2.30	6.28	2.25	2.80	11.44	3.17	3.60
4	-5.94	2.62	-2.26	5.91	2.64	2.24	11.84	3.72	3.18
5	-6.58	2.88	-2.29	7.17	3.04	2.36	13.75	4.19	3.28
6	-6.75	3.04	-2.22	8.22	3.25	2.53	14.98	4.45	3.37
7	-6.72	3.25	-2.07	9.72	3.47	2.80	16.45	4.75	3.46
8	-10.27	3.42	-3.00	10.54	3.70	2.85	20.81	5.04	4.13
9	-12.27	3.61	-3.40	10.66	3.87	2.75	22.93	5.29	4.33
10	-10.57	3.78	-2.80	10.89	4.05	2.69	21.46	5.54	3.87
11	-9.88	3.93	-2.51	10.30	4.26	2.42	20.18	5.79	3.48
12	-8.64	4.05	-2.13	9.68	4.43	2.19	18.33	6.00	3.05
13	-9.60	4.00	-2.40	11.92	4.45	2.68	21.52	5.98	3.60
14	-8.34	3.95	-2.11	6.00	4.44	1.35	14.34	5.94	2.41
15	-9.60	3.89	-2.46	7.67	4.45	1.72	17.27	5.91	2.92
16	-9.54	3.82	-2.50	5.95	4.50	1.32	15.49	5.90	2.62
17	-10.05	3.79	-2.65	7.20	4.47	1.61	17.25	5.86	2.94
18	-11.59	3.80	-3.05	8.95	4.48	2.00	20.54	5.88	3.50
19	-11.93	3.79	-3.15	8.22	4.50	1.83	20.15	5.88	3.43
20	-14.35	3.78	-3.79	8.59	4.52	1.90	22.94	5.89	3.89
21	-13.92	3.80	-3.66	6.31	4.52	1.39	20.23	5.91	3.42
22	-14.96	3.82	-3.92	7.73	4.54	1.70	22.69	5.93	3.83
23	-12.89	3.83	-3.37	9.15	4.56	2.01	22.04	5.95	3.70
24	-14.63	3.86	-3.79	9.28	4.58	2.03	23.91	5.99	3.99

Table 6. Returns following two year overlapping formation period with 20% of the pooled sample

Table 6 reports similar results for overlapping two year winner, loser and arbitrage portfolios with the 20% of the pooled sample. The arbitrage value decreases from 42.29% to 23.91%, which is also consistent with De Bondt and Thaler's findings.

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	0.39	1.97	0.20	0.62	1.63	0.38	0.23	2.55	0.09
2	-0.38	2.60	-0.15	0.80	2.70	0.29	1.18	3.74	0.31
3	-3.49	3.08	-1.13	1.80	3.47	0.52	5.29	4.64	1.14
4	-2.27	3.59	-0.63	-0.37	4.14	-0.09	1.91	5.48	0.35
5	-3.92	3.99	-0.98	2.79	4.64	0.60	6.71	6.12	1.10
6	-3.31	4.24	-0.78	2.79	4.86	0.57	6.10	6.45	0.95
7	-0.21	4.72	-0.04	2.86	5.43	0.53	3.07	7.20	0.43
8	-2.35	5.02	-0.47	4.13	5.89	0.70	6.49	7.73	0.84
9	-3.87	5.46	-0.71	3.47	6.15	0.56	7.34	8.22	0.89
10	-6.44	5.83	-1.10	3.49	6.37	0.55	9.93	8.64	1.15
11	-3.42	6.10	-0.56	6.77	6.81	0.99	10.19	9.14	1.11
12	-4.21	6.32	-0.67	7.61	7.16	1.06	11.82	9.55	1.24
13	-6.54	6.35	-1.03	11.24	7.28	1.54	17.77	9.66	1.84
14	-1.39	6.40	-0.22	5.47	7.29	0.75	6.86	9.71	0.71
15	-4.88	6.42	-0.76	5.22	7.20	0.73	10.11	9.65	1.05
16	-7.94	6.37	-1.25	4.93	7.11	0.69	12.88	9.54	1.35
17	-8.22	6.39	-1.29	8.10	7.15	1.13	16.32	9.59	1.70
18	-9.74	6.44	-1.51	10.36	7.15	1.45	20.10	9.63	2.09
19	-9.20	6.39	-1.44	9.47	6.97	1.36	18.66	9.46	1.97
20	-15.87	6.37	-2.49	10.14	6.88	1.47	26.01	9.38	2.77
21	-17.36	6.23	-2.79	9.77	6.85	1.43	27.13	9.26	2.93
22	-18.11	6.12	-2.96	9.25	6.86	1.35	27.36	9.19	2.98
23	-17.68	6.10	-2.90	9.05	6.75	1.34	26.73	9.10	2.94
24	-17.08	6.11	-2.80	7.01	6.59	1.06	24.09	8.99	2.68
25	-15.26	6.08	-2.51	8.02	6.53	1.23	23.28	8.92	2.61
26	-12.55	6.10	-2.06	5.14	6.47	0.79	17.70	8.90	1.99
27	-15.88	6.13	-2.59	7.51	6.48	1.16	23.40	8.92	2.62
28	-18.30	6.19	-2.96	8.22	6.57	1.25	26.52	9.03	2.94
29	-18.24	6.16	-2.96	9.36	6.48	1.45	27.60	8.94	3.09
30	-19.08	6.14	-3.11	10.18	6.51	1.56	29.26	8.95	3.27
31	-21.42	6.08	-3.52	8.59	6.50	1.32	30.01	8.90	3.37
32	-22.43	6.16	-3.64	9.93	6.43	1.54	32.35	8.90	3.64
33	-21.37	6.20	-3.45	11.86	6.42	1.85	33.23	8.93	3.72
34	-23.67	6.20	-3.82	12.71	6.36	2.00	36.37	8.89	4.09
35	-21.62	6.27	-3.45	13.48	6.36	2.12	35.10	8.93	3.93
36	-20.48	6.24	-3.28	15.44	6.41	2.41	35.92	8.94	4.02

Table 7. Returns following three year overlapping formation period with 10% of the pooled sample

With overlapping 3 year formation / test periods, number of cumulative average excess returns, which have statistically significant t-statistics decrease compared to

shorter periods. As can be seen from Table 7, the returns of winner and loser portfolios are statistically significant after the 20th and the 33rd month, respectively. Winner portfolio loses 20.48% (CAER_{W,36}) at the end of the 3rd year whereas loser portfolio earns 15.44% (CAER_{L,36}). Similar to the one and two year formation periods, loser portfolio earns less than the winner portfolio in absolute value. The return of arbitrage portfolio reaches 42.29 % (CAER_{A,24}) at the end of the period and the returns are statistically significant after 18th month.

<i>t</i>	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	0.11	1.32	0.08	3.74	1.43	2.62	3.62	1.94	1.86
2	-1.36	1.80	-0.75	2.54	2.04	1.25	3.90	2.72	1.43
3	-3.47	2.21	-1.57	4.43	2.53	1.75	7.90	3.36	2.35
4	-1.58	2.55	-0.62	3.28	2.96	1.11	4.86	3.91	1.24
5	-1.97	2.83	-0.70	4.96	3.32	1.49	6.93	4.36	1.59
6	-1.11	3.06	-0.36	6.25	3.54	1.77	7.36	4.68	1.57
7	-0.22	3.33	-0.07	5.94	3.85	1.54	6.16	5.09	1.21
8	-1.88	3.56	-0.53	6.15	4.11	1.50	8.03	5.44	1.48
9	-3.40	3.81	-0.89	6.16	4.28	1.44	9.57	5.73	1.67
10	-4.62	4.05	-1.14	6.51	4.43	1.47	11.13	6.01	1.85
11	-3.58	4.24	-0.85	7.13	4.69	1.52	10.71	6.32	1.69
12	-4.36	4.38	-0.99	8.60	4.88	1.76	12.95	6.56	1.97
13	-5.45	4.39	-1.24	10.93	4.89	2.23	16.38	6.57	2.49
14	-1.91	4.43	-0.43	7.69	4.94	1.56	9.60	6.63	1.45
15	-4.44	4.48	-0.99	7.87	4.89	1.61	12.30	6.63	1.85
16	-5.40	4.48	-1.21	8.36	4.87	1.72	13.76	6.61	2.08
17	-5.64	4.49	-1.26	10.66	4.85	2.20	16.30	6.61	2.47
18	-7.03	4.47	-1.57	12.86	4.83	2.66	19.89	6.58	3.02
19	-7.63	4.43	-1.72	10.56	4.76	2.22	18.19	6.50	2.80
20	-12.17	4.42	-2.75	10.85	4.75	2.28	23.02	6.49	3.55
21	-12.30	4.40	-2.79	11.00	4.73	2.33	23.29	6.46	3.61
22	-11.40	4.38	-2.60	11.84	4.71	2.51	23.24	6.43	3.61
23	-9.79	4.39	-2.23	10.82	4.68	2.31	20.61	6.41	3.21
24	-12.01	4.42	-2.72	9.99	4.65	2.15	22.00	6.42	3.43
25	-11.06	4.41	-2.51	11.21	4.66	2.41	22.27	6.42	3.47
26	-8.69	4.42	-1.97	9.39	4.58	2.05	18.08	6.37	2.84
27	-11.59	4.39	-2.64	12.29	4.62	2.66	23.88	6.37	3.75
28	-13.13	4.40	-2.98	12.83	4.65	2.76	25.96	6.40	4.06
29	-12.26	4.38	-2.80	14.82	4.64	3.20	27.09	6.38	4.25
30	-12.00	4.46	-2.69	16.35	4.68	3.49	28.35	6.47	4.39
31	-11.77	4.45	-2.64	15.66	4.66	3.36	27.44	6.45	4.26
32	-13.85	4.46	-3.10	15.50	4.59	3.38	29.35	6.40	4.59
33	-13.55	4.46	-3.03	16.43	4.61	3.57	29.98	6.42	4.67
34	-14.67	4.46	-3.29	17.72	4.60	3.85	32.39	6.41	5.05
35	-13.50	4.49	-3.01	18.72	4.60	4.07	32.21	6.42	5.02
36	-12.80	4.45	-2.88	19.97	4.61	4.34	32.78	6.40	5.12

Table 8. Returns following three year overlapping formation period with 20% of the pooled sample

Table 8 lists the findings of overlapping 3 year formation period figures with 20% of the pooled sample. The arbitrage value decreases to 32.78%, which is 35.92% in the portfolio with 10% of the pooled sample. While winner portfolio return decreases to -12.8% (CAER_{W,36}), the loser portfolio return increases to 19.97% (CAER_{L,36}). Return of loser portfolio is higher in absolute value than the return of winner portfolio, which is consistent with the De Bondt and Thaler's findings.

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	-0.46	2.41	-0.19	2.38	2.15	1.11	2.84	3.23	0.88
2	-5.05	3.57	-1.42	6.23	3.22	1.94	11.28	4.80	2.35
3	-3.74	4.55	-0.82	6.92	3.96	1.75	10.66	6.03	1.77
4	-3.55	5.42	-0.66	5.61	4.61	1.22	9.16	7.11	1.29
5	-7.91	5.82	-1.36	10.17	5.78	1.76	18.08	8.20	2.20
6	-8.75	6.18	-1.42	10.53	6.09	1.73	19.28	8.68	2.22
7	-10.17	6.51	-1.56	12.13	6.56	1.85	22.31	9.24	2.41
8	-12.54	6.92	-1.81	15.99	6.91	2.32	28.53	9.78	2.92
9	-18.31	7.31	-2.50	19.32	7.18	2.69	37.63	10.25	3.67
10	-16.52	7.65	-2.16	21.05	7.63	2.76	37.58	10.81	3.48
11	-13.12	7.92	-1.65	17.58	7.98	2.20	30.70	11.25	2.73
12	-12.05	8.15	-1.48	17.39	8.41	2.07	29.43	11.71	2.51
13	-13.92	7.99	-1.74	19.19	8.54	2.25	33.11	11.70	2.83
14	-14.85	7.87	-1.89	13.26	8.50	1.56	28.11	11.59	2.43
15	-18.43	7.54	-2.45	15.91	8.52	1.87	34.34	11.38	3.02
16	-18.22	7.26	-2.51	14.83	8.72	1.70	33.05	11.34	2.91
17	-15.84	7.16	-2.21	18.42	8.52	2.16	34.27	11.13	3.08
18	-17.65	7.04	-2.51	23.08	8.76	2.63	40.73	11.24	3.62
19	-16.29	7.08	-2.30	23.00	8.82	2.61	39.29	11.31	3.47
20	-19.21	6.90	-2.78	22.34	8.90	2.51	41.55	11.26	3.69
21	-18.97	6.93	-2.74	16.02	8.88	1.80	35.00	11.26	3.11
22	-21.24	6.86	-3.10	18.82	8.71	2.16	40.07	11.09	3.61
23	-18.36	6.98	-2.63	17.65	8.83	2.00	36.01	11.25	3.20
24	-19.79	6.91	-2.86	19.25	8.73	2.20	39.03	11.14	3.50

Table 9. Returns following two year non-overlapping formation period with 10% of the pooled sample

Table 9 reports the findings of non-overlapping two year formation period portfolios with 10% of the pooled sample. At the end of the period, the winner portfolio loses 19.79% (CAER_{W,24}) and the loser portfolio earns almost as much with a return of

19.25% (CAER_{L,24}). The returns are statistically significant after the 8th month with the exception of months 11 to 13 for the winner portfolio. Compared to the overlapping portfolios, there is an approximately 3% decrease in the return of arbitrage portfolio (CAER_{L,24}=39.04 %).

<i>t</i>	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	-1.05	1.66	-0.63	3.23	1.56	2.07	4.28	1.56	2.74
2	-5.80	2.48	-2.34	5.30	2.37	2.23	11.10	2.35	4.72
3	-6.00	3.02	-1.98	6.52	2.84	2.30	12.52	2.84	4.40
4	-5.66	3.51	-1.61	6.15	3.31	1.86	11.81	3.31	3.57
5	-7.73	3.81	-2.03	8.99	3.89	2.31	16.72	3.74	4.48
6	-7.13	4.03	-1.77	8.48	4.08	2.08	15.60	3.93	3.97
7	-7.23	4.28	-1.69	8.62	4.36	1.98	15.85	4.19	3.79
8	-11.67	4.54	-2.57	8.59	4.61	1.87	20.26	4.43	4.57
9	-13.11	4.79	-2.74	9.34	4.81	1.94	22.45	4.66	4.82
10	-10.67	5.01	-2.13	9.19	5.07	1.81	19.86	4.89	4.06
11	-7.92	5.17	-1.53	7.39	5.30	1.39	15.31	5.08	3.01
12	-7.02	5.34	-1.32	7.48	5.55	1.35	14.50	5.28	2.75
13	-7.84	5.26	-1.49	9.97	5.59	1.78	17.81	5.27	3.38
14	-7.91	5.16	-1.53	4.98	5.56	0.90	12.89	5.20	2.48
15	-10.85	5.01	-2.17	6.93	5.57	1.25	17.78	5.14	3.46
16	-10.47	4.92	-2.13	6.74	5.62	1.20	17.21	5.12	3.36
17	-9.47	4.87	-1.94	9.06	5.56	1.63	18.52	5.07	3.66
18	-10.40	4.84	-2.15	11.82	5.67	2.08	22.22	5.11	4.34
19	-9.52	4.83	-1.97	10.73	5.69	1.89	20.25	5.12	3.96
20	-11.09	4.74	-2.34	9.66	5.73	1.69	20.76	5.10	4.07
21	-10.09	4.73	-2.13	6.18	5.75	1.07	16.26	5.11	3.18
22	-11.79	4.71	-2.51	8.94	5.74	1.56	20.74	5.10	4.07
23	-9.04	4.76	-1.90	10.32	5.84	1.77	19.36	5.17	3.75
24	-10.75	4.80	-2.24	9.11	5.79	1.57	19.85	5.16	3.85

Table 10. Returns following two year non-overlapping formation with 20% of the pooled sample

Table 10 lists the findings of non-overlapping 2 year formation period portfolios with 20% of the pooled sample. The arbitrage value decreases to 19.85%, which is 39.04% in the portfolio of 10% of the pooled sample. While winner portfolio return decreases to -10.75% (CAER_{W,36}), the loser portfolio return decreases to 9.11%

(CAER_{L,36}). Cumulative return of loser portfolio is close in absolute value to the cumulative return of winner portfolio.

t	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	2.78	3.09	0.90	2.25	2.40	0.94	-0.52	3.92	-0.13
2	-1.46	4.29	-0.34	3.55	3.79	0.94	5.02	5.72	0.88
3	-1.12	5.25	-0.21	4.65	5.05	0.92	5.77	7.28	0.79
4	-1.22	6.10	-0.20	6.01	5.80	1.04	7.22	8.41	0.86
5	-3.40	6.82	-0.50	13.79	6.86	2.01	17.19	9.67	1.78
6	-0.81	7.19	-0.11	9.07	7.20	1.26	9.88	10.17	0.97
7	-3.65	7.43	-0.49	11.11	8.04	1.38	14.76	10.95	1.35
8	-5.35	8.27	-0.65	14.09	9.02	1.56	19.44	12.24	1.59
9	-10.82	9.55	-1.13	12.97	9.65	1.34	23.78	13.58	1.75
10	-11.33	10.28	-1.10	15.67	9.94	1.58	27.00	14.30	1.89
11	-8.97	10.81	-0.83	10.43	10.47	1.00	19.40	15.05	1.29
12	-11.24	11.20	-1.00	5.29	10.97	0.48	16.53	15.68	1.05
13	-7.54	11.20	-0.67	9.98	11.15	0.89	17.52	15.80	1.11
14	-0.75	11.26	-0.07	2.23	11.14	0.20	2.98	15.84	0.19
15	-7.28	11.36	-0.64	4.83	10.99	0.44	12.11	15.81	0.77
16	-7.46	11.41	-0.65	8.16	11.33	0.72	15.62	16.08	0.97
17	-9.65	11.50	-0.84	16.93	11.57	1.46	26.58	16.31	1.63
18	-9.81	11.53	-0.85	19.14	11.66	1.64	28.95	16.40	1.76
19	-5.90	11.89	-0.50	14.15	11.42	1.24	20.05	16.48	1.22
20	-14.31	11.58	-1.24	9.58	11.34	0.84	23.89	16.21	1.47
21	-14.87	10.93	-1.36	8.84	11.12	0.79	23.70	15.60	1.52
22	-18.28	10.60	-1.72	10.65	11.19	0.95	28.94	15.41	1.88
23	-16.93	10.69	-1.58	9.35	11.31	0.83	26.28	15.56	1.69
24	-18.32	10.65	-1.72	12.69	11.33	1.12	31.01	15.55	1.99
25	-20.47	10.99	-1.86	13.46	11.47	1.17	33.94	15.88	2.14
26	-16.10	11.07	-1.45	5.28	11.92	0.44	21.38	16.27	1.31
27	-19.44	10.89	-1.79	5.47	12.25	0.45	24.91	16.39	1.52
28	-24.96	10.74	-2.33	3.98	12.22	0.33	28.94	16.27	1.78
29	-21.47	10.59	-2.03	7.55	11.95	0.63	29.02	15.96	1.82
30	-25.16	10.62	-2.37	12.65	12.12	1.04	37.81	16.11	2.35
31	-25.30	10.21	-2.48	9.76	12.35	0.79	35.05	16.02	2.19
32	-31.87	10.54	-3.02	15.28	12.09	1.26	47.15	16.04	2.94
33	-32.71	10.78	-3.03	20.68	12.12	1.71	53.39	16.22	3.29
34	-33.31	10.92	-3.05	17.94	12.01	1.49	51.25	16.23	3.16
35	-31.98	10.63	-3.01	12.88	12.08	1.07	44.86	16.09	2.79
36	-27.37	10.69	-2.56	12.19	11.88	1.03	39.56	15.98	2.48

Table 11. Returns following three year non-overlapping formation period with 10% of the pooled sample

Table 11 reports the findings of non-overlapping 3 year formation portfolios with 10% of the pooled sample. Although the cumulative return of the arbitrage portfolio is 39.56%, the returns of arbitrage portfolio are statistically significant only after the 30th

month. Moreover, the returns of loser portfolio are not statistically significant for any month except for the 5th month and the returns of winner portfolio are statistically significant only after the 28th month.

<i>t</i>	Winner Portfolio			Loser Portfolio			Arbitrage Portfolio		
	CAER _W (%)	std	t-ratio	CAER _L (%)	std	t-ratio	CAER _A (%)	std	t-ratio
1	2.87	2.14	1.34	5.31	2.34	2.27	2.45	3.17	0.77
2	-0.91	3.11	-0.29	4.35	3.28	1.32	5.26	4.53	1.16
3	-0.67	3.89	-0.17	5.55	4.20	1.32	6.22	5.72	1.09
4	-1.36	4.42	-0.31	7.33	4.75	1.54	8.70	6.48	1.34
5	-4.74	4.79	-0.99	11.47	5.51	2.08	16.21	7.30	2.22
6	2.24	5.08	0.44	11.20	5.94	1.88	8.96	7.82	1.15
7	-1.26	5.31	-0.24	12.97	6.41	2.02	14.23	8.32	1.71
8	-2.23	5.90	-0.38	14.10	6.89	2.05	16.33	9.07	1.80
9	-5.07	6.61	-0.77	14.00	7.21	1.94	19.06	9.78	1.95
10	-5.75	7.07	-0.81	14.82	7.49	1.98	20.56	10.29	2.00
11	-3.48	7.38	-0.47	10.55	7.76	1.36	14.03	10.71	1.31
12	-2.87	7.60	-0.38	7.67	7.99	0.96	10.54	11.03	0.96
13	-0.59	7.52	-0.08	10.18	7.89	1.29	10.76	10.89	0.99
14	3.76	7.50	0.50	7.34	7.84	0.94	3.58	10.85	0.33
15	-2.13	7.42	-0.29	7.79	7.78	1.00	9.92	10.75	0.92
16	0.09	7.51	0.01	5.84	7.83	0.74	5.74	10.85	0.53
17	1.89	7.68	0.25	10.32	7.74	1.33	8.42	10.90	0.77
18	1.01	7.70	0.13	11.89	7.69	1.55	10.88	10.88	1.00
19	3.07	7.85	0.39	7.84	7.60	1.03	4.78	10.93	0.44
20	0.02	7.75	0.00	3.02	7.58	0.40	3.00	10.84	0.28
21	0.57	7.40	0.08	2.76	7.44	0.37	2.18	10.50	0.21
22	-1.28	7.21	-0.18	6.70	7.39	0.91	7.98	10.32	0.77
23	1.53	7.35	0.21	5.30	7.57	0.70	3.78	10.55	0.36
24	-3.15	7.53	-0.42	9.12	7.73	1.18	12.27	10.79	1.14
25	-4.23	7.88	-0.54	9.79	7.87	1.24	14.02	11.14	1.26
26	0.24	7.95	0.03	5.03	7.99	0.63	4.79	11.27	0.43
27	-0.47	8.09	-0.06	5.32	7.97	0.67	5.79	11.36	0.51
28	-4.65	8.02	-0.58	4.41	8.03	0.55	9.06	11.35	0.80
29	-1.45	7.93	-0.18	7.80	8.00	0.97	9.25	11.27	0.82
30	-5.32	7.99	-0.67	12.07	8.11	1.49	17.39	11.39	1.53
31	-4.27	7.83	-0.54	10.03	8.15	1.23	14.30	11.30	1.26
32	-8.54	7.87	-1.09	11.72	7.99	1.47	20.26	11.22	1.81
33	-7.97	7.99	-1.00	15.52	8.07	1.92	23.50	11.36	2.07
34	-6.90	8.06	-0.86	13.41	8.06	1.66	20.31	11.39	1.78
35	-4.42	7.94	-0.56	11.45	7.98	1.44	15.87	11.26	1.41
36	-1.02	7.85	-0.13	7.87	7.81	1.01	8.89	11.07	0.80

Table 12. Returns following three year non-overlapping formation period with 20% of the pooled sample

Table 12 lists the findings of non-overlapping 3 year formation period portfolio with 20% of the pooled sample. The findings are not statistically significant except for the 9th, 10th and 33rd months for the returns of the arbitrage portfolio. The cumulative return of the winner portfolio is only -1.02% (CAER_{W 36}), whereas the loser portfolio earns 7.87% (CAER_{L 36}) at the end of the period.

The findings of the further estimation analyses (pooled least squares) also support the Overreaction Hypothesis:

A negative estimated coefficient ($\hat{\delta}$) found from formula (11) with a value of -0.056231 supported by a -8.492447 t-statistic, indicates a significant negative relation between the excess return at month t and month t-1. Thus, the winner stocks turn out to lose value and the loser stocks turn out to gain value for the next month.

In the formula (12), the relation between the monthly return of the stocks and their past cumulated 12, 24 and 36 months returns are analysed by using Moving Sum operator. The findings are reported in Table 13.

K	12 months	24 months	36 months
$\hat{\delta}$	-0.027786	-0.025253	-0.024606
t-statistics	-11.75806	-12.67768	-12.77549

Table 13. Regression results for monthly returns on past cumulative returns

Similar to the monthly figures, the negative coefficients with high statistically significant values indicate overreaction in the market.

CHAPTER 4

FOREIGN INVESTORS BEHAVIOUR IN ISE

We also study the behaviour of foreign investors in ISE. Monthly net purchase ($NP_{j,t}$) and net sales ($NS_{j,t}$) of foreign investors data for stocks in the ISE are used for a period from 1997 to 2001. Stocks that do not have transaction for a month or more are discarded from the data (Remaining 47 stocks are listed in Appendix C). For a methodological convenience, a f -value for every stock j in month t is calculated with the formula below;

$$f_{j,t} = \frac{NP_{j,t} - NS_{j,t}}{NP_{j,t} + NS_{j,t}} \in [-1,1] \quad (14)$$

Highest net purchases by foreign investors correspond to $f = +1$ and highest net sales corresponds to $f = -1$.

First, we analyse whether the market is affected by the behaviour of foreign investors. We regress f -value on excess return ($ER_{j,t}$) according to the formula below:

$$ER_{j,t} = \alpha_i + \delta f_{j,t} + \varepsilon_{j,t} \quad (15)$$

The regression equation is estimated by Least squares on the pooled data with fixed effects on the constant term.

We test for the null of;

$$H_0 : \delta = 0$$

against

$$H_1 : \delta > 0$$

We observe a positive estimated coefficient ($\hat{\delta}$) with a value of 12.42 supported by a 11.47 t-statistic, which shows that the excess returns increase (decrease) with the foreign purchases (sales).

Second, we analyse whether the foreign investors chose contrarian strategies or not. We use MOVSUM operator to cumulate the excess returns from month $t-k$ to month $t-1$ and regress this sum ($CER_{k,j,t-1}$) on f-value at month t . In the formula, k stands for the cumulated months that period includes ($k=1\dots\dots36$).

$$f_{j,t} = \alpha_j + \delta CER_{k,j,t-1} + \varepsilon_{j,t} \quad (16)$$

$$CER_{k,j,t-1} = \sum_{k=1}^k ER_{j,t-k} \quad (17)$$

We test for the null of;

$$H_0 : \delta = 0$$

against

$$H_1 : \delta < 0$$

We use the same method as above and find out a negative estimated coefficient (δ) for every k and these results are statistically significant for every month, except for $k=1$.

K	12 months	24 months	36 months
$\hat{\delta}$	-0.000403	-0.000491	-0.000575
t-statistics	-3.953738	-3.33084	-3.362514

Table 14.Regression results for net foreign investments on past cumulative returns

The results in Table 14 show that the foreign investors use contrarian strategies. This behaviour can be classified as rational since it is in line with contrarian strategy in Turkish market where it brings abnormal profit as demonstrated in Chapter 3.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The purpose of this thesis is to test the overreaction for stocks listed in the İstanbul Stock Exchange. Using a modified version of De Bondt 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 for the following test periods. Findings support the success of the contrarian strategies: The arbitrage portfolio earns 17.86% for a one year formation / test period, 42.29% for two years overlapping and 35.92% for a three year overlapping formation / test period. For non-overlapping formation / test periods; the two year arbitrage portfolio earns 39.03%, three year arbitrage portfolio earns 39.56%. The returns of arbitrage portfolio for one and non-overlapping two year formation / test period are statistically significant for all months except for the 1st month. For non-overlapping three year formation / test period arbitrage portfolio returns are statistically significant after 18th month. For overlapping two and three year formation / test periods arbitrage portfolio returns are statistically significant after 5th month and 30th month, respectively.

Similar findings are obtained for the portfolio with 20% of the pooled sample with lower arbitrage values, which is consistent with De Bondt and Thaler (1985).

Contrary to De Bondt and Thaler's findings, the absolute values of returns of winner portfolios are higher than the loser portfolios except for overlapping and non-overlapping three year formation period portfolios with 20% of the pooled sample.

Pooled least squares findings also support the existence of overreaction in the market. Negative estimated coefficients indicate the negative relation between excess return month t and month $t-k$ ($k=1 \dots 36$) supported with the significant t -statistics.

The findings of these two methodologies show existence of overreaction and the profitability of contrarian strategies in ISE and these results may indicate that ISE is not weak form of efficient.

For a further analysis, we inspect the foreign investors' behaviour and its effects in ISE. A significant relation between foreign investors purchase and sales decision and the return of the stocks are found. It is also observed that foreign investors behave rationally since they choose contrarian strategies in ISE.

Although these results indicate the existence of overreaction and the profitability of contrarian strategies, this subject can be re-analyzed when a longer period of data is available. Moreover, this analysis may be conducted using Conrad and Kaul's (1993) methodology.

Despite De Bondt and Thaler's argument that overreaction is not primarily due to size effect and is not attributable to differences in risks, further studies may elaborate on these issues for the İstanbul Stock Exchange.

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APPENDIX A

LIST OF THE STOCKS USED IN CHAPTER 2

ABANA	AYGAZ	DİSBA
ADANA	BAGFS	DİTAS
ADBGR	BANVT	DMRYO
ADEL	BEKO	DOGUB
ADNAC	BERDN	DOHOL
AFYON	BFREN	DOKTS
AGİDA	BİSAS	DUROF
AKALT	BOLUC	ECİLC
AKBNK	BOSSA	ECYAP
AKCNS	BRİSA	ECYZT
AKFİN	BRMEN	EDİP
AKGRT	BROVA	EGEEN
AKİPD	BRSAN	EGGUB
AKSA	BRYAT	EGPRO
ALARK	BTCİM	EGSER
ALCTL	BUCİM	EMNİS
ALFA	BUMYO	ENKA
ALGYO	BURCE	EPLAS
ALNTF	CARSİ	ERBOS
ALTİN	CBSBO	EREGL
ANACM	CELHA	ESEMS
ANSGR	CEMTS	EVREN
ARCLK	CİMSA	FENİS
ARFYO	CLEBİ	FFKRL
ASELS	CMENT	FİNBN
ASLAN	COMUN	FNSYO
ATEKS	CYTAS	FRİGO
ATLAS	DARDL	GARAN
ATSYO	DENCM	GEDİZ
AVRSY	DERİM	GENTS
AYCES	DEVA	GİMA

GLMDE
GOLTS
GOODY
GORBN
GRNYO
GUBRF
GUSGR
HEKTS
HURGZ
HZNDR
İNTEM
İSCTR
İSYAT
İZMDC
İZOCM
KAPLM
KARTN
KCHOL
KENT
KERTV
KLBMO
KNFRT
KONYA
KORDS
KOTKS
KRTEK
KUTPO
LUKSK
MAALT
MAKTK
MARET
MERKO

METAS
MİGRS
MİLYT
MİPAZ
MMART
MRDİN
MRSHL
MUTLU
MYZYO
NETAS
NİGDE
NTHOL
NTTUR
OKANT
OLMKS
OTKAR
OZFİN
PARSN
PETKM
PİMAS
PİNSU
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PNSUT
PRTAS
PTOFS
RAKSE
RANTL
RKSEV
SARKY
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SKTAS

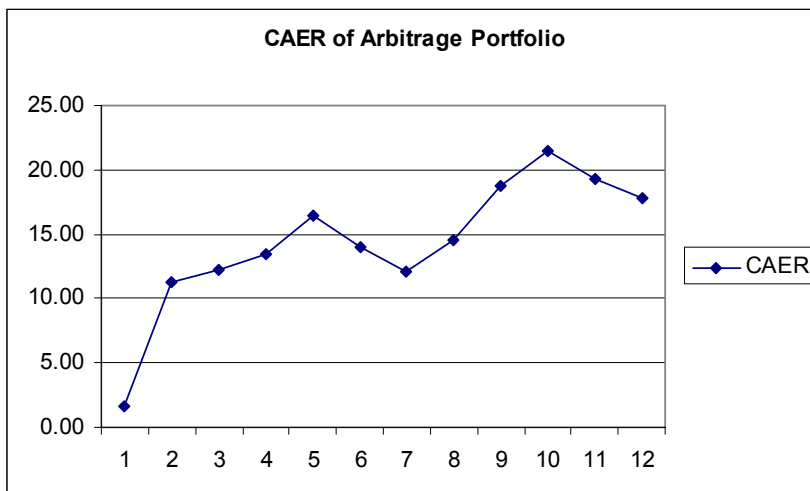
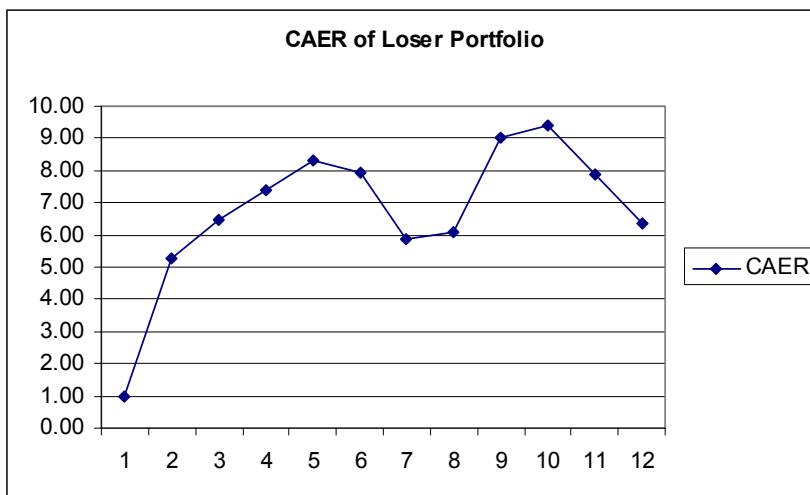
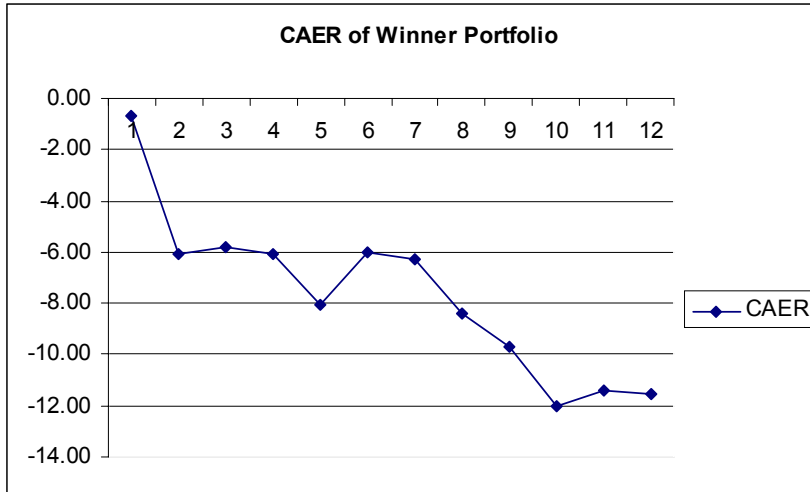
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TBORG
TEKTS
THYAO
TİRE
TKBNK
TNSAS
TOASO
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TUDDF
TUKAS
TUPRS
UCAK
UKİM
UNYEC
USAK
VAKFN
VESTL
VKGYO
VKFYT
VKİNG
YASAS
YKBNK
YKFİN
YKRYO
YUNSA

APPENDIX B

CUMULATIVE AVERAGE EXCESS RETURN (CAER) GRAPHS OF PORFOLIOS

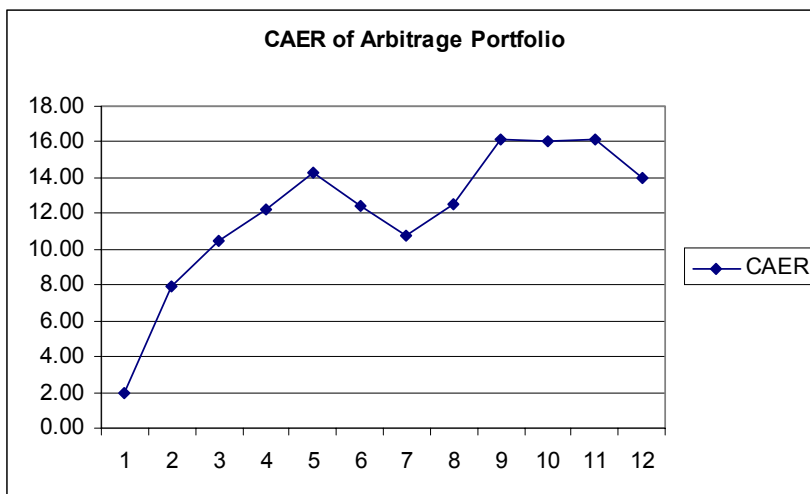
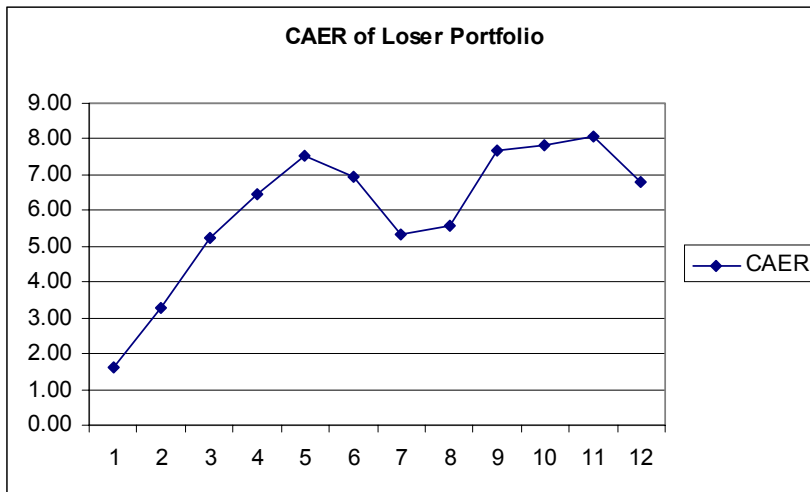
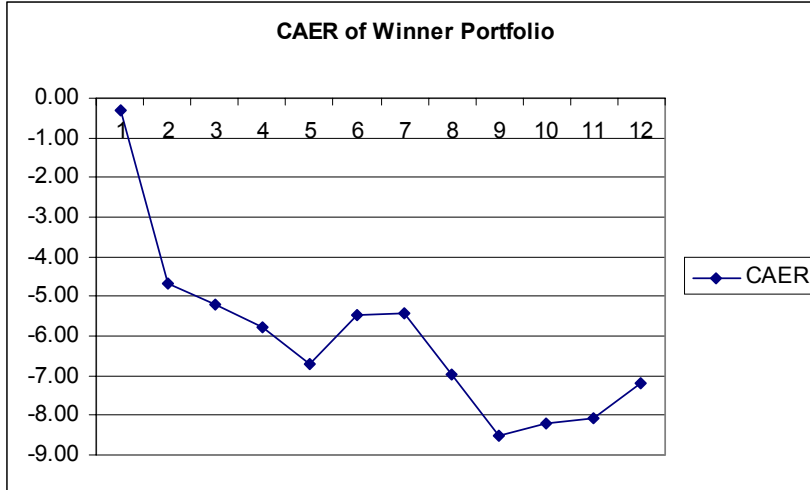
One year Formation Period

10% of the pooled sample



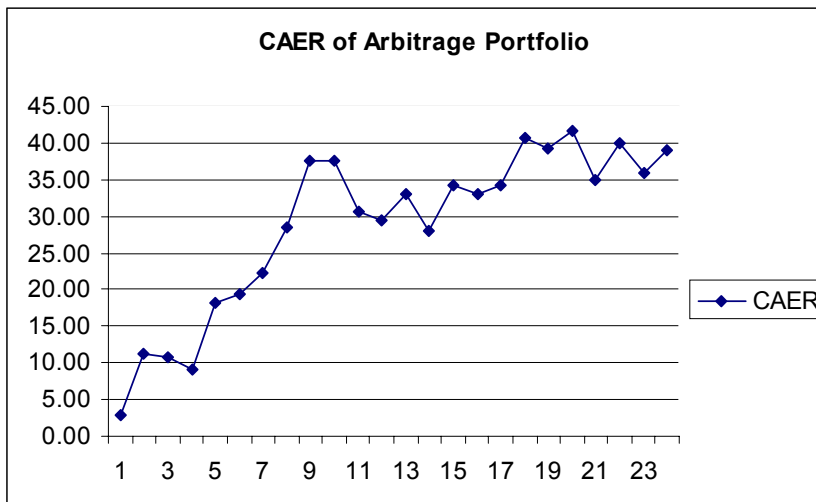
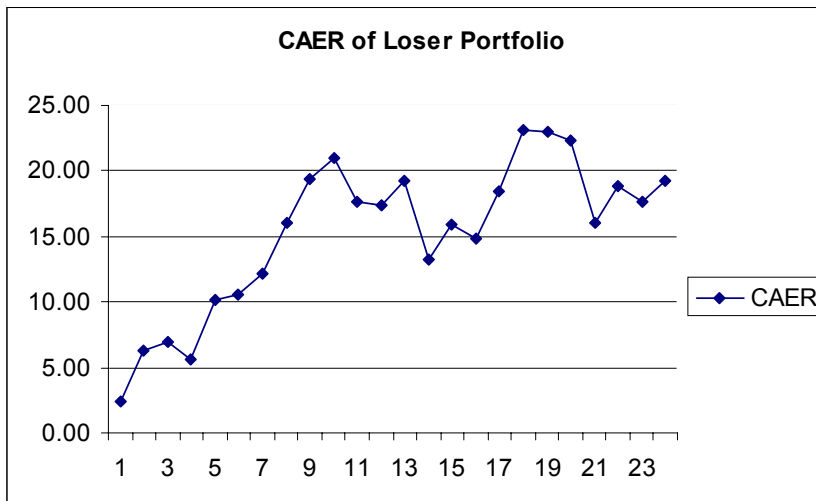
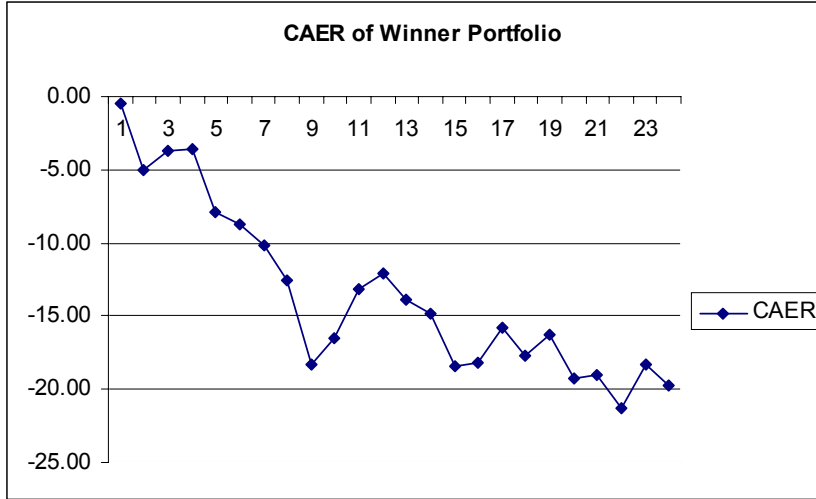
One year Formation Period

20% of the pooled sample



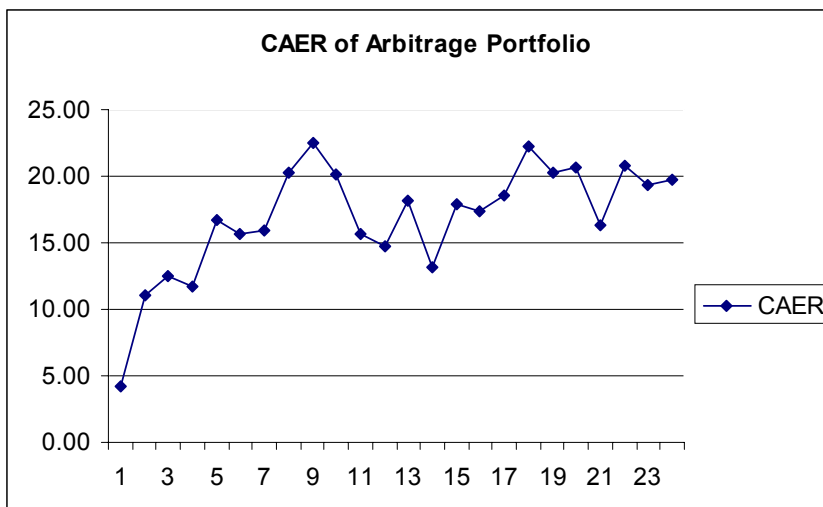
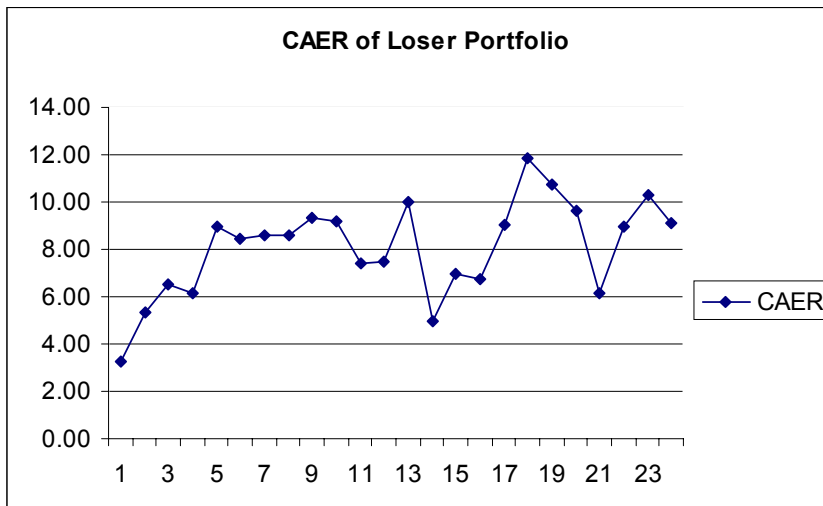
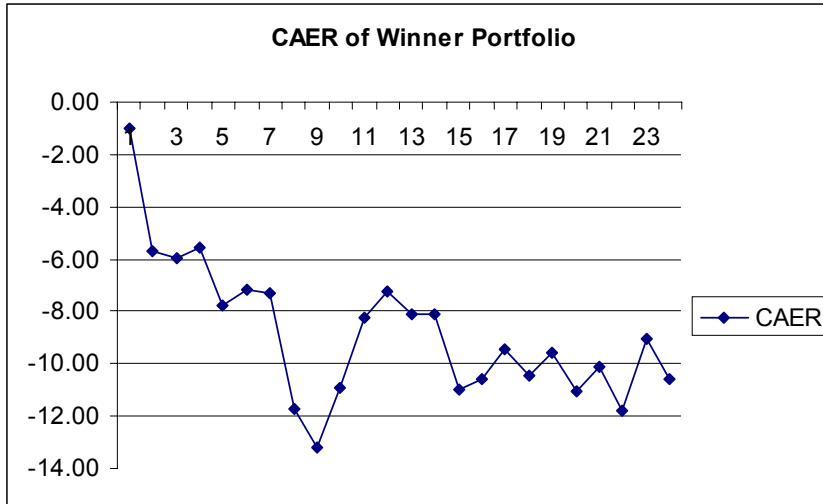
Two Year Formation Period - Overlapping

10% of the pooled sample



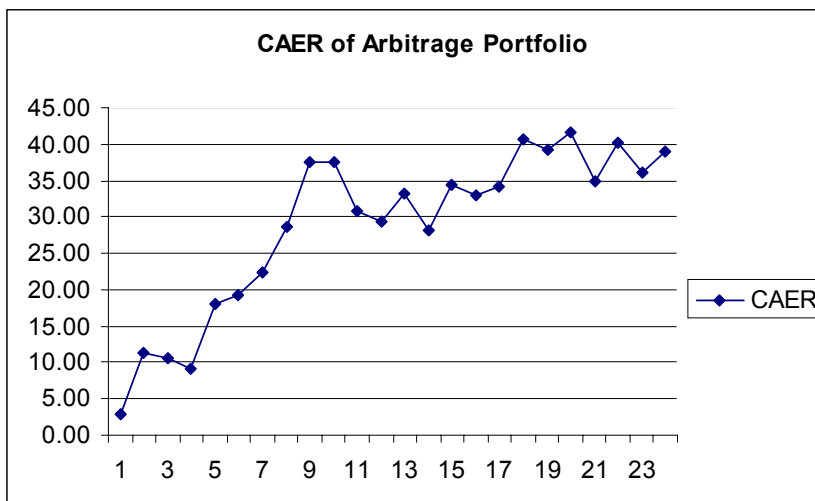
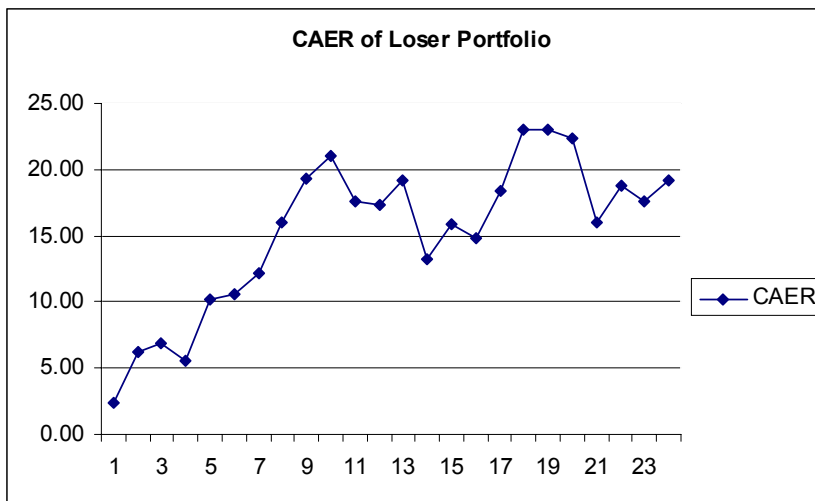
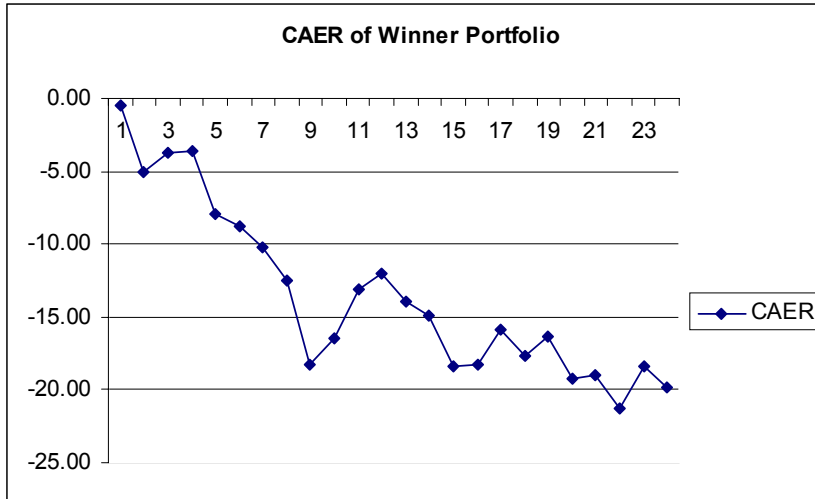
Two Year Formation Period - Overlapping

20% of the pooled sample



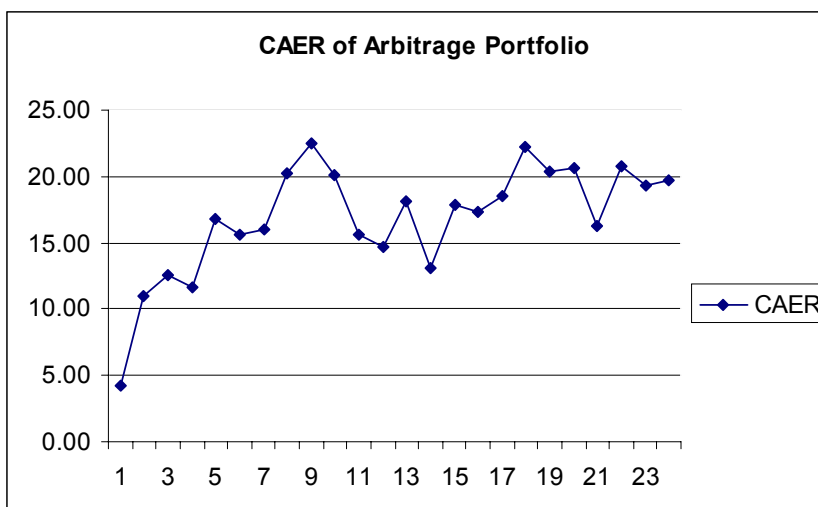
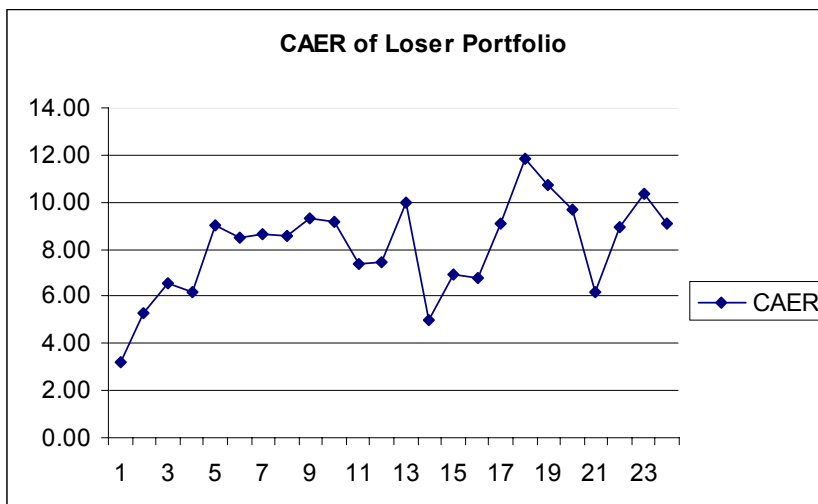
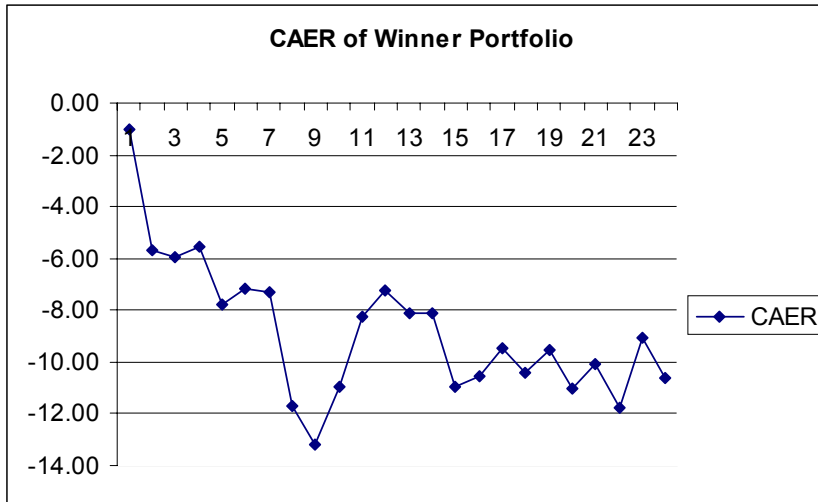
Two Year Formation Period - Nonoverlapping

10% of the pooled sample



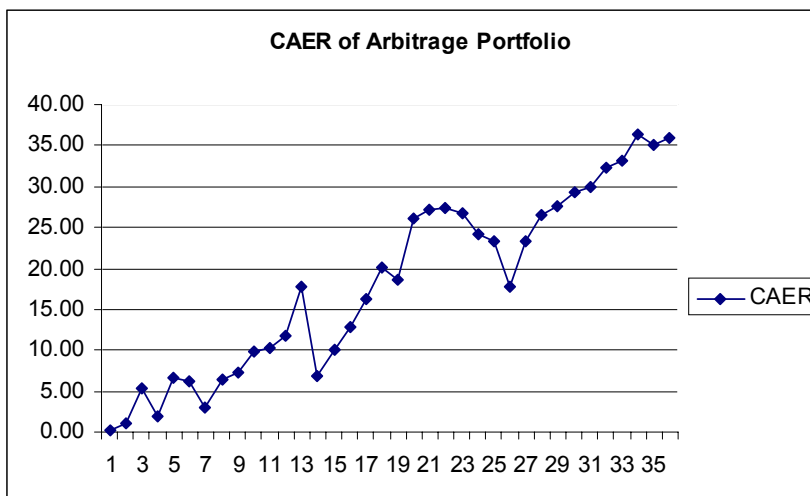
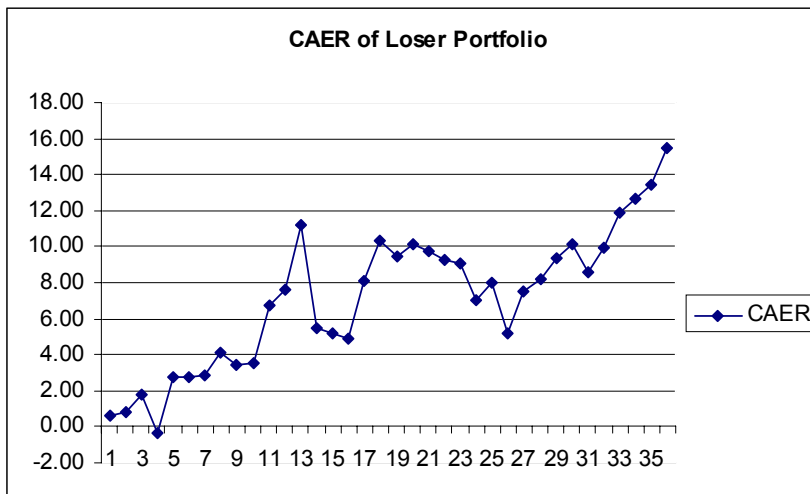
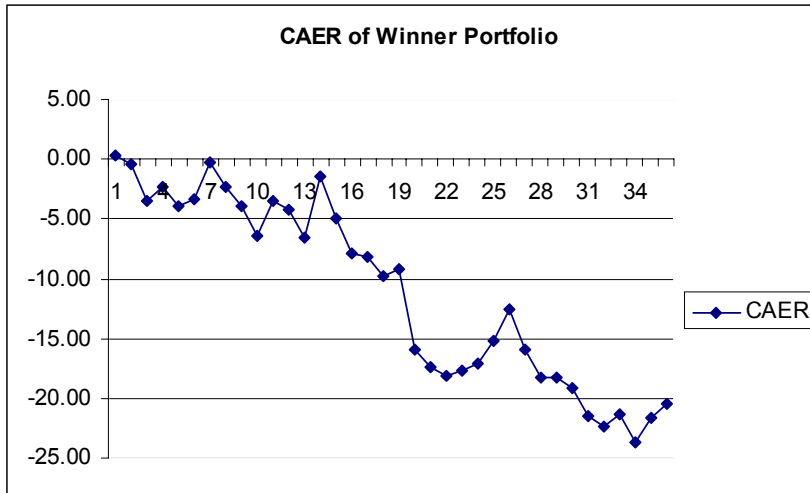
Two Year Formation Period - Nonoverlapping

20% of the pooled sample



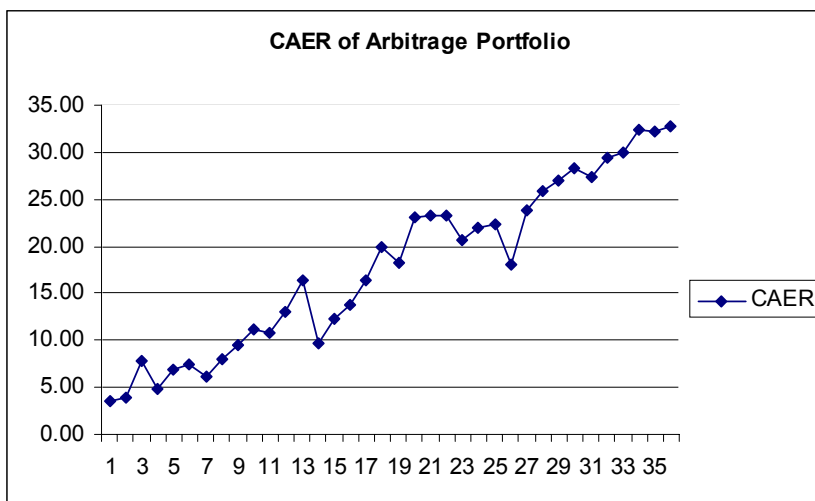
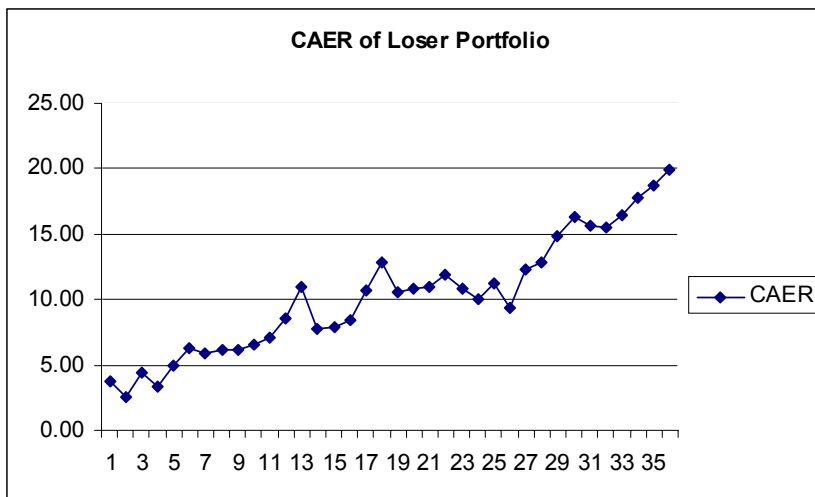
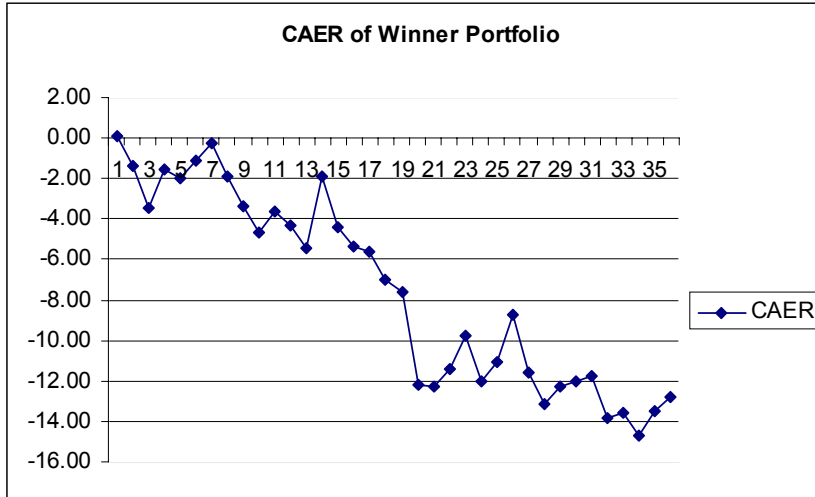
Three Year Formation Period - Overlapping

10% of the pooled sample



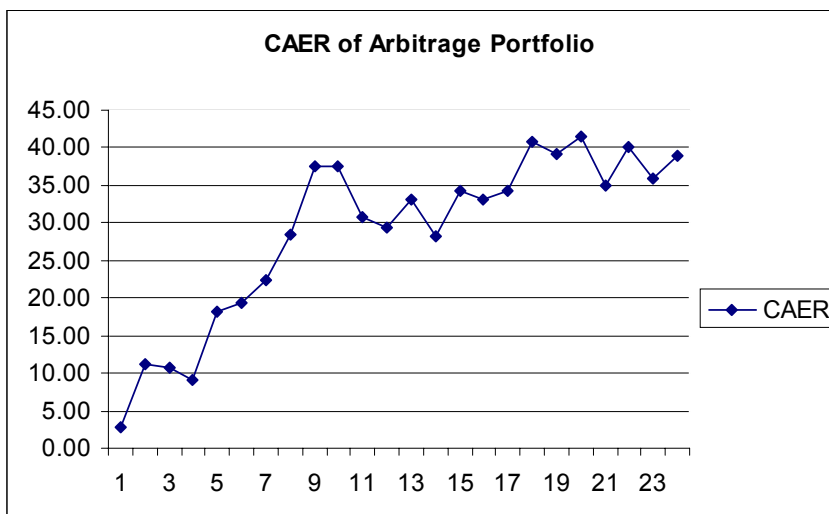
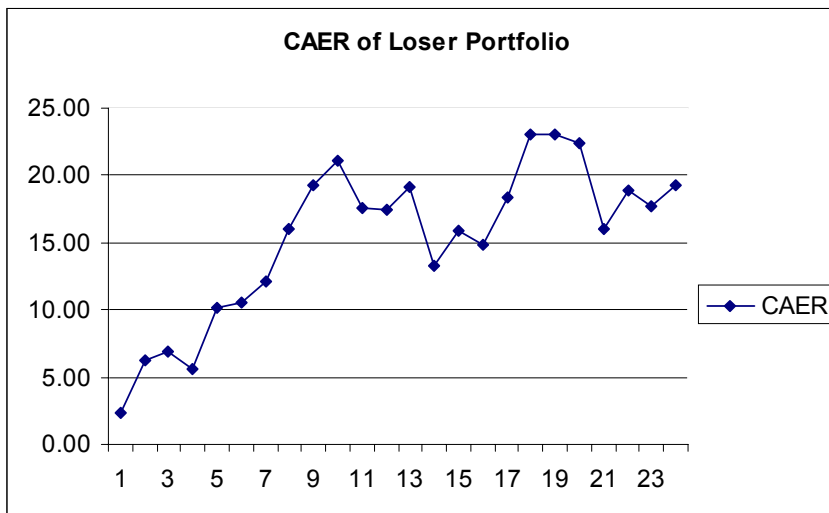
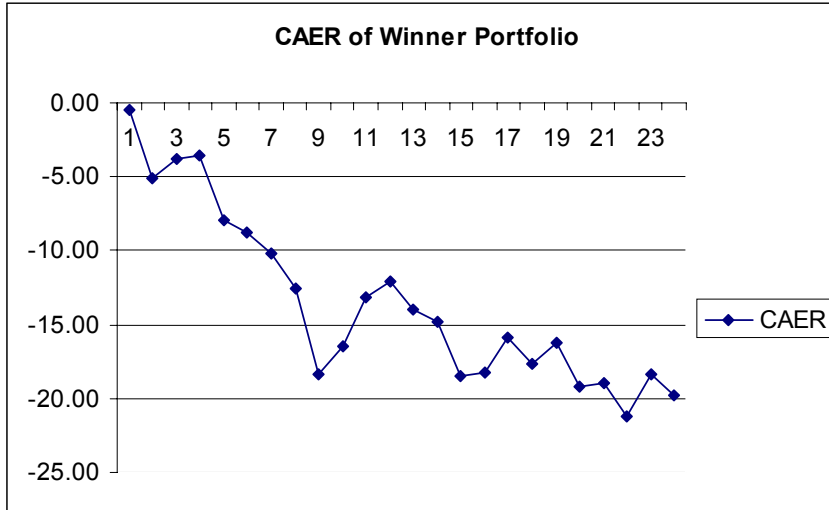
Three Year Formation Period - Overlapping

20% of the pooled sample



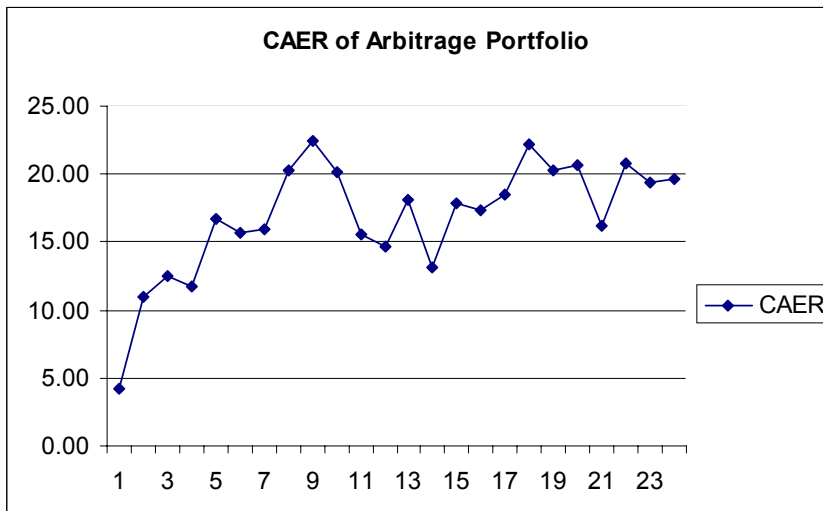
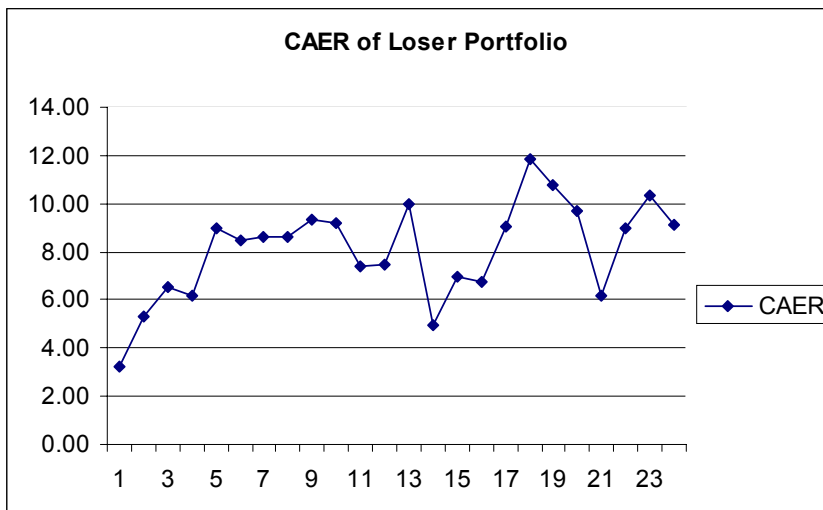
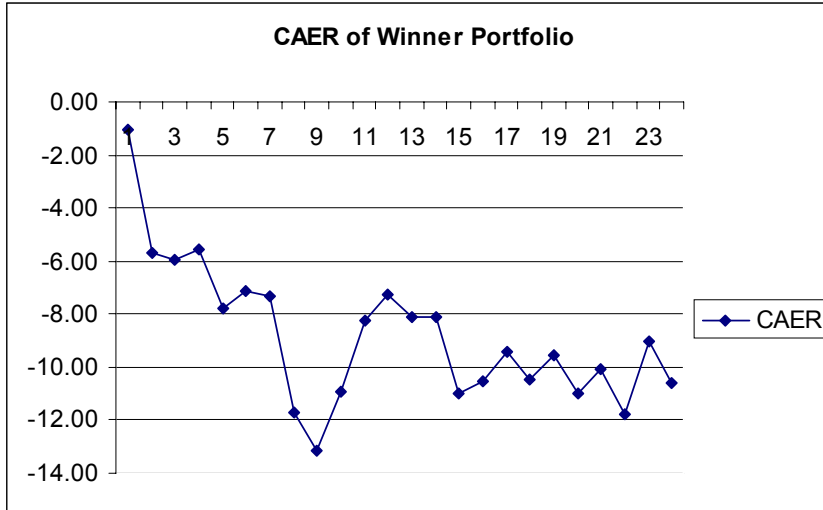
Three Year Formation Period – NonOverlapping

10% of the pooled sample



Three Year Formation Period – NonOverlapping

20% of the pooled sample



APPENDIX C

LIST OF THE STOCKS USED IN CHAPTER 4

ADANA	İSCTR
ADNAC	İZMDC
AKBNK	KARTN
AKGRT	KCHOL
AKSA	KORDS
ALARK	MERKO
ALCTL	MİGRS
ARCLK	MİLYT
AYGAZ	MUTLU
BAGFS	NETAS
BEKO	NTHOL
BRİSA	NTTUR
CİMSA	PETKM
DOHOL	PTOFS
ECİLC	SARKY
ECYZT	SISE
ENKA	THYAO
EREGL	TOASO
FİNBN	TRKCM
GARAN	TUPRS
GİMA	UCAK
GLMDE	VESTL
GOODY	YKBNK
HURGZ	